ENERGY TRANSITION: A CLIMATE FOR NEW OPPORTUNITIES

JOINT ADVICE OF THE COUNCIL FOR HOUSING, SPATIAL PLANNING AND THE ENVIRONMENT AND THE GENERAL ENERGY COUNCIL OF THE NETHERLANDS
ABRIDGED VERSION

ENERGY TRANSITION: A CLIMATE FOR NEW OPPORTUNITIES

JOINT ADVICE OF THE COUNCIL FOR HOUSING, SPATIAL PLANNING AND THE ENVIRONMENT (*VROM-RAAD*) AND THE GENERAL ENERGY COUNCIL (*ALGEMENE ENERGIERAAD*) OF THE NETHERLANDS

ABRIDGED VERSION

(ENGLISH TRANSLATION OF "ENERGIETRANSITIE: KLIMAAT VOOR NIEUWE KANSEN")

THE HAGUE, THE NETHERLANDS, DECEMBER 2004

ENERGIERAAD

GENERAL ENERGY COUNCIL

The General Energy Council (Algemene Energieraad) is an advisory board for the government and parliament of the Netherlands on matters of energy policy. The Energy Council aims to serve as a conscience for government and society and to contribute to the public energy debate, with the public interest always as its central concern.

The Energy Council is independent and its members are appointed on the basis of their expertise and their knowledge of and experience in society in general. The council comprises a maximum of ten members who are appointed by Royal Decree. Council members come from relevant social groups but fulfil their advisory duties on their own responsibility. The tasks and position of the Energy Council are defined by law (General Energy Council Act).

VROMraad

COUNCIL FOR HOUSING, SPATIAL PLANNING AND THE ENVIRONMENT

The Council for Housing, Spatial Planning and the Environment (VROM Council or VROM-Raad) was established in 1996. The Council is charged with advising government and parliament on the main aspects of policy with regard to the sustainability of the environment and on other main elements of national policy relating to housing, spatial planning and environmental management. The VROM Council is also charged with providing advice on the environmental policy activities of the government at the international level.

“In terms of climate change and long-term energy security we are now beginning to see what can be done. There are ways to meet the challenge – at a manageable cost.

I do think that one of the real challenges of this issue is that it seems almost too big, too global and too full of uncertainty to be susceptible to the normal policy process. That’s why I think the answer lies not in finding a single instant solution but in taking an incremental approach supported by market forces. Setting some objectives, doing what we know we can do, learning from experience, and then doing more.

This isn’t an insoluble problem. We can find a solution. And we should start now".

From the speech by Lord Browne (Group Chief Executive of BP plc) for the Council on Foreign Relations, New York, 24 June 2004

CONTENTS

SUMMARY FOR POLICY MAKERS 1

SUMMARY OF THE ADVICE AND MAIN RECOMMENDATIONS 5
1. Introduction 5
2. Problems and challenges 6
3. Barriers 7
4. Lessons from the past 8
5. System innovation 9
6. Transition management 10
7. A two-track strategy in the transition policy of the Netherlands 11
8. Possibilities for the Netherlands: making choices and providing funds 12
9. Possibilities for the Netherlands: the technological perspective 15
10. Possibilities for the Netherlands: the institutional perspective 19
11. Possibilities for the Netherlands: the international perspective 22
12. Reflections on the approach to energy transition in the Netherlands 24
13. Conclusions 27
Main recommendations 28

APPENDIXES
Appendix 1: Advice request 35
Appendix 2: List of abbreviations 39
Appendix 3: Background documents 41
Appendix 4: Composition of the Councils 43

SUMMARY FOR POLICY MAKERS

1. The current energy system is not sustainable.

The current energy system is not sustainable. This situation is liable to lead to serious and costly consequences in the long term. The two most important themes to be addressed are climate change and securing energy supplies, particularly in view of the increasing dependency on fossil fuels from geo-politically unstable regions.

There are three reasons calling for a vigorous approach to these problems, especially the problem of climate change. These reasons are:
- of a moral nature: the rich energy-intense countries are the primary cause of the problems and, therefore, they must take the lead in seeking solutions;
- of an ecological nature: to preserve the natural environment;
- of an economic nature: it is cheaper to use talent and resources to solve the problems than to fight the symptoms and repair the damage. This of course applies to climate change as well as securing energy supplies.

The aim of the energy transition must be to transform the current energy system over the coming decades into a sustainable energy system.

2. The political urgency is currently underestimated.

Although many see the problems as far off, a strong policy is needed now in order to bring about the desired transition without undue delay. Opinion polls show that this sense of urgency is more prevalent among Dutch citizens than among those governing and representing them. The past few years have seen sustainability lose its priority on the political agenda because other much-discussed issues come into fashion. The Councils regret this development and are calling on politicians to reverse this trend.

3. Strong leadership is essential.

The energy demand and supply system is of great economic and public importance and is characterized by complexity and marked clashes of interests. The transition is a process which requires a long-term vision, cooperation between a large number of stakeholders at a national and international level, and strong leadership. In view of these factors, the government is the only suitable party to fulfil the leadership role. Consequently, there can be no question of the government taking a back seat.

4. International cooperation is essential.

A sustainable energy system can only be achieved at an international level. Only in cooperation with other countries can the Netherlands, being a ‘1% country’, help to bring about meaningful changes leading to tangible results. The Netherlands has not yet fully recognized this and still accords too little importance to international cooperation in energy matters. Also, our country can learn far more from what is happening elsewhere than we are generally aware of.

5. However, this also calls for a strong national policy.

The Netherlands must not only encourage the international community to take the necessary steps. It must also strive strongly to find solutions which are connected to the specific Dutch situation as well as the opportunities the energy transition offers to our economy.

The Councils therefore recommend a two-track policy strategy:
- an international track which positions the Netherlands alongside those countries taking the initiative to develop an energy transition policy, especially at EU level. This requires cooperation with like-minded EU countries;
- a national track comprising a strong and targeted energy transition policy, earning the Netherlands its status as a European leader in innovation.

Each of the two tracks must strengthen the other.

6. The transition is driven by innovation.

Innovation is the key to a successful transition. It is therefore disappointing to note that worldwide expenditure on research and development (both public and private) in the field of energy has taken a drastic fall in the last few decades. This is less the case in the Netherlands; in relation to GNP, however, expenditures have still more than halved in some thirty years. This trend warrants reversal.

On a global scale, a wide range of options is available or under development, and these options must be given a chance. They range from far-reaching efficiency improvements, renewable energy sources, clean energy carriers and the use of fossil fuels with CO_2 capture and storage to safer and cleaner forms of nuclear energy, including nuclear fusion. It will be a combination of many technological solutions, rather than a single solution, which will lead to a sustainable energy future.

The innovation trajectories will have to allow for a “Darwinian” development of variation and selection, based on failures and successes. This implies a certain degree of waste, but this is inevitable for success. It also means that too much attention for cost-effectiveness must be avoided. Innovations in an early stage cannot be evaluated in terms of cost-effectiveness. In the Netherlands, a better balance must also be established between ‘technology push’ and ‘demand-side pull’ in the innovation process.

7. The Netherlands must make choices and seize chances.

It is neither feasible nor necessary to develop all options to the same degree in all countries. There is a growing world market for sustainable energy solutions, technologies, consultancy and services, and the challenge is to invest our talent and resources in such a manner that it provides the largest benefits for the Netherlands. This means choosing a limited number of spearheads to work on. Based largely on the comparative advantages of the Netherlands, the Councils have devised criteria for making these choices. We will have to concentrate above all on options which give our private sector an opportunity to acquire a leading position on the (world) market. Let us make a virtue of necessity.

8. A process which requires patience, innovation and consistency.

The process of successful innovation to achieve a sustainable energy economy will take several decades and requires a long-term vision and commitment. It also requires a government that

inspires trust, is consistent and can resist influences from changeable short-term political standpoints and economic fluctuations. Nothing is as disastrous for investment in long-term innovation as continual changes in stimulation measures and regulations; this would be the wrong kind of waste. The political culture must adjust the way it deals with these sorts of processes of change.

9. The Ministry of Economic Affairs is making a good start, but there is room for improvement.

Over the past two years, the Ministry of Economic Affairs has got off to a good start in tackling the transition process at 'niche level'. The Councils take a positive view in this respect.

However, a great deal more must happen if structural progress is to be made. At a national level, there is still too little support for transition across too limited a spectrum, The Councils are less satisfied with the progress made by the other ministries involved. Also, more focus is needed on the 'common agenda' and cooperation between the government departments. Finally, too little attention is being paid to the important 'international dimension' of the energy transition.

10. Specific recommendations

Transition management is about guiding and directing processes and institutions. It ensures that the large number of parties involved are focused on the right issues.

The Councils have issued a number of recommendations to give the transition process added impetus. The most important are summarized below:

a. A sense of urgency
   Politicians must give the issue 'sustainable energy economy' a high priority on the political agenda.
b. Leadership and culture
   The Minister of Economic Affairs must be designated as the coordinating government official who takes on the leadership and acts as director of the process.
   To guide and steer the process, an 'Energy Transition Committee' must be set up, in which the players involved in energy transition are represented at the highest level.
   Parliament must reflect on its role in this type of long-term development in which not only successes but also failures are essential for the learning process, as are the elements of uncertainty and unpredictability. An approach focused solely on short-term results is not conducive to the constructive role which parliament is called on to perform.
c. The international dimension
   Closer cooperation must be established with like-minded EU countries in order to place transition more firmly on the European agenda and exert more influence at a global level via Europe. The Netherlands must initiate steps towards setting up a European 'Sustainable Energy Policy Review Group'.
d. Vigorous energy conservation policy
   Both inside and outside of Europe, energy conservation remains the most promising and cost-effective option to temper fossil energy consumption and CO_2 emissions in the foreseeable future. The Netherlands must find a way of restoring its annual energy savings to a level of 2%.
e. Refocusing priorities in the field of innovation
   Within the whole expenditure package for the stimulation of a sustainable energy economy, there must be a re-evaluation of how resources are balanced between 'research and development', 'demonstration and market launch' and 'subsidies for large-scale commercial applications'. A more limited range of options must be chosen as spearheads of the

Netherlands within the categories ‘research and development’ and ‘demonstration and market launch’. The option ‘clean fossil fuels’, especially CO_2 capture and storage (CCS), deserves a higher priority due to the comparative advantages of the Netherlands. This could mean leaving other issues to other countries.

f. Consistency
A long-term plan will have to be devised, along with an accompanying long-term finance system, to ensure that commitment, consistency and continuity are guaranteed over long periods of time. Creating an ‘Energy Transition Fund’ may be a way of achieving this.

SUMMARY OF THE ADVICE AND MAIN RECOMMENDATIONS

1 INTRODUCTION

As the Chinese are well aware, each crisis is also an opportunity. Hence the Chinese character for crisis comprises the character for danger and the character for opportunity. The Dutch language has no such word. Were such a word to exist, however, the Council for Housing, Spatial Planning and the Environment and the General Energy Council believe it would accurately describe the current energy situation.

