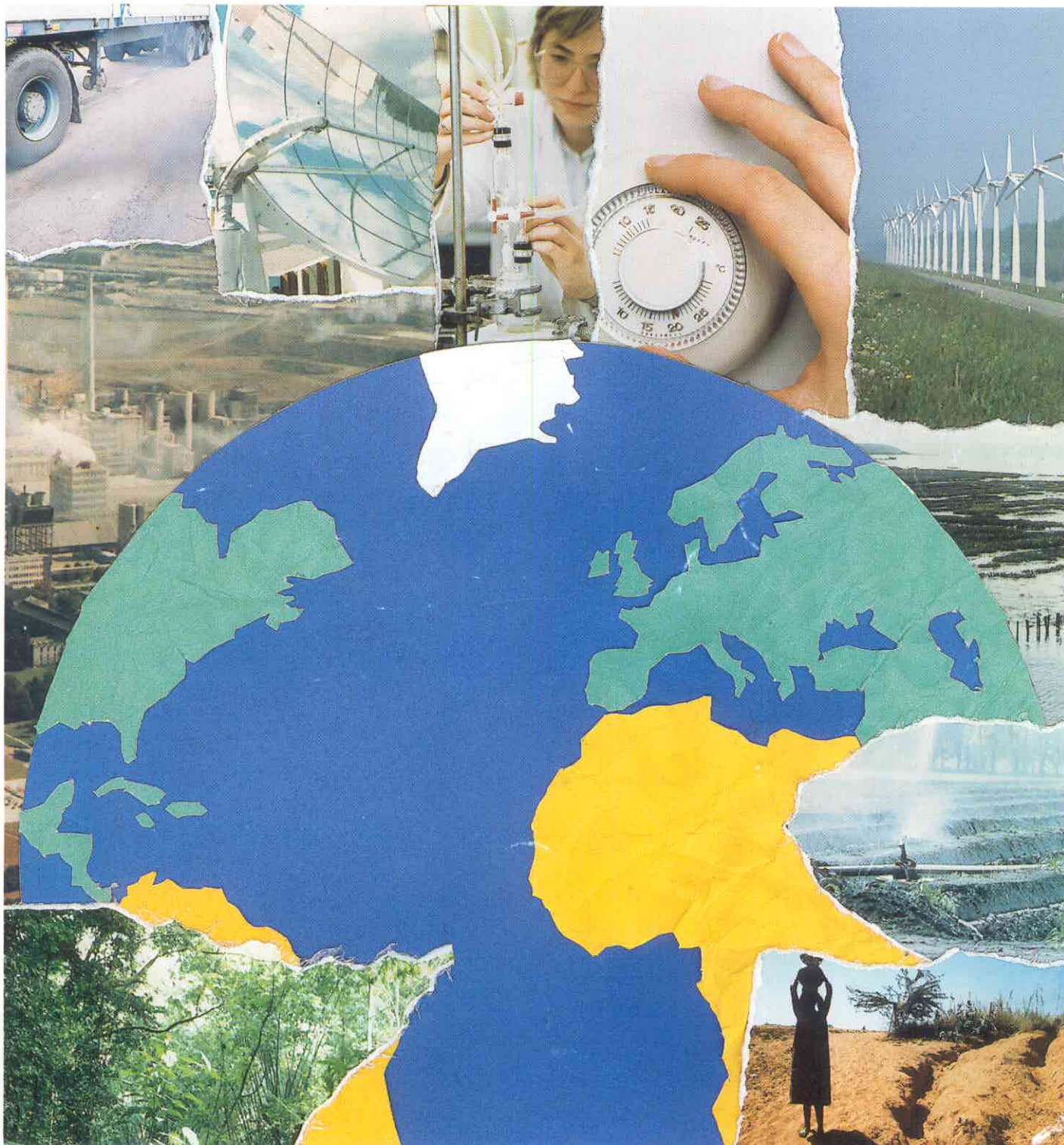
Netherlands' National Communication on Climate Change Policies



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NETHERLANDS' NATIONAL COMMUNICATION ON CLIMATE CHANGE POLICIES

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of the Parties under the Framework
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EXECUTIVE SUMMARY

1. INTRODUCTION

The Netherlands signed the FCCC in 1992 at the Earth Summit (UN Conference on Environment and Development) in Rio de Janeiro on behalf of The Kingdom of the Netherlands. The Convention was ratified by the Netherlands' Government on December 21, 1993.

The Netherlands' National Communication provides a broad overview of the Netherlands' climate change policies, focussing on the national reduction of greenhouse gases in 2000.
Furthermore, the Communication gives an overview of reduction possibilities beyond 2000.
Sectors of society, provincial and municipal governments, business and industry as well as consumer and environmental groups have been involved in the policy making process. Research institutes have provided background information, forecasts and cost analyses.
Policies, measures and activities, however ambitious, can be described as necessary from the climate change perspective and as being 'no regrets' policies.

2. NATIONAL CIRCUMSTANCES

The high population density, the intensive use of land, the high level of industrialization and the location of the Netherlands in a delta of three rivers with intensive traffic lead to great demands on the environment. Natural gas is the biggest energy source in the Netherlands, accounting of almost 50% of the total energy use.

The Netherlands' climate change policy had already been established before the FCCC was signed. In 1989 the Netherlands hosted two international conferences on global climate change. In 1989 and 1990, targets and measures were announced by the Government. These policies were developed further and updated in 1993, and have all been passed by Parliament.

3. EMISSION INVENTORIES

The Netherlands' inventory of greenhouse gas emissions includes the following gases: CO_2, CH_4, N_2O, NO_X, CO, NMVOC, HFCs and PFCs. Table ES.1 and table ES.2 provide a breakdown of the 1990 emission inventory. Expressed in Global Warming Potentials (direct effects), CO_2 emissions amounted to 85% of total emissions, CH_4 emissions contributed 6% and N_2O emissions 9%. Fuel combustion activities are the main sources of CO_2 emissions; waste and animal husbandry are the main sources for CH_4 emissions; and agricultural soils is the main source of N_2O emissions. Removals by sinks are low in the Netherlands, and amount to less than 0.1 % of total CO_2 emissions.
In 1993 CO_2 emissions decreased for the first time since 1990. They were about 1.5% below 1992 level and are now back at where they were in 1990.

Uncertainty
The uncertainty in the estimates of CO_2 emissions amounts to roughly 2%. The uncertainty in estimates of non-CO_2 greenhouse gas emissions is considerably higher and amounts to 30% for methane emissions and 50 - 100 % for N_2O emissions.

Temperature Correction
For policy development and evaluation reasons, CO_2 emissions have been adjusted for temperature influences. Temperature adjustment provides a possibility to distinguish between trends in CO_2 emissions caused by changing economic circumstances, energy prices and policy measures on the one hand, and influences due to annual variations in temperature on the other.

Inventory Methodology
For most sources and sinks, the draft "IPCC Methodology for Greenhouse Gas Inventories" has been applied to estimate emissions. Where appropriate, emission factors specific to the situation in the Netherlands have been used. For CO_2 emissions, the aggregated fuel approach from the IPCC methodology has been applied, since it was found that differences between the aggregated and detailed methodology amounted to less than 0.1%. To estimate emissions from feedstocks, a methodology based on more detailed data concerning products of feedstocks has been applied. A distinction is made between emissions from manufacturing and emissions from product use. For landfills, a time dependent method has been applied. Additional sources of N_2O emissions have been identified, such as the manufacturing of caprolactam, sewage treatment, polluted waters and background emissions from soils.

The IPCC methodology used to estimate CO_2 emissions differs on some points from the Netherlands' policy approach. The main difference concerns the treatment of emissions from feedstocks, waste incineration and industrial processes. The target set by the Netherlands to reduce CO_2 emissions (see next section), is based on the Netherlands' policy approach, and is therefore not

Table ES.1 Netherlands' inventory of CO_2, CH_4 and N_2O emissions, 1990 (Gg)

Greenhouse Gas Source and Sink Categories	CO_2 Actual	CO_2 T-corr.[1]	CH_4	N_2O
Total National Emissions	**167,600**	**174,000**	**1,067**	**59.6**
1. All Energy			**177**	**6.1**
A Fuel Combustion	**164,800**	**171,200**	**28**	**6.1**
- Energy & Transformation	51,400	51,400	NE	0.5
- Industry	33,400	34,100	NE	0.1
- Transport	26,900	26,900	NE	5.4
- Commercial/Institutional	9,500	10,900	NE	0.04
- Residential	19,200	22,300	NE	0.06
- Agriculture/Forestry	8,600	9,700	NE	NE
- Actual emissions from feedstocks	14,800	14,800	NA	NA
- Statistical differences; rounding	1,000	1,100	NA	NA
B Fugitive Fuel Combustion	**NA**	**NA**	**149**	**NA**
- Crude oil and Natural Gas	NA	NA	149	NA
- Coal Mining	NA	NA	NO	NA
2. Industrial Processes	**1,900**	**1,900**	**NO**	**16.4**
A Iron and Steel	NO	NO	NO	NO
B Non-Ferrous Metals	NO	NO	NO	NO
C Inorganic Chemicals	NO	NO	NO	14.6
D Organic Chemicals	NO	NO	NO	1.7
E Non-Metallic Mineral Products	1,900	1,900	NO	NO
3. Solvent and Other Product Use	**NO**	**NO**	**NO**	**NO**
4. Agriculture	**NA**	**NO**	**508**	**22.1**
A Enteric Fermentation	NA	NA	402	NA
B Animal Waste	NA	NA	106	NA
C Rice Cultivation	NA	NA	NO	NA
D Agricultural Soils	NA	NA	NA	22.1
E Agricultural Waste Burning	NA	NO	NO	NO
F Savannah Burning	NA	NO	NO	NO
5. Land Use Change and Forestry	**(-120)[2]**	**(-120)[2]**	**NA**	**NA**
6. Waste	**900**	**900**	**382**	**4.1**
A Landfills	NA	NA	377	NA
B Waste water/Sewage treatment	NA	NA	5[3]	4.0
C Waste Incineration	900	900	0	0.1
7. Other				**10.9[4]**

NO = Not Occurring; NA = Not Applicable; NE = Not Estimated

[1] CO_2 emissions corrected for temperature influences

[2] Not included in total CO_2 emissions

[3] including CH_4 emissions from drinking water treatment

[4] N_2O emissions from polluted inland and coastal water

Table ES.2 Total emissions of NO_X, CO, NMVOC, PFCs and HFCs, 1990 (Gg)

gas	NO_X	NMVOC	CO	CF_4	C_2F_6	HFCs
emission (Gg)	576	459	1,029	0.516	0.052	0

comparable with the 1990 CO_2 emission estimates obtained according to the IPCC methodology. The same applies to the approach taken for projections of emissions.

4. PROGRAMMES, POLICIES AND MEASURES

The Netherlands' climate policy is to a large extent a combination of different policy areas. It coordinates and reinforces policies already in place. Climate policy is basically the sum of a large number of policy areas each with their own set of policy instruments. However, the Netherlands has been working towards an integrated climate policy. Part of the national planning process involves a periodic update of policies and measures on the basis of monitoring and evaluation procedures.

The most important policy areas relevant to the Netherlands' climate policy include energy, transport and waste. The climate policy objectives have been integrated into the sectoral policies, that embrace other environmental objectives as well.
The Netherlands follows a gas-by-gas approach to reduce greenhouse gas emissions. Under the existing national environmental policy plans, the national CO_2 target is to stabilize emissions for 1994-95, and to achieve an emission reduction of 3-5% by 2000 compared to emissions in 1989-1990. In order to achieve the 3% reduction, the target of an annual energy efficiency improvement of 1.7% for the period 1990-2000 has been set. The Netherlands' Government will decide in 1995 whether the provisional 5% emission reduction target should come into force, taking account of international developments and opportunities.

The CH_4 emission reduction target is 10% by the year 2000 compared to the 1990 level, and the target for N_2O is to stabilize these emissions by the year 2000 compared to 1990. Targets for the reduction of emissions of NO_x and NMVOCs have been set within a different policy context. The target is to reduce NO_x emissions by 55% by the year 2000 compared to emission levels in 1988. For VOCs, the aim is to reduce emissions by 60% by the year 2000 compared to 1988. For CO, the aim is to reduce emissions by 50% by the year 2000 compared to 1990.
National targets for HFCs and PFCs have not yet been set.

Table ES.3 provides a selection of the most important policies and measures with respect to CO_2 emissions for the Netherlands (although a slightly different sector classification is generally used in the Netherlands, the National Communication follows the INC guidelines as far as possible for the sector/gas classification in the description of policies and measures).
As can be seen from table ES.3, the Netherlands uses a combination of policy instruments, including voluntary agreements, standards and regulations, fiscal and financial stimuli, information and research and development. In selecting appropriate instruments, preference is given to support for 'self regulation', i.e voluntary agreements. This usually takes the form of a Long Term Agreement between Government and intermediary organizations, such as branch organizations. The principle reason for the emphasis on voluntary agreements is to secure the acceptance of measures by all relevant participants.

Methane reductions are often the beneficial result of policies that are not directly related to climate, such as policies to reduce landfilling, acid deposition and manure surplus. Table ES.4 provides a summary of specific policies resulting in CH_4 emission reduction.

No policies have been formulated specifically aimed at reducing N_2O emissions. Reductions or increases are the result of policies in other areas than climate. For the 1990-2000 period, the main developments involve an increase in nitric acid production, reduced application of fertilizers and manure to soils, and the introduction of catalytic converters. The main part of the NO_x reduction strategy is an acidification abatement policy.

Regulations, standards and subsidies aim to reduce NO_x emissions from energy, transport and industry. VOC emissions from industry are addressed by a Long Term Agreement. Transport policies aiming to improve the quality of vehicles also result in VOC emission reduction. CO emissions are addressed by control and technical measures in the oil, gas and industry sector and by fiscal measures to introduce catalytic converters in the transport sector.

Budgets
Budgets for energy conservation and renewable energy from Government and the energy distribution sector were Dfl. 516 million for 1990 and Dfl. 870 million for 1994. The newly appointed Government has announced budget cuts in this area. It has not been possible to take the consequences of this decision into account in this Communication. Measures for energy conserva-

Table ES.3 Summary table of policies and measures to reduce CO_2 emissions

Sector	Instrument type	Objective/expected results	Policy/measures
Energy and transformation industries			
Electricity production sector	Consultation and making conditions	Efficiency improvement from 40% to 43% between 1990 and 2000	Energy conservation in central generating capacity for electricity production
Renewable energy	Subsidies/ research and development	3% of energy consumption by 2000 provided by renewables.	Stimulation of application of wind energy, waste incineration etc.
Transport			
Private passenger transport	Vehicle related taxes, road taxes, excises, investments in public transport, spatial planning, information and education	CO_2 emission reduction of 11% by 2000 (1990 levels)	Vehicle related measures (quality improvement), limiting growth of automobility, influencing modal split/reduction of individual car use, spatial planning and parking policies
Freight traffic	Government investments (improving and extending infrastructure), efficiency and logistical measures, LTA	Emission reduction of 11% by 2000 (1990 levels)	Stimulation of shift in modal split by enhancing other transport facilities (rail/waterways), efficiency and logistical measures
Industry			
Manufacturing industry	Primarily long term agreements (LTAs) (aim: 90% of the sector); subsidies, fiscal incentives. Information and consultancy, RD & D	19% energy efficiency improvement in 2000 (1989)	Energy conservation; LTAs with different sub-sectors contain various measures. Measures for non-LTA sectors include establishing energy registration and control system, information on available techniques
Waste			
Waste management	LTAs, financial support, RD&D programmes, regulation	Expected emission reduction: about 3,500 Gg annually in 2000	Preventing landfill by legislation; increasing energy benefits from disposal with energy recovery, stimulation of recycling through LTAs
Residential and commercial			
Commercial/Institutional	Regulation (standards), subsidies, LTAs. Information and consultancy, RD & D. Fiscal incentives	23% energy efficiency improvement by 2000 (1989)	Energy conservation by means of: energy efficiency standards for new buildings, energy efficiency programme for Government buildings, LTAs with commercial sector to improve energy efficiency
Households	Regulation, incentive schemes, LTAs, subsidies. Standards, information and consultancy	23% energy efficiency improvement by 2000 (1989)	Energy conservation by means of LTAs with subsidized housing sector, higher insulation standards and energy efficiency standards

Agriculture and forestry			
Agriculture	LTAs. Subsidies, fiscal incentives, information and consultancy, RD & D	26% energy efficiency improvement by 2000 (1989)	Energy conservation by means of LTAs e.g. with greenhouse horticulture
Land use change and forestry	Subsidies, Government finance	Afforestation of 75,000 ha over 25 years (1994)	Extension of the forest area through subsidies for farmers to change activities to forestry, Government afforestation projects and development of 'carbon credit' system
Other policies and measures			
CO_2 capture and disposal	Research and development		Demonstration project to investigate possibilities of storing CO_2 in depleted gasfields
Cross sectoral			
Cogeneration	Subsidies, demonstration projects	Capacity of 8000 Mw by 2000	Cogeneration, district heating recovery of industrial heat
Energy distribution sector	LTAs between government/ energy distribution sector (Second environmental action plan- MAP2)	CO_2 reduction in 2000 of 17,000 Gg (1990); energy conservation by 2000 of 195 PJ (1990)	Stimulate energy conservation in households, commercial and institutional buildings and small and medium-sized businesses; stimulating savings on end use, cogeneration and renewables
Technology development	Subsidies and grants		Formation of technology clusters drawn from manufacturing industry, technological institutes and energy sector

Table ES.4 Policies and measures to reduce CH_4 emissions

Gas/Sector	Instrument type	Objective/ expected results	Policy/measures
Waste Management	Regulation (Soil Protection Act/ Decree on Waste Disposal at landfills)	Expected emission reduction (including additional policies) is 154 Gg by 2000	Recovery of CH_4, followed by incineration and/or energy recovery
Agriculture	Regulations for manure	Expected emission reduction: 35 Gg resulting from manure policy and 10% from Common Agricultural Policy (1990-2000)	Decreasing number of cattle and manure production as a result of Netherlands' manure policy and the European Common Agricultural Policy
Fugitive fuel emissions	Instruments applied within energy policy	Expected emission reduction is 20% (1990-2000)	Measures taken within energy policy. Replacement of gas distribution networks and improved maintenance

tion and renewables do not only address climate change, but the aforementioned budgets are nevertheless relevant to climate change in general. The figures also include programmes on recycling and energy use from biomass and waste, but do not include budgetary effects of fiscal incentives.

Beyond the year 2000
The Netherlands' longer term climate change policy recognizes the need for a further international reduction policy after the year 2000.
With respect to the European CO_2 stabilization target, the Government concluded in the Second National Environmental Policy Plan that, once CO_2 emissions have been reduced by 3 to 5% by the year 2000 compared to 1989/1990, in principle, no further rise in emissions should occur.

5. PROJECTIONS

Estimates of future trends in greenhouse gas emissions are based on scenarios that take account of developments in the world economy and the economic situation in the Netherlands. Table ES.5 provides some key assumptions used in the models. The Energy Policy Scenario is used for forecasting CO_2 emissions for the period up to the year 2000. The European Renaissance Scenario and the Global Shift Scenario have been applied to estimate future trends for the other greenhouse gases as these emissions are less dependent on changes in energy prices and economic growth rates. Table ES.6 provides emission estimates for the years 1990 and 2000.

Table ES.6 shows that a CO_2 emission reduction of approximately 4% is expected by the year 2000 compared to 1990 levels. Since the effectiveness of current policies will lessen after the year 2000, while economic growth will probably continue, the scenarios show that, without further policy changes, total CO_2 emissions will increase in the period after 2000.

According to the Netherlands' policy approach (see Section 3), given the current economic outlook and the effects of other policies, including the possible introduction of a CO_2 energy tax within the European Union or on a national level, the CO_2 target of 3% reduction is within reach.
A reduction in methane emissions is often the beneficial result of policies that are not directly related to climate, such as policies to reduce landfilling, acid deposition and manure surplus. CH_4 emissions are expected to decrease by about 25% by the year 2000, which is considerably more than the target of 10% reduction compared to 1990. A further decrease is expected after the year 2000.

N_2O emissions are expected to increase by 5% by the year 2000 instead of remaining stable at 1990 levels. Options to limit N_2O emissions in the Netherlands are currently being explored.
NO_x, CO and NMVOC emissions are expected to decrease considerably in the next decades. Options to further reduce these emissions and to reduce fluorocarbon emissions are being studied.

Assessments of total effects of measures.
The Netherlands' evaluation process does not make a distinction between policies implemented before 1990 and those implemented after. Furthermore, in projecting future trends of greenhouse gas emissions, no distinction is made

Table ES.5 Some key assumptions in various scenarios

	Energy Policy Scenario	ER-High Scenario	GS-Low Scenario
Annual rate of economic growth (%) 1990-2000 period	1.9	2.7	1.5
End user price of energy in the year 2000 (1990=100)	100	123	100
Effects of structural change[1] (%)	-0.1	-0.2	0.2

[1] Annual rate of change in the ratio 'energy consumption/GNP' due to changes in economic structure.

Table ES.6 Future trends for greenhouse gas emissions, 1990 - 2000 (Gg)

gas	1990	2000
CO_2[1]	174,000	167,600
CH_4[2]	1,067	786
N_2O[2]	59.6	62.2
NO_x[2]	576	366
CO[2]	1,029	630
NMVOC[2]	459	245

[1] Temperature corrected. Based on Energy Policy Scenario.
[2] Based on ER-High Scenario.

between policy induced and autonomous effects on emissions. Therefore, it is difficult to provide seperate estimates of the total effect of measures, policies and programmes on the emissions of the various greenhouse gases.

It is expected that energy conservation will reduce CO_2 emissions by approximately 42,000 - 45,000 Gg compared to a scenario without energy conservation. This figure also includes the effects on CO_2 emissions of anticipated changes to the fuel supply pattern. These effects have been estimated to reduce CO_2 emission by about 7,000 - 9,000 Gg. In these figures no distinction is made between policy induced and autonomous effects on energy conservation.
The most important measures to reduce CH_4 emissions are listed in table ES.4. The total effect of these measures is a methane emission reduction of about 280 Gg by the year 2000 compared to 1990 (approximately 25%). Policies related to transportation, agriculture and the production of nitric acid are expected to cause a net emission increase of about 2.5 Gg N_2O.

6. VULNERABILITY AND ADAPTATION

Given its geographical situation, the Netherlands is highly susceptible to changes in sea level and related changes caused by extreme weather and hydrological conditions. Adaptation to these climate changes may eventually incur additional costs arising from measures such as raising dykes, protecting flood-prone infrastructure, preservation of dunes and adaptation of the water management.
The present institutional and economic situation enables the country to cope with the effects expected; however, this may be at the expense of nature value. The Netherlands has considerable experience in the area of coastal zone management, and has worked to share this experience with other countries, in particular with those developing countries that are most vulnerable to the effects of climate change.

7. JOINT IMPLEMENTATION

The Netherlands' government has shown considerable interest in Joint Implementation (JI). In June 1994, the Netherlands hosted an international conference on JI.
The Netherlands emphasizes the importance of a limited trial period on the basis of preliminary criteria to be established by CoP-1.
The Netherlands' Government announced the development of a programme of pilot projects (PPP) to gain experience with JI. It intends to present the PPP following a CoP decision.

8. FINANCE AND INTERNATIONAL COOPERATION

For 1994, the Netherlands has committed a contribution of 1.5% of the Net National Income to development aid. At UN-CED, the Netherlands announced that the budget allocated for the promotion of environmentally sound development in developing countries will reach a total of almost Dfl. 450 million per annum by 1997. The Netherlands also committed itself to provide, in addition to current commitments for development cooperation which now substantially exceed the 0.7% GNP target , new and additional financial resources up to a maximum of 0.1% GNP for the implementation of global environmental agreements, including the UN FCCC, provided that other countries take a similar course in generating resources for an earth increment.
A contribution of approximately Dfl. 90 million has been made to the pilot phase of the Global Environment Facility up to 1994. The Netherlands' contribution to the second phase (1994 to 1996)

will be 3.57 % (Dfl. 125 Million) of the total target of approximately US $ 2 billion. Several bilateral and multilateral assistance programmes have been developed for developing countries and countries with economies in transition. These include country study programmes (including emission inventories, vulnerability assessment and mitigation), energy efficiency programmes, renewable energy programmes and support for tropical forestry action plans.

9. RESEARCH AND SYSTEMATIC OBSERVATION

Research on climate change and climate-related issues is carried out by universities, governmental and non-governmental research institutes and large technical institutes. Several national research programmes have been developed e.g. the National Research Programme on Global Air Pollution and Climate Change (NRP), which aims to strengthen the involvement of Netherlands' research in national and international programmes; the Global Change Programme of the Netherlands' Organization of Scientific Research; and the National Remote Sensing Programme. Expenditures on energy and climate policy-related energy RD&D amounts to more than Dfl. 700 million per annum, 50% of which is covered by the Government. Priority in energy RD&D policy is given to fuel cell technology, wind energy, coal gasification, photovoltaic solar energy, small scale gas conversion technology and energy conservation.

10. EDUCATION, TRAINING AND PUBLIC AWARENESS

In the Netherlands, awareness raising campaigns are the most important tools for involving the general public in issues concerning climate change. Since 1990, several campaigns have been conducted, including a campaign aimed specifically at climate change and energy, an energy conservation campaign by the energy distribution sector and awareness-raising campaigns for traffic and transport. All the stages of the climate change campaign have been evaluated. Special emphasis is attached to communication between researchers, policymakers and the general public in order to facilitate the policymaking process. Other relevant projects are those by intermediary organizations aimed at specific target groups, and research into means of reducing the energy intensity of lifestyles.

1. INTRODUCTION

The Netherlands' National Communication provides a broad overview of the Netherlands' climate change policies. These policies consist of a comprehensive strategy aimed at a reduction of greenhouse gas emissions; the implementation of a broad range of measures and instruments; development of adaptation-oriented policies; contributions to international cooperation and support for elaborate research and technology ventures; and a communication strategy. Through this National Communication, the Netherlands fulfils its commitments to art. 4.2.b of the Framework Convention on Climate Change (FCCC).

The Netherlands signed the FCCC in 1992 at the Earth Summit (UN Conference on Environment and Development) in Rio de Janeiro on behalf of The Kingdom of the Netherlands. The Convention was ratified by the Netherlands' Government on December 21, 1993. The Netherlands Antilles and Aruba, both part of the Kingdom of the Netherlands, will ratify it independently. This National Communication refers to the Netherlands only.

