Chapter 1

Towards a climate-neutral society

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Introduction

Human-induced climate change presents society with a long-term problem. The challenge is to find ways of reducing CO_2 emissions in the short term that also enable society to reach long-term goals. Over the last 20 years, it has become increasingly clear that human activities are adding to natural changes in the climate. The enhanced greenhouse effect caused by emissions of greenhouse gases related to human activities is a major factor in currently observed climate changes, as well as in climate change that is expected to occur in the coming centuries (IPCC, 2001a).

The long-term character of climate change (having an effect for up to several centuries) is one of the key features of the climate change problem. However, dealing with long-term problems is generally difficult for modern societies, in which political agendas and practices tend to focus on the next shareholders' meeting or election rather than on the needs of future generations. If we are to minimize the human contribution to climate change, society will have to move towards towards a 'future of low greenhouse gas emissions' or in a 'climate-neutral direction'.

If society wants to realize what we refer to in this book as a 'climate-neutral society' (i.e., a society that minimizes its negative impact on the climate system and its contribution to climate change), substantial reductions of up to 60–80 per cent (compared to the 1990 levels) in the greenhouse gas emissions of industrialized countries will have to be achieved before the end of the century. For Western societies, this implies a major shift in current and expected trends in emissions – emissions that are expected to rise in the absence of stringent sustainability and/or climate policies (IPCC, 2000; UNDP, 2000). Achieving such drastic reductions in emissions will be no mean task since societies – particularly Western societies – rely heavily on the availability of relatively cheap fossil fuels and the idea that the atmosphere is a free common good into which greenhouse gases can be emitted. As the Intergovernmental Panel on Climate Change (IPCC) states, 'the successful implementation of greenhouse gas mitigation options needs to overcome many technical, economic, political, cultural, social, behavioural and/or institutional barriers which prevent the full exploitation of the opportunities of these mitigation options' (IPCC, 2001c). 'In the industrialized countries,' continues the IPCC, 'future opportunities lie primarily in removing social and behavioural barriers' to these technical solutions. But what if merely removing barriers is not enough for realizing these drastic reductions? Perhaps societal 'trend breaks' (substantial shifts in societal developments) are also necessary if we are to achieve a climate-neutral society.

The overall objective of this book is to explore *the need for societal trend breaks to realize long-term substantive reductions in the emissions of greenhouse gases and to assess the prospects for realizing such trend breaks in society*.

This book analyses both the long-term prospects for and short-term implications of the transition towards a climate-neutral society from different perspectives. In so doing, climate change will be placed within the wider context of sustainable development. The basic premise is that given the current situation in climate-change policy and the direction we may have to take in order to realize a climate-neutral society, it will probably also be necessary to change several social trends in a climate-friendly direction – as a pre-condition for decreasing emissions.

In this book, The Netherlands serves as a case study for questions and problems of a similar nature that will arise in other industrialized countries as they are confronted with the challenge of developing long-term domestic climate policies. The main focus of the book is the reduction of greenhouse gas emissions and the possibilities for domestic action within The Netherlands. The impact of climate change on humans and nature is outside the scope of this book, as are possible adaptation strategies.

Some chapters discuss the Dutch situation; other chapters reflect the debate in The Netherlands on strategies that in principle are also relevant for other countries. It is clear that besides domestic action, the so-called flexible or Kyoto Mechanisms (joint implementation, clean development mechanism and emission trading) will play an important role in future reduction strategies. With these instruments, international flexibility is introduced within climate policies, to achieve cost-effective emission reductions. The portfolio of climate policies will always consist of both domestic options and the use of the Kyoto Mechanisms. But given the focus on domestic strategies within The Netherlands, the discussion of the Kyoto Mechanisms will be limited in this book.

Much of the research presented in this book was carried out as part of the Dutch National Research Programme on Global Air Pollution and Climate Change, a strategic research programme in The Netherlands that aims to contribute to the development of long-term climate-change policies. This book is an effort to bring together some of the results of this programme in a coherent framework.

The necessity of a climate-neutral society: long-term challenges

Internationally, there is a growing acknowledgement of the need to achieve emission reductions beyond what is agreed upon in the Kyoto Protocol and of the challenges involved in doing so. This awareness arises from a growing body of scientific evidence, which shows the human influence on the climate. The most recent IPCC report (IPCC, 2001a), for instance, states that there is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities. The result of this anthropogenic climate change is that society is now forced to reduce its emissions of greenhouse gases into the atmosphere. The United Nations Framework Convention on Climate Change (UN FCCC) states that the world has *'to stabilize the greenhouse gas concentrations in the atmosphere at a level*

that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner' (UN FCCC, art. 2).