The current energy economy is not sustainable. This advice summarizes the greatest challenges. The most serious problems are of a global nature and can only be solved at a global level. After all, the Dutch are responsible for less than 1% of world energy consumption.

It will only be possible to solve the problems by a radical change of our energy system, by a transition towards a sustainable energy economy. Establishing a sustainable energy economy will come at considerable costs. The Netherlands would do well to look beyond limiting these costs and recognize the *opportunities* which energy transition has to offer. It must strive to seize at least some of the benefits of investing in this new system, such as new commercial activities and job opportunities.

While the Netherlands clearly has a responsibility to help solve the global problems caused by our energy consumption, the Councils also insist that a further reason for contributing ardently towards energy transition lies in the opportunities which finding solutions would offer Dutch society. Until now this aspect has not been sufficiently publicized.

In order to develop a transition policy, there must be sufficient insight into those factors hindering the energy transition. Lessons must also be learned from past attempts to change our energy economy. Additionally, coordination must be sought with policy developments at the international level and we must make use of new scientific insights in the field of transition management. The Councils discuss these points in this advice.

The Councils believe the energy transition must be planned according to a two-track strategy, i.e. an international and a national track. The description and elaboration of the *two-track strategy* form the core of this advice. Recommendations are also given regarding the energy transition policy to be pursued. They are grouped as ten main recommendations and are listed at the end of this summary.

With this advice, the Councils are responding to the request from the Minister of Economic Affairs and the State Secretary for Housing, Spatial Planning and the Environment to advise the government on its role in achieving the necessary system innovations in the field of the energy economy.

2 PROBLEMS AND CHALLENGES

Today's global energy economy is far from sustainable. The problems vary in nature depending on each country's stage of development, but in view of the fast-growing global demand for energy services they will dramatically worsen if policy remains unchanged. We have to solve several environmental problems, including the problem of climate change under the influence of greenhouse gas emissions, due primarily to our energy consumption. There is also the issue of safeguarding energy supply against the background of our increased dependence on fuels from geo-politically unstable regions. Scarcity on the market, for however long, can lead to a period of high energy prices and stagnation of economic development. In the longer term there is the issue of the depletion of cheaply recoverable oil and gas supplies. For instance, Dutch gas supplies are expected to reach depletion point in 25 to 40 years. Finally, there is the question of underdevelopment and poverty in vast areas of the world. Some two billion people have no access to modern energy carriers. A further two billion have an energy system that does not function reliably. Surveys carried out in the Netherlands show that addressing these problems can count on widespread support from the Dutch public.

The transition to a sustainable energy economy is one of the greatest challenges facing mankind today, be it at a global, national or regional level. Before this transition can be achieved, a sense of urgency must be instilled in the leaders of our society. It is essential that leading figures in politics, business, civil society and other fields should be or become aware of the seriousness of the situation and do all they can to create a social climate favourable for the necessary transition to take root. Energy transition needs to be given a far higher political priority. Tackling the problems also requires strong leadership, which must be maintained over many years.

The current energy system will have to be transformed into a truly sustainable one, which is clean, affordable, reliable and socially acceptable. This situation should be achieved around the middle of this century. In view of the inertia of energy systems, urgent action is needed without delay to bring about the energy transition. In the short term there could be competition between the individual issues (clean, affordable, reliable, acceptable), but ultimately more comprehensive solutions must be sought which simultaneously sustain success in all the individual problem areas. The extra costs of a sustainable energy economy in the Netherlands are estimated to amount to some € 4 billion a year. Continuing with the old system can be expected to cause huge economic, ecological and social damage and serious disruption of society. The cost of such a scenario could prove to be much higher.

Possible solutions to the climate problem include improving the efficiency of energy and material use, converting to low-carbon fossil fuel sources, utilising renewable sources of energy, developing cleaner options to use fossil fuels (in particular CO_2 capture and storage) and promoting the use of clean energy carriers.

The following measures are important for guaranteeing a secure energy supply: converting to energy sources available in plentiful supply, developing indigenous energy sources, improving efficiency and implementing renewable energy sources. Advanced conversion techniques, for example for making new fuels from coal, also offer potential, especially as the overall availability of fossil fuel resources does not seem to be a limiting factor for a long period of time.

The following points are important for keeping energy affordable: intensifying research and technological development and ensuring that new technologies are launched and marketed quickly enough to produce a fast learning effect, so that substantial price decreases can be achieved with a minimum of delay. Diversifying our dependence on energy imports is another

avenue of solution. It is also important to transfer knowledge and technology to developing countries.

A range of possible solutions is available for all the problems we have discussed. In some cases, the various types of solution complement each other, whereas in others they are mutually conflicting. Moreover, almost all possible solutions carry a degree of uncertainty. The creation of sustainable development will therefore require an innovative approach to the exploration and exploitation of a wide range of solutions. This must happen on an international scale, but also at a national level we must navigate various avenues of solution.

There are various reasons why the Netherlands should make an ardent contribution to finding solutions. Firstly, on moral grounds: whoever contributes to the cause of problems should help to solve them. Another reason is that the Netherlands, as an energy-intensive, water-rich, low-lying country, will be disproportionately affected by the consequences of climate change. Obvious self-interest is another reason. After all, converting to sustainable energy management offers opportunities which will benefit the Netherlands. This requires that when developing solutions the Netherlands should concentrate on areas in which the Dutch are strong and have a comparative advantage over other countries. Furthermore, a well-chosen contribution from the Netherlands can help to limit the additional costs of a sustainable energy system. Innovation is needed in order to realize the necessary system change and seize the opportunities it creates. The Councils advocate a broad understanding of the word *innovation. It* applies to an overhaul of the whole system of technology, markets, organisational forms, institutional arrangements and even socio-cultural views. Energy policy must incorporate all these elements.

The Councils conclude that the transition to a sustainable energy economy is inevitable. The challenge presented by the energy transition will incur costs but also offer opportunities. Policy making in the Netherlands must aim to identify and use those opportunities.

3 BARRIERS

There are various factors hampering the transition to a sustainable energy economy, of which the five most significant are set out below.

- Firstly, fossil fuels are widely available and can be recovered at a relatively low cost, partly due to the development of new exploration and exploitation techniques. This means that more sustainable alternatives to fossil fuels, such as renewable energy sources, can hardly compete with them at present without government support. Crude oil is expected to be the first fossil fuel resource to become physically scarce. However, the world can theoretically go on using the supplies of coal and natural gas for many decades, perhaps even hundreds of years.
- A second barrier is the ‘lock-in’ with regard to the harmful applications of fossil fuels, which has established itself over time (see also section 5 of this summary). Breaking out of this lock-in will require a radical policy which is adhered to over a long period of time.
- This is related to the third barrier, the lack of a sense of urgency, especially at a political and administrative level. What is worrying in the Netherlands is that the signals being sent out by society do not seem to be sufficiently heard in the political arena. Support among the public for tackling environmental issues such as the greenhouse effect is far greater than politicians generally presume.
- A fourth barrier is the unfavourable investment climate for radical energy innovations. Entrepreneurs are therefore particularly wary about investing in such innovations.
- A final barrier is formed by inadequate international cooperation. Many countries are caught in the ‘prisoner’s dilemma’: the initiative-taker bears the costs, while the benefits are enjoyed

by all. International cooperation and coordination will be required to break through this dilemma.

4 LESSONS FROM THE PAST

With a view to transition policy it is interesting to learn from the energy policy pursued by the Netherlands over the last fifty years. It is also important to examine to what extent the transition policy of the Netherlands can be linked to the energy policy pursued in the European Union and by the United Nations.

In the sixties, the Dutch government initiated the successful transition from coal to natural gas. However, efforts invested in the Netherlands from the fifties until the nineties to achieve the transition to an electricity supply based on nuclear energy did not succeed, due mainly to lack of public support.

In the wake of the oil crisis of 1973, the Ministry of Economic Affairs began the active search for breakthroughs of new energy systems. Together with the liberalisation of energy markets starting in the nineties, this was in retrospect a main line of Dutch policy. The goal was two-fold: *reorganising* the energy system and *giving impetus* to the Dutch private sector. We are still facing this challenge today.

The general impression over the last thirty years is that in terms of innovation and development of energy-related business, the Netherlands has not done too well on many fronts. One reason is that we learn too little from successes and failures, from the past, from other policy areas and from other countries. One lesson from the past is that ambitions in specific areas of technology were set so high that reaching them was never a viable possibility, given the capacities available in the Netherlands. Another lesson from the past is that Dutch innovation efforts were often characterized by too much purely national orientation.

One further lesson is that Dutch innovation policy in the field of energy is based too heavily on ‘technology push’. Furthermore, not enough strong clusters have been created among the relevant players in the various areas, nor has there been sufficient willingness to work together starting from a joint vision. It is now also being recognized that coalitions must be formed increasingly on an international level for success to be possible. This does not happen often enough in the Netherlands. Furthermore, the range of energy research, development and demonstration (RD&D) activities and activities aimed at market launch is too wide. Another problem is that the status of the manufacturing sector in the Netherlands has declined heavily over the past thirty years. New initiatives will be needed to make entrepreneurship in the energy field more attractive. Add to this the changeable policy of governments and changing circumstances in the energy sector (such as liberalisation) and the problems surrounding the incorporation of technology in society (public acceptance; regulations), and it becomes clear that innovation policy needs radical alteration if we really want to benefit from and capitalize on energy transition.

The influence of the European Union and the European Commission on the energy policy of the member states has grown significantly over the years[1]. This influence affects issues such as research, development and demonstration, environmental demands on energy systems and the organisation of the energy sector. Directives are used to stimulate the market development of

[1] See also: Chesshire, J. (2004), *An evaluation of the European Context for a Transition Towards a Sustainable Energy System*, Sussex, United Kingdom.

more sustainable energy systems. There are directives for increasing the proportion of renewable energy in the overall energy supply and for improving energy efficiency. This does not imply that there is no room for national energy policy, but the orientation to Brussels is unavoidable and necessary. Here too the same strategy is called for: investigate where the opportunities for the Netherlands lie and devise policy accordingly.

On a global level, the past ten years have also seen significant progress in the development of a joint vision on the role which energy must play in achieving sustainable development. The World Summit on Sustainable Development in Johannesburg (2002) was a breakthrough in this respect. The coalitions and partnerships formed in Johannesburg, some of which involve the Netherlands or Dutch participants, offer a chance of giving form to the envisaged energy transition at an international level. This is also facilitated by e.g. the Implementing Agreements of the IEA (International Energy Agency) within the OESO.

5 SYSTEM INNOVATION

The energy system as we now know it has grown and evolved throughout more than a century in response to the challenges it had to cope with. What were formerly successful developments may well pose significant obstacles to options for the future. This is referred to as ‘lock-in’: the evolution of the energy system has led to a situation which is not easy to break out of. For decades investments were ploughed into the continued development of existing technologies, giving them a market position which can be maintained even after the arrival of new, potentially superior options. Organisations and arrangements have also grown with the energy system and are equally difficult to change. This is not conducive to the introduction of new systems. We have to realize that changing this system will require policy interventions and a great deal of patience. Just as the current energy system has evolved over many decades, so will it take decades to fully establish a sustainable energy economy.