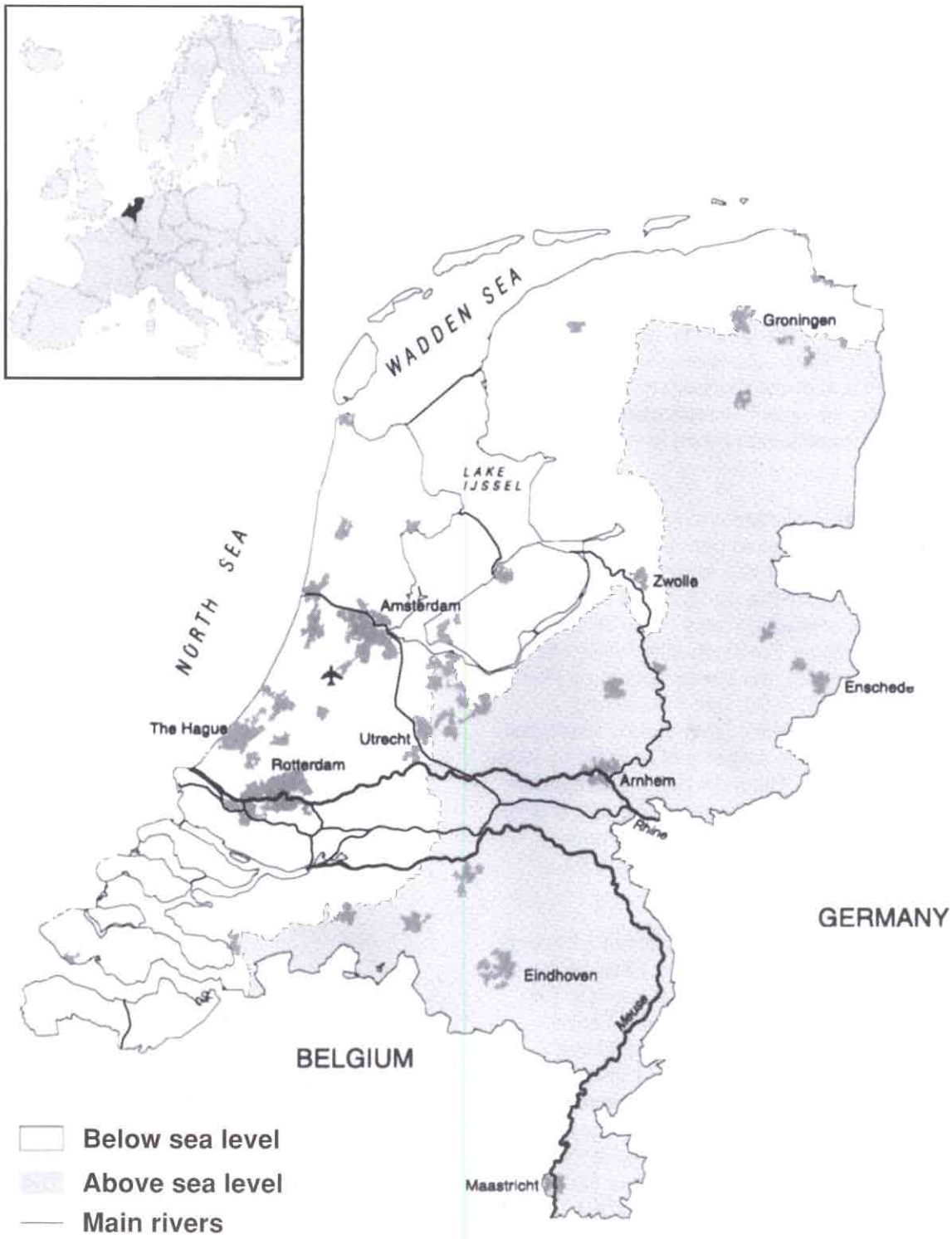
The Netherlands' climate change policy had already been established before the FCCC was signed. In 1989 and 1990, targets and measures were announced by the Government in the National Environmental Policy Plan (VROM, 1989), the National Environmental Policy Plan Plus (VROM, 1990), the Memorandum on Energy Conservation (EZ, 1990) and the Second Structure Plan on Traffic (VW, 1990). These policies were developed further and updated in 1993 (VROM, 1994; EZ, 1993). In 1991, a comprehensive overview of the Netherlands' climate change policies was presented in the Netherlands Memorandum on Climate Change (VROM, 1991b).

The above-mentioned policy documents have all been adopted by Parliament. They aim for the national reduction of greenhouse gases in the year 2000. Furthermore, the Communication gives an overview of reduction possibilities beyond the year 2000. Sectors of society, provincial and municipal governments, business and industry as well as consumers and environmental groups have been involved in the policy-making process. Research institutes provided background information, forecasts and cost analysis.

The EU strategy on CO_2 stabilization, developed since 1990, is an important framework for the Netherlands' climate change strategy as well.

The preparation of the Netherlands' National Communication is based on the documents mentioned above and scientific background documents. It therefore covers all relevant policies, programmes and measures that have been adopted by Parliament. Policies, measures and activities, however ambitious, can be described as necessary from the climate change perspective and being 'no regrets' policies.

Figure 2.1 A number of large cities in the Netherlands and the distribution of land below sea level



2. NATIONAL CIRCUMSTANCES

This chapter provides an overview of background data relevant to this report. Section 2.1 describes characteristics of the Netherlands, using basic data, including profiles of the geography, climate, population, society, economy, energy and the environment. Section 2.2 examines policy making and legislative processes in the Netherlands. The last section, 2.3, briefly outlines policies adopted before the base year.

2.1 BASIC DATA

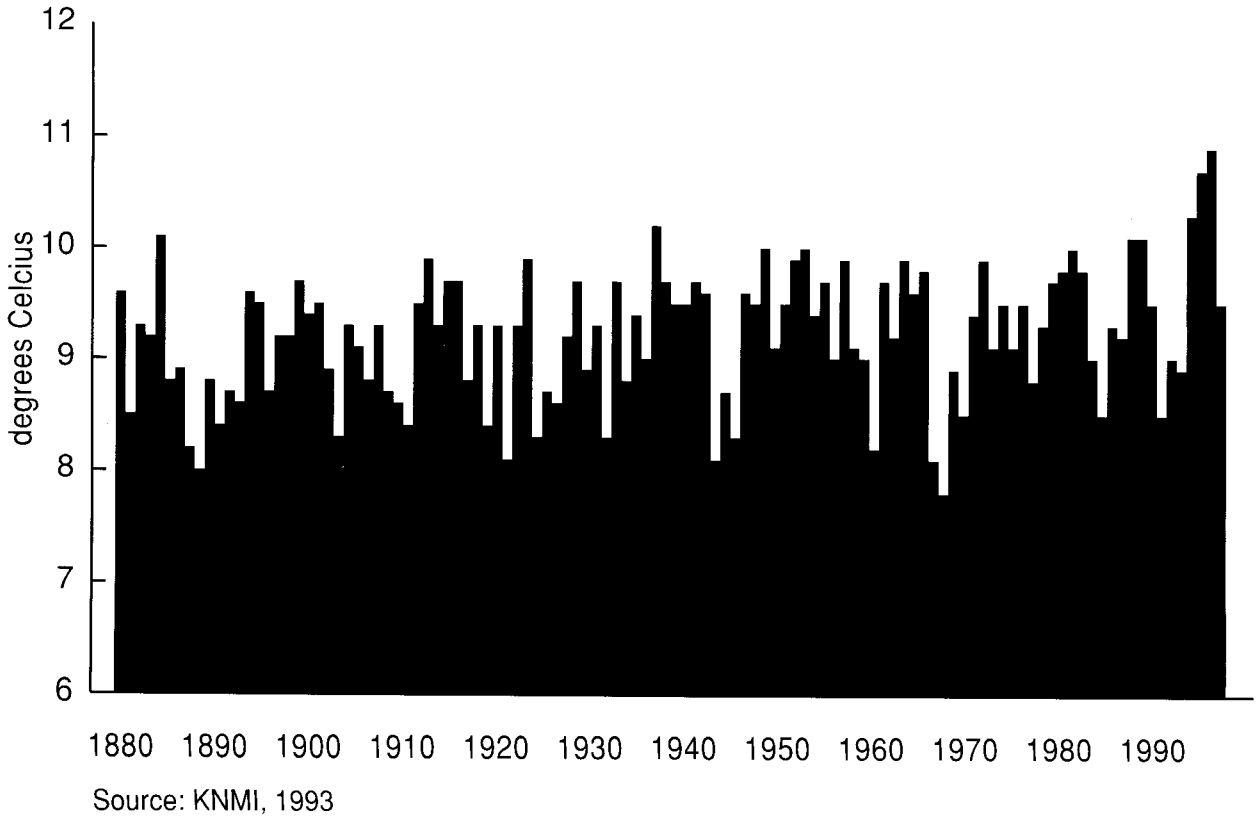
Geography profile

The Netherlands is a low-lying country situated in the delta of the Rhine, IJssel and Meuse rivers. About 27% of its territory is below sea level; the soils consist of fluvial and tidal deposits, partially covered by peat. After the ice age, this Holocene peat was formed behind the coastal dunes in the Western part of the Netherlands, where polders have been created with controlled water levels. In the Eastern part of the Netherlands, Pleistocene ice-pushed ridges are found covered with windborne sand deposits. The south mainly consists of Meuse terraces with loess deposits or windborne sand deposits. The highest point is 321 m above sea level at the border with Belgium and Germany and the lowest point is 7 m below sea level in one of the polders. The surface area of land and inland and coastal water amounts to 41,526 km^2. The land surface covers 34,000 km^2. This area consists of 59% agricultural land and 9% forest, 5% is natural land and 27% is destined for urban, infrastructural and other uses. The population concentration is highest in the 'Randstad', which consists of Amsterdam, Rotterdam, The Hague and Utrecht and the smaller cities in between. The Randstad is located in the western part of the Netherlands. Rotterdam is important for its oil refining capacity and its ports, which are the biggest ports in the world. Schiphol Airport near Amsterdam is important as a transit airport for the rest of Europe. Some geographical features are given in figure 2.1.

Climate Profile

The Netherlands has a maritime climate, characterized by cool summers and mild winters. The influence of the sea results in east-west winds and temperature gradients. Average winter temperatures near the coast range from -3°C to +6°C, with an average of +3°C. Inland, the average winter temperatures range from -3.5°C to + 5.5°C, with an average of +2.5°C.

Figure 2.2 Average temperature in De Bilt in the Netherlands since 1880



Source: KNMI, 1993

The average summer temperatures near the coast range from 14.5°C to 17.5°C, with an average of 16°C. Inland, the average summer temperatures range from 15.0°C to 18.5°C with an average of 16.5°C.

The four warmest years of the last 100 years occurred during the last ten years (figure 2.2). The average precipitation is between 500 and 900 mm per year. Precipitation is fairly evenly spread over the year, with a slight increase in autumn.

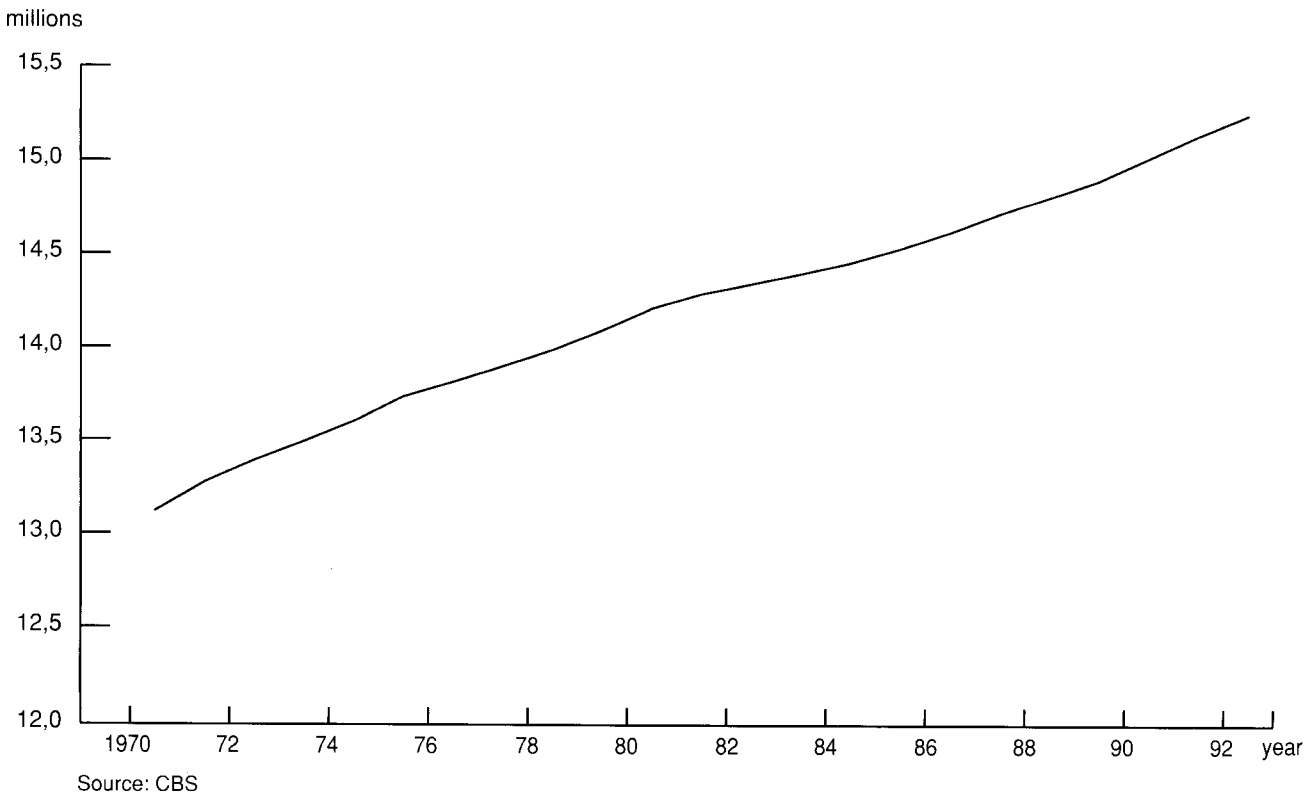
Population profile
The Netherlands' population has grown from about 13 million inhabitants in 1970 to 15,238,000 inhabitants in 1993. Net annual population growth is currently about 0.7%. It is expected that the population will reach 16 million inhabitants by the year 2000 and 16.7 million inhabitants by 2010, which is equivalent to 0.6% annual growth between 1990-2000 and 0.4% between 2000-2010. Figure 2.3 shows population development between 1970 and 1992. The population density increased from 386 persons to 441 persons per km^2 of land between 1970 and 1990.

Society profile
Compared to other countries, the number of people per household in the Netherlands is relatively small. A steady decrease in the average number of people per household has been observed since the forties. In the last decade, this number decreased from 2.8 persons per household in 1980 to 2.4 in 1990. It is expected that the trend will continue in the future. The steady decrease is, amongst other factors, due to an increase in the number of households (trend to individual lifestyles; increased number of old aged people). In 1980 the total number of households was 4.8 million, and was 5.9 million in 1990; this number will continue to rise.

Commuting has increased during the last few years. The number of private vehicle kilometres rose by 17% between 1986 and 1990 (figure 2.4). A slight decline in this trend is expected; the number of private vehicle kilometres is expected to increase by only 15% between 1990 and 2000.

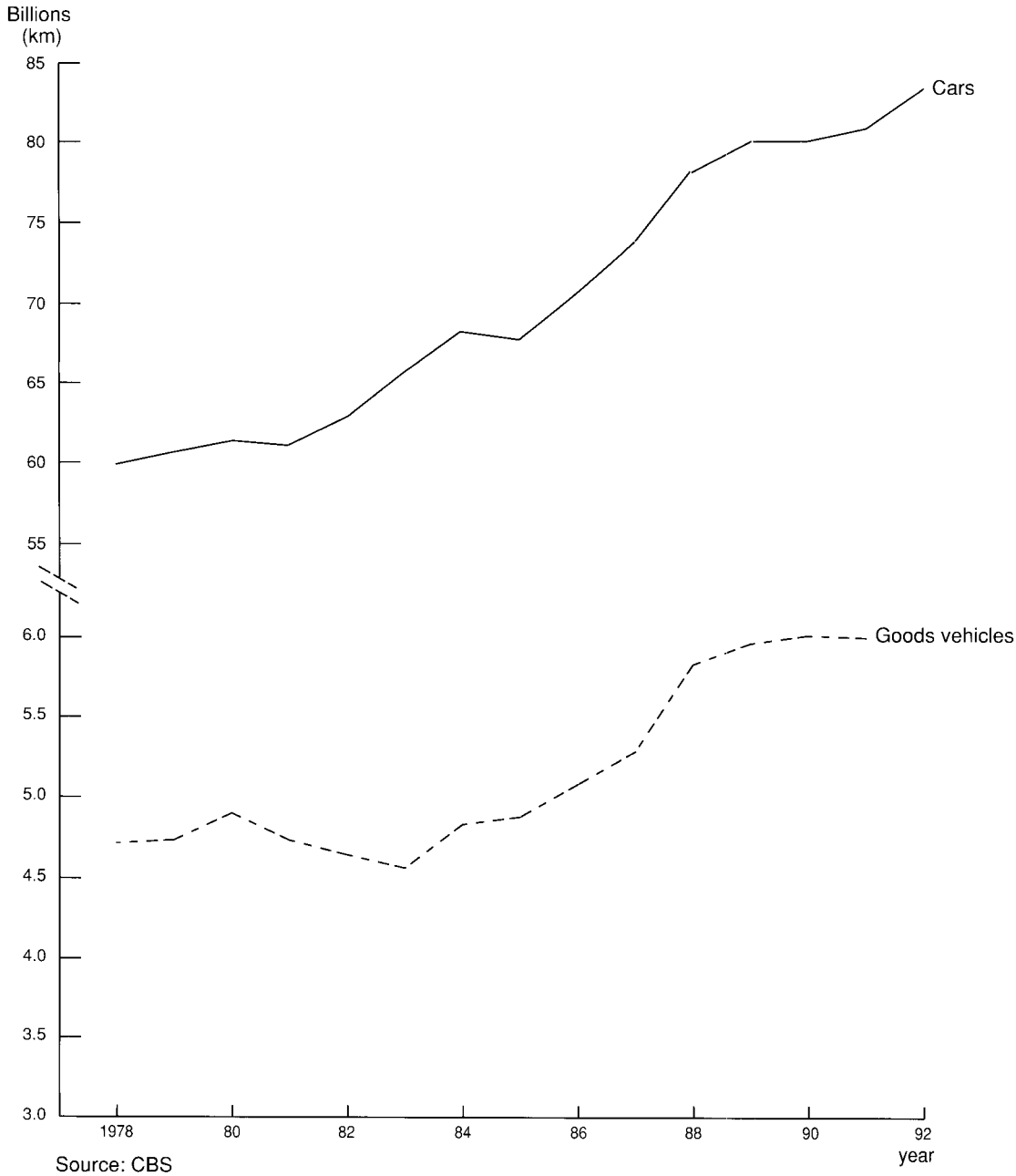
Economy profile
Gross National Product (GNP) in the Netherlands amounted to DFl. 425,350 million in 1985 and DFl. 515,360 million in 1990 (in current prices). The real average annual growth rate in the period 1985-1992 was 2.4%. The expected growth rate for real GNP is between 1.5 and 2.7% per annum

Figure 2.3 Population development in the Netherlands



Source: CBS

Figure 2.4 Developments in car-kilometres and goods vehicle use in the Netherlands



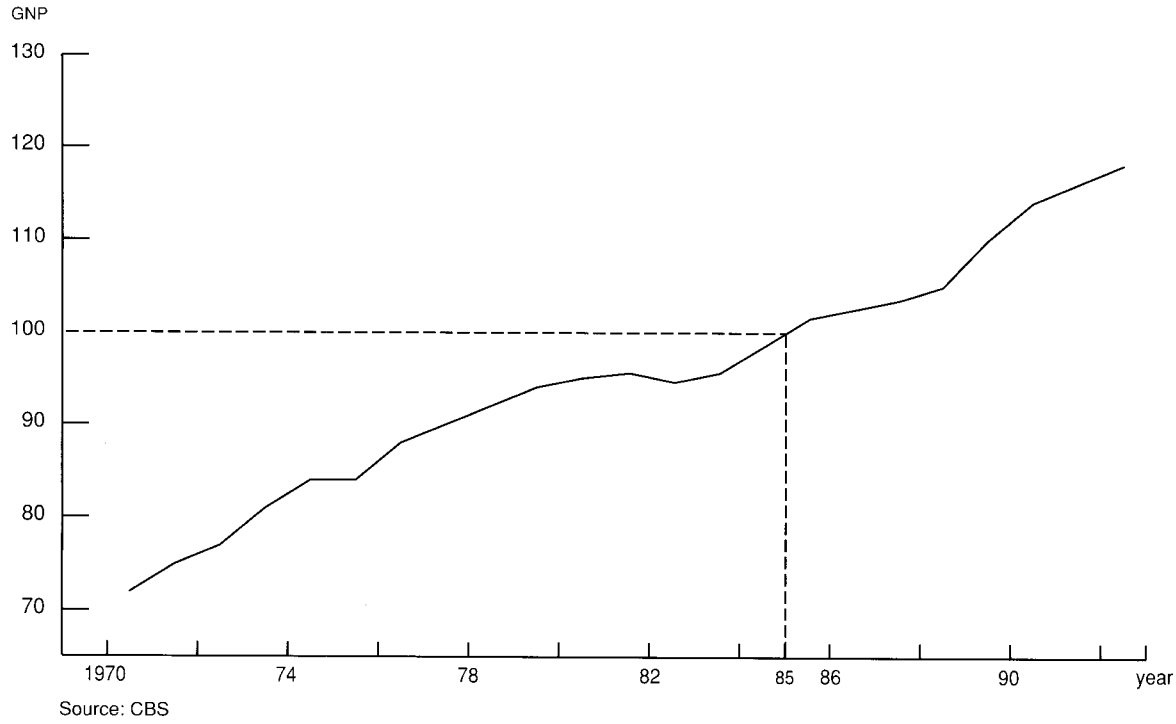
Source: CBS

for the period 1990 - 2000 (see chapter 5); for individual years this growth rate may vary. Figure 2.5 shows the GNP development for the period 1970 to 1992 (in constant 1985 prices).

The Netherlands performs well on the world market, and ranks relatively high amongst agricultural exporters. The principal exports are machinery and transport equipment (24%), articles of food and livestock (18%), and chemicals (16%). The quantity of exports increased by 40% between 1985 and 1992. This growing export trend is inextricably linked to developments in freight traffic (liberalization of the European internal market and the opening of markets in Central and Eastern Europe). Principal imports to the Netherlands in 1992 include machinery and transport equipment (32%) and manufacturing goods (16%). The transport sector is traditionally one of the main economic activities in the Netherlands because of its favourable position with respect to the transportation of goods to the European hinterland.

The GNP growth masks a shift between sectors. The chemical industry has boomed since 1960. This is related to a complex of factors, including

Figure 2.5 GNP development in the Netherlands (in constant 1985 prices : index 1985 = 100)



Source: CBS

the domestic availability of natural gas as a feedstock and the export orientation of this sector, combined with the location of the chemical industry near the main ports. The other sectors kept pace with the overall growth of the economy, with the exception of the construction industry.

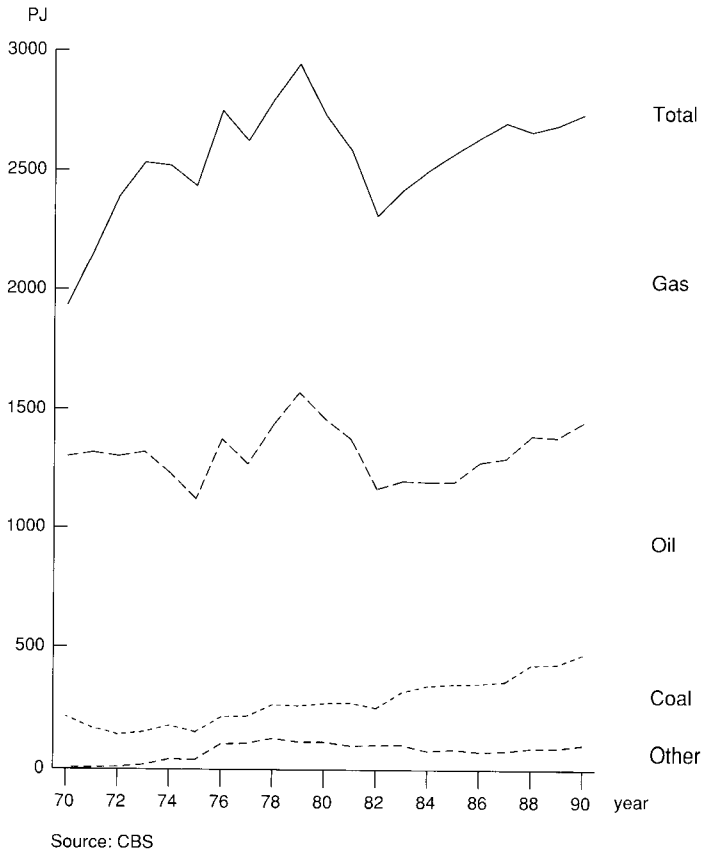
Energy profile

After a drop in energy consumption in the early 1980's, energy consumption rose by about 17% between 1982 and 1990. Figure 2.6 shows energy consumption for the period 1970 to 1992.

Natural gas is the single biggest energy source in the Netherlands, accounting for almost 50% of the total. In western industrialized countries this proportion is about 20%. Consumption of oil and oil products makes up 35%. The remaining energy needs are met by coal products (14%) and by nuclear energy and renewable energy resources (3%).

As of 1 January, 1994, total indigenous gas reserves stood at 2010 billion m^3. After the former USSR, the USA and Canada, the Netherlands is the world's fourth biggest producer of natural gas. National demand for oil and coal is primarily met by imports; electricity production is mainly based on gas and coal, with a small share for nuclear electricity. Electricity demand is also partially covered by imports.

Figure 2.6 Energy development in the Netherlands



Source: CBS

The proportion of energy consumed by industry is relatively high: 43% of the total, including refineries. A large number of modern refineries and chemical industries are located in the Netherlands.
The port of Rotterdam is a distribution centre for oil products to the whole of North Western Europe, so the Netherlands has an important function in the Western European oil supply.

Environment profile
The high population density, the intensive use of land, the high level of industrialization and the location of the Netherlands in a delta of three rivers with intensive traffic leads to a great burden on the environment. The most pressing environmental problems are air pollution and water pollution, acid deposition, manure surplus, and depletion of ground water.
The Netherlands has a very high livestock density, which contributes to environmental problems. However, after 1995 the number of animals is expected to decrease as a combined result of European agricultural policy (the MacSharry package) and policies to reduce the manure surplus which leads to acid deposition from ammonia. Water pollution is tackled through sewage treatment plants. Policies to reduce these environmental problems also affect greenhouse gas emissions, as subsequent chapters will describe in more detail. Some social and environmental indicators for 1987 are given in table 2.1.
An important indicator for this report is the greenhouse gas emission per capita in the Netherlands, which is as follows for 1990:

CO_2 : 11.2 ton/cap (not corrected for temperature)
11.6 ton/cap (corrected for temperature)
CH_4 : 71.1 kg/cap
N_2O : 4.0 kg/cap

2.2 GENERAL NATIONAL POLICY-MAKING AND LEGISLATIVE PROCESSES

General policymaking process
The Environmental Protection Act (EPA) of 1 March 1993 stipulates that the Government draw up a National Environment Policy Plan (NEPP) every four years as well as an annual Environment Programme. Before 1993, NEPPs were prepared on a voluntary basis. Government puts the NEPP to the Parliament. If the Parliament passes the plan, then it becomes permanent; not every commitment in the Plan (e.g. emission targets) needs to be legislated.
At the moment the Netherlands' Government consists of 14 ministers including the prime minister. The Minister for Housing, Spatial Planning and the Environment is primarily responsible for the environmental legislation and policy development. Other ministers are responsible for integrating environmental policy targets and endorsing the NEPP within their respective fields (See box 2.1).

Many actors are involved in the policymaking process, e.g. sectors of the economy, consumers, advisory councils, research institutes, environmental protection organizations, and various trade unions and federations.