What is regarded as a desirable level is ultimately the outcome of a societal and political decision-making process. In Figure 1.1, reasons for concern about future temperature changes are given, based on research on the impact of climate change (IPCC, 2001b).

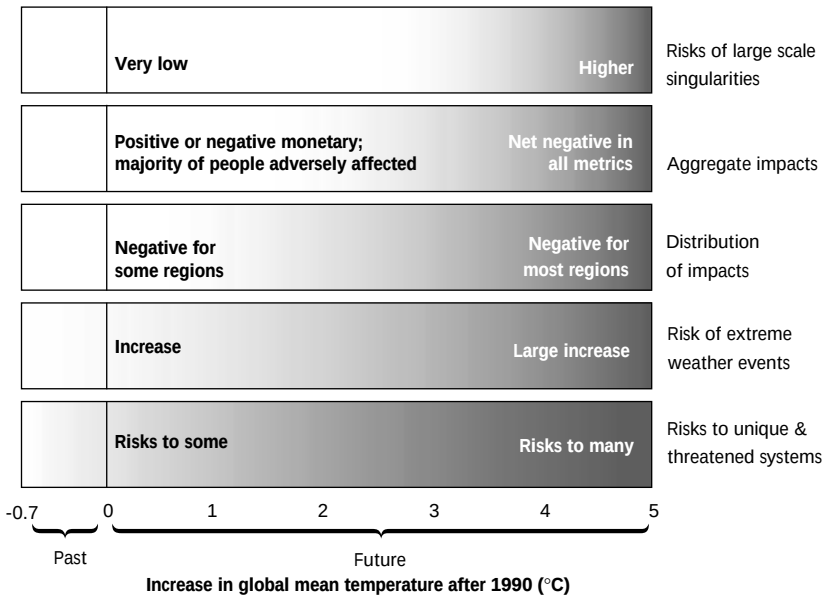

Figure 1.1 *Reasons for concern about the expected consequences of climate change (IPCC, 2001b)*

Ultimately, to achieve a climate-neutral society, the concentrations of greenhouse gases in the atmosphere will have to be stabilized at a new equilibrium, where natural uptake by the oceans and biosphere equals global emissions. This implies that global emissions will have to be cut by half (compared to 1990 emission levels). Historically, industrialized countries have caused most of the observed increases in greenhouse gas concentrations in the atmosphere. Taking equity considerations into account, one could argue that the industrialized world has to make the greatest reductions in future emissions in order to leave 'space' (in greenhouse terms) for development in the South.

Based on several points of departure, such as the maximum allowable temperature change per decade, The Netherlands and the European Union have stated that the concentrations of greenhouse gases should be stabilized before the end of the 21st century at a level well below twice the pre-industrial level. The number of 450 parts per million of volume (ppmv)[1] is often used to quantify a desirable

[1] The pre-industrial level of CO_2 concentrations was 280 ppmv and the level in 2000 was 368 ppmv.

level of CO_2 emissions. The absolute reduction in emissions necessary to realize this level (or any other level) depends on how the world develops. IPCC (2000) devised four future worlds or storylines and, subsequently, six emission scenarios, which reflect different developments in population, economy, energy, technology and land use. These so-called *SRES* scenarios are a combination of global versus regional orientations and an economic versus an environmental orientation. Figure 1.2 shows the different baselines (solid line) and emission-reduction profiles (dotted line) of the world greenhouse gas emissions up to the year 2100 that realize a stabilization level of 450 ppmv CO_2 in the four future worlds of the IPCC SRES scenarios.

The long-term climate challenge for industrialized countries is to transform their carbon-intensive industrial society into a climate-neutral society, and at the same time work with the South in implementing sustainable development there while avoiding large-scale emissions during their economic 'take-off'. The transition towards a climate-neutral society may seem a daunting task, but it is not beyond the bounds of possibility. Chapter 2 of this book presents two visions of how an 80 per cent reduction in emissions (compared to 1990 levels) can be achieved by 2050 in The Netherlands' energy system. The main building blocks of the solutions applied in these two visions are improvements in efficiency, the introduction of sustainable energy sources, reduction of energy demands and CO_2 storage. The two visions are based on the future worlds in the IPCC SRES scenarios A2 and B1 and employ different sets of measures and technologies. They are