The evolution of the energy system is characterized by a process of *variation and selection.* This is, after all, the way in which markets ‘learn’. It is usually impossible to predict at the outset what the winning concepts or technologies will turn out to be. It is precisely the competition between the various technologies and concepts which guarantees progress. This type of learning can be termed ‘wasteful’, ‘Darwinian’ or ‘evolutionary’: alongside all the winning technologies and concepts there are a great many more which did not make the grade. The time, money and effort invested must be seen as ‘the cost of learning’: without them the better options could not have proved themselves.

Learning by *variation and selection* is intrinsically different from learning by *analysis and instruction,* the learning approach frequently adopted by governments. This method involves analysing all options at a certain moment and choosing the options which at that stage emerge as the best potential winners. These options then undergo further systematic development. From the 1960s onwards, the Netherlands’ chosen approach to learning was one of *analysis and instruction,* with strong government direction and a focus on ‘technology push’. Looking at the poor results, one can conclude that this strategy was of little success.

The Councils believe that solutions must be sought in a method of permanent interaction between both learning strategies: ‘bottom-up’ via variation and selection and ‘top-down’ via analysis and instruction.

The process of learning via variation and selection demands a new role of the government. Taking a back seat is certainly not an option; after all, the government must facilitate this

learning process. Variation demands the acceptance of ‘waste’. Selection demands the willingness to make choices. Learning must take place at all levels: from RD&D to market launch and market diffusion activities. There must be a central focus on retaining the lessons learned and making those lessons widely accessible.

6 TRANSITION MANAGEMENT

The recent concept of *transition management* was put on the political agenda of the Netherlands with the publication of the fourth National Environmental Policy Plan (The Hague, 2001). Transition management aims to initiate transitions by means of a participatory and gradual method of management and steering characterized by adjusting, influencing and adapting. The policy developed for this method is called *transition policy*, and the approach chosen in policymaking is called the *transition approach.*

Transitions are processes of change which happen over a long period of time and are characterized largely by complexity and uncertainty. The complexity is caused by the large number and diversity of the stakeholders and sectors involved in the process of change, and the uncertainty is due to the unpredictability of the course transition will take and the influence of exogenous factors.

The so-called multi-level perspective was developed to provide insight into the transition process. This perspective distinguishes three levels:

1. The *socio-technical landscape* (macro level), which determines the environment within which the transition (system change) takes place. This involve issues such as: the type, volume and distribution of energy resources, how the climate change issue is perceived, international agreements, political cultures, outlooks on the world, values and principles.
2. The *socio-technical regime* (meso level), which ensures that basic social functions can be adequately fulfilled, i.e. people are housed, have leisure time and produce goods and services. In terms of energy supply, the regime consists of such elements as technical installations and systems, energy infrastructure, energy markets, preferences, modes of use, policy measures and policy instruments.
3. The *niche level* (micro level), within which radical innovations can emerge and new concepts can be tested in a protected environment.

In terms of these three levels, a transition can be seen as a process which involves the replacement of a dominant socio-technical regime by a new regime. Such a change in regime comes about because the processes on all three levels are interlinked and mutually reinforcing. Hence changes at landscape level (e.g. concern about climate change) can exert pressure on the existing regime and lead to changes in how procedures are implemented or energy systems are modernized. The regime can also come under pressure if innovations developed and tested at niche level become so attractive that they make a breakthrough at regime level and conquer markets.

In order to achieve the desired energy transition, each level must be subject to a policy which takes the other levels into consideration. Transition policy must ultimately take effect at regime level but must simultaneously cover the landscape and niche levels so that change can come about at all at regime level.

The transition can be roughly broken down into four main activities:

1. Setting up and developing a *transition arena* as a learning network for renewing the energy system in whole or in part. Within this arena, policy development takes place in an interactive

manner. A distinction must be drawn between the *strategic level* of policy development and the more *practical level* on which the plans for modernisation are put into action.
2. Developing a *long-term sustainability vision* (final targets) and a *short-term common agenda* comprising aims, points of action, projects and instruments.
3. Setting up and carrying out *transition experiments* and *transition projects.* The purpose of these is to gain more insight into the uncertainties of new models, techniques and systems and to assess their potential for contributing towards the desired transition.
4. *Monitoring* progress and *evaluating* the learning experience. This must take place periodically and be used to make the necessary adjustments in the areas mentioned above.

Transition management is a participatory form of management and steering involving various players. In addition to governments, transition management involves citizens, consumers, non-governmental organisations, companies, knowledge institutions and intermediaries. The knowledge institutions and intermediaries above all have the function of facilitating and supporting the transition process. Governments not only carry out an executive role but are also concerned with developing the process and its contents. The role of the national government is above all to direct. Transition management places particularly high demands on the role of the government, which must be knowledgeable of processes of change and what they involve and be able to respond appropriately to the circumstances. On the one hand, leadership and direction are necessary; on the other hand it is important to listen to the market parties and society as a whole. Finally, the government must be a reliable partner in the process.

In addition, the government must be willing to think and act in an integrated manner: the energy transition is not a matter for the Ministry of Economic Affairs alone but also for the Ministries of Finance; Housing, Spatial Planning and the Environment; Transport, Public Works and Water Management; Agriculture, Nature and Food Quality; Education, Culture and Science; and Foreign Affairs and Development Cooperation.

7 A TWO-TRACK STRATEGY IN THE TRANSITION POLICY OF THE NETHERLANDS

The Councils consider it necessary to follow both an international and a national track in order to achieve the transition towards a sustainable energy economy. The first track can be referred to as a *reinforced international approach.* The second track is an *active national approach.* The two tracks should strengthen each other.

The first track consists of a *strengthening of current international policy* aimed at achieving the transition towards a sustainable energy economy. The degree of effort being invested at present will not suffice to manage the risks facing us. The speed of transition must be accelerated, strengths must be pooled, more efficient action must be taken, and the scale on which work is being carried out to achieve the transition must be enlarged. The Netherlands must *reinforce* its contribution to these processes.

International policy-making and cooperation can help create a substantial demand for sustainable energy systems. International cooperation is needed to create a level playing field for the various energy options. International cooperation is also necessary if the Millennium Goals of the United Nations are to come within reach. Realizing a sustainable energy system is essential for fulfilling these goals. Energy is also necessary for achieving the goals set at the World Summit on Sustainable Development in the fields of water, health, agriculture and biodiversity. Furthermore, in should be noted that policy decisions in these fields influence the availability and reliability of energy services.

The second track involves *an active national approach.* On this track, the Netherlands implements international agreements and develops and applies national policy.

It goes without saying that the Netherlands should be a loyal and punctual participator in the implementation of international agreements and measures. This applies to various levels, both European and worldwide. We will here limit our discussion to the implementation of the Kyoto Protocol.

Cost-effectiveness must be the primary criterion when implementing the Kyoto Protocol. However, cost-effectiveness should apply not only to the short term (until 2012), but also to the long term, for the Kyoto Protocol is just the first step along the course that has to be navigated. One task of the process up until 2012 is to limit the cost of measures thereafter. In addition, when implementing climate policy, attention must be paid to fulfilling the other aims of the energy transition policy: limitation of dependence on energy imports from unstable regions and creating an affordable and innovative energy system. We must also keep in mind the position of our knowledge institutions and private sector, so that investments made in the context of the Kyoto Protocol can wherever possible benefit innovative developments in our own country.

The line of approach outlined here does indicate that less success can be expected in terms of short-term cost-effectiveness, which the Councils consider to be completely justifiable.

Apart from ‘translating’ international agreements into national policy, there is room for our own national policy. This relates to resources for research and development, specific subsidies and regulations, norms and standards, infrastructure measures and the like. The Councils consider that these measures and instruments should be used above all for promoting innovation and for expanding and strengthening the industrial and knowledge position of our country. The transition to a sustainable energy system offers opportunities for Dutch society and the Dutch economy. The course it takes must be designed to reap the gains of these opportunities, based on the strengths (including our knowledge position) and the comparative advantages of our country. However, to achieve this, it will be necessary to establish international cooperation on a far larger scale than is currently the case.

The subsequent sections of this summary provide a picture of the form which the energy transition should take as recommended by the Councils.

8 POSSIBILITIES FOR THE NETHERLANDS: MAKING CHOICES AND PROVIDING FUNDS

The energy transition demands a vigorous policy on a national and international level. After all, the changes which the system has to undergo are profound and far-reaching, as are the barriers and resistances which will have to be overcome.

As previously stated, the extra costs of a transition to a sustainable energy economy could increase to some € 4 billion a year for the Netherlands over the next few decades. However, there is much uncertainty surrounding this figure, which applies mainly to the extra costs incurred in the market diffusion phase of new concepts, technologies and systems. Most of this sum will have to be raised by producers and consumers (based on the ‘polluter pays’ principle), but partly also by the government, from energy income and taxes.

Besides financing these extra costs for market diffusion, there must be means to finance the *research and development* of new energy techniques and systems and also their *demonstration and market launch.*

The Councils note that government expenditure on energy transition has fallen sharply over the past few years, from approximately € 1500 million in 2002 to an estimated € 850 million in 2005. This is mainly due to more efficient spending. It is partly also due to financial cutbacks, the renunciation of set goals (for example, the goal of achieving a 35% increase in energy efficiency by 2020 as compared with 1995) and by disregarding, for the time being at least, the directive of the European Commission on biofuels.

The distribution of these resources is summarized in the table below (figures in millions of euros).

Year	**2002**	**2005**
Research and development*)	146	142
Demonstration and launch*)	80	105
Market diffusion	1250	600
Total	**approx. 1500**	**approx. 850**

*) Excluding resources obtained via the European Union. In 2001 and 2002 this amounted to approximately € 17.5 million per year, in 2003 to € 25 million.

The Councils lay great store by efficient spending of state income and tax revenues. They regret, however, the cutbacks which result from renouncing previously set goals. This does not assist the transition towards a sustainable energy economy. The Councils also regret that a part of the resources that were originally intended to help make the energy system sustainable was not used to further stimulate the energy transition.

The Councils acknowledge that € 850 million a year is still a considerable sum. The question is, however, whether this sum is sufficient to achieve the necessary energy transition. The question must also be asked whether the money can be spent even more efficiently, for example by streamlining resources and reducing bureaucracy. The Councils also question whether the distribution of means over the three stated categories could be improved, in view of the aims to be reached. Looking at the aims of energy innovation policy, financial resources for *demonstration and launch* certainly seem rather low.

With regard to the figures in the table, it should be noted that energy is not only a financial liability for the state but also a source of income. This income could be as high as € 15 billion a year, of which some € 4 billion in natural gas revenue. Seen in this light, the Councils consider that the stated energy expenditure for 2005 is too low, particularly when considering that once Dutch gas reserves have been exhausted, the Netherlands will be largely dependent on energy imports. Avoiding the need for a proportion of these imports by significantly improving efficiency and developing indigenous energy sources would amount to high savings over time. One can therefore also argue in favour of investing a larger proportion of present energy revenues in the development of the energy system of the future.