Table 2.1 Some social and environmental load indicators in 1987 for a number of countries

	Population persons per km²	Car-km 1000 km per km²	Cattle Standard livestock unit per km²	GNP $ per capita	Energy consumption toe per capita	Vehicle-km km per capita
The Netherlands	432	2219	174	14538	3.6	5646
Belgium	322	1606	112	14124	3.4	4983
Denmark	119	759	75	19739	3.0	6378
France	102	693	37	15817	2.5	6813
UK	233	1269	57	11765	2.6	5458
W. Germany	246	1593	63	18265	3.3	6472
USA	26	320	11	18338	5.4	12303
Japan	328	1312	22	19437	2.2	4001
Poland	125	161	38	6799	3.2	1284
India	280	15	57	295	0.2	55

Source: RIVM, 1992

The formulation of first, policy, then, concrete measures, and finally, implementation, is being developed in conjunction with the relevant 'target-groups'[1]. The form the measures take could be, for example, a voluntary agreement between the Government and target group (see chapter 4). Communication between the Government and the target groups is given priority.
In the Netherlands, environmental protection organizations also play an important role, for example since members of these organizations participate in advisory councils.

National Legislative Process
The Netherlands is a constitutional monarchy with Queen Beatrix as its head of state. The legislative powers are vested in the national Government, the 12 provinces and the 650 municipalities (the municipalities are, amongst other things, responsible for granting licences and permits).
The Netherlands' Parliament or States General consist of a First Chamber (75 members, chosen by the Provinces) and a Second Chamber (150 members, chosen by the citizens).
The legislative process is a combined effort of Government and Parliament. Bills, draft decrees and draft orders in council are first submitted to the Council of State. Legislation comes into force when published in The Bulletin of Acts ('Het Staatsblad') or The Netherlands Government Gazette ('Staatscourant').
Policies can also be formulated in memoranda to Parliament. Committments in these documents are politically binding and can be elaborated by legislation e.g. a decree or Order in Council or other binding agreements e.g. Long Term Agreements. The Netherlands' CO_2 emission reduction target is formulated in the National Environmental Policy Plan Plus, NEPPP (VROM, 1990), and reaffirmed in the Second National Environmental Policy Plan, NEPP2 (VROM, 1993).

2.3 POLICIES ADOPTED BEFORE THE BASE YEAR

In response to two reports on CO_2 by the National Health Council (WVC, 1983; Gezondheidsraad, 1986), the Government has developed a three-pronged approach consisting of: 1. promoting research; 2. raising awareness; and 3. taking steps as far as effectively possible (VROM, 1987). Emphasis was given to 1. and 2.

Box 2.1 NEPP Ministries: selected policies, activities, documents and research programmes.

* **Housing, Spatial Planning and The Environment (VROM)**
  - coordinator of National Environmental Protection Plans and Memorandum on Climate Change
  - waste policy, abatement of acidification and air quality
  - Memorandum on the Prevention and Recycling of Waste
  - Transport and Climate Change study (in cooperation with Economic Affairs and Transport, Public Works and Watermanagement)
  - National Research Programme on Global Air Pollution and Climate Change

* **Agriculture, Nature Management and Fisheries (LNV)**
  - nature policy, protection of ecosystems and species
  - Nature Policy Plan
  - Forestry Policy Plan
  - Third Phase Manure and Ammonia Policy (jointly with VROM)
  - Climate Change, Agriculture and Nature Conservation Research Programme

* **Transport, Public Works and Water Management (VW)**
  - integrated water quality control;
  - Third Policy Note on Water Management
  - Second Transport Structure Plan
  - coastal defence, coastal zone management, impact assessment of sea level rise
  - climate change research programme

* **Economic Affairs (EZ)**
  - energy policy
  - (Second) Memorandum on Energy Conservation
  - Long Term (Branch) Agreements on Energy Conservation

* **Foreign Affairs and Development Cooperation (BZ)**
  - coordinates international negotiations
  - environmental policy for development cooperation

* **Education and Science**
  - research infrastructure

1 Technology, Agriculture, Industry, Refineries, Energy Industry, Retail Trade, Traffic and Transport, Consumers, Construction Industry, Waste Disposal Sector, Drinking Water Supply Industry, and Sewage and Waste Water Treatment.

Research policies have targeted at the development of a research infrastructure in the Netherlands through a Stimulation Programme on CO_2 research by the NWO. In 1989 and 1990, more comprehensive programmes were developed (see chapter 9). Public awareness of the issue of climate change has been raised through contributions and initiatives in international workshops by scientists and policy makers.

In 1989, an emission target for a direct greenhouse gas was formulated for the first time: for CO_2 emissions to remain at 1989/1990 levels by the year 2000 (VROM, 1989). In 1990 this target was replaced by a reduction target (VROM, 1990a); targets for other greenhouse gas emissions were also set (VROM, 1991b).

In 1990, the European Community formulated its CO_2 stabilization target. Through its CO_2 reduction strategy, the Netherlands contributes to the fulfilment of this European commitment.

Energy conservation policies originated in the early seventies, after the oil crisis. Goals of energy policies were conservation and diversification, and aimed to reduce dependency on oil and to reduce sensitivity to changing energy prices (EZ, 1990). Subvention programmes contributed to a reduction in energy intensity by 2% per annum. However, as a result of economic growth and a drop in oil prices in 1985, energy consumption increased nevertheless.

In the late 1980's, road traffic also increased sharply, by 20% between 1986 and 1989 (VW, 1990), as a result of economic growth and relatively low fuel prices. This led to a rise in congestion, noise, and local air pollution as well. Climate change was then recognized as a consequence of transport activities. Policies developed in this period are described in chapter 4.

Policies for prevention and recycling of waste were presented in a memorandum to Parliament in 1988 (VROM, 1988).

In order to contribute to the introduction of the climate change issue to the international political agenda, the Netherlands hosted the international Conference for Heads of State in The Hague (organized in cooperation with France and Norway) and the Ministerial Conference on Atmospheric Pollution and Climate Change in 1989. The results of the latter conference were presented to IPCC (VROM, 1990b).

3. INVENTORY OF GREENHOUSE GAS EMISSIONS IN THE NETHERLANDS

3.1 INTRODUCTION

This chapter provides a summary of the inventory of greenhouse gas emissions in the Netherlands. The following gases will be discussed: CO_2, CH_4, N_2O, NO_x, CO, NMVOC, HFCs and PFCs. Estimates of quantities of emission are calculated according to the draft "IPCC Methodology for Greenhouse Gas Inventories" (IPCC, 1994). If methods applied differ from the IPCC methodology, these differences will be described in detail. More extensive information on the emission inventory is provided in the background document "Greenhouse Gas Emission in the Netherlands 1990, 1991, 1992 and projections for 1990-2010" (Amstel et al., 1994). It gives a more detailed sectoral breakdown and provides further information on assumptions made and references to literature. Appendix 1 briefly outlines the differences between the methodologies used in the Netherlands' inventory and the IPCC methodology.

Appendix 2 presents full summary tables, compiled according to the guidelines from the IPCC methodology. The summary tables provide emissions, activity data and aggregate emission factors for all sources and gases included in this chapter. All emission estimates in this National Communication are expressed in full molecular mass (e.g. 'Gg CO_2' instead of 'GgC').

3.2 CO_2 EMISSIONS

Table 3.1 states the total CO_2 emissions and removals in the Netherlands in 1990. Emission estimates have been corrected for variations in temperature. The following sections provide more detailed information on CO_2 emissions from various economic sectors, the methodology applied in correcting for variations in temperature, and the approach taken in estimating CO_2 emissions from fossil fuels used as feedstocks. Information on the uncertainty of emission estimates and on trends in CO_2 emissions is also included.

3.2.1 CO_2 emissions from energy

Combustion of fossil fuels is the most important source of CO_2 emissions in the Netherlands. Emission estimates are based on energy balances recorded by the Netherlands Central Bureau of Statistics, published in the 'Energy Supply in the Netherlands, Annual Figures.' The approach followed is the aggregated fuel approach derived from the IPCC methodology. In the previous inventory of CO_2 emissions (Albers e.a., 1993), it was found that the results of the aggregated fuel approach did not differ significantly from those of the detailed fuel approach. Disparity amounted to less than 0.1%. Hence, it was decided to follow here the more straightforward approach of estimating emissions for the years 1980, 1985, 1990, 1991 and 1992. Emission factors were agreed upon by all the main institutes involved in emission inventories in the Netherlands[1]. Table 3.2 provides a breakdown of the energy balance and corresponding CO_2 emissions in 1990. Table 3.3 presents the emission factors applied (Zonneveld, 1991). These emission factors correspond to the aggregated default values provided by the IPCC methodology (IPCC, 1994).

Table 3.1 Total CO_2 emissions and removals in the Netherlands in 1990, corrected for variations in temperature. Actual emissions are provided for reasons of transparency

	National CO_2 Emissions 1990 (Gg)	
	Actual Emissions	Emissions corrected for temperature influences
1. Energy	164,800	171,200
2. Industrial Processes	1,900	1,900
3. Waste	900	900
Total CO_2 Emissions	167,600	174,000
	National CO_2 Removals 1990 (Gg)	
1. Land Use Change	120	120

[1] These are the Central Bureau of Statistics (CBS), TNO Emission Registration (TNO-ER), the Energy Research Foundation (ECN), the National Institute of Public Health and Environmental Protection (RIVM), the Ministry of Economic Affairs (EZ), and the Ministry of Housing, Spatial Planning and Environment (VROM).

Table 3.2 Breakdown of energy balance and energy-related CO_2 emissions in 1990

	PJ	CO_2 Emissions (Gg)	Total CO_2 Emissions (Gg)	Temperature Adjusted Total CO_2 Emissions (Gg)
Fuel Combustion Activities				
1. Energy and Transformation			51,400	51,400
- Gas	278	15,600		
- Oil	152	11,100		
- Coal	263	24,700		
2. Industry[1]			33,400	34,100
- Gas	334	18,700		
- Oil	83	6,100		
- Coal	92	8,600		
3. Transport			26,900	26,900
- Gas	0	0		
- Oil	368	26,900		
- Coal	0	0		
4. Commercial/ Institutional			9,500	10,900
- Gas	141	7,900		
- Oil	20	1,500		
- Coal	2	200		
5. Residential			19,200	22,300
- Gas	329	18,400		
- Oil	10	700		
- Coal	0	0		
6. Agriculture/Forestry			8,600	9,700
- Gas	126	7,100		
- Oil	21	1,500		
- Coal	0	0		
Non-combustion Activities				
1. Actual Emissions from Feedstocks			14,800	14,800
Statistical Differences[2]			1,000	1,100
Total energy related CO_2 emissions			164,800	171,200

[1] In the summary tables provided in appendix 2, actual emissions from feedstocks are included in emission estimates from Industry for reasons of transparency.

[2] Emissions from the various sectors do not add up to total CO_2 emissions due to statistical differences or approximations, for example in the sectoral breakdown of the energy balance, and due to rounding.

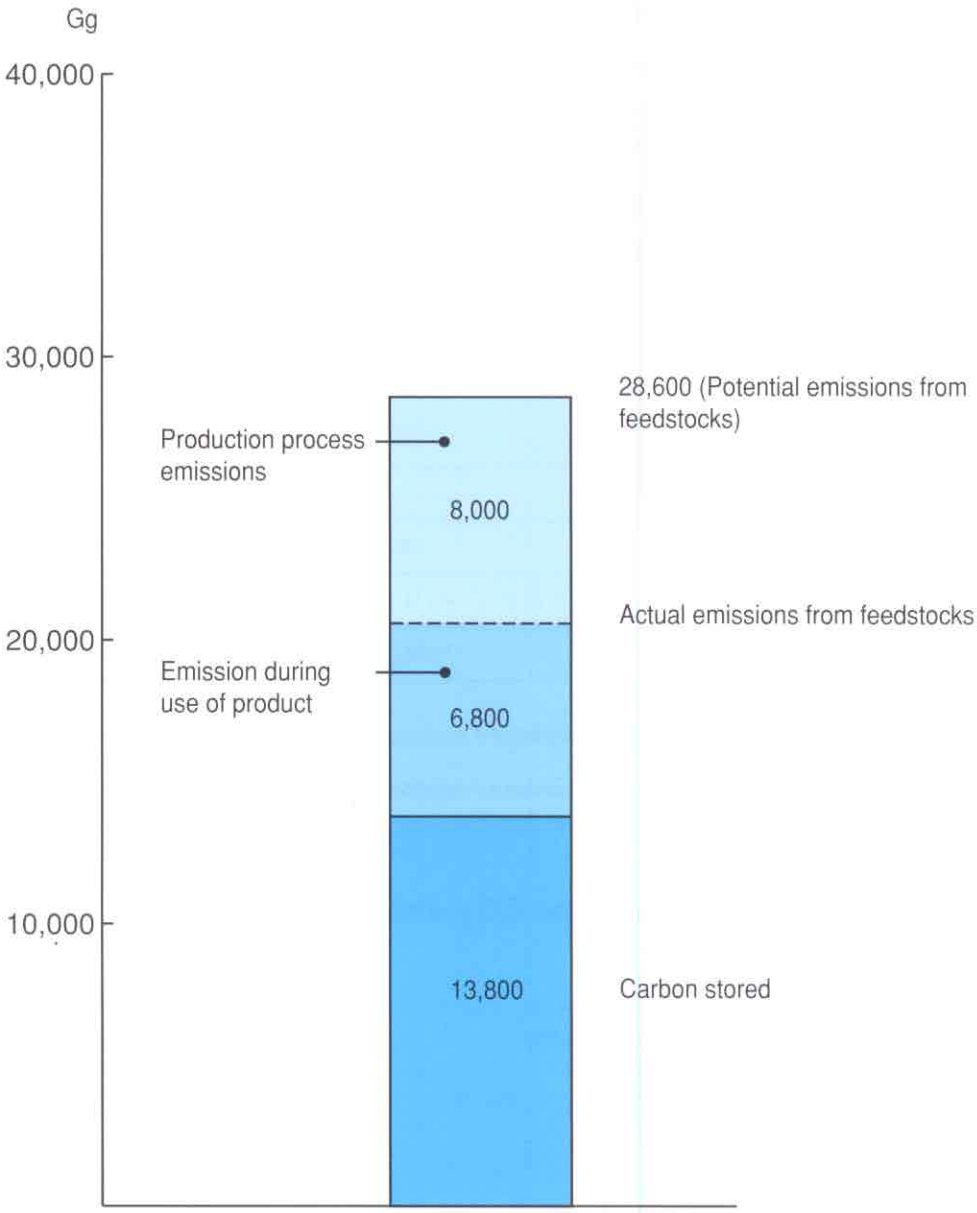
Table 3.3 Emission factors used to estimate CO_2 emissions in the aggregated fuel approach

Fuel Type	Emission Factor kg CO_2 / GJ
Natural Gas	56
Oil and Oil Products	73
Coal	94

Temperature Adjustment
In the Netherlands, fuel consumption, and subsequently CO_2 emissions, are much higher in cold winters than in mild winters. To enable policy development and evaluation, the Netherlands' Government takes these temperature variations into account by adjusting CO_2 emissions. This type of temperature adjustment allows us to differentiate between trends in CO_2 emissions prompted by changing economic circumstances, energy prices and policy measures on the one hand, and influences due to variations in temperature on the other. The methodology for temperature adjustment used in the Netherlands is explained in appendix 3. Table 3.2 provides both the actual and the temperature-adjusted emissions from fuel combustion activities in 1990. As a result of a relatively warm winter in this same year, adjusted emissions are about 5% higher than actual emissions.

Feedstocks and Carbon Storage
The IPCC methodology assumes that part of the carbon in fossil fuels is not oxidized but stored in products such as plastics and bitumen. The Netherlands' Government considers that non-energy use of feedstocks and their subsequent emissions should be distinguished from emissions from energy use of fossil fuels. Therefore, table 3.2 includes a separate category for Actual Emissions from Feedstocks. This inventory does not make use of the default methodology provided

Figure 3.1 CO_2 emissions and carbon stored from feedstocks in 1990



by the IPCC to estimate carbon stored, but uses a methodology based on more detailed data concerning products produced from feedstocks. A distinction is made between emissions due to production processes and emissions due to product use during the lifetime of the product. Energy statistics in the Netherlands provide detailed information on the quantity of fossil fuels used in various products. Detailed information concerning product use and manufacturing provides the basis for estimating the fraction of carbon emitted due to the production process (e.g. CO_2 emissions from fertilizer production), the fraction of carbon emitted during the use of the product (e.g., CO_2 emissions from the use of lubricants) and the fraction of carbon stored in the product and not emitted into the atmosphere. No correction is made for the import and export of products containing carbon. However, as the Netherlands is a net exporting country of products containing carbon, CO_2 emissions from feedstocks actually occurring in the Netherlands have been overestimated to an extent which has not yet been quantified. Research is under way to enable measurement of this in the future.

Figure 3.1 presents CO_2 emissions from feedstocks in 1990. A more detailed breakdown of emissions per product can be found in the background document (Amstel et al., 1994).

3.2.2 Other categories of emissions

Table 3.4 shows CO_2 emissions from non-energy categories. In the Netherlands, industrial processes which cause CO_2 emissions are cement production, iron and steel production, flue gas desulphurization and glass manufacturing. Total emissions from industrial processes are estimated to be 1,850 Gg CO_2. The ceramic industry may also contribute to CO_2 emissions, although precise data is not available.
Estimates of CO_2 emissions from waste incineration are based on a careful analysis of waste flow and the contribution of fossil carbon to the total carbon content of the waste. "Fossil" carbon refers to the amount of carbon derived from products which are produced from fossil fuels, such as plastics. CO_2 emissions from the incineration of organic carbon, for example wood, are not taken into account since there are no **net** emissions from the incineration of organic carbon (assuming that the source of carbon is sustainably grown). Total emissions from waste incineration amounted to 900 Gg.

3.2.3 CO_2 removals

Figures on carbon removals due to reforestation are based on studies of the increase of biomass in the Netherlands and on dynamic models of the carbon cycle (Mohren and Klein Goldewijck, 1990; Nabuurs and Mohren, 1993 a; 1993 b). Net carbon storage is relatively limited and amounts to 120 Gg. Details of the calculation of carbon storage through reforestation can be found in the background document (Amstel et al., 1994).

3.2.4 Comparison of the IPCC methodology and the Netherlands' policy approach

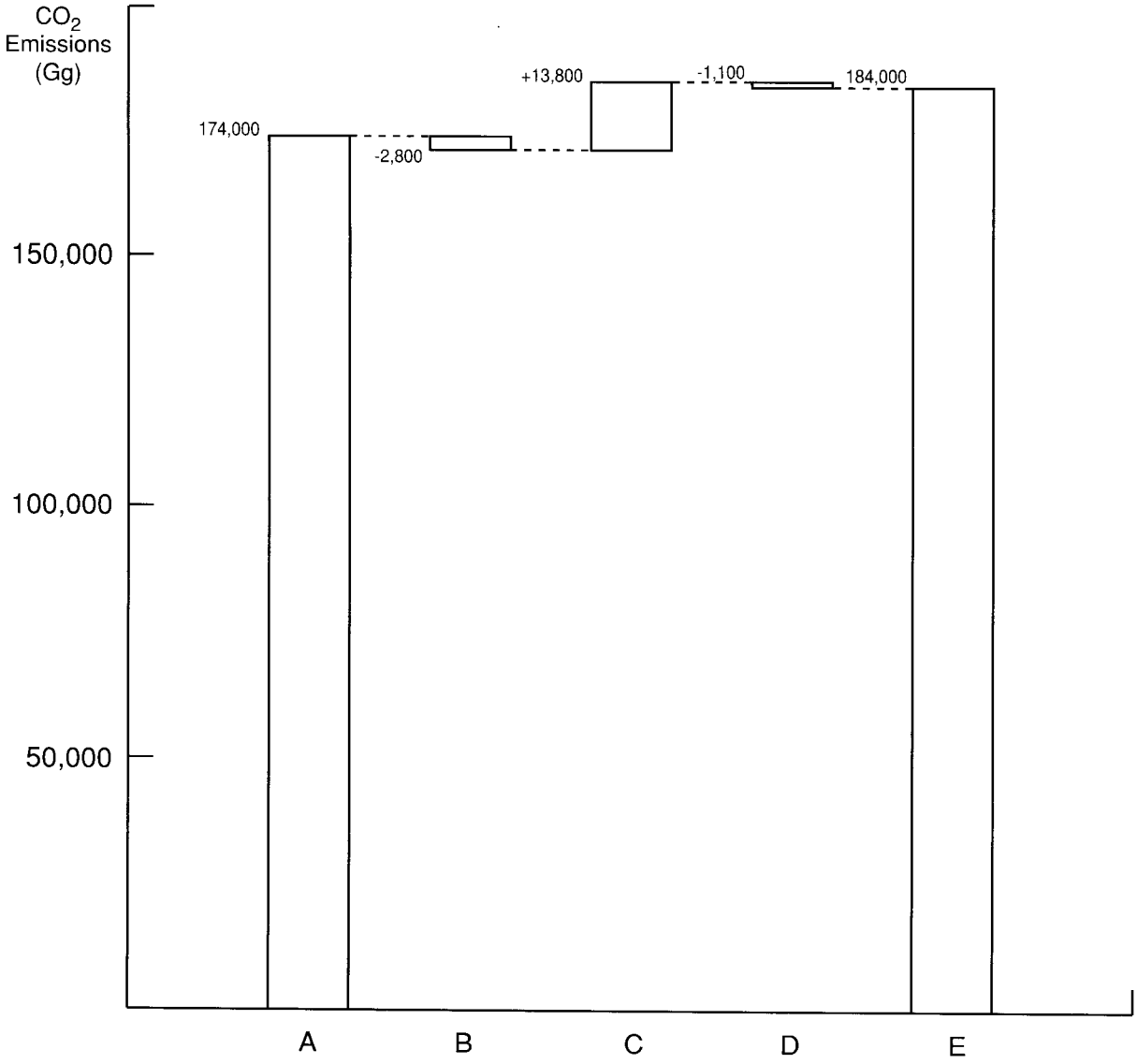
The IPCC methodology used to estimate CO_2 emissions differs on some points from the inventory methodology used by the Netherlands in developing its policy. The target set by the

Table 3.4 CO_2 emissions from non-energy categories in 1990

	Activity Data	Emission Factor	CO_2 Emissions
Industrial Processes			
Portland Cement	1 Mton lime	0.8 ton CO_2/ton lime	800 Gg
Iron and Steel	0.9 Mton lime addition	0.8 ton CO_2/ton lime	700 Gg
Flue Gas Desulphurization	0.2 Mton lime	0.8 ton CO_2/ton lime	150 Gg
Glass Manufacturing	0.25 Mton lime addition	0.8 ton CO_2/ton lime	200 Gg
Total Emissions from Industrial Processes			1,850 Gg
Waste			
Waste incineration	3,400 Gg, carbon content 900 Gg	26% of carbon incinerated is fossil carbon	900 Gg
Total (rounded)			**2,800 Gg**

Source: Amstel et al., 1994

Figure 3.2 CO_2 emissions (1990) according to the IPCC methodology and the Netherlands' Policy Approach



A: Total CO_2 emissions according to IPCC methodology (temperature corrected).
B: CO_2 emissions from Industrial Processes and Waste Incineration.
C: Stored carbon from Feedstocks (potential emissions minus actual emissions).
D: Statistical differences (due to disparity between demand and supply figures).
E: Total CO_2 emissions according to Netherlands' Policy Approach (temperature corrected).

Netherlands to reduce CO_2 emissions is based on this policy approach and can not therefore simply be compared with the 1990 CO_2 emission estimates obtained according to the IPCC methodology. The same applies for the approach taken in projections of emissions (chapter 5).

The main difference between the two approaches concerns the treatment of emissions from feedstocks. The approach taken in developing the target for the Netherlands is based on the assumption that all carbon contained in the feedstocks will be emitted into the atmosphere, without taking the carbon stored in products into account. Therefore, emissions from waste incineration are ignored. Another difference is that the Netherlands' policy approach does not take into account emissions from industrial processes. Furthermore, the IPCC methodology is based on energy supply figures, while the Netherlands' poli-

Table 3.5 CO_2 emissions (Gg) in 1980, 1985, 1990, 1991 and 1992 (corrected for variations in temperature)

Fuel Combustion Activities Energy	1980	1985	1990	1991	1992
Energy and Transformation	46,900	42,500	51,600	52,900	53,300
Industry	41,200	26,700	34,000	32,400	34,800
Transport	23,300	23,400	26,900	26,900	28,000
Commercial/Institutional	18,000[1]	11,600	10,900	11,400	11,500
Residential	26,800	23,500	22,300	21,900	21,600
Agriculture/Forestry	IE[2]	6,400	9,700	9,500	10,100
Non-combustion activities Energy					
Actual emissions from feedstocks	8,300	13,500	14,800	15,600	14,900
Industrial Processes	1,500	1,500	1,900	1,900	1,900
Waste	500	500	900	900	900
Statistical Differences[3]			1,000	1,000	-400
Total	166,500	149,600	174,000	174,400	176,600

1 Including emissions from Agriculture and Forestry.
2 IE = Included elsewhere. Emissions from Agriculture and Forestry are included in the emissions from Residential/Institutional
3 Emissions from the various sectors do not add up to total CO_2 emissions due to statistical differences and approximations e.g. in the sectoral breakdown for the energy balance.

Source: Amstel et al., 1994
Note: CO_2 emissions in 1993 showed a decrease of approximately 1.5% compared to 1992.

cy approach is based on the energy demand figures. The statistical disparity between these two approaches amounts to 1000 Gg. Finally, the Netherlands' target is based on emissions corrected for variations in temperature and on the average emission figures for 1989 and 1990. Figure 3.2 presents the corresponding figures for both approaches.

3.2.5 Trends

Table 3.5 presents trends in CO_2 emissions from 1980 to 1992 according to the IPCC methodology. The emission estimates are corrected for temperature variations for policy evaluation. It can be seen from table 3.5 that CO_2 emissions in 1985 were about 10% lower and in 1990-1992 about 5-6% higher than in 1980. However, the uncertainty in the emission estimates for 1980 and 1985 are relatively high (especially for those concerning actual emissions from feedstocks, and emissions from waste and industrial processes).

3.2.6 International bunkers

Emissions from international aviation and marine bunker fuels are not included in total national emissions and therefore do not appear in table 3.1 and 3.2. Breakdown of CO_2 emissions from international bunkers is provided in table 3.6. The order of magnitude of emissions from bunkers is about a quarter of the emissions from the energy sector. Emission factors for the corresponding fuels (default IPCC values) are also provided in table 3.6.

Table 3.6 CO_2 emissions from marine and aviation bunkers in 1990

	Fuel consumption (PJ)	Emission factor (Gg CO_2/PJ)	CO_2 Emissions (Gg)
Marine Bunkers	466	77	35,900
Aviation Bunkers	61	73	4,500
Total	**527**		**40,400**

Source: Amstel et al., 1994

3.2.7 Uncertainty

The uncertainty in emission estimates from fossil fuel combustion amounts to roughly 2%. This uncertainty is related to uncertainty in activity data (the statistics on energy balances) and emission factors applied in the aggregated approach. The uncertainty in the emission estimates from categories other than energy is not known. However, it is estimated that the overall uncertainty in the emission estimates of total CO_2 emission will not exceed 2%.