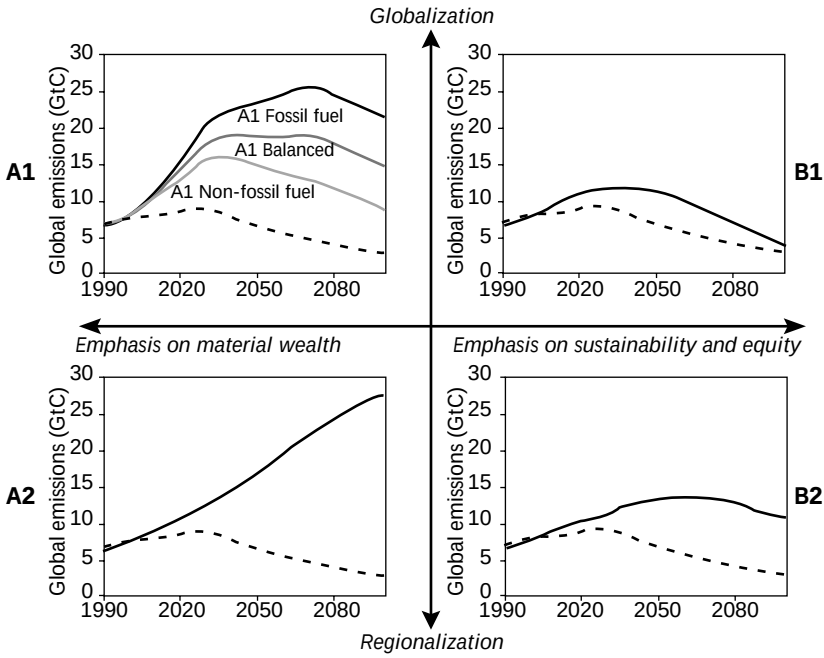

Figure 1.2 *Emission profiles (dotted lines) needed to achieve stabilization at 450 ppmv for the different IPCC scenarios (solid lines). Based on analysis with the RIVM FAIR model (Berk et al., 2001)*

meant to sketch a spectrum of directions that might lead to the development of a climate-neutral society. In this respect, Chapter 2 provides the reader with a starting point for considering possible technological routes of dealing with the long-term challenges of domestic climate-change policies.

Current climate-change policies

In the context of this book, the current policies on climate change and the short-term dimensions of long-term routes to emission reductions are also important. The current situation is basically the ground on which innovations have to flourish and emission trends have to be reversed if the desired long-term goals are to be realized. It is clear that achieving the short-term climate targets is already proving extremely difficult. In industrialized countries, domestic action has so far not produced very impressive reduction figures. And where trend breaks in emissions have been achieved, this has been the result of unexpected developments (German reunification) or other policy goals, such as the closure of British coal mines, which have not been directly related to climate change. A gap between desires and reality can also be clearly observed in The Netherlands (see Box 1.1).

Chapter 3 of this book evaluates the current societal support in The Netherlands for climate-change policies and the actual behaviour of various actors, such as businesses, citizens and local policymakers. It explores whether, and if so how, climate-change issues play a role in the decision-making behaviour of societal actors. If, over the coming decades, we are going to realize the long-term levels of stabilization as described above, the current situation will have to change. Chapter 3 concludes with seven dilemmas that actors in society may currently face (to differing degrees) when dealing with climate change.

An important issue in taking action is the variety of perceptions that exist in society about reducing emissions. At one extreme, there is the position that solving the climate problem will have major ramifications and that it will bring industrialized societies to the brink of economic collapse. At the other extreme, the position is that there are many solutions for dealing with the climate problem and that solving the problem is indeed affordable without major economic sacrifices - and there will even be benefits.

In this discussion, it is interesting to note that over the last 20 years, the final energy costs (as a percentage of GNP) for countries that are members of the Organization for Economic Co-operation and Development (OECD) have more than halved and are now in the order of 6-7 per cent of GNP (Blok, 2000). For The Netherlands, it has been calculated that although the costs for reducing CO_2 emissions will increase drastically in absolute terms, the relative costs will only rise slightly (but will stay below 2 per cent GNP) so long as the Dutch GNP continues to rise (Bezinningsgroep Energiebeleid, 2000). IPCC (2001c) comes up with similar numbers for the costs of reaching the Kyoto targets in industrialized countries, but it also points to the fact that lower stabilization levels will lead to higher costs. Since the share of energy in GNP as a whole apparently declines and the economic consequences of climate policies remain limited, one may conclude that this should offer opportunities for developing long-term policies on climate change

Box 1.1

CO_2 targets in policy documents in The Netherlands and international developments