One of the problems of (energy) innovation in the Netherlands is that the *valorisation* (conversion into money) of the knowledge at our disposal does not function well. Another problem is that we are generally good at *variation,* certainly in the research phase, but not at

making choices with regard to issues we would have to work at to achieve valorisation of knowledge. The Ministry of Economic Affairs is looking into these matters, as shown in the recently developed Energy Research Strategy and the Energy Transition Approach. However, the Councils are calling on the Minister of Economic Affairs to take further steps in this direction.

An essential element is the process of making choices. The Councils feel there must be continual interaction between the 'bottom-up' method of proposing and working out ideas and the 'top-down' method of developing a vision and putting the ideas into action.

The Councils consider the following aspects to be of importance to the selection process:

- *Develop a clear vision for the future.*

- *Make an analysis of comparative advantages and opportunities.*
  In particular, the following advantages and opportunities could be considered:
  - The Netherlands as a gas country;
  - The Netherlands as a coastal country with strong ports, transit and transport facilities;
  - The service sector of the Netherlands (including energy consultancy and engineering firms);
  - The Dutch offshore industry;
  - The Dutch chemical industry;
  - The agricultural knowledge and expertise of the Netherlands;
  - The Netherlands as a country for knowledge development.

- For each energy option it is recommended to make a thorough analysis of the comparative advantages of our country and to map the potential benefits for the Netherlands (i.e.: where do our chances lie?).

- *From 'technology push' to 'demand-side pull'*: more so than in the past, those using and applying knowledge and technology should be called on to play a central role in the selection process.

- *Learn from past experiences*: this also applies to experiences from other policy areas and other countries.

- *Commit market parties*: energy research policy must contribute to private parties investing in RD&D in the energy sector. This may take the form of giving programmes the character of a public-private partnership.

In addition to the aforementioned considerations, the Councils advise that the following criteria should be central to the choice of spearheads:
1. Does the technology have enough development potential?
2. Can the technology make a significant contribution to achieving a sustainable energy system in the Netherlands and in Europe as a whole (or in developing countries with which the Netherlands maintains special relationships)?
3. What is the quality and international visibility (reputation) of the researchers and companies involved?
4. Does the knowledge development take place within an innovation system which can lead to commercial activity and job opportunities in the Netherlands?

These criteria apply above all to *application-oriented activities* in the field of research, development and demonstration (RD&D), financed mainly by the Ministry of Economic Affairs,

and to a far lesser extent, if at all, to energy-related fundamental research financed by the Ministry of Education, Culture and Science. In addition, the criterion of c*ost-effectiveness* will play a role when choosing how best to stimulate the market diffusion of technologies, for example to reduce greenhouse emissions.

The above analysis must, in the opinion of the Councils, lead to a tightening or even revision of the demands set out in the Energy Research Strategy (EOS) and to a further sharpening of the focus of the long-term EOS research programmes.

The Councils value the fact that much of the above is already reflected in the EOS, although more progress is still needed on certain points. The Councils believe, for example, that *knowledge valorisation* must be made an explicit criterion of the EOS. They also feel that the intention of *"focusing publicly-funded energy research on a limited number of themes"* has not been sufficiently honoured. They regret that the aim of *"reinforcing international cooperation"* when drawing up the EOS itself and developing the EOS research programmes has not really become an issue in its own right. Furthermore, the Councils have the impression that the process of planning still involves too much technology push. Ways will have to be found to give those using and applying knowledge a greater role in the process of choosing which energy options to stimulate. Knowledge valorisation to generate new commercial activities and job opportunities in the Netherlands must also be one of the aims when appropriating public money to knowledge institutions such as the Energy Research Centre of the Netherlands (ECN).

9 POSSIBILITIES FOR THE NETHERLANDS: THE TECHNOLOGICAL PERSPECTIVE

Sustainable energy management is expected to comprise a wide range of options, the combination of which will depend on the situation and the country in question. The options can be roughly divided into the following categories:

- drastic improvement of the efficiency with which energy and energy-intensive materials are used;
- accelerated development and application of renewable energy sources;
- far cleaner use of fossil fuels (including capture and storage of CO_2);
- further development and application of a new nuclear energy technology.

The future energy supply of the Netherlands, and in a wider context, of Western Europe, will comprise a range of options. Some of these options will be incorporated into the energy supply through the import of knowledge and technology. The remaining options may issue (partly) from national industry and knowledge institutions. In cases of proven success, these options can also be sold on the world market, thereby contributing to the development of the Dutch economy.

Depending on the existing energy supply, past policy choices or specific characteristics of a country (e.g. physical, geographical and climatological), not all options will be equally relevant for all countries. When developing options, a division of tasks and areas of specialisation will therefore emerge, partly as a natural process and partly dictated by policy choices. It can be a conscious process to allocate tasks, for example in international projects and programmes, so that the strengths and comparative advantages of each country may be used to heighten the efficiency of investing resources at an international level.

The technological perspective of various options can be summarized as follows[2].

[2] See also: Turkenburg, W.C. (2004) *Energietransitie richting duurzaamheid: het technologisch perspectief,* VROM-Council and General Energy Council, The Hague, The Netherlands.

Improving energy efficiency: This remains a key factor, which has produced significant results in the past, but it only offers any guarantee for the future when backed by a steadfast and vigorous policy. Improving energy efficiency still offers huge possibilities and remains one of the most attractive short-term options. The average long-term efficiency (from 1990 to about 2050) can still be improved fourfold. This potential corresponds to a yearly efficiency improvement of some 2%. Technological development is essential if this is to become reality. By investing in technological development, 'low-hanging fruit' can be produced again and again, which can be picked without undue cost. It appears that significant opportunities for the Netherlands lie in the energy-intensive industry (e.g. development of *breakthrough technology*) and in urban development (e.g. the *zero-energy home*).

Conserving materials: By using materials, goods and products more efficiently (e.g. by means of recycling) or converting to other raw materials (e.g. from petroleum to biomass), energy use and/or CO_2 emissions can be significantly reduced. Improving material efficiency is not being given the international attention it deserves. The development, production and application of biomaterials ('biomass-based materials') is a relatively new international area of interest which could be a source of new opportunities for the Netherlands. Research into biomaterials is being carried out in our country by both public and private parties.

Renewable energy sources (general): The Councils believe that developing and applying renewable energy sources constitutes an essential part of the transition towards sustainability. Renewable energy sources will certainly open up great opportunities in the longer term, and it is feasible that in the second half of this century at least half of the worldwide demand for energy services will be met by renewable sources. The situation in the Netherlands is unfortunately complicated by its geographic and climatologic limitations. Replacing, for example, 750 PJ (one quarter) of our current annual fossil fuel consumption with the use of renewable sources available in the Netherlands (on and offshore) could be one of the ultimate aims of the energy transition process. Another aim should be to obtain renewable energy, especially bio-energy, via imports. In the short and medium term, major renewable energy options for the Netherlands are offshore wind energy and the use of biomass for electricity generation.

Wind energy can eventually be expected to compete with conventional electricity generation techniques based on fossil fuel use, especially if one takes into account the external costs of conventional electricity generation. Wind energy can make a large contribution to electricity supply in the Netherlands and Europe as a whole. For the Netherlands, using offshore wind energy has a number of advantages over onshore installations: there is ample room and hardly a possibility of offshore wind energy becoming a NIMBY problem. On the other hand, costs are higher. Offshore wind energy used to generate electricity offers specific chances for commercial activities in the Netherlands. It is recommended that an international plan be made to generate electricity from wind in the North Sea. Additionally, attention should be given to the integration of high wind-energy capacities in the North-West European energy supply, with an aim to obtaining knowledge about the total costs and ensuring the reliability of the electricity supply.

More widespread use of *biomass* as a source of energy and for making materials demands the cultivation of energy crops. In the Netherlands we will rely mainly on the import of biomass or bio-energy, considering the scarcity and high price of land. Biomass can be used to produce materials, electricity, heat and biofuels. For economic and ecological reasons and due to the limited available space, woody plants prove to be the best raw material in almost all cases. The gasification of biomass is one issue which should receive more attention from governments and industries. The synthesis gas can be used to produce various biofuels and also biomaterials and electricity. However, the production of biofuels is set to remain a relatively expensive option for

years to come. Using biomass to generate electricity and perhaps also to produce biomaterials seems at present more attractive, especially when a cascade approach is possible.

Solar PV (the photovoltaic conversion of solar light into electricity using solar cell systems) seems to be an important option in the worldwide transition towards sustainability. In sunny regions, introducing solar PV can already be economically competitive, especially in areas where there is no electricity grid. This is not the case in the Netherlands. The current yield of solar cells is still too low and the costs are too high for solar electricity to be an economically attractive option for our country, especially if we consider grid-connected installations. The cost of electricity from solar cell systems – now approximately 60-80 eurocents per kWh – would have to become 10 or 15 times cheaper before such applications could be possible on a large scale. It is not yet clear whether this is achievable technologically. In the Netherlands, a price drop to approximately 12 eurocents per kWh certainly seems feasible with further technological development. Further research should reveal whether a price drop to a level comparable to other alternatives is a real possibility for the Netherlands. Over the course of time, large-scale market development of solar PV will emerge mainly in sunny regions. This is one reason why the development of knowledge in the field of solar PV, which is of a high standard in the Netherlands, should focus primarily on application outside of the Netherlands. This has the potential to generate Dutch business opportunities in the development and sale of production process technologies and PV system expertise. Business opportunities also lie in applications for solar panels suitable for the Netherlands. It is also worth noting that the use of solar panels on the roofs of houses has a significant inspiring value for a broad public. This can have a contagious effect in the energy transition process that should be realized in the coming decades.

Cleaner use of fossil fuels: The development of a third main method (besides *energy conservation* and *renewable energy*), namely *cleaner use of fossil fuels,* is necessary to achieve far-reaching reductions in environmentally harmful emissions at the various levels (international, national, regional and local). This approach, provided it is well organized, can also contribute towards lowering our dependency on oil from unstable regions. Beneficial options open to the Netherlands include using natural gas as a transport fuel and the production of cleaner fuels by means of, for instance, the gasification of coal (and biomass), followed by a synthesis process. The Netherlands also has significant opportunities and possibilities in the area of CO_2 capture and storage (CCS). The storage of CO_2 is concerned primarily with geological formations (empty natural gas fields, empty oilfields, deep-lying saltwater aquifers, deep-lying non-retrievable layers of coal). A combination with enhanced recovery of oil or gas (methane) is sometimes possible. In particular the safety and reliability of CO_2 storage are points for further research. Given the significance of this option for a non-polluting energy supply, the geological possibilities for CO_2 storage available in our country, the position of the Netherlands in this field and the chances it would open up for new commercial activity, this option could well become one of the spearheads of Dutch energy policy. This is not the case at present. The CCS policy set out in 2003 by the Ministry of Economic Affairs can essentially be referred to as a ‘wait and see’ approach. However, meanwhile this option is being given more attention both in EOS programming of energy research and in the energy transition approach recently adopted by the Ministry of Economic Affairs.