3.3 CH_4 EMISSIONS

The methodology used to estimate CH_4 emissions is described in detail in the background document (Amstel et al., 1994) and is based primarily on the IPCC methodology (IPCC, 1994). For the estimation of CH_4 emissions from enteric fermentation and animal waste, emission factors have been adjusted to local conditions. Since sufficient data is available on landfilling, a detailed time-dependent method has been used to estimate emissions from landfills.

Table 3.7 gives a breakdown of CH_4 emissions in the Netherlands. The main sources of CH_4 emissions are animal husbandry and landfills. Other sources are gas production and distribution. In the 1980's, emissions from agriculture rose slightly and there was a marked increase in emissions from landfills. During the early 1990's, emissions in agriculture and landfilling returned to a more stable level. In 1990, total fugitive fuel emissions were relatively low compared to emissions in the eighties, in 1991 and in 1992. This can be best explained by a lower energy consumption due to the relatively mild winter of 1990.

The uncertainty in the estimates of CH_4 emissions from various sectors is estimated at 30%, while the uncertainty in emission estimates from wastes is 50%. The overall uncertainty of CH_4 emissions is estimated at 30%.

3.4 N_2O EMISSIONS

Compared to other greenhouse gases, sources and sinks of N_2O emissions are not yet fully understood. Although the number of identified sources has increased since a previous inventory of N_2O emissions in the Netherlands (Born et al., 1991), current research may not cover all sources of anthropogenic N_2O emissions. Some sources of N_2O emissions may remain unidentified, while other sources are not yet quantifiable, for example, the formation of N_2O due to air pollution in the lower atmosphere.

Depending on the source of N_2O emissions, emission estimates have proved to be highly unreliable. The overall uncertainty in emission factors applied can range from 50 - 100 %. Nevertheless, the uncertainty in N_2O emission estimates has decreased considerably since the previous emission inventory, especially regarding N_2O emission

Table 3.7 CH_4 emissions (Gg) in 1980, 1985, 1990, 1991 and 1992, from various sectors

	1980	1985	1990	1991	1992
Energy, Total	**192**	**194**	**177**	**197**	**193**
Fuel Combustion Activities	28	28	28	28	28
Fugitive Fuel Emissions					
- Gas Production	65	58	52	60	60
- Gas Transportation	9	8	6	8	8
- Gas Distribution	83	80	72	84	80
- Oil Production	7	20	19	17	17
Agriculture, Total	**494**	**512**	**508**	**512**	**498**
Enteric Fermentation	416	421	402	412	401
Animal Waste	78	91	106	100	97
Waste, Total	**265**	**328**	**382**	**380**	**378**
Landfills	260	323	377	375	373
Sewage Treatment[1]	5	5	5	5	5
Total	**951**	**1034**	**1067**	**1089**	**1069**

Source: Amstel et al., 1994

[1] Including Drinking Water Treatment

Table 3.8 N_2O emissions (Gg) in 1980, 1985, 1990, 1991 and 1992, from various sectors

	1980	1985	1990	1991	1992
Total Energy	**4.2**	**4.3**	**6.1**	**6.0**	**6.2**
Fuel Combustion Activities					
- Energy and Transformation	0.4	0.4	0.5	0.4	0.4
- Industry	0.4	0.3	0.1	0.1	0.1
- Residential and Commercial	0.1	0.1	0.1	0.1	0.1
- Transport	3.3	3.5	5.4	5.4	5.6
Industrial Processes	**13.6**	**16.4**	**16.4**	**16.4**	**16.4**
Total Agriculture	**23.1**	**23.4**	**22.1**	**22.3**	**21.9**
- Soils: Fertilizer Induced Emissions			8.3		
- Soils: Anthropogenic Background Emissions			13.8		
Total Waste	**4.0**	**4.1**	**4.1**	**4.4**	**4.6**
- Waste Incineration	0.0	0.1	0.1	0.1	0.1
- Waste Water Treatment Plants	4.0	4.0	4.0	4.3	4.5
Other	**10.8**	**10.8**	**10.9**	**11.0**	**10.7**
- Polluted Inland and Coastal Water[1]	10.8	10.8	10.9	11.0	10.7
Total	**55.8**	**59.1**	**59.6[2]**	**60.2**	**59.9**

Source: Amstel et al., 1994

[1] Contributing sectors: agriculture, energy, transport, industry, households.
[2] Since the background emissions of N_2O from soils has only recently been quantified, the estimates of N_2O emissions provided in various policy documents (VROM 1994) include natural emissions of N_2O from soils (with a total of 62.6 Gg N_2O emissions in 1990).

estimates from fossil fuel combustion. This uncertainty currently lies nearer the lower end of the above-mentioned range.

Table 3.8 presents estimates of N_2O emissions from various sectors for the years 1980, 1985, 1990, 1991 and 1992. Land use, industrial processes and polluted water are the main sources for N_2O emissions in the Netherlands.

The methodology of estimating N_2O emissions from soil takes into account various types of land use, various types of soils, and nitrogen input from both synthetic fertilizers and animal manure. In contrast with the IPCC methodology, indirect emissions due to the atmospheric deposition of, amongst others, volatilized ammonia, are also taken into account. Since deposition of ammonia takes place on both agricultural and non-agricultural soils, the figure for N_2O emissions from soils includes both types of soils. In the Netherlands, the natural background emissions of N_2O emissions is assumed to be 3 Gg N_2O.

N_2O emissions from inland and coastal waters may increase due to human activities, as a result of increased run-off of nitrogen into water. Since estimates of these indirect N_2O emissions are rather unreliable, the IPCC does not yet provide a default methodology for indirect emissions. However, since the Netherlands has a very high level of manure application to soils, these indirect emissions are substantial and must, therefore, be taken into account in this inventory. The natural background of N_2O emissions from inland and coastal waters is assumed to be negligible. Table 3.8 also shows that N_2O emissions from agriculture are fairly constant over time. During the 1980's in particular, N_2O emissions from transport show an increase, due to sharply rising transport and de-NO_x catalytic converter use.

3.5 OTHER GASES

Table 3.9 presents emissions of NO_x, CO, NMVOC, HFCs and PFCs. The figures do not include emissions from international bunkers. NO_x emissions amounted to 575 Gg in 1990 and have not increased since 1985; an increase in emissions of transport was offset by a decline in other sectors. The main sources of CO emissions are the steel industry and road transport. CO emissions amounted to 1030 Gg in 1990. Emissions of CO have shown a marked decrease since 1985. NMVOC emissions amounted to 459 Gg in 1990 and have decreased slightly since 1985. Emissions of PFCs have also increased slightly since 1985.

Table 3.9 Emissions of NO_x, CO, NMVOC, PFCs and HFCs (Gg) in 1985 and 1990

	1985	1990
Emissions of NO_x (Gg)		
Energy and Transformation	94	92
Industry	86	86
Transport	339	351
Other	57	47
Total	576	575
Emissions of CO (Gg)		
Stationary Sources	342	313
- Steel Industry	239	229
Mobile Sources	962	716
- Road Transport	923	675
Total	**1304**	**1029**
Emissions of NMVOC (Gg)		
Energy and Transformation	23	19
Industry	110	104
Transport	232	195
Commercial/Institutional	62	58
Residential	32	30
Other	50	53
Total	**509**	**459**
Emissions of PFCs and HFCs (Gg)		
CF_4	0.502	0.516
C_2F_6	0.0502	0.0516
HFCs	0	0

Source: Amstel et al., 1994

3.6 AGGREGATED EMISSIONS

Emissions of various greenhouse gases can be expressed in aggregate terms using Global Warming Potentials (GWP). Although the Netherlands' Government will take, at least in the period up to the year 2000, a gas-by-gas approach in addressing climate change, this section provides aggregate emission estimates for reasons of comparison (because of the ultimate target of the FCCC) and to indicate the extent to which various greenhouse gases contribute to the radiative forcing of total emissions. Table 3.10 gives a breakdown of 1990 emissions expressed in CO_2 equivalents (direct effects). CO_2 emissions amount to 85% of total emissions (expressed in CO_2 equivalents), CH_4 emissions amount to 6% and N_2O emissions amount to 9%.

As can be seen from table 3.10, aggregated emission estimates are based on the direct effects of greenhouse gases.

To give a rough indication of aggregated emissions based on both the direct and indirect effects of greenhouse gas emissions, the Netherlands assumes for the time being that the direct and indirect effects of CH_4 have the same order of magnitude (IPCC, 1992). In 1990, aggregated emissions (based on direct and indirect effects) are estimated at 213,500 Gg CO_2 equivalents (relative contribution of CH_4 was 11%; relative contribution of N_2O was 8%). Aggregated emissions based on direct effects amounted to 187,000 Gg CO_2 equivalents in 1980. Emissions based on direct and indirect effects amounted to 197,500 Gg CO_2 equivalents in that year. In 1985, aggregated emissions amounted to 177,100 Gg CO_2 equivalents (based on direct effects) and 188,500 Gg CO_2 equivalents (based on direct and indirect effects).

Table 3.10 Aggregated emissions based on direct effects of CO_2, CH_4 and N_2O in 1990, 1991 and 1992

	CO_2 (Gg)[1]	CH_4 (Gg CO_2 equivalents)[2]	N_2O (Gg CO_2 equivalents)[2]	Aggregated emissions (Gg CO_2 equivalents)
Energy	171,200	1,900	1,700	174,700
Industrial Processes	1,900	0	4,400	6,300
Solvent Use	0	0	0	0
Agriculture	0	5,600	8,900[3]	14,500
Land Use Change & Forestry	(-120)[4]	0	0	(-120)[4]
Waste	900	4,200	1,100	6,200
Total 1990	**174,000**	**11,700**	**16,100**	**201,800**
Total 1991	**174,400**	**12,000**	**16,300**	**202,700**
Total 1992	**176,600**	**11,800**	**16,200**	**204,600**

[1] Temperature adjusted
[2] Global Warming Potentials (GWPs) used were provided by the IPCC in its 1992 supplementary report. GWPs used are based on the direct effects of greenhouse gases over a 100 year time horizon: GWP of CH_4 = 11; GWP of N_2O = 270.
[3] Including N_2O emissions from Polluted Inland and Coastal Water.
[4] Carbon sinks are not included in the total budget of CO_2 emissions.

4. PROGRAMMES, POLICIES AND MEASURES

4.1 INTRODUCTION

This chapter provides a summary of policies and measures to address climate change with a focus on measures that have been adopted for the 1990-2000 period. Section 4.2 presents the overall policy context. In section 4.3 an overview is given of the (sectoral) instruments which contribute to attaining climate policy objectives; this section also gives an overview of some intermediary organizations that play an important role in implementation. The final part of section 4.3 provides for an overview of all policies and measures taken since 1990 which are relevant to climate change. Policies and measures included have been set out in a number of memoranda and plans, which have been approved by Parliament. Although implementation has already taken place in many cases, it is less definite for a few measures, which are discussed in section 4.4 of this chapter. Section 4.5 deals with monitoring. Necessary funds have been allocated in the annual budget (see section 4.6). Therefore, a firm commitment exists to implementing those measures. This chapter ends with a short description of the policy approach for the period after the year 2000 (section 4.7).

Measures and policies are presented by gas and by sector, in compliance with the INC guidelines. The following sectors are included: energy transformation industries, transport, (energy-related and non-energy related) industry, waste, residential and commercial, agriculture, and land use change and forestry. For each sector, relevant targets, policy instruments, supporting programmes and measures are indicated.

4.2 OVERALL POLICY CONTEXT

4.2.1 Policy development since the base year 1990

The Netherlands' Government has subscribed to a long-term international environmental quality target, calling for the stabilization of concentrations of greenhouse gases in the atmosphere at a level well below twice the pre-industrial concentration level, by the end of the next century (VROM, 1991b). It stated that it will make a reasonable contribution towards achieving this international objective. The Netherlands' policy aims to anticipate the possibility of strengthening reduction targets in the next century by preparing relevant policy options which take into account international reduction scenario alternatives. In this respect, the need for joint commitments on an international level is recognized.

The Netherlands' climate policy is to a large extent a combination of different policy areas. It coordinates and reinforces policies already adopted for other reasons, e.g. acidification abatement or the promotion of efficient energy management. Hence, climate policy is basically the sum of a large number of policy areas, each with their own sets of policy instruments. However, the Netherlands has been working towards integrating climate policy. The first National Environmental Policy Plan 1989 (NEPP) attempted to integrate climate policy into energy, transport and waste policy. This integration was reinforced with the next National Environmental Policy Plans of the Netherlands (VROM, 1990a; 1994). The Netherlands Memorandum on Climate Change (VROM, 1991b) elaborated climate policy in greater detail and set out a framework for addressing the problem in the longer term. Actual policy measures with relevance to climate change have been incorporated into sectoral policy documents (e.g. EZ, 1990, VW, 1990) prepared by different ministries in cooperation. Evaluation of the policies formulated in the National Environmental Outlooks is conducted regularly (RIVM, 1989; RIVM, 1991; RIVM, 1993 a-b; RIVM, 1994). The conclusions of the evaluation are taken into account in subsequent policy development. Box 4.1 gives an overview of relevant documents.

The Netherlands' environmental policy (and its objectives for the year 2000) has been developed on the basis of a number of themes, including climate change, acidification, eutrophication, diffusion, disturbance, waste disposal, dehydration, and squandering (VROM, 1989). For each theme, environmental deficiencies are identified, and objectives and policies are formulated. The theme 'climate change' includes the problems of depletion of the ozone layer and the greenhouse effect. Since ozone depletion is covered in the Montreal Protocol, this document focuses only on the greenhouse effect. Hence, in this document 'climate change' refers exclusively to the greenhouse effect.

The Netherlands' short-term climate policy focuses on the emissions of all relevant greenhouse gases and follows a 'gas by gas' approach (CO_2, CH_4, N_2O, NO_x, CO, NMVOC, CFCs). The Netherlands will continue to follow this approach in preference to a comprehensive gas strategy. However, the Netherlands will consider the adoption of a comprehensive approach after the year 2000, depending upon availability of scientific data on global warming potentials (VROM, 1991b).

Box 4.1 Overview of documents

Environmental policy with respect to climate change

VROM, 1989	**National Environmental Policy Plan (NEPP)** Objectives for environmental policy for the year 2000, formulated on the basis of various policy themes including climate change.
VROM, 1990	**National Environmental Policy Plan Plus (NEPPP)** Aims to accelerate the speed of long term environmental objectives of NEPP, by reinforcing rather than changing existing policy (NEPP); strengthened the national CO_2 strategy.
VROM, 1993	**Second National Environmental Policy Plan (NEPP 2)** Formulates supplementary policy (additional measures) needed to fulfil the objectives of NEPP.
RIVM, 1988	**National Environmental Outlook 1 ('Concern for tomorrow')**
RIVM, 1991	**National Environmental Outlook 2** Evaluation of environmental policies
RIVM, 1993a	**National Environmental Outlook 3** Evaluation of NEPPP
RIVM, 1993b	***Milieurendement van het NMP-2*** Evaluation of the effects of the measures indicated in NEPP2
RIVM, 1994	***Bijlage E t/m H*** (Annexes E-H to RIVM, 1993b)
Climate policy	
VROM, 1991	**Memorandum on Climate Change** Elaborates the climate policy in greater detail, and formulates CH_4 and N_2O strategies; sets out longer term framework.
Sectoral policy	
EZ, 1990	**Memorandum on Energy Conservation (MEC)** Strategy for energy conservation and renewable energy sources.
EZ, 1993	**Second Memorandum on Energy Conservation (SMEC)** Update of MEC with additional measures to fulfil the energy conservation target for the year 2000 and with an assessment of long-term options for CO_2 emission reductions.
VROM, 1988	**Memorandum on the Prevention and Recycling of Waste** Strategy to reduce waste streams
VROM, 1991 (app. 3)	**Summary of plan for CO_2 reduction through waste policy** Plan defining aims and implementation modalities of waste management policy with respect to greenhouse gas emissions
Senter, 1993	***Rapportage programma CO_2 en afvalstoffen 1992-1993*** Monitoring of waste management policy with respect to greenhouse gas emissions
VW, 1990	**Second Transport Policy Plan** Integrated approach of accessibility and environment.
VW, 1993	**Review of the Second Transport Structure Plan (condensed version)**
LNV, 1993	***Bosbeleidsplan*** Afforestation policy; adjusted afforestation target

Quantitative targets formulated in the Netherlands' Climate Policy include levels of CO_2, CH_4 and N_2O. The objectives for other greenhouse gases (NO_X and NMVOC) are covered by policies concerning other themes. Phasing out CFC emissions is covered by a CFC action programme within the context of the Montreal Protocol, while abatement of NMVOC is covered in the Hydrocarbons 2000 Project under the theme diffusion. NO_X is addressed under acidification. Other policy themes with relevance to climate policy include squandering, waste management and eutrophication.

Chapter 3 shows the inventory of greenhouse gas emissions in the Netherlands. This inventory forms the basis for the measures, policies and programmes adopted to address climate change.

For each policy or programme, a range of instruments is available. In order to assist planning and implementation, an institutional structure has been set up and linking mechanisms between different departments and bodies have been established. This has been followed up by a process of monitoring and evaluating the effects of the plan. The results of the evaluation have been used to adjust policies.

Table 4.1 illustrates various reduction targets for all the main greenhouse gases, as formulated by the Netherlands. Under the existing national environmental policy plans, the national CO_2 target is to stabilize emissions in 1994-95, and to achieve an emission reduction of 3-5% by 2000 compared to emissions in 1989-90 (VROM, 1990a). As discussed in NEPP 2, the Netherlands' Government will decide in 1995 whether the provisional 5% emission reduction target should come into force, taking account of international developments and opportunities. The CH_4 emissions reduction target amounts to 10% by 2000 compared to 1990, and the target for N_2O is to stabilize these emissions by 2000 compared to 1990. Targets for the reductions of emissions of NO_x and NMVOCs have been set within a different policy context. With respect to NO_x, the target is to reduce emissions by 55% by the year 2000 compared to emission levels in 1988. For VOCs, the aim is to reduce emissions by 60% by 2000 compared to 1988. For CO, the aim is a 50% emission reduction by the year 2000 compared to 1990 (VROM, 1991b). The target for CFCs is to phase out these compounds completely and to reduce emissions to zero by the year 2000. However, since emission reduction strategies are covered by the Montreal Protocol, they will not be described in this document. National targets for HFCs and other Fluorocarbons have not yet been set. A background study on HFC and PFC emissions is underway.

Part of the National Planning process is a periodical update of policies and measures on the basis of monitoring and evaluation procedures. In this respect, important milestones are, amongst other things, the update in 1997 of NEPP 2 and SMEC. In 1995 an interim evaluation is scheduled of the assumptions underlying NEPP 2 and SMEC policies and measures. Monitoring programmes have been developed to register progress in the implementation and the effects of policies and measures. These monitoring activities are described in section 4.5.

4.2.2 An introduction to the sectoral approach

The most important policy areas relevant to the Netherlands' climate policy include energy (Ministry of Economic Affairs), transport (Ministry of Transport, Public Works and Water Management) and waste (Ministry of Housing, Spatial Planning and Environment). However, policies overlap to a considerable extent. Energy policy, for example, includes energy conservation policy for transport. The policy strategies of these sectors are presented below. These policy strategies are further specified in various sectoral policy documents, including the two Memoranda on Energy Conservation (EZ, 1990; EZ, 1993), the Second Transport Structure Plan (VW, 1990) and the Memorandum on the Prevention and Recycling of Waste (VROM, 1988). The targets of the Netherlands' Climate Policy have been integrated into sectoral policies, but sector-specific targets are broader in nature, i.e. embrace other sectoral objectives as well. The targets in the various policy fields are generally formulated in units relevant to that field, for example in terms of energy efficiency, number of vehicle kilometres or tons of waste. However, in general, the reduction targets for specific gases have not been subdivided into sectoral sub-targets. Although the INC

Table 4.1 The Netherlands' targets for reducing greenhouse gas emissions

Gas	Emissions in 1990 (Gg)[1]	Reference year	Emissions in reference year (Gg)	Emissions in the year 2000 (target)(Gg)	Reduction % by the year 2000 compared to reference year
CO_2[2]	184,000	'89-'90	182,000	173,000-177,000	3% - 5%
CH_4	1,067	1990	1,067	970	10%
N_2O	59.6	1990	59.6	59.6	0%
NO_x	575	1988	548	240-249[3]	55%
VOC	459	1988	520	193-205[3]	60%
CO	1,030	1990	1,030	515-540[3]	50%

[1] CO_2 emission is temperature corrected

[2] CO_2 emissions as calculated according to the Netherlands' Policy Approach (see section 3.2.4). According to the IPCC methodology, total CO_2 emissions amounted to 174,000 Gg in 1990.

[3] VROM, 1991b, 1994

suggests a slightly different sector classification, the policy objectives and targets are briefly described using the Netherlands' sector approach, i.e. energy policy (including energy conservation policies in various sub-sectors, fuel mix policies and cross-cutting policies), transport policy and waste management. In describing policies, measures and programmes, this document follows INC guidelines of sector/gas classifications as far as possible.

Energy policy

The goal of energy policy is to contribute to a reliable, cost-effective and clean energy supply. Energy policy can make an important contribution to environmental and climate change policies. Accordingly, energy policy, as presented in the first and second Memoranda on Energy Conservation (EZ, 1990; EZ, 1993), has been coordinated with environmental policy planning, as presented in the National Environmental Policy Plans (VROM, 1989; VROM, 1990a; VROM, 1994). The Memorandum on Energy Conservation (EZ, 1990) further encouraged energy conservation and renewable energy resources, thanks to increasing environmental awareness. The ambitious target was set so as to increase the annual energy efficiency improvement rate to 2%. Given unchanged policy, this percentage would not have exceeded 1%. The Memorandum made clear that in order to reach this target, concerted efforts from many participants - citizens and companies, as well as governments - were required. Given the general economic outlook of that time and the effects of other relevant policies, the overall CO_2 target was considered feasible (VROM, 1990a). In the first half of 1993 the effect of the energy policy was evaluated; the Second Memorandum on Energy Conservation (EZ, 1993) evaluated developments since 1990. Although this evaluation concluded that the chosen strategy was effective and that the policy effort has given a substantial momentum towards achieving the envisaged energy conservation goals, additional measures were considered necessary (EZ, 1993). Due to revisions in expectations regarding economic growth and energy price development, the target for annual improvements in energy efficiency has been adjusted to 1.7% for the period 1990-2000 (see table 4.2). For renewable energy, the target is to increase the contribution from less than 1% of primary energy consumption in 1990 to 3% by the year 2000. These targets can still be met with 'no regrets' measures. Given the current economic outlook, the fuel mix in electricity generation and the effects of other relevant policies, including the possible introduction of a CO_2 energy tax in the European Union or nationally, the overall CO_2 target (3% emission reduction) is still within reach (EZ, 1993).

Transport Policy

The primary objective of the Netherlands' transport policy is to increase accessibility while protecting the environment. Measures have been taken to tackle a number of environmental pro-

Table 4.2 Energy efficiency improvement in the Netherlands in the period 1989-2000

Sector	Share of Energy Consumption in 1990 in %	Updated Target in Second Memorandum on Energy Conservation in %
Manufacturing Industry		
- incl. feedstocks	43.1	12
- excl. feedstocks	27.6	19
Agriculture	6.1	26
Non-Residential buildings	10.1	23
Households	16.2	23
Transport	13.3	10
Power Stations[1]	11.2	26
Total for the Netherlands	**100 incl. feedstocks**	**17 incl. feedstocks** **19 excl. feedstocks**

Source: EZ, 1993

[1] The energy savings in this sector largely consist of reduced conversion loss due to the transmitted effect of electricity savings by end users. In addition, the energy efficiency of the generating sector has increased from 40 to 43%.

blems, including climate change. In fact, no measures for the period 1990-2000 have been taken solely to reach the CO_2 targets. The Ministry for Transport, Public Works and Water Management is primarily responsible for transport policy, i.e. infrastructure and mobility.

The Ministry for Economic Affairs is charged with efficiency improvement of vehicles and the development and application of alternative fuels in road transport. Transport policies and measures should be considered in a context of growing international reliance on transportation, due to logistical processes in the European market, economic growth, access to Eastern Europe etc. Freight traffic has developed at a higher rate than was expected a few years ago. The major causes of present growth of freight traffic are structural economic changes in sectors that are more dependent on freight transport and increased international transport (more volume, longer distances).

Waste Management
The main objectives of waste policy are to prevent waste and to minimize the environmental risks of waste disposal. In 1988, the Memorandum on prevention and recycling of waste was published (VROM, 1988). The policy set out in this memorandum is still relevant. It aims to concentrate on the most important waste substances (priority substances) and to establish measures to be taken in consultation with the parties concerned.

Examples of priority waste substances are used paper, building and demolition waste, packaging waste, household appliances (refrigerators, televisions etc.) and batteries. The Environmental Protection Act lists waste disposal methods in order of preference, known as the so-called 'ladder concept'. The order of preference is the following: prevention, product recycling, material recycling, useful applications, disposal with energy recovery, other disposal methods, landfilling. Recycling of waste can conserve energy involved in producing the materials and products.

Furthermore, recovery of energy through incineration of waste and recovery of landfill gas for energy purposes contributes to reductions in CO_2 emissions. At the same time, controlling emissions from landfills contributes to the reduction of methane emissions.

4.3 CLIMATE CHANGE POLICY

4.3.1 Instruments

The Netherlands uses a policy mix of different instruments, including standards and regulations, financial and fiscal incentives, voluntary arrangements (long-term agreements) between Government, industries and sectors ('self regulation'); raising public awareness, and research and development (technology development). The choice of instruments depends upon each target and target group, and hence, the general policy may be described as 'tailored to each target group'. There is a large number of target groups to be considered (see chapter 2, section 2.2), each having their own specific features which require an 'individual' approach. The various policy instruments have their own strengths and weaknesses and are most effective when implemented as a whole. Usually, policy instruments and measures are supported by relevant programmes and legal instruments. In box 4.2, an overview of supportive programmes is given, and box 4.3 provides a comprehensive overview of relevant legislative frameworks.

Voluntary agreements
The Netherlands has a tradition of developing voluntary agreements between various economic sectors and the ministries responsible. The principle reason for this emphasis on voluntary agreements is to secure the acceptance of measures by all relevant participants. Negotiations on voluntary agreements usually take place with intermediary organizations, such as branch organizations. The agreements usually take the form of a Covenant or a Long-Term Agreement (LTA). A voluntary agreement resembles a contract in which signatories commit themselves to the obligations of the agreement. Such agreements are applied in various sectors, including the energy and transport sector, and in waste management. Box 4.5 provides more detailed information on the use of LTAs in energy conservation policy (EZ, 1994b).

Standards and regulations
The Netherlands applies regulatory measures, including prohibitions and standards. Wherever possible, such legislation is in accordance with internationally accepted standards, particularly at the level of the European Union (EU). Major legislative frameworks include the following:

- the Housing Act; provides general regulations for energy savings in new residential and other, non-residential buildings;

- the Energy Savings Appliances Act; provides the basis for general regulations for energy efficiency and labelling of appliances;
- the Environmental Protection Act (1993); requires that permits for installations fulfil all the requirements needed in the interests of protecting the environment. It states explicitly that protection of the environment also includes the economical use of energy.

Current Netherlands' policy involves measures for energy conservation based as much as possible on voluntary agreements with industrial branches. Once it is certain that a company will implement measures, clauses are included in the permit to formalize the situation. Box 4.3 provides a comprehensive overview of legislative frameworks.