Year	Target
1988	Toronto target: reduction of CO_2 emissions by 20% of 1988 levels by the year 2005 as an initial global goal.
1989	National Environmental Policy Plan (NEPP): short-term target of stabilization of CO_2 emissions in 2000, based on 1990 level; long-term target of stabilizing global emissions on a level that can be maintained by oceans and biosphere
1990	After the change in government, the new government presents a stricter version of the NEPP in the form of NEPP-plus: stabilization of CO_2 emissions by 1994-1995 and a new target for 2000, i.e., reduction of CO_2 emissions by 3% in 2000, compared to 1990 levels, and a possible reduction of CO_2 emissions by 5% in 2000, compared to 1990 levels, if international developments allow, and based on decisions made in 1995.
1990	The Netherlands states that together with other countries, they will research the Toronto target as an option for more drastic climate policy. It is clear that this will go beyond no-regret policies (Memorandum on Climate Change).
1993	Second National Environmental Policy Plan: reduce CO_2 by 3% in 2000, compared to 1990 levels, and if international developments allow (and based on decision making in 1995), a possible reduction of CO_2 emissions – by 5% in 2000, compared to 1990 levels (NEPP-II).
1995	Given the slow international progress and the difficulties of realizing reductions domestically, the government maintains its -3% CO_2 target but will not go for -5% (Letter to Parliament about CO_2).
1996	A goal of post-2000 stabilization of CO_2 emissions within The Netherlands of at least -3%, compared to 1990 levels, if international conditions allow (2nd Memorandum on Climate Change). Further reductions of greenhouse gases after 2000 by 1%-2% per year in industrialized countries.
1997	EU target of -15% and Dutch target of -10% in CO_2 emissions as part of EU burden-sharing agreement before Kyoto.
1997	At Kyoto, the introduction of a basket approach of 6 greenhouse gases, international flexibility through Joint Implementation, Clean Development Mechanisms and Emission Trading and inclusion of sinks. Worldwide reduction of –5.2% in period 2008-2012.
1998	Dutch target as part of the EU burden-sharing agreement: -6% between 2008-2012, compared to 1990 levels, and for the EU as a whole, -8% for all greenhouse gases.
1999	The Netherlands is one of the first industrialized countries to publish an implementation plan aimed at achieving its Kyoto targets (Memorandum on Implementation of Climate Change Policies).
2001	The Fourth National Environmental Policy Plan looks 30 years ahead and considers the transition towards a sustainable energy system crucial for dealing with the climate problem.
2001	At COP-6 bis in Bonn, a political agreement is reached about the rules of the Kyoto Protocol. This deal is made after earlier unsuccessful negotiations at COP-6 in The Hague (November 2000).
2001	At COP-7 in Marrakech, the COP-6 bis deal is finalized and put into legal language. This should make ratification of the Kyoto Protocol possible before the Earth Summit in Johannesburg in 2002.

Box 1.2

Some key figures about The Netherlands

- Population 2001: 16 million
- Number of households 2001: 6.9 million with a stronger increase in number of households than in population (2001: 2.4 million 1-person households)
- Population density is high: in 2001 472 inhabitants per square km on average, with about 1000 inhabitants per square km in the so-called Randstad (Western part of The Netherlands)
- The political culture is characterized as the 'Poldermodel', a culture that emphasizes dialogue and collaboration between different societal interests in developing new policies. Polder refers to the low parts of the country, which are vulnerable to flooding, areas that traditionally require a high level of collaboration to keep them safe for their inhabitants. This approach has been criticized for its alleged slow process of decision making.
- The economy of The Netherlands is very open. It is a net exporter. This is because of its geographical position and the port of Rotterdam, as well as large, well developed and well accessible neighbouring countries upstream of the main rivers. Industry and agriculture export a relatively large proportion of their production.
- The economic growth of The Netherlands GNP over the period 1990-2000 averaged 3.5% per year. Energy use in that period increased approximately 1% per year.
- In The Netherlands added value is mainly created in the trade, services and public sector (65.9%) and in industry (16.3%). Agriculture contributes with 2.4% and energy supply with 1.9%.
- Imports and exports in The Netherlands are still growing, resulting in an increase of transport of goods and services and a subsequent increase in the pressure on the environment.
- The emissions of all six greenhouse gases increased about 8% between 1990 and 1998. The target for the first budget period is to reduce emissions by 6%, compared to 1990 levels.

Source: RIVM (2001), RIVM/CBS (2001).

and for achieving targets. But even this seemingly favourable situation has not led to a reduction of emissions in The Netherlands over the last 10 years.

Achieving trend breaks: some historical examples

In light of the current inability to meet either the agreed-upon short-term targets for reducing emissions or even modest targets, it would appear that the long-term goals for drastic reductions in greenhouse gas emissions are extremely ambitious. If minor reductions are already proving difficult in the short term, will major transitions be achievable in the long run? It may be tempting to think of many relatively easy small steps (annual 1-2 per cent CO_2 reduction) leading to an 80 per cent reduction in 50 years. But the annual growth in the economy must also be considered, since it is directly linked to increasing emissions of greenhouse gases. Radical innovations are therefore necessary - innovations that will require changes in many domains in society.