Nuclear energy, due above all to matters of safety, proliferation, waste and cost, is currently not an option with widespread public support in the Netherlands. However, technological developments (inherently safe reactors; transmutation of long-lived radioactive waste; improved proliferation resistance) are under way which may reserve a certain role for nuclear energy in a sustainable development of our society, although this will be a long process and will require global efforts. The Dutch contribution in this field should remain limited since essential elements

necessary for a nuclear energy industry are lacking in the Netherlands, as is sufficient public support for the construction of new nuclear fission power plants.

Hydrogen: There is uncertainty about the future development and role of hydrogen in our energy system. The great advantage of hydrogen is that converting it into electricity using a fuel cell produces high yields while the waste product consists only of water. However, hydrogen is an energy carrier which relies on existing energy sources for its production. This is expensive, especially if hydrogen is to be produced from renewable sources such as solar and wind energy or from nuclear electricity. Most cost-effective production at present is from natural gas or coal. Development of an efficient fuel cell is fundamental for the clean and safe application of hydrogen. This development mainly takes place abroad and is proving considerably more time-consuming and costly than many supposed five to ten years ago. Another problem with hydrogen is its storage.
In short, the development of a hydrogen economy will most probably be many more decades in coming than many hope and have suggested over the past few years.

Based on the above, the Councils in principle see the following options as offering promising opportunities for *Dutch* industry and business and *Dutch* knowledge institutes:
- gaseous energy carriers;
- cleaner use of fossil fuels (including CO_2 capture and storage);
- extensive energy efficiency improvement (process and chain efficiency) in industries and urban areas;
- cultivation, import and processing of biomass (at this stage mainly for generating electricity);
- offshore wind energy.

Solar PV offers opportunities for the development and trade of knowledge on production technologies and the development and application of system expertise. Further analysis is needed before a clear picture can be given of the prospects for widespread application of solar PV in the Netherlands. The same applies to the potential and opportunities of biomaterials for the Netherlands.

The Councils currently see fewer possibilities for knowledge valorisation in the Netherlands in areas such as nuclear energy and onshore wind energy. Similarly, they would not designate the various forms of hydropower and marine energy as an area for specific attention in Dutch energy innovation policy.

It appears that the options of biofuels and hydrogen still have a long way to go, but these too may open up chances for the Netherlands in the more distant future.

The number of selected areas potentially offering opportunities for the Netherlands is still too high. Further restriction is necessary in order to really make a difference in each chosen area of interest. More specific selection is above all necessary with regard to support for *demonstration and market launch*.

In order to capitalize on the possibilities, it is necessary to elaborate and further develop energy clusters (companies, knowledge institutes) around promising themes. In almost all cases, such a cluster will need to be set in an international framework with agreements on task allocation. Involving large industrial companies in energy innovation is just as important as involving smaller innovative companies, considering they often play a pioneering role in the innovation system. Finally, it is important that all parties in the innovation clusters are driven by a clear *commitment* to the development of market and technology.

The first thing required of the government is that it makes a clear choice for specific key areas. The points mentioned previously can assist the government in making a selection. The government must also see to it that energy policy and innovation policy in these key areas are developed hand in hand. Government commitment to developing these areas must be sustained for longer than one or several terms of government. With regard to the main routes to be taken in the energy policy, the Councils appeal for more attention to be given to the improvement of energy efficiency and the cleaner use of fossil fuels. There should be a set aim to return to an average energy efficiency improvement of 2% per year. The policy should also devote more attention to the option of CO_2 capture and storage. The target of deriving 10% of our energy consumption from renewable sources by 2020, however ambitious, must be maintained, as must the aims set for wind energy. The Councils also wish to warn against excessive expectations for the ultimate potential of biomass and hydrogen in the short and medium term.

10 POSSIBILITIES FOR THE NETHERLANDS: THE INSTITUTIONAL PERSPECTIVE

Changes at an institutional level will also be needed in order to achieve the intended energy transition.

At *landscape level,* not enough pressure is exerted by the landscape factors to bring about most of the intended changes at the *energy regime level* before the middle of this century. Such factors include a sense of urgency, support for processes of change and the accompanying measures, the degree to which principles such as ‘the polluter pays principle’ and ‘the precautionary principle’ are endorsed, new international agreements about restricting greenhouse gas emissions and restricting the import of energy from unstable regions, the strictness and ramifications of international agreements and treaties, and recognition of the opportunities which the energy transition represents. The transition policy must address all these factors.

Changes in the energy system have to be implemented at *regime level*, requiring a transition policy directed towards three factors:
1. creating a level playing field for the various options to provide energy services;
2. translating guiding principles and long-term goals into short-term policy;
3. gradually opening up the regime to promising technologies and systems.

Restructuring energy subsidy flows is important to create a level playing field. Worldwide, approximately 250 billion US dollars are spent yearly on energy subsidies, of which 80% go to fossil fuel options and 20% to non-fossil fuel options (including nuclear energy). At the same time, work must be continued on internalising external costs, especially with regard to CO_2 emissions. Added to this, policy is needed to break out of the lock-in into today’s polluting use of fuels.

Translating guiding principles into short-term policy mainly involves applying the principle that ‘the polluter pays’ (instead of the government) as well as the ‘precautionary principle’. With regard to the latter, ways must be found to apply this principle in specific areas when developing an innovation strategy. One example is the further development of the option of CO_2 storage in geological formations.

As far as possible, the transition policy should make use of generic, market-orientated instruments (such as tradable emission permits, levies and green taxes). Specific instruments will be needed to help break the lock-ins and facilitate market launches of new technologies. These may take the form of legislation, they may be physical adjustments (e.g. to infrastructure)

or they may serve to adapt or develop new measures to stimulate change at regime level (e.g. technology-enforcing standards, agreements on the development of breakthrough technology and specific subsidies).

At *niche level* the policy must be directed at stimulating and facilitating those developments which have the potential to add to system innovation and create opportunities for Dutch business. The existing innovation system does not cater for this sufficiently. Changes are needed to boost the following functions of the innovation system:
1. creation of technological and other knowledge;
2. exchange of information through networks;
3. giving direction to the innovation process;
4. regulation and formation of markets;
5. supply of resources for innovation (capital and manpower);
6. prioritising of public and private resources;
7. development of advocacy coalitions for processes of change.

It is the government's job to help the innovation system fulfil these functions.

Transition management is a new form of management of which little experience has been gained to date. It is an approach which can only hope to succeed if the following criteria are fulfilled:
- a widely-felt sense of urgency;
- leadership;
- commitment to the approach;
- willingness to initiate the necessary cultural transformation;
- an active government in different roles;
- careful direction and steering;
- trust between the players and stakeholders involved, and
- willingness to invest in the energy transition.

These criteria are discussed below.

Leadership

The transition to sustainable energy management is a vast, complex and time-consuming operation requiring strong leadership. The government is the first party called on to assume leadership, as public issues are at stake and the process will take many years. To deliver lasting, convincing leadership to the transition process, the Councils recommend setting up an Energy Transition Committee under the authority of the Minister of Economic Affairs. This committee should serve as a strategic level with respect to the transition process.

The chairperson of the committee could be the minister himself, being the governmental coordinator of the energy transition, or an eminent former politician or 'captain of industry'. Members of the committee should occupy executive positions at the highest levels of the government departments most closely involved or should be representatives of the stakeholders at the highest levels. The primary task of the committee is to give strategic advice to the government (ministers) on objectives, design and direction of energy transition policy and its integration in other policy areas. A second task is to strategically direct events at the practical level, where the actual campaigns and courses of action in the various energy transition programmes are coordinated in the partnership between stakeholders and governing authorities. A third task is to help solve major problems hampering the transition process.

Commitment to the transition approach

The Councils currently feel there is a lack of commitment to the goal of energy transition. More interest in this issue has to be generated at a political level in the Dutch cabinet and Lower House. Failing this, the goals of energy transition policy will not be reached. A well-prepared political debate about energy transition would also help encourage companies, knowledge institutions and other organisations to place this issue higher on their agendas. The Councils also recommend that innovation towards a sustainable energy economy should be one of the areas that the Innovation Platform[3] of the Netherlands bases its actions on.

Cultural change

Today's culture is not particularly suitable for directing complex processes of change, an observation already made in the past by the General Energy Council and the Council for Transport, Public Works and Water Management. The same can be said of the transition process towards a sustainable energy economy. The Councils are therefore keen to involve the Lower House more closely in the transition process, including the accompanying learning processes. The working method which the Councils envisage for the Lower House should be adapted taking into account the specific character and needs of this type of long-term change process.

An active government in different roles

The government will not be able to operate in the transition process in a traditional way. It will have to fulfil several roles (pioneer, initiator, stimulator, facilitator, partner, negotiator, regulator, supervisor, co-financer), all of which will change in character and intensity throughout the course of the process. This demands versatility and also careful direction, which must adapt to the different stages in the transition process. Essential elements in the process are: cooperation and interaction, dynamic networking, learning and communicating, experimenting, decisiveness in uncertain situations, stimulating and motivating, monitoring and evaluating. The Ministry of Economic Affairs took the lead in designing the energy transition policy, and it is of great concern to the Councils that so little contribution to the policy has been forthcoming from the other ministries involved. In particular, the Ministry of Housing, Spatial Planning and the Environment is lagging behind in the field of housing and urban development. As yet, no whole-hearted cooperation has been established between the ministries.

Trust

The Councils are most concerned that sufficient mutual trust between the different players in the energy transition process seems to be lacking. Particularly worrying is the fact that potential innovators do not look upon the government as a dependable partner. They consider the government lacking in *commitment* and consistency and continuity of policy. Trust must be re-established via concrete action and every care must be taken to ensure it does not suffer renewed damage.

[3] The Innovation Platform aims to strengthen the innovation potential of the Netherlands in order to secure a leading role for the Netherlands in the European knowledge economy of 2010. To achieve this the Netherlands should recover/regain values such as excellence, ambition and entrepreneurship. See: http://www.innovatieplatform.nl/en/missie/index.html

Willingness to invest

To increase and maintain the willingness of market parties to invest heavily, the government will have to adopt a consistent, long-term approach in its own financing. The Councils recommend developing a *project financing* model as part of the transition policy in order to give successful experiments a chance to succeed in the phase of market launch. In addition, subsidies must be committed to the necessary accompanying research for the required length of time.

The Councils also recommend that not all government funds for activities related to energy transition should be linked to the yearly budget, but that money for energy purposes should be allocated to a separate earmarked Energy Transition Fund. An additional consideration here could be to use part of the natural gas profits under the regulation governing the Dutch Economic Structure Enhancement Fund (*Fonds Economische Structuurversterking*) to contribute to this Energy Transition Fund.

11 POSSIBILITIES FOR THE NETHERLANDS: THE INTERNATIONAL PERSPECTIVE

In global terms, the Netherlands is a '1% country'. This means that the energy transition in the Netherlands can only be achieved if it also comes into effect in Europe and ultimately also worldwide. It is in the Netherlands' interest to actively promote this cause, either directly or indirectly via the European Union.

The Councils define four forms of cooperation in this context:
1. multilateral cooperation at a global level;
2. community cooperation at EU level;
3. cooperation with forerunners within the European Union;
4. international cooperation on the basis of national economic interest.