Fiscal/financial instruments

A range of economic and fiscal instruments are being applied to encourage environmentally friendly behaviour by changing costs and prices, introducing subsidies, tax provisions, reward frameworks and, where possible, incentives via tariff differences. Besides excise duties on oil products, the Netherlands has a special environmental tax on all fossil fuels. The revenues from this tax have not been allotted. Individual tax rates for different fuels are set on the basis of their energy content (50% of total tax) and their carbon content (other 50%). At the moment the energy portion of the tax amounts to Dfl. 0.3352 per GJ and the carbon part of the tax to Dfl. 5.16 per ton CO_2, depending on type of fuel raising energy prices by 5-20%).

The energy conservation programme of the energy distribution sector is partly financed by a surcharge on the gas and electricity price. Financial instruments are the most important for a number of areas, in particular the promotion of research and development, but also to implementation of energy conservation and renewable energy options which are insufficiently cost-effective without financial support. Financial instruments are not only provided by the central Government. Energy and gas distribution companies play an important role in administering and financing subsidies and other financial incentives aiming at energy conservation. An overview of relevant support programmes containing financial incentives is given in box 4.2.

Box 4.2 Supportive programmes

EMA	Subsidy scheme for energy conservation and environmental consultancy; financial assistance for consultancy services on energy conservation and/or environmental improvements.
BSET	Subsidy framework for new energy conservation techniques; subsidy scheme to stimulate investments in cogeneration, solar cells and solar boilers, and new energy-saving technologies.
TIEB	Tender scheme for industrial energy conservation: subsidy scheme to stimulate feasibility studies, demonstration and market introduction projects on industrial energy conservation.
VAMIL	Tax allowances (accelerated depreciation) on certain investments in environmentally sound and energy saving technologies.
Subsidy scheme wind energy	Investment subsidy to stimulate wind energy.
Tender Programme Environmental Technology	Business oriented technology promotion programme to subsidize environmental technology feasibility studies and research projects on, amongst other things, waste.
Environmental Technology Incentive Scheme	Subsidy scheme on RD&D of environmental technology.
NOVEM programmes	Financial and advisory support for the development, demonstration and application of energy conservation, conversion techniques and energy management in various economic sectors.
MAP-2 instruments	Various financial incentives and energy services provided by the energy distribution sector, aimed at energy management and conservation particularly in small firms, non residential buildings and households.
MPI	The Environment Plan for Industry, formulated by the Gasunie (supplier of natural gas), aims to maximize utilization of natural gas and minimize the emission of hazardous substances.
Thermal Plan	An initiative of the Netherlands Electricity Generating Board (SEP) and production companies aimed at the large-scale utilization of residual heat.

Information
The reduction of greenhouse gas emissions requires the cooperation of the general public in complying with a range of specific regulations. It is vitally important to ensure the social acceptability of the proposed legislation. Education and communication are the primary instruments for raising public awareness, forming an important part of national policy.

Research and technology development
The Government encourages research and technology development in order to improve energy efficiency in industry, transport and households, to increase the use of renewable energy sources and to increase the application of environmentally sound techniques e.g. in agriculture and waste management. The application of research and development instruments, and education training and public awareness, are further elaborated in chapter 9 and chapter 10 respectively.

4.3.2 Intermediary organizations

There is a large number of umbrella organizations, branch organizations and institutions which play an important role in the implementation of climate policy. This section gives a limited overview of the most important intermediary organizations which facilitate the implementation of climate policy. To a large extent, these organizations act as intermediaries between the Government and target groups.

Energy distribution companies
Energy distribution companies (electricity and natural gas) are organized within EnergieNed. The energy distribution companies are closest to the small-scale end users. This makes them most suitable to approach those end users, who tend to require personal attention. Over the past three years, experience has shown that the distribution companies can fulfil that role very effectively. A new set of agreements was concluded early in 1994 between the Ministry of Economic Affairs and the energy distribution sector. The Second Environmental Action Plan (MAP-2) is currently the most important long-term action plan guiding the energy distribution companies (EnergieNed, 1993 and 1994b).

Energy production companies
The electricity production companies, united under the Electricity Generating Board (SEP), are responsible for electricity generation. Gasunie is responsible for the nationwide supply of natural gas. The Gasunie Environmental Plan for Industry (MPI) analyses industrial processes and recommends possibilities for limiting energy consumption in industry. The SEP Thermal Plans also deserve to be mentioned (see box 4.2). Gasunie, EnergieNed and SEP are working to improve coordination of their contribution towards energy conservation policy. The Cogeneration Project Bureau promotes the application of cogeneration and district heating by means of stimulatory measures, consultancy, mediation and information.

NOVEM and Senter
On behalf of the Ministry of Economic Affairs, the NOVEM agency undertakes programmes in various sub-areas, aimed at the development of energy technology and the realization of energy conservation. NOVEM is closely involved in establishing and implementing long-term agreements between Government and target groups. In the construction industry, NOVEM promotes measures aimed at energy conservation, energy management and energy-efficient construction and renovation, both in residential and other construction, and in non-residential buildings. As an intermediary organization, NOVEM bridges the gap

Box 4.3 Legislative frameworks

Housing Act	Legal framework for insulation and energy performance standards for new residential and other buildings
Energy Savings Appliances Act	Legal framework for regulations on labelling and energy efficiency standards for appliances.
DWDL	Decree on Waste Disposal at Landfills contains regulations on methane, i.e. incineration on the landfill gas.
Environmental Protection Act	Provides framework for environmental planning, rules and procedures for environmental permits and financial aspects of policy.
Energy Distribution Act	Includes specification of the role of energy distribution sector in energy conservation policy

between theoretical knowledge and practical application. Another agency, Senter, implements a number of stimulatory schemes in the area of energy conservation and energy transformation technologies.

Provinces and municipalities
Provinces and municipalities both function as custodians of buildings and plants and have responsibility for decision making. In the spatial planning sphere, energy conservation and the utilization of renewable energy will become increasingly important. A guide has been compiled by the Ministries of Economic Affairs and of Housing, Spatial Planning and Environment on how to deal with the licensing procedure for energy and Long-Term Agreements (LTAs) in the context of new powers under the Environmental Protection Act. This procedure includes consultation with municipalities and provinces and is based on the Energy Conservation and Environmental Instruments Project. Steps will also be taken to encourage references to the LTA recommendations in municipal and provincial environmental policy plans. In principle, LTA measures will be approved as part of the licensing procedure. It should also be noted that, traditionally, environmental licences issued by the municipalities and provinces have been the main instrument for regulation of emissions of greenhouse gases such as CH_4, NO_x and NMVOC.

Netherlands' Association of Waste Processors (VvAV)
One of the main intermediary organizations for the disposal of waste is the Association of Waste Processors (VvaV). Members of this organization include landfill owners, incineration companies and composting plants. The VvAV encourages and assists members to increase energy benefits from incineration of waste with research and operating programmes for optimalisation of the burning process and to increase use of the energy produced (thermal energy and electricity). Furthermore, it is involved in the implementation of methane emission reduction through landfill gas recovery.

4.3.3 Reduction strategies for carbon dioxide emissions

National CO_2 strategy
The national target with respect to CO_2 is to stabilize emissions in 1994-95 and to achieve an emission reduction of 3-5% by the year 2000 compared to the emissions in 1989-90.
With reference to NEPPP, the Netherlands' Government will decide in 1995 whether the provisional 5% emission reduction target should come into force, taking into account international developments and opportunities.

Energy and transformation industries
Electricity Production Sector - The electricity production sector should be successful in raising the electricity generation capacity of the central production from 40% in 1990 to 43% by 2000, due to investments in new and more efficient electricity generation capacity. In their Thermal Plans, the sector projected the construction of six new big gas-fired cogeneration plants with a total capacity of 1500 MW by the year 2000. Heat recovery and waste heat distribution will hence become more important.

The increase in electricity imports and the decrease in coal fired capacity will lead to a less carbon-intensive fuel mix for the period 1990 - 2000. In the longer term, coal-fired electricity capacity may not exceed one third of total capacity with an absolute maximum of 6000 MW.

Renewable energy - Renewable energy will already have begun contributing towards CO_2 reduction during the period up to the year the year 2000. The **target** for the year 2000 allocates 3% of the total national energy consumption to be produced by renewable energy. It is expected that in 2000, 85 PJ of fossil energy use will be replaced by renewables. However, its greatest potential lies beyond the year 2000. Instruments to stimulate generation of renewable energy include a wide range of subsidies as well as research and development. Demonstration programmes are linked to market introduction subsidies. Wind energy and waste incineration will remain at the forefront of electricity generation policies. More emphasis will be laid on **measures** to stimulate the application of solar photovoltaic energy, heat pumps, biogasification and cold storage through the provision of subsidies. Furthermore, the use of hydropower and biomass will continue to be encouraged. An action plan on electricity production from biomass will be implemented.

Transport
There is no overall target for the transport sector as a whole. However, the **target** for road transport is to stabilize CO_2 emissions by 1995 at 1989/90 levels of emissions, and achieve 11% emission reduction by 2000 compared to 1990. This emission reduction will apply to both private passenger transport and freight transport. Energy efficiency should improve by 10% in the period 1990-2000 .

No measures for the period 1990-2000 have been taken specifically to reach the CO_2 targets. Nevertheless, a wide range of policy instruments have contributed to reaching the overall environmental targets in the field of transport. Although there is a commitment to implement these measures for the period 1990-2000, the exact time frames for implementation may be lacking.

Private passenger transport - In the absence of any measures, CO_2 emissions are likely to increase by 30% in the year 2000 with respect to 1990 levels of emissions. **Measures** in the private passenger transport sector aim to reach the **target** of an emission reduction of 11% in the year 2000 with respect to 1990 levels. Relevant policy **instruments** include technical measures, fiscal measures, pricing policies, spatial planning, parking policies, enforcement of speed limits, raising public awareness and education. **Measures** in the following policy areas should achieve the intended emission reductions by 2000.

Vehicle related measures
A legislative measure was implemented in 1991 incorporating a mandatory check of engine adjustment as part of the annual vehicle inspections. Through a revision of taxation (emphasizing vehicle-related taxes instead of road taxes), purchase of efficient and clean cars will be stimulated. This taxation will be introduced in 1995 (VROM, 1994). Together with the influence of pricing policy (see below), these measures are expected to counteract negative trends such as a possible trend to drive at higher speeds. Total fuel efficiency in the carpark is expected to increase by 14% by the year 2000 with respect to 1990 levels of efficiency; to a considerable extent, however, autonomous developments are responsible for this increased efficiency.
These vehicle-related measures are expected to account for almost half the expected emission reduction (about 40%).

Limiting the growth of automobility through pricing policy
Pricing policy is an important instrument for limiting the growth of automobility. The real costs of driving a car will increase considerably. Excises have already been increased by 35% between 1986 and 1993 (inflation adjusted prices). Alongside autonomous price increases by 7% (gasoline) to 14 % (LPG and Diesel), price measures have been introduced for the 1990-2000 period, the most significant being an increase of the excise of 20 cents/litre gasoline between 1993 and 2000. Of this excise increase, 11 cts. has already has been achieved, excluding inflation effects (VROM, 1994). These measures are expected to increase general fuel prices for cars by approximately 20%, taking account of autonomous developments. It is agreed that other pricing policies will be introduced i.e.:

- an increase in the annual tax on LPG cars (taking into account the desired market position of LPG with respect to other fuels)
- a fee on driving during rush hour, to be introduced in 1996/1997
- introduction of fiscal instruments (e.g. to reduce the use of lease cars)

These measures will account for about 20% of expected CO_2 emission reduction.

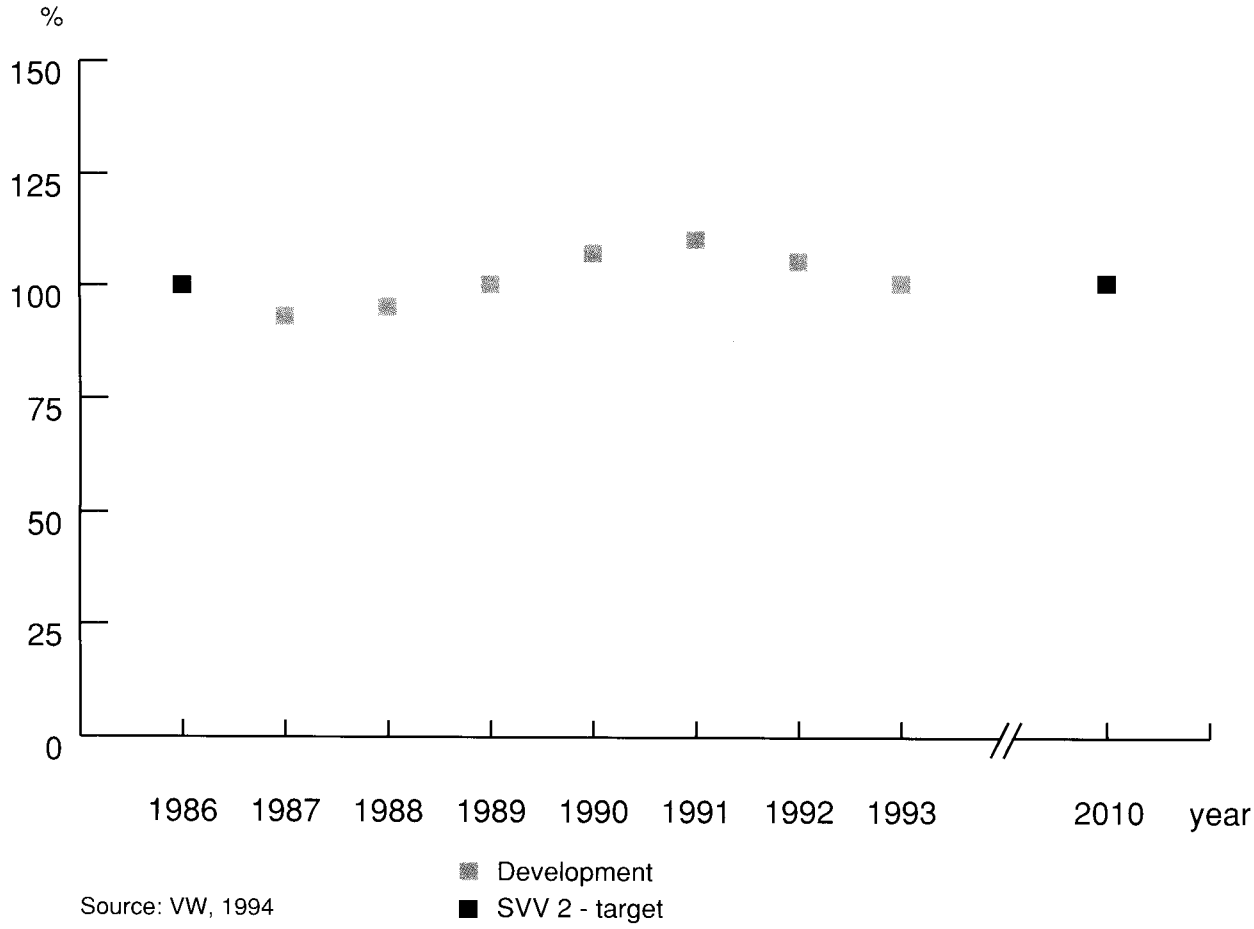
Influencing modal split/ reduction of individual car use
A comprehensive investment programme to improve railroad connections is currently being implemented ('Rail 21'). The introduction of connections between the major cities in the Netherlands and the European high speed train system is under consideration. Together with other measures in the railway sector and bus transport improvements (higher average speed, more buses in peak hours, more comfort, etc.), the potential negative effects of tariff increases in public transport are expected to be more than counteracted by these measures (see also box 4.4 and figure 4.1). Passenger transport by train is expected to increase by about 35% between 1990 and 2000. Its share in total passenger transport will increase up to 12% (VW, 1994). Road transport will be discouraged by means of fixed speed limits and greater enforcement and monitoring of speed limits, as well as public campaigns. In addition, in 1994 car importers have volunteered to abstain from advertising high speed performance of new cars.

These measures will account for about 5% of the expected emission reductions.

Box 4.4 Improvement in price ratio for public transport

One of the goals of the Netherlands' transport policy is to improve the price ratio for public transport to private passenger transport in favour of public transport. Between 1989 and 1991 this ratio improved due to a rise in fuel prices (as a result of external price developments and increased excise duties). In 1992 and 1993 the ratio deteriorated due to significant increases in tariffs for public transport and lower fuel prices. In 1993 the ratio returned to the 1986 value. The ultimate goal is that by 2010 the ratio will have remained at its 1986 level (see also figure 4.1).

Figure 4.1 Price ratio public transport to private passenger transport



Source: VW, 1994

Spatial planning and parking policies
The Netherlands' Government applies a strict land use policy to encourage the establishment of companies and the location of new residential projects in appropriate areas. A shift from locations along highways to locations in the vicinity of railway stations has already been observed. Parking policies include the extension of the number of paying parking places and fixed maximum number of parking places depending on the type of location. For example, locations situated close to railway stations are subject to parking restrictions.

These measures will account for 10-20% of the expected emission reduction.

Other measures
Since 1990, an increasing number of employers have introduced transport strategies for their workers (transport demand management, i.e. voluntary agreements). Carpooling and collective contracts with public transport companies are important elements in these strategies. It is estimated that these strategies may reduce commuter transport by 7-10%. Better provisions for cyclists (improving infrastructure, improving storing facilities) will increase bicycle use. Awareness campaigns on most of the above-mentioned items are crucial for continuing interest in these issues.

These other measures will account for about 10% of the expected CO_2 emission reduction.

Freight traffic - Without any measures, CO_2 emissions would be expected to grow by about 35-40% in the year 2000 with respect to 1990. Policies and measures in the freight traffic sector aim to reach the target of 11% emission reduction by the year 2000 with respect to 1990 levels. However, policies and measures adopted will probably only achieve a modest reduction in the growth of emissions in this sector; taking adopted measures into account, growth in this sector will amount to 25-30%.
For freight traffic, an agreement will be based on cleaner and more efficient carpark and an improvement of transport efficiency, better driving behaviour and a shift in modal split.

The **measures** adopted include: shift in modal split (shift from road transport to rail and inland waterways) by making rail transport and transport by inland waterways more attractive, and a variety of efficiency and logistical measures. **Instruments** applied include government investments, improving and extending infrastructure, matching supply and demand, searching for new markets, efficiency and logistical measures such as extending cabotage and the introduction and use of telematics.

In order to improve the perspectives of achieving the target for road transport, it was recently announced (VROM, 1994) that government and transport sector will investigate further measures to limit emissions together. This may take the form of a Long-Term Agreement (LTA).

Industry

Energy conservation in the manufacturing industry - The overall **target** for the industrial sector is to achieve an efficiency improvement of 19% in the year 2000 with respect to 1989. The key **instrument** in energy conservation policy for industry is the Long-Term Agreement (LTAs). Advocation of LTAs in branches of industry has proved to be a successful approach to energy conservation. The usual procedure is as follows (see also box 4.5): approaching an individual branch results in an

Box 4.5 Long-Term Agreements

The process towards a Long-Term Agreement includes the following steps:

Step 1: NOVEM approaches a selected industrial sector for a Long-Term Agreement.
Step 2: The sector records its willingness to undertake energy conservation in a declaration of intent with the Minister of Economic Affairs.
Step 3: The sector's energy conservation potential is inventoried, under the guidance of experts.
Step 4: The result of the inventory are translated by NOVEM and the sector concerned into a multi-year plan which forms part of the Long-Term Agreement.
Step 5: The Long-Term Agreement is signed by the sectoral association, the individual firms and the Minister of Economic Affairs. It embodies the following subjects:
- objective
- energy conservation strategy
- the Ministry's role
- energy-saving plan for individual firms
- monitoring energy efficiency
- clause providing for amendment or premature termination
- duration

The following industrial sectors have already signed a Long Term Agreement or a declaration of intent (as at 1/8/1994).

Long-Term Agreement	*Declaration of intent*	*Consultation*
Iron and steel	Mechanical and Electrical	Refineries
Chemicals	Engineering	Starch
Glass	Metal plating	Feed
Cement	Bakeries	Cold store/
Brick-making	Iron foundries	deep freeze operators
Textiles	Plastics	
Paper-making	Rubber	
Philips	Asphalt	
Margarine/fats/oils	Soft drinks	
Sugar		
Meat processing		
Beer		
Fruit & vegetables		
Non-ferrous		
Coarse ceramics		
Graphical industry		
Fine ceramics		
Coffee roasters		
Dairy sector		
Laundry		

Part of the agreement involves an yearly monitoring system on the basis of an annual report of individual members of the sector. The aggregated reports are submitted to NOVEM as operating agent and quantified in an energy efficiency index for the sector. After some years the parties will evaluate the achievement to date and review the effectiveness of the agreement.

Of the expected reduction in the growth, the shift in modal split will be responsible for the greatest part, logistical measures for a minor part, and autonomous developments will account for only a very small part. As a result, intermodal transport by inland waterways is increasing by about 10% per year (VW, 1994).

declaration of intent to cooperate, which is followed by an inventory on the potential to conserve energy in this particular branch. The result of this inventory is translated into a long-term plan, which is part of the LTA. The LTA is then signed by the Minister for Economic Affairs, the branch organization and all relevant individual companies. In this process, a key role is assigned to NOVEM. The agreements with individual industrial branches concern actual energy efficiency improvement figures and financial support for research and development, energy management, information and training. These agreements are generally welcomed and supported by a broad base of the industrial sector for their attempt to provide tailor-made solutions. However, it is difficult to cover the whole sector with LTAs. Hence, a different strategy is applied to the segment of the industrial sector not covered by LTAs, amounting to approximately 10% of the total. The overall target for this segment of the sector, which mainly comprises small and medium-sized firms, is 15% energy conservation in the year 2000 with respect to 1989. NOVEM has developed an action plan for these industries. A key role is assigned to umbrella organizations of various sectors, energy consultants and services from distribution companies (MAP-2, see box 4.2). Tools developed to achieve energy efficiency measures, in small enterprises in particular, include energy registration and control systems, and information on energy-conservation techniques available.

LTAs have been signed with 20 branches of industries, whereas 9 declarations of intent have been accomplished, together covering 75% of industrial energy use (excluding feedstocks). Policies in this area aim to increase the number of LTAs still further. The intention is to have LTAs in about 35 branches of industry, totalling 90% of industrial energy use (excluding feedstocks)(see box 4.5). The overall target for LTAs in industry is 19% efficiency improvement (excluding feedstocks) between 1989 and 2000. Box 4.6 provides three examples of results of LTAs. Cogeneration projects may contribute about 25%-30% to the realization of this target.
Energy conservation in industry is **supported** by:

- NOVEM programmes and industrial experts;
- energy consultants and services from energy distribution companies (MAP-2);
- subsidy scheme for the demonstration of new technologies (TIEB);
- subsidy scheme for new energy conservation techniques (BSET);
- Environmental Plan for Industry (MPI) from Gasunie;
- subsidy scheme for energy conservation and environmental advice (EMA);
- fiscal policy (VAMIL);
- Environmental Protection Act;

Box 4.6 Three examples of LTAs

Example 1: Long-Term Agreement in glass furnace
A project within a Long-Term Agreement: a glass furnace. On 17 July 1992, the glass industry signed a Long-Term Agreement with the Ministry of Economic Affairs, with the target of a 20% improvement in energy efficiency by 2000 relative to 1989. All glass-manufacturing firms are thereby cooperating in a project to test oxygen-firing in glass-smelting furnaces. This benefits both energy and environment interests. Combustion of gas with pure oxygen reduces NO_x emissions by 80% and, depending on the furnace size, between 15% and 40% energy is saved. Applications of this technology also appear feasible in the cement and food manufacturing industries.

Example 2: Long-Term Agreement in glasshouse horticulture
In the glasshouse horticulture sector, a number of good results have been achieved regarding energy-saving techniques. For example, with the support of the Ministry for Economic Affairs and NOVEM, several promising techniques for cogeneration of gas purification have been investigated. Today, a number of these techniques appear to be technically and economically feasible, and the first demonstration project is due to start in 1994. This technique enables the off-gases from the cogeneration plant to be used for CO_2 fertilization, thereby saving energy. Another energy-saving option is the application of energy screens, which currently attracts growing interest as it does not entail any production losses.

Example 3: Energy efficiency improvement in steel industry
In a Long-Term Agreement with the Netherlands' Government, the Netherlands' steel industry agreed to improve its energy efficiency by 10% in 1995 compared to 1989. The final goal is to achieve a 20% improvement by 2000. The 10% goal had already been achieved by 1994. Important measures which contributed to this success were, among others: economizing the use of raw materials by introducing a special furnace which can process scrap; more cogeneration; and reuse of residual gases.

Waste
Waste management policy is expected to reduce CO_2 emissions by the year 2000 by 3,500 - 4,500 Gg (compared to the reference situation) (VROM 1990a). A plan has been developed to stimulate and coordinate policies in this field (VROM, 1991b appendix 3). This plan is currently in the implementation phase.

Instruments applied in this sector include legislation, Long-Term Agreements (LTAs), and finan-

cial support and programmes for research, development and demonstration. In formulating waste policy, priorities are set according to the 'ladder concept' (see section 4.2.2). **Support** programmes include the National Research Programme on Reuse, Energy Production from Waste and Bio-mass, and the Innovation Oriented Research Programme on Environmental Technology. Support groups include a working group on wood by-products and a platform on fermentation. The most important **measures** to reduce CO_2 emissions by waste policy, which are complementary, include the following:

- *Ban on Landfill*
  Landfilling is the least preferable way of disposal in the ladder concept. Landfill of combustible waste has been prevented by imposing legislation by an Order in Council ('Decree on Ban on Landfill' and 'Decree on Waste Disposals'; see also box 4.3). This Order in Council is expected to become enforceable for some wastes in 1995 and for others later, depending on the capacity of the existing processing methods. As a result of this measure, a larger amount of the waste will have to be incinerated, and hence there will be an increase in energy recovery from biomass waste. All incineration plants can recover the energy from the treated waste. The waste generators affected by this measure include municipal waste, wood waste, sewage sludge, plastic waste, used paper, bio-waste (garden, fruit and food) and packaging. As measures to prevent landfilling are primarily intended to support other measures, the expected effects of these measures have not been assessed.

- *Increased energy benefits from disposal with energy recovery*
  Energy recovery will be enlarged by means of technical optimalisation and introduction of alternative disposal techniques e.g. anaerobic digestion, thermal gasification and co-combustion. This is expected to reduce CO_2 emissions by 1,900 Gg by 2000. Policy instruments in this respect include financial support, demonstration projects and research and development. An important programme is research, development and demonstration of optimalisation of energy recovery. Flexibilisation of disposal for incineration (separate-ferment incineration concept) has received considerable attention, and activities in this area will probably be increased in the future. Financial support is given to development of techniques that increase the energy recovery from wood waste.

- *Plans for priority waste disposals*
  According to the 'ladder concept', recycling takes preference over energy recovery and landfill. Compared to virgin materials in production processes, less energy is used when recycling is practised. The **targets** set for recycling include a 70% recycling of used paper and cardboard, 35% recycling of plastic waste and 60% recycling of packaging waste (aluminium package, glass) (VROM, 1988). Hence it is expected that relevant measures will reduce CO_2 emissions by 1,800 Gg by the year 2000 as a result of reduced fossil fuel use and by an additional 700 Gg of CO_2 in other countries (Veen et al., 1993). These targets will be realised by means of a number of LTAs which are currently being implemented. A LTA has been agreed on recycling of used paper/cardboard with paper manufacturers. Agreements on recycling plastic waste have been reached with both producers and industrial users of plastics, and a similar agreement on recycling package waste has been reached with relevant producers and users.