In implementing the technologies necessary to achieve a climate-neutral society, government and businesses will face many obstacles because technologies will have to compete with established practices and technological trajectories. One should be aware that changes in the order of magnitude discussed here cannot result from central government directives. In the first place, in our modern Western societies, the span of control of national government is diminishing. In the second place, one also has to acknowledge that the type of transitions we discuss in this book are society-wide changes that to a large extent depend on a multitude of diffuse and independent decisions made by individuals, businesses and other societal institutions. Some speak of the *network society* (Castells, 1996: 243-307). It should be noted that these decision makers have not previously included energy, climate or the environment in their considerations and daily routines and have in many cases not been expected to do so. Achieving significant society-wide changes in greenhouse gas emissions over a period of several decades may imply that 'powerless states' have to take up a stronger role in this network society and its liberalized markets. But governments may no longer be able to exert the influence needed.

Will our modern society be able to deal with the ambitious targets that have been set? It may be tempting to say *no*, but targets that appear too ambitious should not put us off. History provides many examples of radical changes that were made in relatively short periods of time (some even within a few years or a few decades). Environmental policies set goals for drastic changes, including the need for major investments and ongoing innovations to make emission reductions feasible. In 1970, The Netherlands launched a 20-year programme to reduce water pollution, calling for a 60 per cent reduction in pollutants. The Netherlands seems to have a tradition of setting ambitious medium- and long-term targets. In 1989, the first National Environmental Policy Plan in The Netherlands contained a series of targets aimed at reducing a large number of emissions by 70 to 90 per cent within 20 years. More recently, in 1997, the Dutch Minister of the Environment stated that environmental impact per unit of consumption should be reduced by a factor of four in 25 years. Results from the third example can of course not yet be given, but the 60 per cent reduction in water pollution was achieved almost within the allotted time (Vermeulen et al., 1994). The second example refers to 73 industrial emissions to water and air, all with reduction targets in the range of 50–90 per cent for the period 1985–2000. By 1996, 51 of them had already been achieved. It appeared that another 11 would be achieved in 2000, but the remaining 11 emissions (including CO_2) turned out to be problematic (Ministerie van VROM and VNO/NCW, 1998).

An impressive example of rapid change can be found in the national energy infrastructure of The Netherlands. This transition demonstrates the need for simultaneous institutional and socio-cultural changes alongside technological developments. The Netherlands' energy infrastructure changed from mostly coal-based energy production to gas-based in the mid-1960s. This is an interesting example of a managed transition. It reveals powerful co-operation between business and state, carefully planned over a short period, implemented at the same overwhelming pace and building on the experience and expertise of a few actors in society. Within barely 10 years of the discovery of large supplies of natural gas in

Box 1.3

A short history of the 1960s gas revolution in The Netherlands

'Large scale transitions cannot be organized.' This statement no longer holds true after the gas revolution in The Netherlands in the 1960s. Within barely 10 years of the discovery of large supplies of natural gas, the Dutch energy infrastructure was completely turned around.

The transition was impressive. The change households were just starting to make from coal-based to oil-based heating was completely overtaken by the transition to natural gas. Within five years the market for domestic heating appliances had completely converted to gas-based heating. In 1963, only 10 per cent of all new dwellings had central heating. Five years later it was 80 per cent. All 5 million domestic gas stoves (fuelled by gas from local gas factories) had to be converted or replaced. This involved 5000 different types of appliances. In an operation of almost military precision, 1.7 million appliances were replaced by new ones and 3.3 million were converted. Figure 1.3 shows the rapid transition in the market for new cooking appliances.

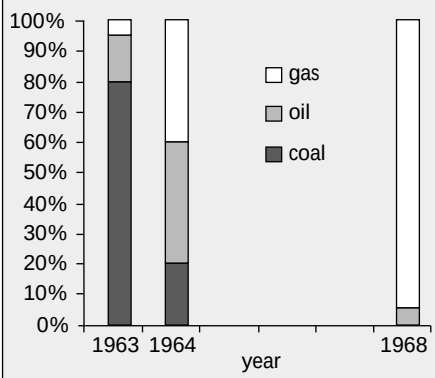

Figure 1.3 *Transition in sales of stoves*

During the 1950s, the Dutch economy and households were largely fuelled with coal, oil and gas from local gas factories using coal and some peat. In 1948-1950, the first natural gas supplies were discovered in the north of The Netherlands by NAM, an oil extraction company jointly owned by Shell and Esso. At first they were not at all interested: gas was considered an annoying by-product of oil extraction and was sold to local gas companies. The situation changed drastically after tremendous new discoveries in 1959. NAM initially kept it silent for more than a year, until a Belgian member of the European parliament revealed it in October 1960.