Multilateral cooperation at a global level

The aim of this form of cooperation is to jointly shape and decide on the energy component of existing international agreements and treaties (for example, the Millennium Goals and the UN Convention on Climate Change), to achieve new agreements (for example regarding the future of the Kyoto protocol), to press ahead with talks about the necessary energy transition, and to create extensive markets for sustainable energy systems. In the light of these aims the following courses of action are recommended for the Netherlands:
- Continue investing in the preparation of new protocols within the UN Framework Convention on Climate Change, following on from the Kyoto protocol.
- Continue talks about energy transition in international committees, with eyes and ears open for strategies already under way elsewhere. Examine what we can learn from other countries' approaches and experiences.
- Promote the creation of large-scale markets for sustainable energy systems, for example by setting up international coalitions and partnerships, thereby striving to combine the advantages of an enlarged market with a range of technological options.
- Invest in the partnerships in the field of energy which were formed in Johannesburg and which are expedient for the Netherlands.
- Continue to participate in IEA programmes and agreements which are expedient for the Netherlands.
- Stimulate the setting up of an Intergovernmental Panel on Energy for Sustainable Development modelled on the existing Intergovernmental Panel on Climate Change in terms of its approach and way of working.

- Assist and facilitate the timely compilation of a new World Energy Assessment (WEA II) which can be used to evaluate action recommended at the world summit on sustainable development held in Johannesburg.
- Promote further *coordination* of energy activities within the UN system and further *cooperation* between UN bodies which have a mandate in energy affairs.

Community cooperation at EU level

The aim of this form of cooperation is to make an active contribution to the continued development of energy and climate policy (both in Europe and further afield), to secure energy supplies, to create a level playing field at *regime level* and to stimulate niche developments in Europe. These aims give rise to the following recommended courses of action for the Netherlands:

- Influence the international landscape above all via EU channels; stimulate cooperation between countries and parts of the world which have a stake in securing the world energy supply.
- Elaborate further initiatives with a number of like-minded countries to place the idea of energy transition high on the EU agenda.
- Encourage the European Union to increase pressure on the regime level (i.e. the current system of energy management in Europe), perhaps by introducing additional green taxes, gradually lowering emission limits, abolishing subsidies for unsustainable options and introducing a progressive *Golden Standard* (in addition to a *minimum standard*) for the energy efficiency of machinery and installations.
- Take the initiative in setting up a Sustainable Energy Policy Review Group in the European Union, along the lines of the existing Environmental Policy Review Group, for the joint development of long-term visions and the quest for solutions. Members of this group must include senior officials from the European Commission and from the various member states.
- Play an active role in directing the EU stimulation policy for sustainable energy systems towards creating markets, and ensure that market creation is possible at EU level.
- Develop a vision for European research policy in the light of the envisaged energy transition.
- Take active part in those European Technology Platforms relevant for the Netherlands[4].

Cooperation with forerunners within the EU

It is recommended that in the energy field the Netherlands should join forces with a number of like-minded, progressive countries. The Councils are thinking in particular of Germany, the United Kingdom, Austria, Finland and Sweden. Work can also be carried out with multinationals. One example of such cooperation in the field of traffic emissions reduction is the European Auto-Oil Programme. More generally, the Councils would also like to see the Netherlands move out of the EU's centre-field group of followers to re-establish itself actively among the leading countries.

International cooperation based on national economic interest

It is recommended that the national policy for stimulating niche development should do more to recruit foreign partners in areas where this is essential for niche development in the Netherlands. This applies for example to the continued development of *bio-energy* and *offshore wind energy*.

[4] These platforms are responsible for setting up strategic research agendas for the development of a certain technology.

12 REFLECTIONS ON THE APPROACH TO ENERGY TRANSITION IN THE NETHERLANDS

Following the publication of the fourth National Environmental Policy Plan in 2001, the Ministries of Economic Affairs; Transport, Public Works and Water Management; Agriculture, Nature and Food Quality, and Foreign Affairs began to introduce programmes to facilitate transitions in the areas of energy, traffic and transport, agriculture and biodiversity. The ministry of Housing, Spatial Planning and the Environment (VROM) acts as the coordinating ministry for all transitions and is also considering the start of its own transition in the field of housing and urban development. The Ministry of Economic Affairs is directing the energy transition.

The following overall picture emerges when current energy policy and in particular energy transition policy are assessed on the basis of the recommendations set out in this advice.

The Councils are extremely positive in their judgement of the approach of the Ministry of Economic Affairs: energetic steps have been taken to begin the process of change, successful work is being carried out in cooperation with the private sector and other players, market parties are closely involved in the activities, and a culture of learning is evolving. The main directions within the Dutch energy transition process have been marked out and a number of transition routes have been established along which new developments can take shape. There is a budget for test projects known as the Unique Opportunities Scheme, and a start has been made, albeit cautiously, on international cooperation.

The approach of the Ministry of Economic Affairs targets the very issue which is stagnating in the Dutch innovation process: namely, knowledge valorisation and the development of knowledge aimed at such valorisation. By working on a broad front, the Ministry aims to spread the risks, for not all test projects (experiments) will prove successful. The Ministry's approach makes use of an open agenda to seek a new role for the government in the innovation process. Targets are set, but there is room for a high degree of flexibility in defining how to reach them.

The Councils see the approach of the Ministry of Economic Affairs as refreshing and in many aspects in line with the visions and insights described in this advice.

The Councils believe that the transition approach should form the guiding principle for energy policy as a whole. However, a number of steps in the energy transition approach still have to be taken. Many of these steps have already been discussed in this summary, to which the following suggestions can be added:

Expansion within the Ministry for Economic Affairs
The value of energy transition must be acknowledged throughout the whole of the department. All those in leading administrative and political positions must embrace the approach, in word as well as deed. The Councils stress the importance of establishing closer coordination with other policy areas related to energy research policy, in particular innovation policy and the industrial policy currently under development.

Whole-hearted cooperation within the government
Energy transition also affects the policies developed by the Ministries of Transport, Public Works and Water Management (traffic and transport systems, fuel mix and civil and hydraulic engineering); Housing, Spatial Planning and the Environment (emissions, climate policy, spatial planning, energy use in the urban environment); Agriculture, Nature and Food Quality (energy use in agriculture and horticulture, agro-business and agricultural technology, biomass); Development Cooperation (transfer of knowledge and technology to developing countries;

cultivation, import and sustainability of biomass; competitiveness of biomass and other options for using land and space) and Finance (fiscal and other regulations). Interdepartmental coordination and cooperation are still underdeveloped. More cohesion must be created between on the one hand the energy research policy and the transition approach within the Ministry of Economic Affairs and on the other hand the related policies within other Ministries.

Streamlining of resources and regulations
The current situation is marked by a wide range of funds and regulations which operate on the basis of different principles and considerations. Current funds and regulations governing research, innovation and market launch should be analysed and existing budgets reorganized in the light of energy transition. Resources should also be spread appropriately over the phases of *research and development, demonstration and market launch* and *market diffusion*. The redistributed financial resources should then be committed over a longer period of time.

Reinforced cooperation between the government and other players
A successful energy transition demands that close cooperation be maintained over a long period of time between the government and the stakeholders involved. The parties will have to show evidence of a consistent policy. Those demanding and using knowledge (the market) must be given a far more prominent, clearly defined role in the transition process. Ways must also be found of how best to involve *citizens* in the energy transition process.

Expanding the scope
Energy transition policy seems to concentrate most of its attention on the niche level of concrete innovation projects. The Councils feel that not enough importance is being accorded to the regime level and landscape level. Interdepartmental coordination is one way in which policy will have to be developed at these levels. The government could for example draw up a long-term strategic plan, possibly as part of the next Energy Report.

Stronger direction of the transition process
For the direction of the energy transition process, the Councils suggest setting up a strategic task force in the form of an Energy Transition Committee which would answer to the Minister of Economic Affairs and be made up of representatives from authorities and high-level stakeholders (see section 10).

Sharper focus of energy innovation policy
Although steps have already been taken to further narrow down the choices, the overall scope of the energy transition is still too broad. The Councils therefore advocate further prioritisation and focusing on options which are to be accorded special attention in energy RD&D and transition policies. Criteria, considerations and approaches useful for this process are discussed elsewhere in this summary (see section 8).

Attention needed for further development
More attention must be given to the continued development of options after the first steps (scaling up, market introduction, cost reduction). How can promising options in a niche come to fruition? Solutions can be sought in a method of *project financing* in which innovations are funded from a single source, from the original idea through to its realization. It is also important to maintain coordination with the current policy. For example, agreements could be made with regional and local authorities for creating markets for new options using the so-called BANS subsidies for energy and climate policy under the New Style Administrative Agreement.

Promoting international cooperation
There must be clarity regarding the form of international cooperation involved in the energy research policy and the energy transition approach. At present it is not sufficiently clear in which areas cooperation as opposed to competition is being sought, nor is it clear what type of cooperation is needed within the various spearhead areas. The Councils recommend conducting a thorough analysis of current partnerships to help establish what kinds of new partnerships should be initiated and to stimulate and facilitate their formation.

Other suggestions
Finally, the Councils advocate the following courses of action: creating a better balance between how resources are made available and the number of transition routes, conducting an independent evaluation (possibly by a non-Dutch reviewer) of the prospects for the chosen transition routes for the Netherlands, expanding the range of possible experiments (not only technical), monitoring and evaluating the experiments, and learning from past experiences.

Intensifying the transition approach
The Councils believe that if the policy is not changed, the transition process is in danger of losing its character of renewal over the years and not expand to reach all sectors relevant for energy transition. There is also the danger that the intended reinforcement of national energy innovation will fail to occur, that the energy transition policy will gradually revert to the regular traditional energy policy and that Dutch businesses and other parties will not be able to profit sufficiently from the opportunities of energy innovation. The Councils therefore advocate intensification of the current transition approach as outlined in this advice, as well as a significant increase in financial means needed for the transition projects. The currently available sum for the transition approach of the Ministry of Economic Affairs, € 35 million spread over a total of several years, is no more than about 1% of the total means reserved for energy-related issues (approximately € 850 million in 2005). We must prevent this from being viewed – for example by multinationals – as a lack of commitment.

Hence the Councils wish to emphasize the importance of effective direction of the energy transition at a political level. The idea of a process of change over many years involving choices backed by long-term commitment is hardly compatible with the short-sightedness currently prevalent in politics and the alternating political attitudes and perspectives. Tackling energy transition can only have a chance of success and offer opportunities to Dutch industry and knowledge centres if these parties can count on total commitment from the government, which must demonstrate its reliability with a long-term, steadfast policy and process-based approach. There must be critical reflection on the tension between short-term political thinking and the demands made by the energy transition approach in terms of continuity, clarity and consistency. In the light of developments over the past thirty years, great gains now stand to be made.

13 CONCLUSIONS

The transition from the current harmful, inefficient and unsustainable energy system to a sustainable energy system requires a long process of change. In the Netherlands, the Ministry of Economic Affairs has taken the first steps towards such a transition. Its approach contains many commendable elements, but it will have to be expanded, intensified and structurally improved if it is to result in actual transition over the coming decades.