Residential and commercial
Energy conservation in non-residential buildings. The **target** for non-residential buildings is to improve energy efficiency by 23% in the period 1989-2000. The **instruments** being applied differ somewhat for specific sub-sectors within this category.

Energy efficiency standards have been introduced for new buildings within the framework of the Housing Act (see box 4.3), for example, double glazing. More stringent requirements for insulation and efficient lighting are also being prepared. Central Government has been carrying out an energy efficiency programme involving its own buildings since 1991.

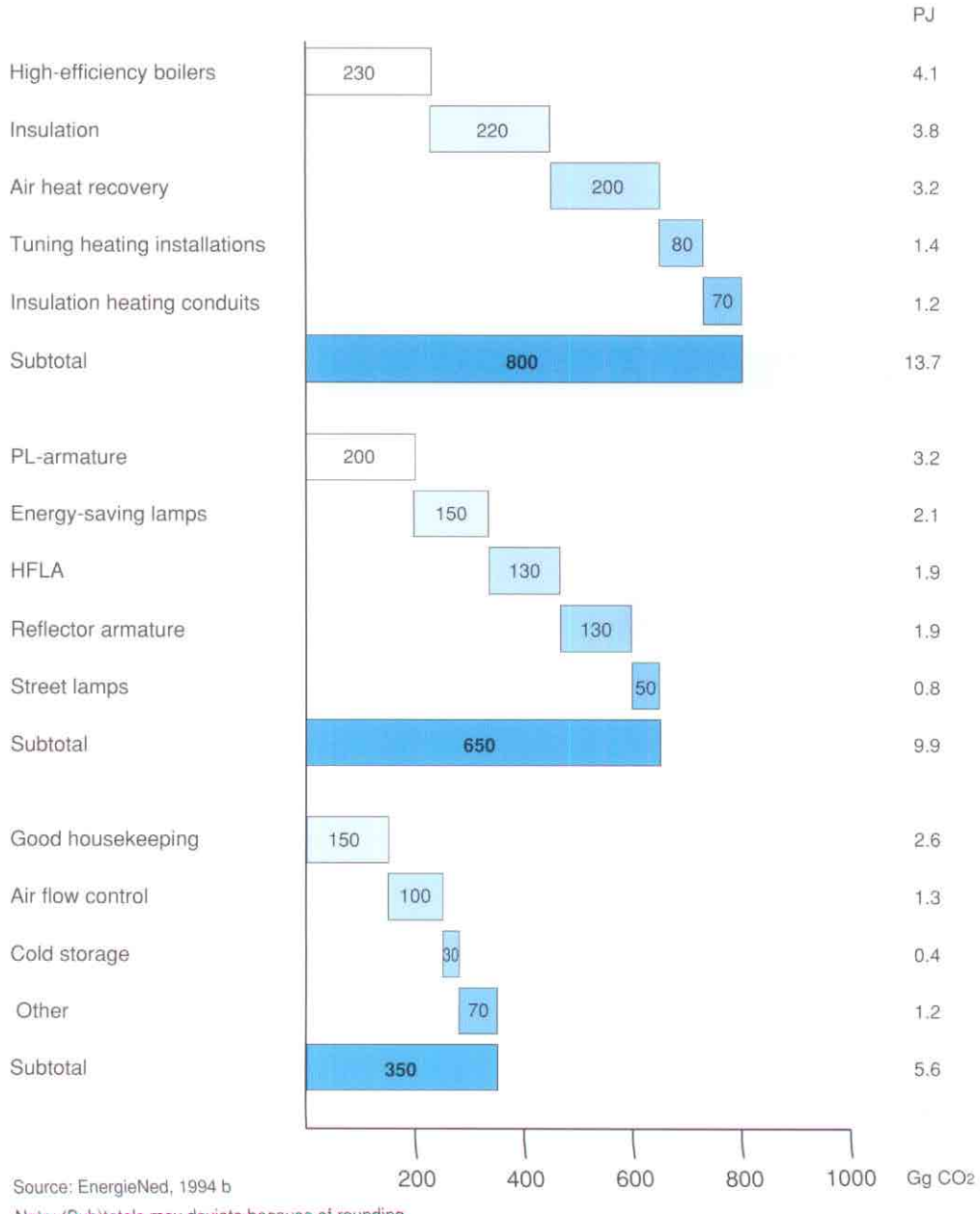
The National Government Building Management Agency is currently signing energy conservation covenants with all ministries, aimed at both energy management and energy conservation investments in government buildings (see box 4.7). Due to the heterogenous character of the sector, it is difficult to apply LTAs to energy use in all non-residential buildings.

Box 4.7 Energy management policy by the Tax Department

The Tax Department has provided an impressive example of how an energy-savings programme can be introduced. An energy coordinator has been appointed for each tax office, responsible for implementing an energy management policy for that particular building, with support from the Buildings Project Bureau. In addition, a campaign to motivate Tax Service staff has been developed. After a trial in three provinces, which led to a 50% reduction in electricity consumption, the campaign has been adopted nationwide. In addition, energy management has been integrated into the new administrative structure of the Service, thereby giving it a permanent character, incorporating progress monitoring.

In the non-residential sector, LTAs are being prepared for several sub-sectors: health care (in cooperation with the Ministry for Welfare, Public Health and Culture), education (in cooperation with the Ministry for Education), banks, and supermarket chains. The LTA approach covers about 30% of energy use in this sector and has an overall target of 25-30% efficiency improvement in the

Figure 4.2 Energy conservation in non-residential buildings on the basis of the Second Environmental Action Plan of the energy distribution sector (MAP-2)



Source: EnergieNed, 1994 b

Note: (Sub)totals may deviate because of rounding.

enterprises covered. Special attention is being devoted to removing institutional barriers to energy conservation in these sub-sectors. The Second Environmental Action Plan of the energy distribution companies (MAP-2) plays a key role here. The most important support programmes include:

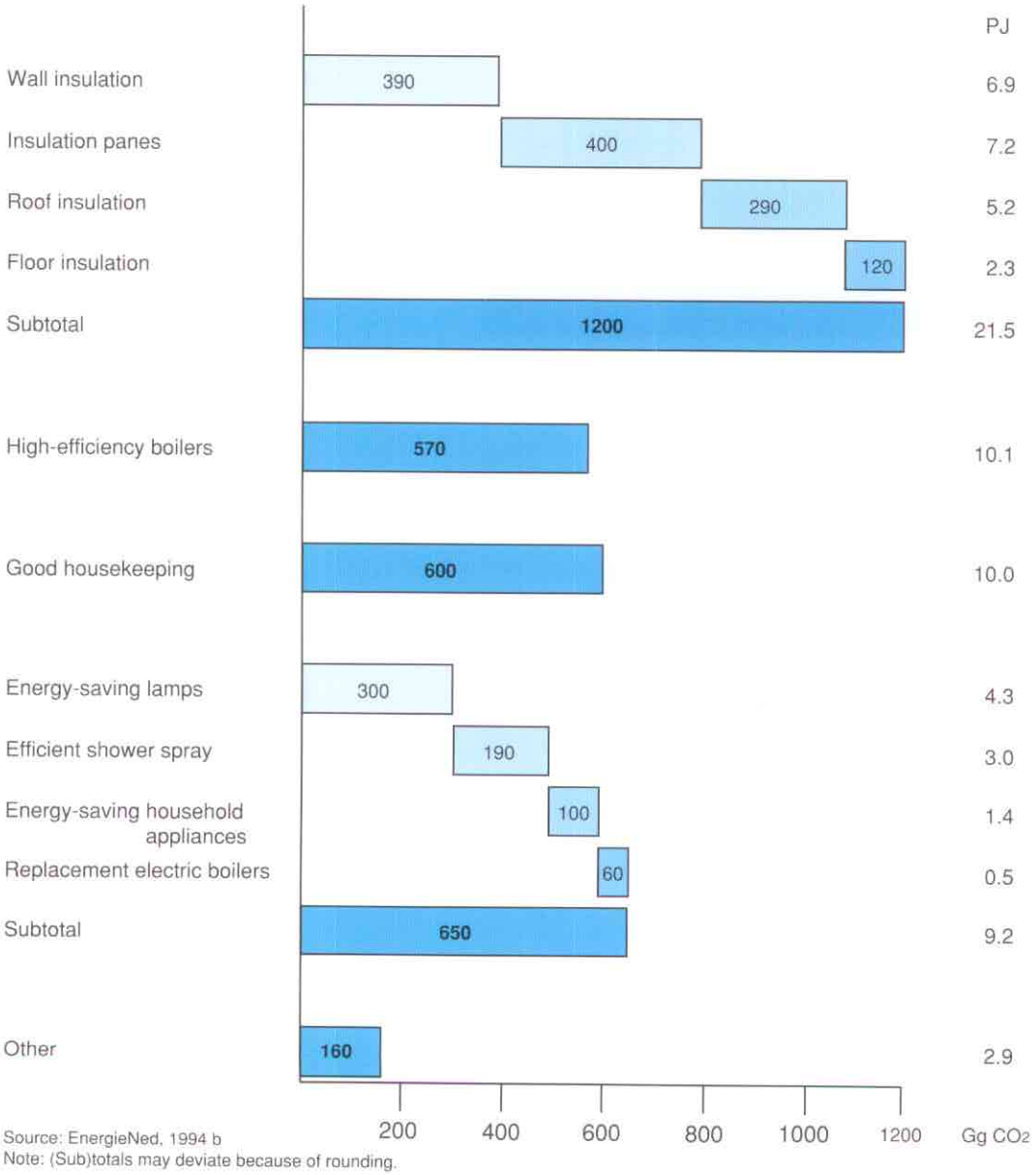
- NOVEM programmes and experts
- MAP-2
- subsidy scheme for new energy conservation techniques (BSET)
- subsidy scheme for energy conservation and environmental advice (EMA)
- VAMIL Accelerated Depreciation Scheme

Figure 4.2 provides an overview of **measures** being taken in this sector on the basis of MAP-2.

Energy conservation in households

The **target** for energy conservation in households is to achieve an efficiency improvement of 23% by the year 2000. In this sector, a wide range of instruments are being applied, including regulations (minimum-efficiency norms), incentive schemes and LTAs. In order to enhance the efficiency of renovating rented accommodations, a LTA with the subsidized housing sector has been concluded. Energy efficiency regulations have been intro-

Figure 4.3 Energy conservation in households on the basis of the Second Environmental Action Plan of the energy distribution sector (MAP-2)



Source: EnergieNed, 1994 b
Note: (Sub)totals may deviate because of rounding.

duced in compliance with the Building Code. With respect to energy conservation in existing buildings, a major role has been assigned to the energy distribution sector, in particular as a medium of information, subsidies, financial regulations, and recommendations to end-consumers. Policy in the household sector is **supported** by

- NOVEM programmes and experts
- subsidy scheme for solar heat and heat-pumps (BSET)
- subsidy scheme for district heating
- subsidy scheme for insulation
- MAP-2
- Housing Act
- Energy Savings Appliances Act

Relevant **measures** to stimulate energy conservation in construction of new housing include strengthened insulation standards. An even stricter standard for energy efficiency is in preparation. Figure 4.3 gives an overview of relevant measures in existing buildings. In this respect, the efforts of the Netherlands' Government to stimulate the development of common guidelines on minimum-efficiency for a number of household appliances within the European Union deserves to be mentioned.

Agriculture

Energy conservation in agriculture
The overall energy efficiency target for agriculture is 26% improvement between 1989 and 2000. In this sector, as in manufacturing industry, LTAs are the main instruments being implemented to realize the target (see box 4.6) for an example of a LTA in glasshouse horticulture. A LTA with the greenhouse horticulture sector was signed in early 1993, covering 85% of agricultural energy use. This LTA has a target of 23% improvement in energy efficiency between 1989 and 2000 and a target value of 30% improvement. LTAs with four other agricultural sub-sectors are being considered/prepared, namely with the livestock industry, flower bulb producers, mushroom growers and agricultural mechanisation. The primary **supports** for LTAs with agricultural enterprises include:

- NOVEM programmes and agricultural experts
- subsidy scheme for new energy conservation techniques (BSET)

Land Use Change and Forestry
In 1994, the Netherlands' Government presented a domestic forestry policy plan (LNV, 1994). The target of this plan is to afforest an area of 75,000 hectares in 25 years (at present, an area of 335,000 hectares is covered with forests, including parks and roadside trees). Of the total additional area, 30,000 hectares is to be afforested by farmers. The MacSharry plans of the European Union for afforestation provide subventions to encourage farmers to change their activities from agriculture to forestry. Another instrument is government finance (from public funds) to afforest 25,000 hectares. It is intended that economic sectors voluntarily participate in the realisation of the remaining area. A system of 'carbon credits' for afforestation is under development. This system will give economic sectors an incentive to invest in afforestation; the quantity of carbon fixed through afforestation will determine the number of credits awarded.

Other measures

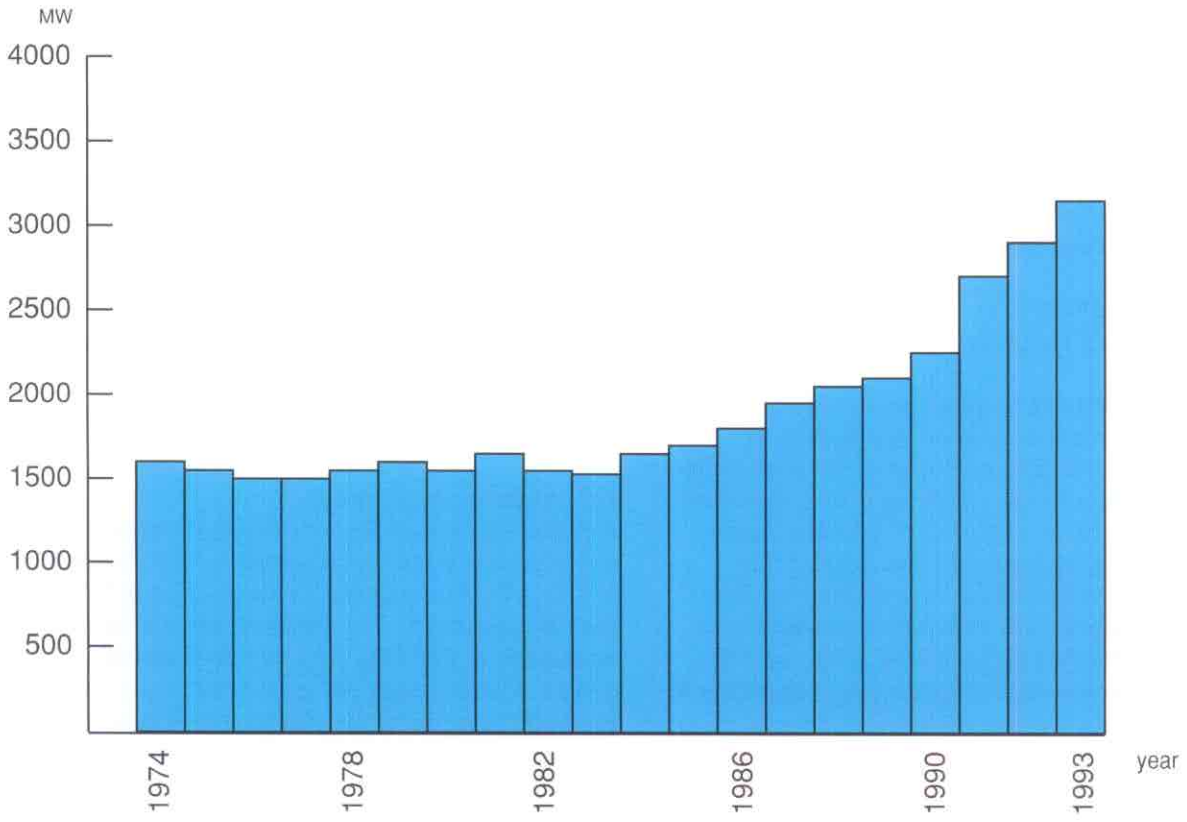
CO_2 capture and disposal
A demonstration project is being developed in order to investigate the feasibility of the removal of CO_2 from flue gases and the storage of CO_2 in depleted gasfields. The Netherlands is continuing evaluation of this CO_2 capture and disposal option. A project was set up in 1994 to provide a thorough analysis of the potential for future commercial deployment and a more site-specific assessment of technical performance, costs, feasibility and the positive and negative environmental benefits/impacts effects of CO_2 removal.

This study project has been initiated by the Government in cooperation with gas and electricity producers. In addition, the Netherlands is participating in the International Energy Agency project: 'Greenhouse Gas R&D Programme'.
The results of these projects will provide all the information needed for a decision on the possible realisation of a demonstration project before 2000.

Cross sectoral

Cogeneration
Cogeneration is applied in various sectors. The aim of the Government is to achieve a capacity of 8000 MW by 2000. The policy on cogeneration has been very successful so far (see box 4.8). However, in the period up to the year 2000, greater emphasis will be placed on the quality of projects in view of capacity and integration problems.
The possibilities for district heating and the recovery of industrial residual heat are to be elaborated further, especially at the development locations identified in the Fourth Report (EXTRA) on

Figure 4.4 Generating capacity of autoproducers



Source: EnergieNed, 1994 a

Physical Planning in the Netherlands (VROM 1991a). As far as possible, the potential in existing buildings will be incorporated into the project. The Cogeneration Project Bureau will play a major role here (see section 4.3.2).

Box 4.8 Cogeneration by autoproducers

Use of cogeneration by autoproducers in the Netherlands has shown a remarkable increase in recent years. In 1993 total installed generating capacity amounted to 3,100 MW, which is approximately 17.5% of the total electricity-generating capacity installed in the Netherlands. In 1993 cogeneration amounted to approximately 21% of the total amount of electric energy generated in the Netherlands.

Energy distribution sector

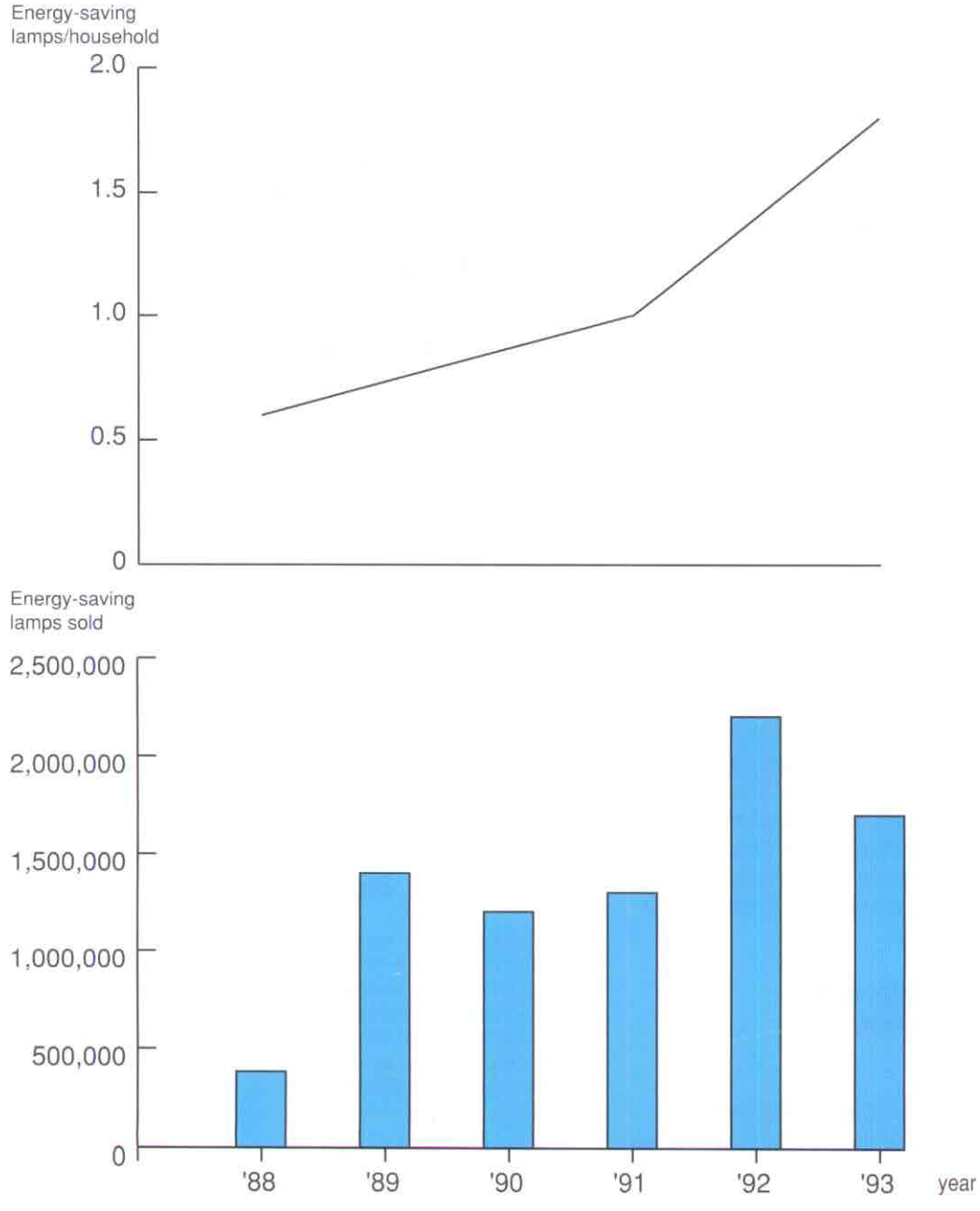
Within the energy conservation sector, an important role is assigned to energy distribution companies. Expected CO_2 reduction and energy conservation due to measures within the energy distribution sector will amount to 17,000 Gg of CO_2 and 195 PJ by the year 2000 respectively (EnergieNed, 1993). One half of the CO_2 reduction will be achieved by savings on end use. The other half will be achieved by decentralized generation: cogeneration, wind energy, hydropower and biomass. For some results on CO_2 reduction, see box 4.9.

Box 4.9 Results of CO_2 reduction in the energy distribution sector

With the first Environmental Action Plan (MAP-1), one of the aims of the energy distribution companies was to reduce emissions of CO_2 by 520,000 tons by the year 2000 through the insulation of offices in the private and public sector. Between 1991 and 1993 the total was reduced by 101,000 tons (20% of the target) (EnergieNed, 1994a). Another target was to reduce emissions by 620,000 tons of CO_2 by 2000 by insulating both private and rented homes. Between 1991 and 1993, the total has been reduced by 211,000 tons (34% of the target). This progress was made using subsidies combined with information campains. New reduction targets have recently been set in the Second Environmental Action Plan (MAP-2). See figure 4.2 and 4.3.

An increase in total cogeneration capacity of around 5000 MW is envisaged over the period 1990 - 2000. This will result in a capacity of about 8000 MW by the year 2000 i.e. 40% of total electricity production capacity. The main instrument applied is a voluntary agreement between the Government and the energy distribution sector. In early 1994, a new set of agreements was concluded between the Ministry for Economic Affairs and the energy distribution sector.
These agreements have taken shape in the Second Environmental Action Plan of the energy distribution sector (MAP-2). In this plan, the energy distribution sector has indicated its willingness and capability to make a bigger contribution to achieving the overall energy conservation objective; their contribution now amounts to one third of overall national efficiency improvement in 2000 compared to 1989 levels. The target mentioned above is recorded in the MAP-2. The annual budget for MAP-2 amounts to about Dfl. 420 million per annum.

Figure 4.5 Energy-saving lamps per household/energy-saving lamps sold



Source: EnergieNed, 1994 a

Instruments applied by the distribution companies to encourage energy conservation by individuals, in non-residential buildings, and by the small and medium-sized business sector, include information, consultancy, subsidies and provision of several services. The distribution companies manage a number of support programmes, including subsidy schemes designed to promote energy-effective purchasing behaviour and insulation and heating appliances in existing buildings. In 1994, energy distribution companies are due to become responsible for stimulatory schemes in the field of insulation and energy-efficient refrigerators, in addition to the existing stimulatory scheme for lighting (see results on CFL sales in box 4.10).

Box 4.10 CFL sales by energy distribution companies

In their Second Environmental Action Plan (MAP-2), the energy distribution companies intend to replace 15 million incandescent bulbs by compact fluorescent lamps (CFLs) in the period up to 1995. This should lead to a 300,000 ton CO_2 reduction. As a result of awareness campaigns by the energy distribution companies, CFL sales have shown a marked increase (see figure 4.5).

Technology development
The development of energy technology will be more actively promoted, and the role of renewable energy and conservation technology will be further extended. This emphasis on technology development is necessary to ensure that in the medium and long-term (after the year 2000), techniques available will be capable of contributing to further efficiency improvement and energy conservation in manufacturing industry and buildings. This approach envisages the formation of technology clusters for Netherlands' manufacturing industry, technological institutes and the energy world, leading to increasing opportunities for innovation. Coordination and cooperation between the various research programmes and institutes will be further improved. Development of technology is elaborated in chapter 9.

4.3.4 Reduction strategies for methane emissions

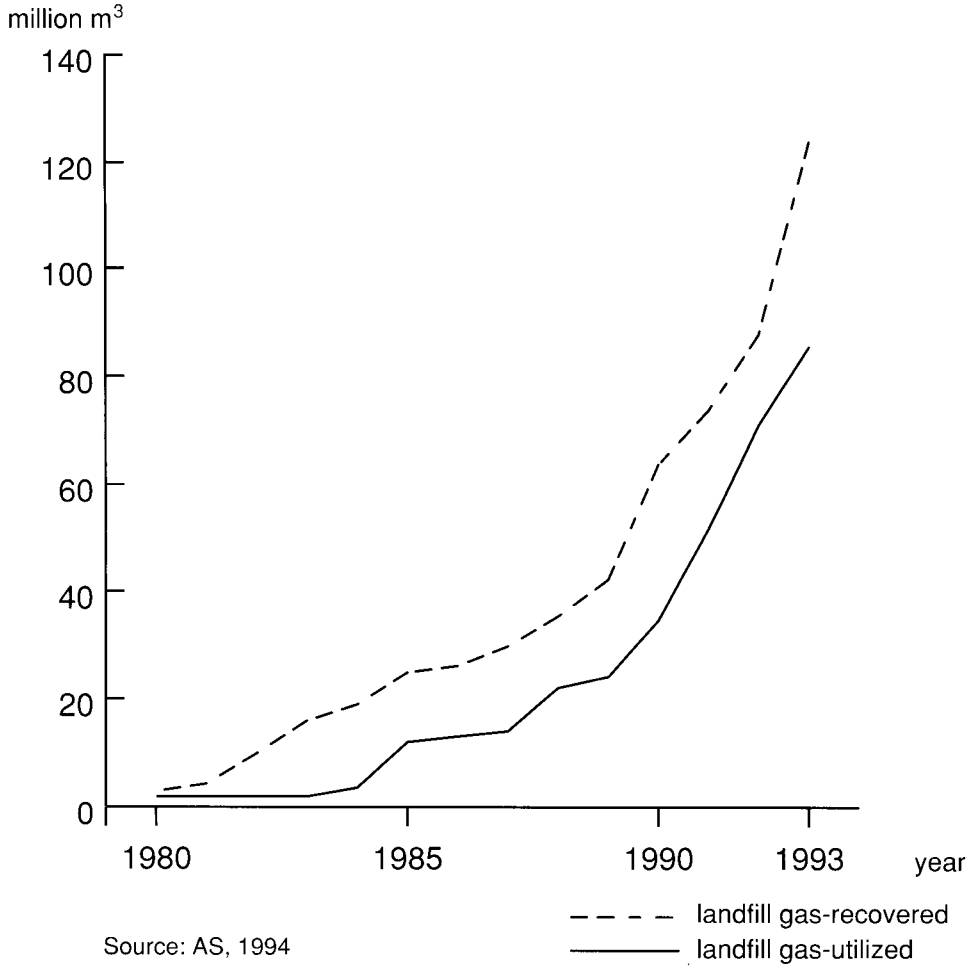
National target
On the basis of current policies on agriculture, waste management and energy distribution, it was expected that methane emissions would decrease by 10% by the year 2000 compared to 1990 levels. In the Memorandum on Climate Change (VROM, 1991b), on the basis of this knowledge, a 10% reduction target was set. Currently a decrease of more than 20% is expected by the year 2000. Policies affecting methane emissions are mainly covered by existing policies on other environmental problems; reductions in methane emissions are often the positive result of other existing policies. Strategies to reduce methane emissions also have positive results for energy use and efficiency, and for air, soil and water pollution.