This was the start of a very rapid chain of events. The market parties involved realized they could earn substantial revenues from these gas reserves, as could the Dutch government. As a result, a large-scale transition was made in the traditional energy infrastructure to a gas-dominated infrastructure.

A central planning approach was used, with close co-operation between a small number of large market actors and the national government. This planning approach included re-institutionalization, orchestration of the phasing out of coal stoves and conversion of gas stoves, establishing prices and addressing socio-economic side effects.

The high pace of the transition was remarkable. Natural gas was discovered in the country in July 1959, but it was only made public in October 1960. Esso completed its major implementation plan in December 1960 and secured agreement on it with its NAM partners in March 1961, before submitting it to the Dutch Minister of Economic Affairs. The subsequent NAM-government negotiations lasted until mid-1962. In July 1962, a mem-

Box 1.3 continued

orandum was sent to the Dutch parliament. It was accepted in October 1962. The transition to natural gas required a national-level institutional structure, in contrast to the existing, locally oriented institutions. In April 1963, the national government established a national organization, the Gasunie, as the nationwide distributor. From that moment on, implementation could start, resulting in a complete transition within five years.

Initially, the Esso parent company in the USA did not recognize the opportunities. However, in 1960, they saw the situation in The Netherlands as a chance to reduce the role of the pipeline companies, which was something they had just missed in the USA. Getting a foothold in this market would only be possible if the enormous costs of establishing the pipeline infrastructure could be covered. That required complete and rapid conversion of all Dutch households to heating and cooking with natural gas. Esso's partner, Royal Shell, first reacted sceptically, but soon followed suit. In 1962, Esso issued a report that identified many institutional, socio-economic, social and psychological barriers.

Institutional barriers

Gas supply was organized at the local level. This was the start of inter-municipal co-operation. Provinces were trying to assume a co-ordinating role in the local gas markets. After the Esso report, the national government intervened with the establishment of the Gasunie.

Prices were not set in a free market; they were artificially set through negotiations amongst the tradition local gas producers, national government and Esso and Shell. Market prices for traditional energy resources served as a guide. This resulted in a regressive price system, allowing financial stimuli for conversion and replacement of stoves and heating systems. Distributors paid 20 per cent of the conversion costs. Replacement allowances were high.

Technical barriers

There were technical barriers to be addressed: all gas appliances had to be converted because the natural gas had a higher caloric value than the manufactured gas. Some municipal gas companies, which were in charge of certifying appliances, set requirements that were too stringent, thus hindering the diffusion of new appliances.

Social barriers

Of course such a change in the energy infrastructure raised public resistance. An entire sector – mostly small local enterprises in the coal and oil retail sector – would lose their market. Some of them were offered jobs in the conversion programmes or in other programmes. Fitters also resisted, partly due to a lack of knowledge, but also because installing new gas appliances was more expensive, giving them smaller margins. At first, small-scale industries didn't convert because of unfavourable costs; however, this changed after 1970 when their gas price was no longer linked to the price of fuel oil.

The transition was accompanied with a marketing campaign that was impressive for the time. All kinds of information campaigns were used: stickpins, village parties at the moment the village was connected to the natural gas grid, advertising in newspapers and, after 1968, also on television. Selling points such as comfort, health and logistic advantages were intensively communicated.

Source: Schot, J.W. et al. (eds.), 2000.

the country, the Dutch energy infrastructure was completely turned around. Yet it is doubtful whether a comparable programme could be implemented today (see Box 1.3).

The cleaning up of Dutch waters mentioned earlier also involved comparable institutional changes. Reducing water pollution required the development of new technologies, but even more, it required institutional changes within government agencies. The existing structures and institutions were re-shaped during this process from small-scale organizations with a single objective, strongly oriented towards agricultural needs, to multi-purpose, more democratic organizations.

A third historical example also illustrates the possibilities and mechanisms of socio-cultural change. Smoking behaviour has changed considerably in many Western countries. In The Netherlands, the transition mainly took place between 1970 and 1988, when the number of smokers declined from 60 per cent of the population to 33 per cent, a level that has remained stable since then. In addition to increased taxation, the government used information campaigns stressing the effect of smoking on health. In her study about 'the status of voluntary moderation', Aarts (1998) described this as an example of the 'trickle-down effect' where high-status groups may adopt forms of self-restraint and voluntary moderation as a way of distinguishing themselves from other groups in society. These other groups may then follow the behaviour of the higher-status groups (Aarts, 1998: 73, 282). One might expect such mechanisms to be helpful in changing culture, but Aarts is rather pessimistic about this because essential features for far-reaching cultural change are absent (Aarts, 1998).