In the short term, a series of significant changes will have to be introduced, changes which often clash with current views and customs in the Dutch government:

1. The government must demonstrate its involvement as an active director of the energy transition process, fulfilling various roles; the energy transition must not be left to the market but must command the full involvement of government, the private sector, knowledge institutions and non-governmental organisations.
2. The transition process must be increasingly oriented towards similar developments in Europe and the world as a whole. To assist in this process, the Netherlands must not adopt a role of follower in the mid-field of the European Union, but must play an active role among the leading countries.
3. In order to allow the Dutch business sector to play a role in energy innovation, policy must be directed towards increasing the opportunities which energy transition presents for Dutch business and employment (strengthening the knowledge economy in accordance with the Lisbon objectives).
4. With regard to energy research and the development of energy innovations, the Netherlands must narrow down its choice of key areas. Energy innovation must shift its focus from cost-effectiveness in the research and developmental stage to a strategy of variation and selection, which must allow for a certain inevitable degree of waste of the invested resources (which could be considered an ‘apprenticeship fee’).
5. The development of energy innovations must see a shift from supply driven by technological knowledge (‘technology push’) to demand driven by the users of technology (‘demand-side pull’).
6. In order to secure the long-term commitment of the private sector and other parties to the transition process, the underlying government policy must cease to be dominated by short-term economic considerations, and must instead acquire a steadfast character geared towards the longer term.
7. As a result of historical developments, current investment of government resources in energy policy is inefficient and fragmented. This must be converted into a more streamlined system of investment, which is tailored to the needs of the energy transition so that more money can be invested in this process.
8. In the energy transition process, the government and politicians must renounce their risk-avoiding, controlling and short-term-oriented decision-making processes and embrace a new culture of learning, long-term decision-making and accountability.

The Councils consider these changes essential for the success of the energy transition. The government, and in particular the Minister of Economic Affairs, will have to take the necessary initiatives to intensify the attention given to the energy transition and to strengthen acceptance and understanding of what such a process entails.
The Councils have condensed the preceding remarks in the following main recommendations. Additionally, the advice itself contains a number of more detailed recommendations with regard to specific issues.

I. Use clear communication to show that the problem of an unsustainable energy economy is urgent yet manageable, and put energy transition high on the various agendas.

1. The government and politicians still fail to grasp the necessity and ramifications of a transition to a sustainable energy economy. Nor do they sufficiently recognize the economic opportunities such a transition offers. Although the population is largely aware of the necessity of change, as illustrated by a recent survey, efficient public relations work is needed to increase awareness and support. The Cabinet is called on to show strong leadership and communicate the sense of urgency towards energy transition and increase public awareness of the sense of opportunity such a transition presents.

   Recommendation 1: During the current term of office, the Minister of Economic Affairs launches a well-prepared, broad political debate about the necessity of energy transition and the opportunities it opens up.
   - All relevant parties (stakeholders) are involved in this process.
   - The debate will address the consequences of a 'wait and see' approach.
   - The debate must put energy transition high on the various agendas.
   - The debate should be reinforced by clear public relations work and education campaigns.

2. The energy transition must take shape on an international scale, with the European Union playing a leading role. The Netherlands must vigorously support this, not least on account of the related opportunities. International cooperation in this field must be intensified with a view to increasing effectiveness, using the opportunities presented and learning from each other's experiences. Cooperation will take various forms: within a UN framework, at EU level, in an OESO/IEA context, with forerunners and of a commercially oriented nature.

   Recommendation 2: Together with a number of like-minded countries, various members of government (the ministers of Economic Affairs; Housing, Spatial Planning and the Environment; Transport, Public Works and Water Management; Foreign Affairs) take the initiative to place the transition to a sustainable energy economy high on the agendas of EU and UN institutions.
   - The Netherlands must be actively involved alongside the leading countries.
   - The Netherlands must strengthen cooperation in this field, in particular in an EU context and with like-minded countries.
   - A way of achieving this could be an initiative on the part of the Minister of Economic Affairs to set up a Sustainable Energy Policy Review Group in the European Union.

3. In view of the long-term dimension and the large number of parties and (government) agencies involved, a long-term strategic plan is needed which sets out the main course of the transition policy and the related Dutch input at the three decisive levels of intervention. What is important is influencing international developments at 'landscape level', achieving change at national and European 'regime level' and facilitating actual energy innovations and their market launch at 'niche level'. At present, there is not enough focus on the need to influence landscape and regime levels. Important elements in the plan are: strengthening international cooperation, capitalising on opportunities at a national level, creating a level playing field for energy services, promoting research, development and demonstration and the market launch of energy innovations and facilitating knowledge exchange between providers and users of energy innovations.

Recommendation 3: As part of the next Energy Report, to be published in 2005, the Minister of Economic Affairs draws up a long-term strategic plan for the transition policy to be followed and the related Dutch input on the three levels of intervention.

- This plan must be a framework to which the private sector, the environmental movement and other players can all contribute.

II Tackle this problem with a specially designed two-track policy: a strong international orientation and an active national approach

4. The Dutch transition policy should essentially follow two paths: one with an intensified international approach, and the other with an active national approach. These two paths must be so designed as to strengthen each other, produce the necessary progress in the desired transition and at the same time encourage the national private sector to capitalize on the new opportunities.

   Recommendation 4: The Dutch transition policy must be based on two mutually supportive tracks: an intensified international approach and an active national approach.

   - When planning these two tracks, keep in mind options which draw on the comparative advantages of the Netherlands.
   - The Minister of Economic Affairs uses a SWOT analysis to draw up an inventory of the opportunities which energy transition offers Dutch business.

5. When stimulating energy innovations at niche level, variation and selection must be generously applied to achieve genuine innovation. This means that short-term cost effectiveness must not play a dominant role at the research and development stage, and that promising technological options must be given an adequate chance. The various avenues of solutions must be explored in innovative ways.
   In order to break 'lock-ins' and support market launch, use not only generic market-oriented instruments (such as tradable emission permits and levies) but also specific, tailored instruments to give new technology the time to become competitive. Such instruments must be applied with sufficient consistency and continuity.

   Recommendation 5: For the promotion of energy innovation, base transition policy on the mechanism of variation and selection.

   - Replace the current focus on short-term cost-effectiveness with a focus on opportunities and potential long-term contributions to energy transition and economic activity.
   - Set up the supporting instruments with the necessary consistency and continuity.

6. In energy research and energy transition, consistent choices must be made in order to obtain useful results with the available means and to best align with specific Dutch needs and opportunities. The current situation with five energy research themes (EOS) and five main paths for energy transition still lacks focus. There must be a more critical examination of what should take place in the Netherlands and what would be more successful in an international context.

   The following criteria are most important for the choices to be made: development potential of technology; expected contribution to a sustainable energy economy; the quality of researchers, developers and the market sector involved; and the possible contribution to economic activity and employment opportunities.

Recommendation 6: Narrow down the options which should be given special attention in the transition policy.

- Use the above criteria to do so.
- Promote a shift from the 'technology push' situation to a 'demand-side pull' situation.

III The transition process: convincing leadership, perseverance and improved investment

7. In view of the long-term cooperation between a large number of parties and the complexity of the energy transition process, a particular type of process direction is needed. Following on from former recommendations from the Councils on how to deal with complex processes of change, an Energy Transition Committee could be set up to decide on strategic matters, whereby high-ranking stakeholders in the process work out the strategy for energy transition and advise the government on how transition policy should be organized and developed. This committee would also have the task of giving strategic direction to the network of cooperating parties at the practical level, and of helping to overcome major obstacles to the process. It would also act as a clearing house to identify best practices and lessons from other countries and serve as an 'institutional memory bank' for the entire process. This committee should be retained over a long period of time.

   The government itself plays a special role in the process: as alternatives are lacking, an active, participating government is required to fill various roles: initiator, stimulator, facilitator, partner, negotiator, broker, regulator, supervisor, co-financier and launching customer. This requires the necessary skills and clever governance.

   Recommendation 7: To direct the energy transition process, a high-level Energy Transition Committee will be set up under the authority of the Minister of Economic Affairs.

   - It could be an option to let the Minister himself chair this committee, to give a clear identity to the leadership of the transition.
   - It is particularly important to avoid a situation whereby the committee becomes involved in the short-term decision-making process with regard to energy issues, although these will have to be incorporated into the overall long-term strategy.
   - The government takes measures to be able to fulfil the various roles in the process.

8. The right conditions will be needed for the transition process to progress well. They include above all good leadership, commitment, trust between parties and a suitable climate for taking decisions and assuming responsibility. These are not the conditions in today's situation. Steps must therefore be taken to demonstrate convincing leadership and commitment at the top of the Ministries involved and in other participating parties. Trust must be established by means of more consistent action and good public relations work and by coming up with results and learning lessons from the past and from other countries. There must also be periodic monitoring and evaluation on the basis of carefully chosen criteria. The process of taking decisions and making political bodies accountable must be accompanied by a move away from a risk-shunning, short-sighted culture. A more enterprising culture must develop instead, one which is willing to learn and work towards sustainable, long-term results. Not only the government departments, but also parliament must reflect on which methods would best achieve these aims.

   Recommendation 8: The Dutch government, especially the Minister of Economic Affairs and the State Secretary of Housing, Spatial Planning and the Environment, are

responsible for creating the adequate conditions under which the energy transition can take place.

- This means demonstrating strong leadership and commitment at the highest level.
- Initiatives must be introduced to build up trust between parties involved in this process.
- Political initiatives must also be taken to bring the decision-making process and the culture of accountability more in line with the nature of the process.

9. The energy transition requires heavy investment in the process itself, in innovations and in ways of replacing current production means, user machinery and infrastructure. In time, the sum required could amount to over € 4 billion per year on top of the 'normal' investment level. The government will have to defray part of the costs and ensure that good use is made of the existing energy-related money flows. As the transition projects will run over a period of many years and willingness to invest will have to be nurtured in other parties, a funding system will have to be devised which guarantees consistency and continuity and is not subject to fluctuations in the economic and political landscape. The possibility should be examined of using a portion of the natural gas profits, which flow into the Economic Structure Enhancement Fund (*Fonds Economische Structuurversterking*), by transferring them to an Energy Transition Fund.

   Recommendation 9: Further elaboration of the transition policy should involve analysing what financial implications and what benefits are expected over the next ten years, how a socially acceptable distribution of costs can be achieved, which instruments will be needed to achieve that, and how a form of project financing can be found which can earmark a significant portion of the resources contributed by the government and commit it for the necessary period of time.

   - In the short term, existing energy-related money flows must be pooled, streamlined and reorganized in accordance with the long-term character of the energy transition, whilst maintaining and increasing the currently available means.
   - At this stage, efforts should be concentrated more on RD&D and market launch than on large-scale marketing, depending on the technology involved.

IV Improve the organisation of the energy transition approach currently in use

10. The energy transition approach currently employed needs to be intensified, reinforced and expanded on a number of points so that it can evolve to become the transition process championed by the Councils.