Waste management
The expected emission reduction due to current policies and measures in waste management is 80 Gg between 1990 (337 Gg) and 2000 (257 Gg). However, taking NEPP 2 (VROM, 1994) into consideration, it is expected that additional policies will lead to an additional 34 Gg reduction, which will bring the level of emissions to 223 Gg by the year 2000. Hence, the total reduction of methane emissions through waste management (landfills) is expected to be 114 Gg. The Soil Protection Act defines policy for minimization of risks of soil contamination. The aim of this policy is to insulate, control and inspect the landfill. The most important instrument supporting this policy is regulation. Regulations concerning landfills cover provisions that newly-designed landfills need to have equipment to recover methane. The Decree on Waste Disposal in Landfills contains regulations affecting methane emissions, i.e. incineration of the landfill gas. Emissions from landfills will be reduced by incineration of landfill gas and, in some cases, energy recovery of the landfill gas (see box 4.11). Measures in this area will affect the owners of landfills. The Decree on Waste Disposal at Landfills will be revised in 1996. The revision will cover the regulation of energy recovery of the landfill-gas. Reduction of methane from landfills will be supported by the Ban on Landfilling (see section 4.3.3).

Box 4.11 Winning landfill gas in the waste sector

15.6 million tons of waste are dumped in approximately 600 landfills in the Netherlands annually. At 17 landfills, landfill gas is used for energy recovery. After refining, the gas is supplied to the national gas grid or used for electricity or heat production. Heat production takes place in adjacent industrial plants (like a brick factory, an aluminium factory or chemical plants). In this way, per landfill, about 60% of the emissions can be used in a constructive way. The development of landfill gas recovery and utilization since 1980 is shown in figure 4.6. (Ecofys, 1994)

Figure 4.6 Development in landfill gas recovery and utilization



Source: AS, 1994

Agriculture

Manure policy
As a side effect of manure policy measures, methane emissions from agriculture are expected to be reduced by 35 Gg by the year 2000. The main **instrument** applied in this policy area is regulation. Manure policy **measures** are described in the policy document *Nota Derde Fase Mest- en Ammoniakbeleid* (Memorandum on Third-Phase Manure and Ammonia Policy; LNV/VROM, 1993). To reduce the manure surplus and ammonia deposition by 2000, it will not be permitted to bring more phosphate on to the land than is taken up by the crops. This policy is expected to result in a decrease of cattle and manure production and, consequently, in a reduction in CH_4 emissions. The policy was implemented in early 1994.

Common Agricultural Policy
To a large extent, the Netherlands' agricultural policy is dominated by the Common Agricultural Policy (CAP) of the European Union. This policy will affect methane emissions in the Netherlands both positively and negatively. The net effect, however, is expected to be positive, i.e. a reduction of 10% methane emissions from the agriculture sector in the period 1990-2000. The CAP results in decreasing numbers of dairy cattle leading to a reduction in methane emissions. Methane emissions per animal are expected to increase; this is explained below.

Increasing methane emissions per animal
With the introduction of the MacSharry Plan, which was included in the CAP, a dramatic drop in price guarantees for wheat and feeding grains is expected. Feeding costs for grain will consequently drop. It is expected that more European grain will replace imports. The shift to roughage and increasing production per animal will lead to an increase in methane emissions per animal through enteric fermentation.

Decreasing numbers of animals
The European Common Agricultural Policy has also affected the total number of animals over the past years. The milk quota instrument proved to be very effective in reducing milk surplus and dairy cattle numbers. The number of cattle in the Netherlands has already decreased and is expected to decrease by a further 10% between 1995 and 2000. However, a slight compensatory effect is noticeable in the increasing number of beef cattle.

Fugitive fuel emissions
Production and distribution of natural gas is the main contributor to fugitive methane emissions in the Netherlands. The future demand for oil and gas and the technical options available to reduce leaking of methane will determine the amount of future emissions and reduction potentials. The national gas company, Gasunie, expects stable domestic and export demand for natural gas over the coming years (GASUNIE, 1992).

Measures implemented in relation to national energy policy (see section 4.3.3) will also result in a reduction of methane emissions. Assuming a stable domestic and export demand for natural gas over the next 25 years, and providing no additional measures are introduced as a response to climate change, the expected effect of the developments within the gas and oil sectors is to decrease methane emissions by more than 20% in the period 1990-2000. The regular replacement of old cast-iron gas distribution networks and improved maintenance by the distribution companies are particularly worthy of note. This will result in a decrease in leaking pipes, and a subsequent decrease in methane emissions.

4.3.5 Reduction strategies for nitrous oxide emissions

National target
In the Netherlands, no specific N_2O policy has yet been formulated. It has been estimated that, taking present policies into account, emissions of nitrous oxide in the Netherlands will remain unchanged (Born et al., 1991). The stable trend of N_2O emissions is due to the adverse effects of acidification and manure policies (declining N_2O emissions) and increased catalytic converter use in passenger vehicles (increasing N_2O emissions).
Based on information concerning trends of N_2O emissions, the Netherlands' **target** for N_2O emissions is a stabilization at 1990 levels by the year 2000 (VROM, 1991b).

Industry (non-energy)
Annual production of nitric acid in industry is expected to increase by about 15% by the year 2000 and 33% by 2015 compared to 1990 levels. Consequently, N_2O emissions are expected to increase by 15% by the year 2000 compared to 1990 (19.1 Gg N_2O in 2000). These figures also include some other industrial sources.

Measures undertaken with respect to existing energy and industry policy (see section 4.3.3) will also lead to a reduction in N_2O emissions. Options to reduce N_2O emissions are being investigated. On the basis of this investigation, follow-up measures will be considered.

Agriculture
Policies with regard to nutrients (nitrate) and ammonia (NH_3) emissions will have a considerable effect on N_2O production in soils. This policy is described in the policy *Nota Derde Fase Mesten Ammoniakbeleid* (Memorandum on Third Phase Manure and Ammonia Policy; LNV/VROM, 1993). The impact of manure policy on the use of chemical fertilizers and animal manure will also result in lower N_2O emissions in agricultural areas. Furthermore, animal manure production is expected to decrease. It is estimated that, as a result of these policies, N_2O emissions will decline from 3.5 to 2,8 Gg N_2O-N/year between 1990 and 2015.

Transport
Policies taken within the transport sector have had an adverse effect on N_2O emissions. The introduction of catalytic converters considerably reduces emissions of CO, NO_X and VOCs, while N_2O emissions increase. In particular, higher N_2O emissions have been recorded for passenger vehicles with unregulated catalytic convertors. This could lead to an almost 100% increase in N_2O emissions from 5.4 to 11 Gg/yr between 1990 and 2000.

Total energy consumption in the transportation sector also influences N_2O emissions from this sector. Current trends suggest that energy consumption in the transportation sector will increase more than anticipated by the Second Transport Structure Plan (SVV-2; VW, 1990) and the NEPPP (VROM, 1989), which form the basis for national transportation policy. This could lead to an additional increase in N_2O emissions.

4.3.6 Reduction strategies for NO_x emissions

This section summarizes policies and measures taken with respect to emissions of other greenhouse gases, including NO_x, VOC and CO emissions. To a large extent, policies and measures for emissions of CO_2 (and CH_4 and N_2O) will influence emissions of these other greenhouse gases.

The NO_x strategy is basically an acidification abatement policy, that takes account of effects of formation of photochemical oxidants in the biosphere. The strategy has beneficial effects on energy use, efficiency and fuel mix, and hence on the climate change problem. It also leads to a reduction in ozone formation in the troposphere. In international policy, the Netherlands is Party to the present NO_x protocol on the UN-ECE Convention on Long-Range Transboundary Air Pollution and is actively participating in the development of a second phase NO_x protocol. Furthermore, the Netherlands is a signatory of the Sofia Declaration, which calls for a 30% reduction in NO_x emissions.

National target
The national **target** for NO_x is to reduce emissions by 55% by the year 2000 and 80-90% by 2010 with respect to 1980 levels of emissions.
Measures for transportation, electricity production and industrial processes have led to a decrease in NO_x emissions. This reduction is partly reversed by some opposite trends such as increase in freight traffic and expanding decentralised cogeneration.

Transport
The policies up to the year 2010 with respect to NO_x emissions from transport are covered by the SVV-2 (VW, 1990). NO_x requirements for passenger cars are in conformity with EU regulations. Under existing policies directed at reducing acid precipitation, a subsidy has been offered for the purchase of cleaner trucks and buses, to conform with stricter NO_x standards. Measures to discourage the use of cars, and measures to make use of alternative modes of transport more attractive, should reduce the increase in automobility. Policies and measures described in section 4.3.3 (measures to reduce CO_2 emissions in transport, i.e. freight traffic sector) are also relevant to the reduction of NO_x emissions.

Energy and industry policy
The existing General Administrative Orders under the Air Pollution Act for combustion plants (came into force in 1987) and under the Nuisance Act for smaller combustion plants (came into force in 1990) were amended in the last half of 1990. This amendment imposed stricter standards on NO_x emissions from combustion plants. A covenant (Long-Term Agreement) between central and provincial government and the Electricity Generating Board (SEP) for 2000 provides for further NO_x reductions from power plants of 63% compared to 1980. A subsidy is available to stimulate the purchase of central heating installations that have a high energy efficiency and low NO_x emissions, and there are also subsidies for low NO_x gas-engines and gasturbines. Cogeneration in industry is actively promoted. Additional steps have been announced in NEPP 2. In 1994, a General Administrative Order (GAO) setting NO_x standards for central warming installation is expected to come into force. In anticipation of this GAO, subsidies have been provided for energy-efficient low NO_x central heating installations in houses and low NO_x gas engines. There are NO_x emission standards for waste incineration plants. Process emissions are regulated by 'Dutch Emission Guidelines'. These guidelines are used by Regional Authorities when granting permits.

4.3.7 Reduction strategies for VOC emissions

National target
The national VOC **target** is to reduce emissions by 70% by the year 2000 and 80% by 2010 with respect to emissions in 1981.
In the international policy field, the Netherlands signed and ratified the 1991 VOC-Protocol under the UN-ECE Convention on Long-Range Transboundary Air Pollution, calling for a 30% reduction. Existing policies to reduce the emissions of VOCs aim to reduce the problem of forest die-back and smog formation.

Industry
There is great potential for reducing VOC emissions from stationary as well as mobile sources. The aim of policies in the industrial sector is to reduce VOC emissions from a large variety of stationary sources and products by 50% by the year 2000. The most important instruments applied in the industrial sector are LTAs. A LTA has been agreed between the Government and industry, establishing the above-mentioned target. This project, called KWS2000 ('Hydrocarbons 2000'), contains measures for both products and processes. The KWS2000 project involves industry, refineries, the building sector, and households, as well as local and regional governments (see box 4.12).

Box 4.12 Control strategy for emissions of Volatile Organic Compounds ('KWS2000')

Between May 1986 and April 1988 policies were formulated to reduce the emission of Non-Methane Volatile Organic Compounds (NMVOCs) into the air from industry, small business and households in the Netherlands. The objective is a NMVOC emission reduction of at least 50% by the year 2000 compared to the emission level in 1981. The policies were set out in the Control Strategy for Emissions of VOCs report, which was presented to Parliament in February 1989.
The Control Strategy represents an agreement between the public authorities, the provinces, municipalities and trade and industry. In 1992 a 22% reduction compared to the 1981 level had been achieved. Considerable reductions were achieved by the chemical industry, oil industry and paint use.
The NMVOC-programme 'KWS2000' includes demonstration and research projects and public-information on prevention techniques available. For the product-oriented part of the programme, the pace of implementation is no longer determined just by technical developments but more by acceptance of alternative products (expecially in the case of various coats of paint). The programme will therefore focus more attention on stimulating market demand.

Transportation
VOC policy for traffic is explained in the SVV-2. Existing transport policy with respect to technical measures targeted at improving the quality of vehicles (cleaner and more fuel efficient) will lead to an improvement in technologies used in this sector, and a subsequent reduction in VOC emissions (see also under section 4.3.3).

4.3.8 Reduction strategies for CO emissions

National target
The anticipated 50% reduction in CO emission is based on a further extension of existing policies in other fields having an impact on the emissions of CO (like in case of CH_4 and N_2O).

Oil, gas and industry policy
There is a compulsory periodical control of gas-fired industrial heating installations. One of the aspects is the monitoring of CO emissions, leading, as a side effect, to a reduction of CO emissions. In steel industry, technical measures are being considered for the recycling of CO emissions from the production process.

Transport policy
Fiscal measures to promote catalysts are being undertaken within the framework of existing transport policy. These measures will help reduce the emission of greenhouse gas precursors such as CO. EU regulations also impose strict limits on new vehicles.

4.4 MEASURES UNDER CONSIDERATION

4.4.1 CO_2
In order to attain the (minimum) national target of reducing CO_2 emissions by 3% in the year 2000 relative to 1989/1990 levels, according to the scenario established by the Second Memorandum on Energy Conservation (EZ, 1993) a regulatory tax on energy must be introduced. It is expected that about a quarter of the additional emission reduction required in the year 2000 (on top of the reductions gained by policies formulated in NEPPP (VROM, 1990a) and MEC (EZ, 1990)) will be achieved by the net effect of over and under performance trends and, possibly, the EU tax.

Although the Netherlands' Government has a strong preference for working within an EU framework, it is as yet unclear whether this tax will be introduced. Therefore, technical preparations for both a national tax (on smaller consumers of energy) and an European tax are being undertaken. These preparations will enable the introduction of a national tax in 1995, in case the EU fails to reach a positive decision on the introduction of an European tax in 1994. A final decision will be taken by the new government in 1994/1995.

Lastly, the Second Memorandum on Energy Conservation describes several measures which are still under consideration in the European Union. These measures include efficiency requirements for electric appliances and efficiency requirements for passenger cars.

4.4.2 Methane
The methane target is not based on measures under consideration. The approved measures will lead to more than a 20% reduction compared to the 10% reduction target. On top of that, measures are considered as follows:

Options for further reductions have been investigated by the National Institute for Health and Environmental Protection (Amstel et al., 1993). A cost study has also been carried out (Ecofys, 1994).

In the *Nota Derde Fase Mest en Ammoniakbeleid* (Memorandum on Third-Phase Manure and Ammonia Policy; LNV, 1993), a levy on ammonia emissions was announced. This aims to reduce ammonia emissions. If it comes into force in early 1996, it is not only expected to reduce manure production but also to reduce methane emissions by a further 37 Gg/year.

Although offshore fields for natural gas production only contribute 25% of total natural gas production in the Netherlands, they are responsible for 80% of the methane emissions from this sector. This is due to venting practices on offshore platforms, when flaring on-shore excess natural gas. Measures are being discussed by government and gas-producing companies, regarding increased gas use on platforms offshore during gas production in particular. Gas vented in other ways on offshore gas platforms in the North Sea is increasingly used in installation of systems for gas condensate measurements. Studies have concluded that investments needed to use excess gas can be cost-effective (Ecofys, 1994). The effect on CH_4 emissions could lead to a reduction of 21 Gg/year by the year 2010 compared to a scenario with no additional policies. Total savings would amount to approximately Dfl 1.6 million.

Desorption of gas from the condensate and feeding into the mainstream may lead to a further 30 Gg/yr methane reduction by 2010. Although this measure is less cost effective, some savings may be possible nevertheless.

4.5 MONITORING

In order to gain an idea of the progress of the policy, it is important to monitor the effects the policy has had. In energy conservation policy, market monitoring and programme monitoring are carried out separately. Programme monitoring charts relevant data for specific policy programmes. It measures whether the intended milestones and targets are (can be) effectively achieved. The methods used for this purpose have mostly been developed. These methods are currently being refined in consultation with the intermediary organizations concerned.
This procedure will make it possible to follow the programme effects and developments regularly and accurately. The information and insights obtained can also be used as a basis for policy evaluations and adjustments. Market monitoring charts relevant data for overall energy consumption in various (sub)sectors. It also considers underlying causal factors, such as economic growth, structural effects and energy conservation. Together with Gasunie and the SEP, the Ministry for Economic Affairs has set up the NEEDIS foundation, a nationwide data bank for energy consumption and conservation. The Ministry for Economic Affairs is now working on establishing a link between the two monitoring systems, to facilitate communication between the various (sectoral) levels regarding the impact on consumption and the effects of the conservation programmes. As in preceding periods, the Parliament will receive an annual report on the progress of the policy and the results attained. If the evaluations proposed show that the policy needs adjustments, these reports will be accompanied by appropriate proposals, including a reallocation of budgets, if necessary.

A programme for monitoring waste by the RIVM was set up in 1993. The first results are mainly based on estimations for 1991 and 1992. In 1995 there will be an evaluation of the programme (VROM, 1994). A new action programme will then be formulated in which new measures will be considered. Targets may change according to national consideration on the target of climate change. Reduction figures presented in this document are mainly based on a report by Senter (Veen e.a., 1993). Consequently most reports are based on monitoring, supported by independent estimates on the subject and knowledge of the target groups. Estimates are based on the IPCC-methodology, excepting some reports of minor importance.
With respect to transport policies, a monitoring system has been set up in order to respond efficiently to environmental or policy defects, if they arise. This involves implementation of the policy formulated to date as faithfully as possible, elaborating it with monitorable indicators, which are then used to determine whether targets are being met. With a clear definition and comparison of indicators, different policy effect reports will form one consistent tool for policy adjustments. Monitoring results are presented as 'Policy Effect Reports', which present information on the extent to which the goals have been met in a straightforward, graphical manner. The reports are published annually. They are an important source of the annual policy planning cycle, which is linked closely with the budgeting process. In accordance with the goals of the Second Transport Structure Plan, the Policy Effect Report contains indicators on four policy categories:

- Environment and amenity- refers to transport damage to the environment by air pollution, noise, and the fragmentation of the countryside.
- Accessibility- refers to traffic congestion making access to the country's economic centres difficult.
- Managing and retaining mobility- refers to the assumption that the prime contributor to the environmental problems and the problem of congestion is the automobile.

- Support measures- aimed at strengthening the foundations of transport policy. This includes communications, inter-authority collaboration, investment, enforcement and research.

Emissions of greenhouse gases are reported annually as part of a comprehensive emission report by RIVM, TNO, and CBS. This emission inventory also provides emission data to the CORINAIR database.

The RIVM has a legal obligation to report annual trends in emissions and other environmental parameters. Every four years, a comprehensive evaluation is made of environmental policies and prognoses on future emissions will be presented (Environmental Outlook). On the basis of the Environmental Outlook, additional measures may be introduced in the new NEPP. Previous Environmental Outlooks were published in 1988, 1991 and 1993.

4.6 BUDGETS

Budgets for energy conservation and renewable energy from government and the energy distribution sector are presented in Table 4.3. These measures for energy conservation and renewables do not only address climate change, but the presented budgets are on the whole relevant for climate change. Table 4.3 also includes programmes for the Recycling of Waste Substances (NOH) and on Energy from Waste and Biomass (EWAB), both managed by NOVEM. The budgets of the Ministry for VROM contain insulation subsidy schemes for housing.

A breakdown in programmes and instruments of the 1994 budget for the Ministry of Economic Affairs (EZ) is set out in table 4.4. The new appointed Government has announced energy budget cuts. The consequences could not be incorporated in this Communication.

Table 4.3 Budgets for energy conservation and renewables (Millions Dfl.)

	Ministry for Economic Affairs total	of which RD&D	Energy Distribution Sector	Ministry of VROM
1989	248	104	0	56
1990	448	168	0	68
1991	523	160	230	93
1992	541	174	230	34
1993	470	168	230	43
1994	421	215	419	30

Source: EZ, VROM, 1994. Not included is the VAMIL Accelerated Depreciation Scheme.

Table 4.4 EZ Budgets for energy conservation and renewable programmes and instruments in 1994

Instrument	1994
Subsidy scheme for energy conservation and consultancy (EMA)	2
Subsidy scheme for new energy-efficiency techniques (BSET)	96
Tender scheme for industrial energy conservation (TIEB)	25
RD&D industrial energy conservation (through NOVEM)	51
RD&D energy conservation in buildings, transport and agriculture (through NOVEM)	57
Subsidy scheme for energy conservation in existing buildings	35
Implementation costs of subsidy schemes	9
Wind energy subsidy scheme	35
Long-term research in renewable energy	65
Other (includes subsidies for research institutes)	45

Source: EZ, 1993

The Netherlands' Government contributes about Dfl. 10 million to the comprehensive National Research Programme for the Recycling of Waste Substances (NOH). The Government also finances a programme to stimulate and apply waste and biomass for energy purposes. This EWAB-programme amounts to about Dfl. 7.5 milion. Both programmes are managed by NOVEM. The Waste and CO_2 programme has an annual budget of about Dfl. 750,000.

Environmental measures and transport measures are more or less relevant for climate policy but are not included in budgetary overviews. In 1993, a project on reducing pollution and providing more energy-efficient transport in towns was launched. In this project research, development, experiments and simulation are combined, promoting environmentally-friendly forms of public transport and transport of goods in towns. About Dfl 15 million has been reserved for the project for the period up to 1998.

4.7 AFTER THE YEAR 2000

Netherlands' policy in the longer term with regard to climate change is based on the continuing recognition of the problem of global warming, and of the possibility of a stringent international reduction policy after the year 2000. The possibility must be faced that the industrialized countries may together have to reduce their emissions of CO_2 by 1% to 2% per year in the decades after the year 2000 in order to get within reach of a stabilization of concentrations by the year 2100. An international approach to the problem is essential, as is the need to prepare now for the larger reductions which may be necessary in the future. The main elements of this Netherlands' anticipatory longer-term policy are based on a review of long-term possibilities, and on accelerating the development, demonstration and usage of technologies contributing to the reduction of greenhouse gases (EZ, 1993; ECN, 1994).

With respect to the European CO_2 stabilization target, the Government concluded in the National Environmental Policy Plan 2 that, once CO_2 emissions have been reduced by 3% or 5% by the year 2000 compared to 1989/1990, no further rise in emissions should occur, in principle.

For the transport sector, the target is to reduce CO_2 emissions by the year 2010 by 10% compared to the 1986 level (VW, 1990). Furthermore, the Electricity Plan 1993-2002 (SEP, 1994) of the Netherlands' Electricity Generating Board (SEP) includes the objective that the CO_2 emissions attributable to the electricity generating sector should be held approximately at their 1990 level in the year 2010. The implementation of this objective is being discussed by the Government and the SEP (VROM, 1994).

5. PROJECTIONS AND ASSESSMENT OF EFFECTS OF MEASURES

5.1 INTRODUCTION

A major element of policy development concerns the survey of possible future trends, with the development of the world economy in mind. The Netherlands' Central Planning Bureau CPB (CPB, 1992b) generated four scenarios for the development of the world economy between 1990 and 2015. Each scenario outlines a specific view on the future, taking into consideration the driving forces behind the process of economic development, an assessment of the current position of the various regions in respect of these driving forces, and analysis of long-term trends influencing the development of the world economy for the next 25 years.

The two most plausible scenarios, European Renaissance and Global Shift, are further elaborated with reference to the Netherlands' economic situation (CPB, 1992a). The European Renaissance Scenario assumes a high economic growth, in contrast with the Global Shift Scenario, which assumes a low economic growth. Since the level of future fuel prices is particularly hard to predict, variations of these scenarios have been developed, adapted to a range of fuel prices. The 'low energy price' version assumes that actual energy prices in the year 2000 will be the same as in 1990; the 'high energy price' version assumes that there will be an increase of 45% in world oil prices and of 23% in end user prices of energy in the year 2000 compared to 1990.

To estimate future trends in CO_2 emissions, a specific scenario has been developed by the Ministry of Economic Affairs and the Ministry of Housing, Spatial Planning and Environment. This Energy Policy Scenario is based on more recent developments in economic growth, energy prices and energy supply and demand. The Energy Policy Scenario falls between the European Renaissance Scenario with high energy prices (ER-High) and the Global Shift scenario with low energy prices (GS-Low). It assumes constant real energy prices in the year 2000 compared to 1990, moderate economic growth and a limited decrease in the energy intensity of the economic structure. The central projection of CO_2 emissions is based on the Energy Policy Scenario, while the results of ER-High and GS-Low provide a range of projected emissions.

For future trends in non-CO_2 greenhouse gas emissions, the ER-High scenario has been used as the central projection scenario. Future emissions of non-CO_2 greenhouse gases are less dependent on energy prices and economic growth than are CO_2 emissions, and, therefore, the adjustments made in the Energy Policy Scenario are less relevant for these gases.

Table 5.1 provides some of the key assumptions in the Energy Policy Scenario, ER-High and GS-Low. Other key assumptions and a more detailed description of the scenarios are included in appendix 4.

The modelling tools used in the scenarios are the energy demand model CENECA developed by the Central Planning Bureau (CPB), the energy supply model SELPE developed by the Energy Research Foundation (ECN) and the RIM+ emissions model (RIVM). A qualitative description of these models is provided in appendix 4.

In projecting greenhouse gas emissions, measures, policies and programmes already implemented or committed to, as described in chapter 4, section 4.3, are taken into account. Measures under consideration (chapter 4, section 4.4) are not included in the projections. It is assu-

Table 5.1 Some Key assumptions in various scenarios

	Energy Policy Scenario	ER-High Scenario	GS-Low Scenario
Annual rate of economic growth (%) 1990-2000 period	1.9	2.7	1.5
End user prices of energy in the year 2000 (1990=100)	100	123	100
Effects of structural change[1] (%)	-0.1	-0.2	0.2

Source: EZ, 1993

[1] Annual rate of change in the ratio 'energy consumption/GNP' due to changes in economic structure.

med that all measures and policies are, or will be, adequately and fully implemented. The Government has monitoring programmes at its disposal (see chapter 4, section 4.5) to recognize inadequate implementation of measures and adverse effects on emission reductions. If necessary, adjustments of policies and measures as required, could be proposed.