One lesson to be learned from these examples is that in elaborating the possible paths towards a drastic reduction of greenhouse gas emissions, the establishment of technological scenarios is merely a first step. Trend breaks and transitions are always a co-ordinated development of changes in technology, the economy and society (De Vries, 1994: 296; Jansen, 1994: 499). Most of the chapters in this book address developments in society and focus on structural, institutional and cultural barriers to achieving a climate-neutral society, along with the co-evolution of technology and society to reach this goal.

Using the concept of trends, trend breaks and transition management

In the previous sections, we used the term 'trend break' and we will continue to do so, but it requires some explanation, as does the use of the terms 'transitions' and 'transition management'. This vocabulary springs from Dutch literature on long-term environmental policy-making (see Box 1.4). It is useful to elucidate some of the discussions on these concepts and the theory of 'trend breaks' and transitions.

In order to realize drastic reductions in CO_2 emissions, societal trend breaks will take place against the background of dominant, almost autonomous, societal developments, such as individualization, demographic trends, internationalization and rapid technological developments (especially in information and communication technology and services) (see Box 1.5). Technological innovations may allow for reduced levels of CO_2 emissions, but one also has to take into account the existence of rebound effects. This is the phenomenon of increased consumption of a service (e.g., lighting or transportation) when the variable cost for that service

Box 1.4

Definitions

In this book, we use, rather loosely, a number of closely related concepts such as *trends, trend breaks* (shifts in trends), *transitions, innovations* and *transition management*.

Trend is defined as a gradual change in a particular observed variable, which originates from other, possibly interrelated, developments in society, is constructed from human actions, persists for a long time and covers a certain domain (Slob et al., 1999).

The term *trend break* is not used in English. It is a direct translation of the Dutch word *trendbreuk*. *Breuk* can be interpreted as 'discontinuity' and is closely connected to the idea of 'shifts in trends' or 'radical changes' (De Vries, 1994). A *trend break*, therefore, is a change in a current trend that persists for a long period of time and covers a certain domain. An appealing element in the Dutch meaning of *trend break* is the sense of urgency it implies, which we consider relevant in the context of climate change.

Transitions are defined by Rotmans et al. (2000) as long-term, gradual, continuous processes of structural societal change. Transitions take place through mutually reinforcing and counteracting developments in technological, economic, ecological and socio-cultural domains. Transitions, according to Rotmans et al., should be distinguished from trend breaks and *innovations*, which they consider to be developments in a specific domain that can contribute to the transition process. In their view, the transformation of the current society into a climate-neutral society can be defined as a *transition process*, because it implies a system *innovation* (as opposed to optimization). The transition to a climate-neutral society can also be seen as a collection of breaks with current trends. *Transition management* is an approach designed to deliver an active contribution to the shaping of transitions.

decreases following an attempt to reduce energy use/emissions through an investment (such as a low-energy lamp or a fuel-efficient heater).

The concept of trend breaks will be used in two ways throughout this book. Trend breaks can be used first of all in a *normative way* to express necessary changes. In this book, the trend breaks required to achieve a climate-neutral society are identified. And second, the concept of trend breaks can be used to *analyse constraints and opportunities* in the transition towards a climate-neutral society. The emphasis in this book will be on this second way of using the concept. We argue with De Vries that it would be rather naive to think that we can 'break' trends if they go against underlying dynamic forces (De Vries, 1994: 295-303). Provoking trend breaks implies identifying such underlying forces and managing simultaneous changes in technology, culture and social and institutional structures to shift the direction of societal developments.

To explore new directions for society (such as the transition to a climate-neutral society) a method called 'back-casting' can be applied. 'Back-casting' can be defined as a participatory method that explores the innovations necessary to realizing a collectively formulated picture of a sustainable future in the long term (Jansen, 1994: 502; Weaver et al., 2000: 121; Jansen, 2000: 173-180). Or, as Robinson (1990) states, 'the major distinguishing characteristic of backcasting