    Recommendation 10: Strengthen the current transition approach by giving more attention to the process itself, by improving interdepartmental cooperation, by setting up experiments in the institutional field, by looking more closely at obstacles, by involving users more directly in the process, and by emphasising the element of learning.

    - The Minister of Economic Affairs is appointed as the coordinating government official for energy transition.
    - Give the process a long-term dimension.
    - In consultation with the Minister of Economic Affairs, members of the Ministries of Housing, Spatial Planning and the Environment; Transport, Public Works and Water Management; and Agriculture, Nature and Food Quality should be urged to set up a similar strategy for those aspects of energy transition which fall under their responsibility.
    - Give more attention to cleaner use of fossil fuels, especially CO_2 capture and storage, in the current approach.

- Start working on the aim of revitalising energy-saving policy by setting the target of 2% energy efficiency improvement per year.

APPENDIXES

APPENDIX 1:
ADVICE REQUEST

Translation of letter requesting an advice on energy transition

From: Minister of Economic Affairs (mr. L.J. Brinkhorst) and the State Secretary for Housing, Spatial Planning and the Environment (drs. P.L.B.A. van Geel)
To: Chairmen of the VROM Council and the General Energy Council

Date: 28 August 2003

Now that you have begun preparing the energy transition advice as part of your work programme, we hereby request that you address the following themes and questions in your advice.

The Dutch energy system is undergoing continual development. This development is partly autonomous and partly influenced by government policy. The aim of the government is to gradually establish a sustainable energy economy. Sustainable in this context is taken in its broadest sense to describe a system which is affordable, reliable and clean.

The required policy is already under way for the short term. Measures and incentives are already in place to promote the free-market process, the safeguarding of energy supplies, energy conservation, renewable energy and 'climate neutral' (fossil) energy carriers. While these measures and incentives are aimed at bringing about a sustainable energy economy, they do not cater for the longer term.

To give impetus to the creation of long-term sustainable energy economy the concept of transition management was introduced at the start of 2002. This concept is set out in the Fourth National Environmental Policy Plan (NMP4) as a method of tackling a number of the most difficult long-term environmental problems, based on the idea that the current policy approach was not yielding satisfactory results. Changes in the system will be necessary in the long-term, which will require the mobilisation of a large number of stakeholders.

More than has hitherto been the case with the current energy policy, the transition approach is characterized by its long-term aims, by an integral way of thinking aimed at *system* innovations and by the attempt to mobilize parties which could make a significant contribution to energy transition and incite them to make that contribution. The aim is to try and assimilate in the new approach the best elements of the 'traditional' policy for creating sustainable energy system.

This approach is currently being developed in four fields, namely:
- biomass;
- new gas;
- modernisation of energy chains;
- sustainable Rijnmond[5].

[5] Rijnmond is an industrial region close to Rotterdam.

A project has also been introduced to overhaul the existing policy. This involves indicating which demands the government has to meet in order to facilitate energy transition. These go far beyond the government's traditional financial instruments.

This year must see the formulation of strategic objectives for each sub-area to be met over a period of 20 years. Clear indications must be given as to which transition trajectories are most likely to lead to the realization of these objectives and experiments must be decided upon as the first step en route to fulfilling these goals.

It will thus be possible to reconcile the more distant visions of long-term sustainable energy system with the present situation by mobilising and calling on all stakeholders to join forces.

In the current stage of today's approach, the government's main role in this process is that of stimulator and director. This is no coincidence, for too central a role on the part of the government could easily conflict with the notion that change of such a long-term nature should come about within and on the initiative of society itself. On the other hand, it is unlikely that the government will be able to stand on the sidelines and watch as the first steps are taken towards a long-term energy transition. It is therefore logical that the government should be called on as a participant in the aforementioned experiments and as a designer of policy in the broadest possible sense, directed at stimulating energy transition.

Furthermore, the main aspects characterising the concept of transition management seem so self-evident that the question can be asked whether energy policy in its entirety should not be modelled along those lines. Its elaboration would, however, have to differentiate between stages in the policy cycle and position within the energy economy.

In the light of the previous points we would also request you to devote particular attention in your advice to the question of which roles the government can best play in the different types of system innovations and their various stages in order to guide development towards a sustainable energy system. How can self-management by the market best be stimulated? And how can the frameworks put in place by the government be designed to best conform to the need for being as flexible as possible when choosing strategic aims and the accompanying transition trajectories? In other words, how is the government to organize a "flexible response" (as an effective answer to blueprint-thinking)?

It is important to recognize that the development of the Dutch energy system and the possibilities for influencing it are largely conditioned by the international context. As well as looking at technological developments, opportunities and threats, comparative advantages and disadvantages and international energy and climate policy, the international context can also be analysed from the point of view of what we can learn from the approach to energy policy elsewhere and what chances international cooperation offers to strengthen the transition approach.

We therefore request that you devote due attention to the international context in your advice, with particular attention to the role of the EU.

One important aspect in an international context is the question of what form and content the post-Kyoto climate policy will assume and what repercussions the sustainable development policy will have following on from Johannesburg. Whichever possible scenario becomes reality, the question of how the development, diffusion and implementation of climate-friendly energy technology can be accelerated will be an inevitable component of such a scenario. It does not

seem likely that an adequate answer can be provided without forms of reinforced international cooperation. We would greatly welcome your views on this matter.

We would be very grateful to receive your advice by the end of April 2004 at the latest. This will enable us to incorporate your recommendations in our preparations of the Energy Report, which is due to be issued next year, and in our preparations of the second evaluation of the climate policy.

mr. L.J. Brinkhorst
Minister of Economic Affairs

drs. P.L.B.A. van Geel
State Secretary for Housing, Spatial Planning and the Environment

APPENDIX 2:
LIST OF ABBREVIATIONS

BANS	*Bestuursakkoord Nieuwe Stijl* (New Style Administrative Agreement)
ECN	*Energieonderzoek Centrum Nederland* (Energy Research Centre of the Netherlands)
EOS	*Energie Onderzoek Strategie* (Energy Research Strategy)
EU	European Union
GNP	Gross National Product
IAEA	International Atomic Energy Agency
NIMBY	Not In My Back Yard
OESO	*Organisatie voor Economische Samenwerking en Ontwikkeling* (Organisation for Economic Cooperation and Development)
PJ	Petajoule (10^{15} Joule)
PV	Photovoltaic energy
R&D	Research and Development
RD&D	Research, Development and Demonstration
RIVM	*Rijksinstituut voor Volksgezondheid en Milieu* (National Institute for Public Health and the Environment)
UN	United Nations
WEA	World Energy Assessment

APPENDIX 3:
BACKGROUND DOCUMENTS

Blok, K. and Beer, de, J. (2004) *Energietransitie en opties voor energie-efficiency verbetering,* Ecofys, Utrecht, The Netherlands.

Bruggink, J.J.C. (2004) *Energiescenario 's in relatie tot transitiebeleid, overzicht en evaluatie,* ECN, Petten, The Netherlands.

Chesshire, J. (2004) *An Evaluation of the European Context for a Transition Towards a Sustainable Energy System,* Sussex, United Kingdom.

Menkveld, M. et al. (2004) *Energietechnologieën in relatie tot transitiebeleid, Factsheets,* ECN, Petten, The Netherlands.

Turkenburg, W.C. (2004) *Energietransitie richting duurzaamheid:het technologisch perspectief,* VROM Council and General Energy Council, Den Haag, The Netherlands.

Verbong, G. (2004) *Biedt de energietransitie kansen voor de Nederlandse industrie?,* Stichting Historie der Techniek, Technische Universiteit Eindhoven, Eindhoven, The Netherlands.

These documents are available on the websites of the VROM Council (www.vromraad.nl) and the General Energy Council (www.energieraad.nl).

APPENDIX 4:
COMPOSITION OF THE COUNCILS

COMPOSITION OF THE GENERAL ENERGY COUNCIL*

ir. P.H. Vogtländer, chairman
Prof. Dr. J.C.J.M. van den Bergh
ir. M.E.E. Enthoven
mr. J.J. Heusdens
Prof. Dr. J.G. van der Linde
J.A. Jorritsma-van Oosten
drs. G.H.B. Verberg
Prof. Dr. *ir*. M.P.C. Weijnen
ir. W.K. Wiechers
Prof. *mr*. M.H. van der Woude

* Prof. Dr. *ir*. P. Vellinga was a member of the General Energy Council until the end of December 2003, after which he remained an active participant in the compilation of this advice.

Secretary of the General Energy Council
drs. B.J.M. Hanssen

COMPOSITION OF THE COUNCIL FOR HOUSING, SPATIAL PLANNING AND THE ENVIRONMENT

drs. F.H. van der Veen, chairman
mr. *drs*. L.C. Brinkman
H.M.C. Dwarshuis-van de Beek
Prof. Dr. R. van Engelsdorp Gastelaars
ir. J.J. de Graeff
Prof. Dr. W.A. Hafkamp
Prof. *mr*. J. de Jong
M.C. Meindertsma
drs. A.M.J. Rijckenberg
Prof. Dr. *ir*. I.S. Sariyildiz
Prof. Dr. *ir*. J. van der Schaar
ir. D. Sijmons
Prof. Dr. P. Tordoir
Prof. Dr. W.C. Turkenburg
drs. T.J. Wams

General secretary of the Council for Housing, Spatial Planning and the Environment
drs. A.F. van de Klundert

Observers of the Council for Housing, Spatial Planning and the Environment
mr. N.R. van Ravesteyn, on behalf of the Netherlands Institute for Spatial Research (*Ruimtelijk Planbureau*)
Dr. M.A.J. Kuijpers-Linde, on behalf of the Office for Environmental Assessment (*Milieu- en Natuurplanbureau*)
Dr. V. Veldheer, on behalf of the Social and Cultural Planning Office (*Sociaal en Cultureel Planbureau*)
drs. T.H. van Hoek, on behalf of the Central Planning Office (*Centraal Planbureau*)

The following members of the secretariat participated in this advice
ir. T.T. van der Werff, project leader for the Council for Housing, Spatial Planning and the Environment
ir. P.W. Broekharst, project leader for the General Energy Council
C.I.A. de Vries, project assistant for the Council for Housing, Spatial Planning and the Environment

The following persons also contributed to the preparation of this advice
drs. D.A. van der Hoeven, Daedalus Onderzoek & Advies
ir. J.P. van Soest, Advies voor Duurzaamheid

COLOPHON

Energy Transition: A Climate for New Opportunities
Joint advice by the Council for Housing, Spatial Planning and the Environment and the General Energy Council of the Netherlands
Abridged version

DESIGN
TelDesign, The Hague

This advice is available from the secretariats of the following organisations:

General Energy Council
Adelheidstraat 8
PO Box 11723
2502 AS The Hague
Telephone: +31 (0)70 392 40 01
Telefax: +31 (0)70 365 28 36
E-mail: info@energieraad.nl
Website: www.energieraad.nl

Council for Housing, Spatial Planning and the Environment
Oranjebuitensingel 6
PO Box 30949 – IPC 105
2500 GX The Hague
Telephone: +31 (0)70 339 15 05
Telefax: +31 (0)70 339 19 70
E-mail: vromraad@minvrom.nl
Website: www.vromraad.nl