Box 1.5

Examples of dominant societal trends

	Most important trends	Positive environmental effect	Negative environmental effect
NL in international economy	Large, stable share of EU in international trade Growing importance of transport and services	Services have relatively small impact	Increasing emissions due to transport
Technology	In some fields, NL is behind in R&D and new technology		Delayed upgrading: insufficient decrease in environmental pressure per unit of added value
Demography	Increasing age of population Increasing number of immigrants More and smaller households		Higher energy consumption due to smaller households
Lifestyle and preferences	Individualization Risk avoidance Increasing ownership of durable commodities Increasing mobility Housing preferences: suburban or city centres, one-family dwellings Increasing leisure time spent abroad	Possibly green consumption pattern Increasing use of space for housing and traffic	Strong growth in household use of energy and materials
Institution/ government role	Liberalization New forms of business-government co-operation Increasing role of EU	Phasing out of support schemes for certain hazardous activities Increased efficiency in use of energy and resources caused by market stimuli	Focus on short-term revenues Loss of direct influence on relevant decisions in former public sector
Labour market	Shortage of educated personnel Increase of flexible work Increase of part-time work Rising levels of education Increasing participation of women Concentration in centre, west and south of NL	Increased working at home (less traffic)	More use of space and appliances per labourer

Source: Felsö et al. (1999), Nijkamp en Verbruggen (2001), Slob et al. (1999).

analysis is a concern, not with what futures are likely to happen, but how a desirable future can be attained.'

In this approach, back-casting always includes focusing on opportunities and constraints. In this book, images of possible futures (such as those described in Chapter 2) are used in identifying barriers and opportunities for innovation and diffusion, relevant interests, roles and responsibilities, and economic and administrative institutions that will need to be reshaped in order to achieve the long-term target of an 80 per cent reduction in the emission of greenhouse gases.

The next question that arises is how to realize the necessary trend breaks and orchestrate the transition towards a climate-neutral society. In the context of the societal trend breaks necessary for successful development and implementation of the technologies required for a climate-neutral society, it would be wise to open the window of opportunity as wide as possible (Rotmans et al., 2000: 71). In a recent contribution to the debate on long-term policies, Rotmans et al. apply the concept of 'transition management', stating that it should be characterized by the following:

- long-term perspectives as a framework for assessing short-term policy;
- reasoning in terms of multiple domains and various actors;
- governance based on learning processes;
- aiming at system innovation and improvements;
- keeping ranges of opportunities open (a broad playing field).

They predict that a drastic transition in the energy system will take at least two generations, based partly on a retrospective analysis of historical transitions from wind to steam (in the 19th century) and from coal to electricity (in the early 20th century). In Chapter 4, possible ways to orchestrate this transition will be analysed and discussed in detail.

The structure of this book

Chapter 2 presents two long-term visions of a climate-neutral energy system in The Netherlands. It looks at the window of opportunity and shows that there are a number of technically feasible ways to realize drastic emission reductions. At the same time, it is well known that climate change is a tough problem to deal with and that the results of current policies have been relatively meagre. Chapter 3 goes on to identify a number of dilemmas that play a role in current climate-change policies. These dilemmas are elaborated in the light of desired long-term developments. Chapters 2 and 3 together illustrate a sharp contrast between the problematic current situation and the substantive targets that need to be achieved over time. The question, then, is how to realize trend breaks and orchestrate the transition towards a climate-neutral societal. Chapter 4 looks at the governance of technological change and innovation.

Chapters 2, 3, and 4 together form the basis on which the authors of the subsequent chapters have written their analysis about the transition towards a climate-neutral society. As a whole, the book provides the reader with an analysis of

prospects of long-term climate policies, short-term issues, the societal trend breaks needed to realize substantive emission reductions and possible ways to realize these trend breaks. However, this book can't provide a complete picture of all relevant elements of such a transition. There are many relevant issues that are beyond the scope of this book, such as the role of business and other new technologies such as genetic engineering, to mention just two.

Chapter 5 analyses households, behaviour and consumption patterns. It assesses future opportunities for drastic changes that would lead to more environmentally sound energy consumption by households and discusses constraints to changes in behaviour. In Chapter 6, the role of local authorities in the transition to a climate-neutral society is discussed. Chapter 7 takes the perspective of materials management as a breakthrough technology for reducing greenhouse gas emissions. In Chapter 8, the contribution that information and communication technology (ICT) (as another breakthrough technology) can make to the transition is discussed and some of the pitfalls related to ICT are identified. Chapters 9 and 10 then take more of a governance perspective. In Chapter 9 the economic preconditions for drastic emission reductions are examined, along with the possibilities of emission trading. Two forms of trading are analysed from a policy lock-in perspective. In Chapter 10 the legal possibilities of achieving long-term reductions are analysed. Chapter 11 presents a stakeholder perspective on long-term reductions, based on the results of an 18-month dialogue in The Netherlands about drastic emission reductions in the long term. The visions presented in Chapter 2 form the starting point for this dialogue. Chapter 12 is a concluding chapter by the editors.

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