5.2 CO_2 EMISSIONS

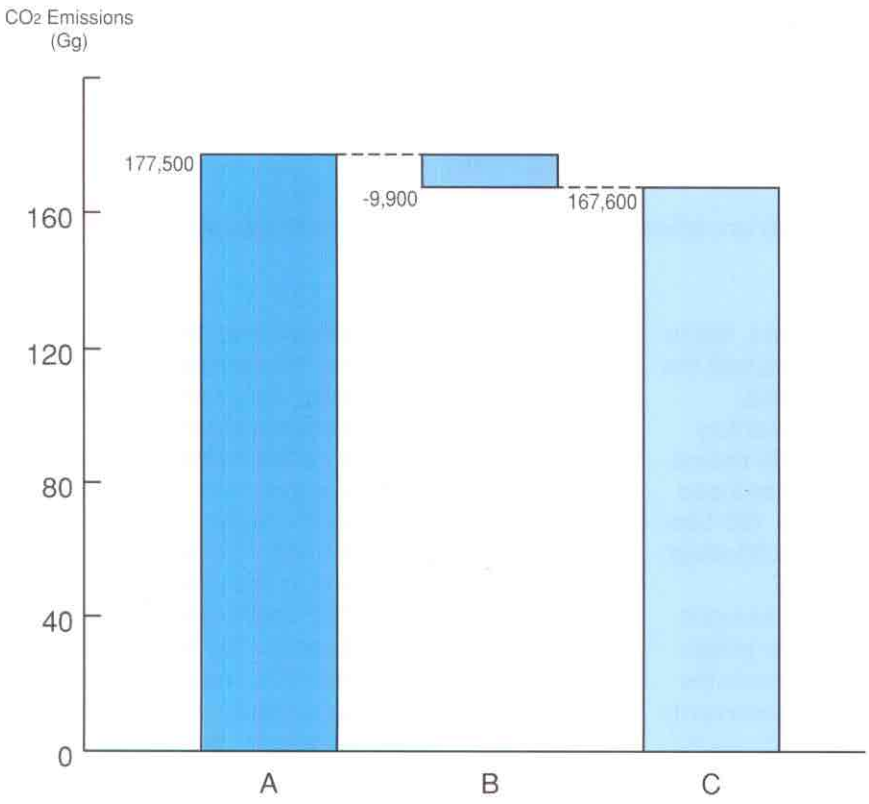
5.2.1 Projections of CO_2 emissions in the year 2000

The Energy Policy Scenario has been used as the central scenario to estimate future trends in CO_2 emissions. Firstly, CO_2 emissions in 2000 were estimated with regard to policies and measures formulated in the National Environmental Policy Plan Plus (NEPPP; VROM, 1990a) and the Memorandum on Energy Conservation (MEC; EZ, 1990). Then, the effects of additional policies formulated in the Second National Environmental Policy Plan (NEPP 2; VROM, 1994) and the Second Memorandum on Energy Conservation (SMEC; EZ, 1993) on CO_2 emissions were quantified. CO_2 emissions in 2000 amount to 167,600 Gg, as compared to 174,000 Gg in 1990 (see figure 5.1).

The anticipated relative contribution of various sectors to total CO_2 emissions in 2000 as compared to 1990 is presented in figure 5.2. It should be noted that the sectoral breakdown in figure 5.2 does not fully correspond with the sectoral breakdown using the IPCC methodology. Data according to the IPCC sectoral breakdown are not available for the year 2000. CO_2 emission reductions are expected in the energy and residential sectors.

The Energy Policy Scenario is regarded as the most accurate scenario to take latest developments on economic and social trends into account. However, to get a better insight into the uncertainty of the results due to the specific

Figure 5.1 CO_2 Emissions in the year 2000 (Energy Policy Scenario)

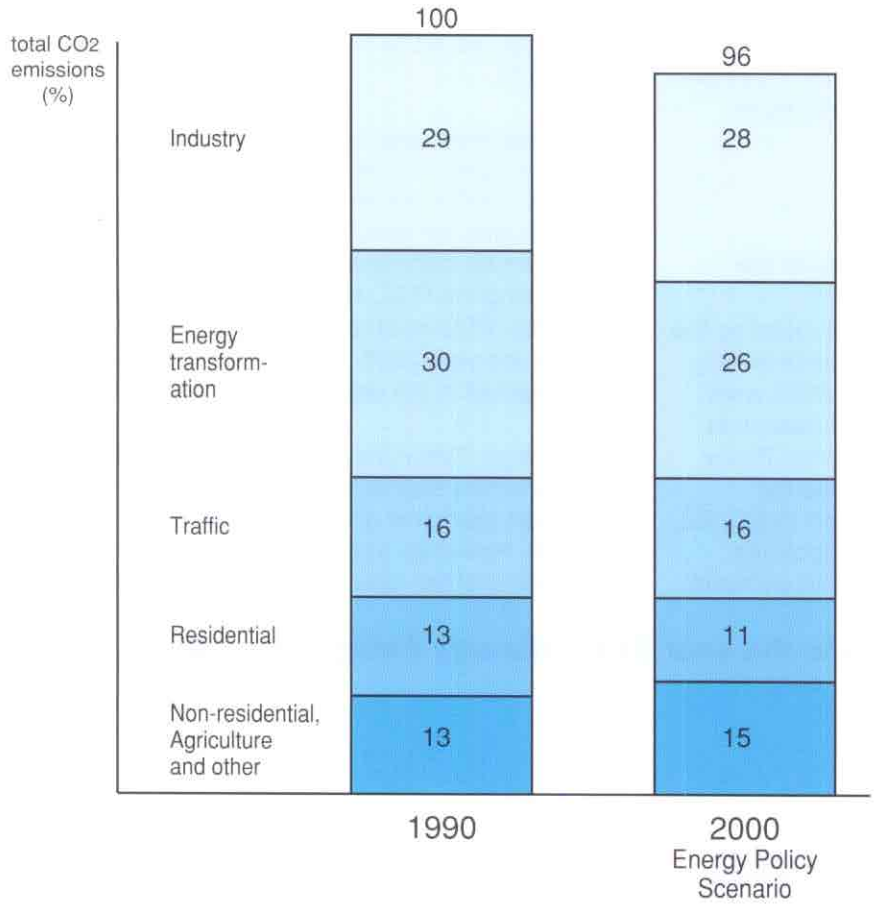


A: Emissions in 2000, taking into account policies formulated in NEPP (VROM, 1990) and MEC (EZ, 1990).

B: Reductions from additional measures formulated in NEPP 2 (VROM, 1994) and SMEC (EZ, 1993).

C: Estimated CO_2 emissions in the year 2000 (includes only CO_2 emissions. Additional measures relating to sinks (afforestation; CO_2 removal and disposal)) increase the sink capacity in the year 2000 by 800 Gg CO_2, resulting in a net CO_2 emission of 166,800 Gg CO_2 by the year 2000.

Figure 5.2 Relative contribution of sectors (%) to total CO_2 emissions in 1990 and 2000. Total CO_2 emissions in 1990=100%



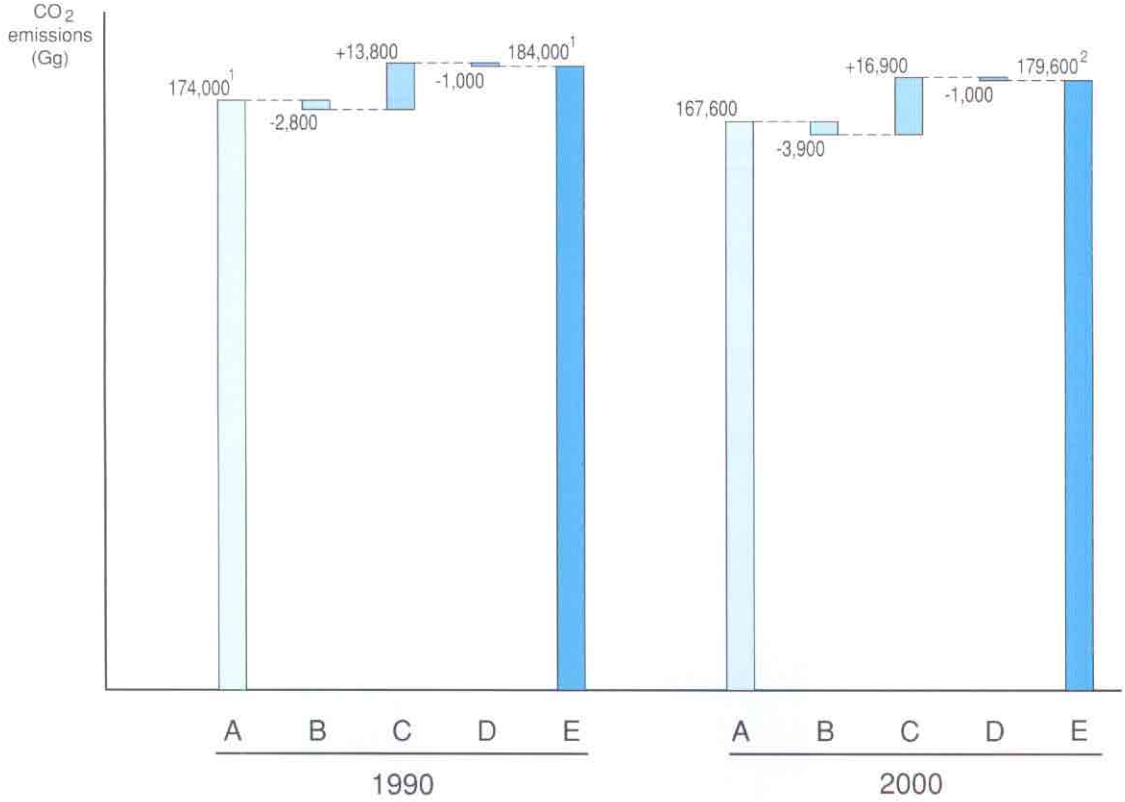
Note: Totals are rounded. Figures are adjusted according to the IPCC methodology
Source: EZ, 1993

assumptions in the Energy Policy Scenario, future CO_2 emissions have also been calculated with the help of the ER-High and GS-Low scenarios. These scenarios use other assumptions for key variables. CO_2 emissions in the year 2000 estimated with ER-High are 1,000 Gg higher than those estimated by the Energy Policy Scenario. GS-Low results in an emission level in the year 2000 which is 1,000 Gg lower than the Energy Policy Scenario. On the basis of this sensitivity analysis, it can be concluded that uncertainty in the projections due to evaluation of key assumptions in the various scenarios does not exceed the uncertainty in emission factors applied (see chapter 3, section 3.2.7), nor the uncertainty in implementation and enforcement of measures.

5.2.2 The Netherlands' policy approach in projecting CO_2 emissions

As explained in chapter 3, the inventory methodology used by the Netherlands in policymaking and policy evaluation differs on some key points from the IPCC methodology. The approach used in forecasting emissions, the subsequent results presented in various policy documents and the CO_2 reduction target as formulated by the Netherlands are based on the Netherlands' policy approach. To enable a comparison with 1990 emissions as presented in chapter 3 as well as international comparison with forecasts from other countries, the projections in this chapter are provided in line with IPCC methodology. The most important differences between the Netherlands' Policy Approach and the IPCC methodology are the inclusion of potential emissions of feedstocks instead of the actual emissions, and the exclusion of non-energy emissions from industrial processes and waste incineration (see also chapter 3). Figure 5.3 presents the adjustments and resulting emissions according to the Netherlands' Policy Approach in 1990 and 2000. It is assumed that non-energy emissions from industrial processes are constant over time. No data are available for a more accurate estimate. Based on the policy plan

Figure 5.3 CO_2 emissions (1990, 2000) according to the IPCC methodology and the Netherlands' Policy Approach



A: Total CO_2 emissions according to IPCC methodology.
B: CO_2 emissions from industrial processes and waste incineration.
C: Stored Carbon from feedstocks (Potential Emissions minus Actual Emissions).
D: Statistical Differences (due to differing demand and supply figures and due to rounding).
E: Total CO_2 emissions according to the Netherlands' Policy Approach.

1: Temperature corrected
2: If, as in policy documents (VROM, 1994; EZ, 1993), measures under consideration and measures increasing carbon sinks are included, this figure is 177,000 Gg.

on waste disposal (Veen e.a., 1993), it is assumed that CO_2 emissions from waste incineration will increase from 900 Gg to 2,000 Gg by 2000. A rough estimate based on the anticipated growth in feedstock production indicates that the carbon stored in products from feedstocks will increase from 13,800 Gg in 1990 to 16,900 Gg in the year 2000.

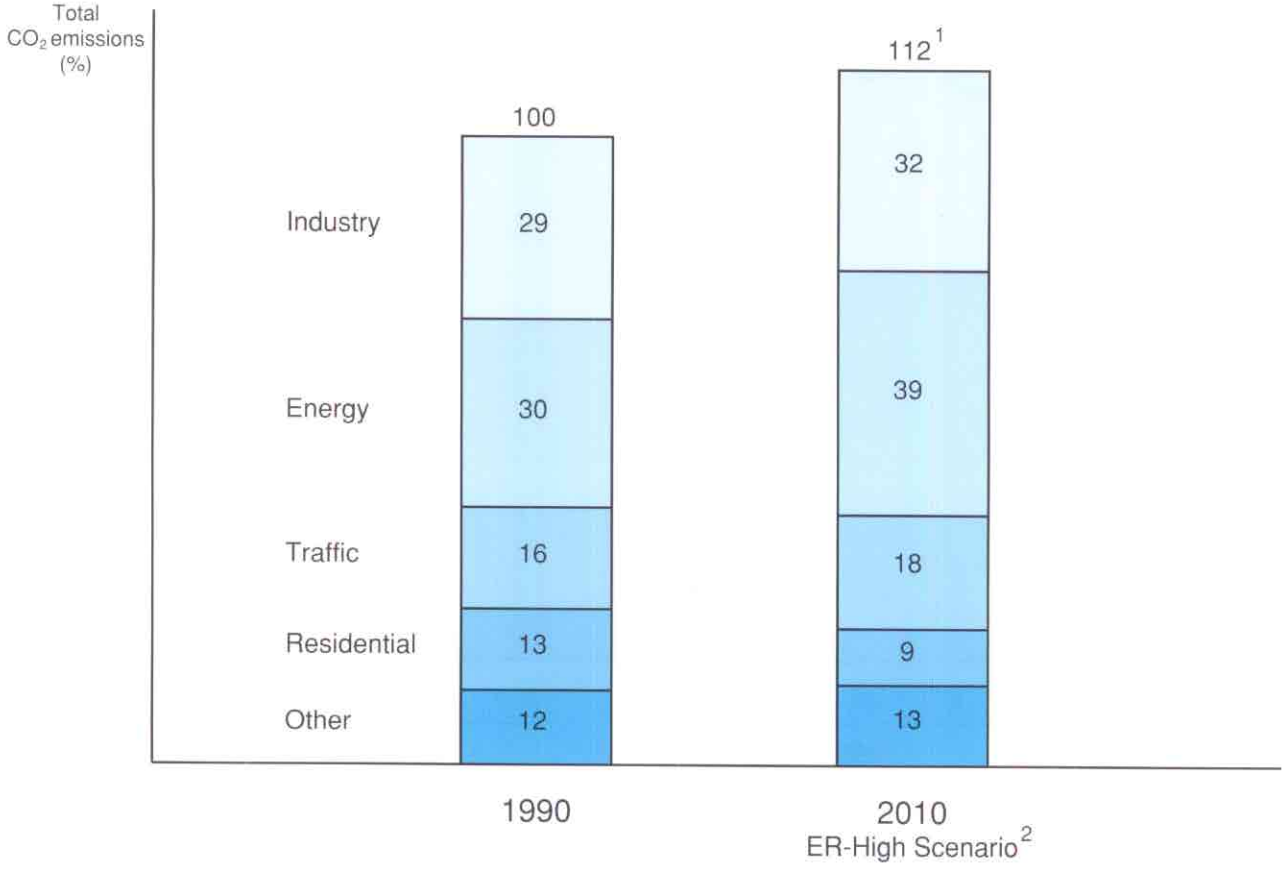
5.2.3 CO_2 emissions in 2010

Figure 5.4 presents the projected relative contribution of various sectors to total CO_2 emissions in 2010 as compared to 1990. (Base year 1990: 100% for total CO_2 emissions). Since the Energy Policy Scenario does not extend beyond the year 2000, the ER-High scenario has been used to give an indication of how CO_2 emissions may develop in the long term. This figure shows scenario results in 2010, not policy targets.

As in figure 5.2, the sectoral breakdown does not fully correspond with the sectoral breakdown in the IPCC methodology.

After the year 2000, total CO_2 emissions, and especially emissions from the energy, industry and traffic sectors, show a marked increase. The Netherlands' energy and climate policy is focussed on emissions during the period up to the year 2000. Since the effectiveness of the policies adopted will decrease after the year 2000, while economic growth is most likely to continue, the scenarios show that, without future policy changes, total CO2 emissions will increase after the year 2000. (It should be noted that the results of the Energy Policy Scenario for the year 2000 and the ER-High Scenario for the year 2010 are not directly comparable, because the ER-High Scenario assumptions for the 1990-2000 period are different from those of the Energy Policy Scenario.)

Figure 5.4 Relative contribution of sectors (%) to total CO_2 emissions in 1990 and 2010. Total CO_2 emissions in 1990=100%



Note: Totals are rounded. The 2010 figures are scenario results assuming unchanged NEPP 2 and SMEC policies after 2000.

1 Source: RIVM, 1993 b. Figures are adjusted according to the IPCC methodology.

2 According to GS-Low, total CO2 emissions will be ca. 115-117.

5.2.4 Assessment of effects of measures on CO_2 emissions

The INC guidelines for the preparation of first communications by Parties listed in Annex I of the FCCC require that these Parties provide a specific estimate of the total effect on greenhouse gas emissions and removals of policies and measures. This specific estimate should, as far as possible, take into account all policies and measures implemented or committed to since the base year. Since the Netherlands' evaluation process does not make a distinction between policies implemented before and after 1990, the Netherlands cannot provide this type of estimate. Furthermore, in projecting future CO_2 emissions, no distinction is made between policy and autonomous effects on emissions.

Future CO_2 emissions are largely dependent on future energy consumption and the relative contribution of fossil fuel use to total fuel consumption. Consequently, the effects of energy conservation, and a change in fuel use, on CO_2 emissions have been estimated.

Table 5.2 shows the development of energy consumption from 1990 to 2000 based on two different assumptions. First, that energy efficiency in the year 2000 will remain at the same level as in 1990. The second is that the policy induced, and the autonomous energy conservation activities anticipated in the Second Memorandum on Energy Conservation, will actually be achieved. No distinction can be made between policy-induced, and autonomous effects, on energy conservation. As can be seen from table 5.2, energy consumption in the year 2000 would be about 550 PJ

Table 5.2 Energy use and energy conservation in various sectors in 1990 and 2000, based on the Energy Policy Scenario

	1990 (PJ) temperature corrected[1]	2000 (PJ) Without energy conservation	2000 (PJ) With energy conservation	2000 (PJ) Effect of energy conservation
Energy and Transformation	318	320	240	80
Industry				
- Energy	781	915	755	160
- Feedstocks	440	540	540	0
Transport	376	415	375	40
Commercial/Institutional	286	425	335	90
Residential	459	535	420	115
Agriculture	174	265	200	65
Total	2834	3415	2865	555

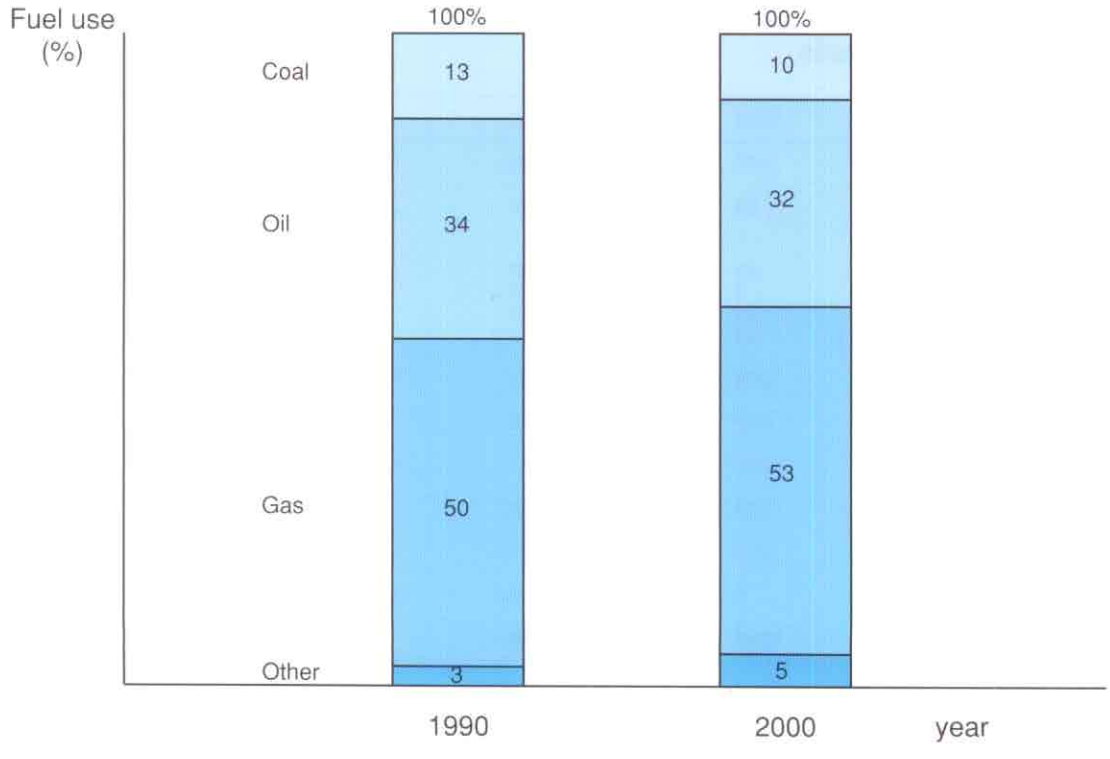
Source: EZ, 1993

[1] Figures are based on total energy sources (including non fossil); sector categories differ slightly from IPCC categories.

higher according to the 'without energy conservation' scenario than in the 'energy conservation' scenario, which is more realistic. In terms of CO_2 emissions, this difference amounts to roughly 42,000 - 45,000 Gg. Besides the effects of energy conservation (policy-induced and autonomous), this figure also includes the effects of anticipated changes in the fuel supply pattern (see figure 5.5) on CO_2 emissions. These effects have been estimated to reduce CO_2 emissions by about 7,000 - 9,000 Gg.

This development contrasts with an increasing proportion of coal in the fuel supply mix, which would have resulted in an increase in CO_2 emissions if plans drawn up in the 80s had been realized.

Figure 5.5 The relative contribution of fuels to total fuel use in 1990 and 2000, based on Energy Policy Scenario



5.3 CH_4 EMISSIONS

5.3.1 Projection of CH_4 emissions

The projection of CH_4 emissions in the year 2000 is based on NEPP2 and SMEC policies (VROM 1994; EZ 1993) under the assumption of the European Renaissance scenario with high energy prices. More details on assumptions within the various economic sectors are described in the background document (Amstel et al., 1994). Table 5.3 provides a breakdown of CH_4 emissions in 1990 and 2000. In this table, a column has been added with respect to CH_4 emissions in 2010. The figures in this column assume unchanged NEPP2 and SMEC policies after the year 2000. There is no methane emission target for 2010.

5.3.2 Assessment of effects of measures on CH4 emissions

Methane reductions are often the positive result of non-climate policies, such as policies to reduce landfilling, acid deposition and manure surplus. As is shown in table 5.3, the total effects of these policies are estimated at a reduction of about 280 Gg (26%) in methane emission between 1990 and 2000 (compared to the reduction target of 10%), and about 500 Gg (47%) between 1990 and 2010. The 26% reduction can be achieved by the year 2000, provided the following policies are implemented:

- less waste landfilled: 117 Gg CH_4 emission reduction
- methane recovery from landfills: 37 Gg CH_4 emission reduction;
- common agricultural policies: 70 Gg CH_4 emission reduction;
- domestic manure policies: 35 Gg CH_4 emission reduction.

Furthermore, emissions from energy are expected to decrease by 19 Gg by the year 2000 compared with 1990 levels.

5.4 N_2O EMISSIONS

5.4.1 Projections of N_2O emissions

As a result of developments mentioned in chapter 4, N_2O emissions are expected to increase slightly, in contrast to the target of stabilization at 1990 levels by the year 2000. In NEPP 2 (VROM, 1994), the Government announced that it will develop an action plan based on a background study on N_2O emissions and the reduction potential (to be completed by the end of 1994).

Projections are calculated based on the European Renaissance scenario with high energy prices. The Global Shift scenario with low energy prices leads to identical results, except for total emissions from transport. In 2000, these are 1 Gg lower in the GS-Low Scenario than in the ER-High Scenario.

It should be noted here that the effects of de-NO_x

Table 5.3 CH_4 emissions (Gg) in 1990, 2000 and 2010 based on ER-High Scenario

	1990	2000	2010[1]
Energy, Total	**177**	**156**	**107**
Fuel Combustion Activities	28	26	24
Fugitive Fuel Emissions			
- Gas Production	52	52	52
- Gas Transportation	6	6	6
- Gas Distribution	72	72	72
- Oil Production	19	0	0
Agriculture, Total	**508**	**402**	**353**
Enteric Fermentation	402	325	288
Animal Waste	106	77	65
Waste, Total	**382**	**228**	**110**
Landfills	377	223	105
Sewage treatment	5	5	5
Total	**1067**	**786**	**570**

Source: Amstel et al., 1994

[1] The 2010 figures are scenario results assuming unchanged NEPP 2 and SMEC policies after the year 2000.

facilities in stationary sources are ignored in the projections. Decreased N_2O emissions from soils, as a result of decreased deposition of NO_x, are not taken into consideration in the present projection either.

Furthermore, a number of possible policy influences on soil emissions are not considered in the present forecast, due to a lack of knowledge about the effects on N_2O emissions. These policies include the method of fertilizer application to soils and the storage of animal manure. Injection of animal manure into soils may cause higher N_2O emissions than surface application of similar amounts of nitrogen. Similarly, acid treatment of animal manure to reduce NH_3 emissions may enhance N_2O emissions during storage. Deep-litter stables are also found to be potential sources of enhanced N_2O emissions. At present, the net effect of Netherlands' policy on N_2O emissions concerning animal manure is not clear. On the one hand, decreased livestock numbers and low(er)-nitrogen diets result in a decrease in nitrogen input in Netherlands' soils. On the other hand, N_2O emissions may increase due to different methods of manure storage and method of applications of nitrogen to soils.

Table 5.4 presents a breakdown of anthropogenic N_2O emissions in 1990 and 2000. It also provides a projection for N_2O emissions in 2010 based on the assumption that NEPP2 and SMEC policies remain unchanged after the year 2000. Emissions from transport will increase considerably. In the year 2000, transport-related emissions will amount to 11.0 Gg N_2O, which is an increase of about 100 % compared to 1990. This increase is mainly a result of the introduction of three-way catalytic converters in vehicles. Other sectors showing increased N_2O emissions are industry (adipic acid and nitric acid production) and sewage water treatment.

Emissions from agriculture are expected to decrease in the future. The production and application of animal manure will decrease as well as the use of synthetic fertilizers. Therefore, indirect emissions due to nitrogen leaching from soils into surface water will also decrease.

5.4.2 Assessment of effects of measures on N_2O emissions

N_2O emission reductions or increases are the result of policies in other areas than climate (see section 3.4). For the period from 1990-2000, the main developments are expected to be the following:

- increase in nitric acid production;
- reduced manure on soils;
- introduction of catalytic converters.

As table 5.4 indicates, these developments are expected to result in a net increase of 2.7 Gg N_2O between 1990 and 2000.

Table 5.4 N_2O emissions (Gg) in 1990, 2000 and 2010 based on ER-High scenario

	1990	2000	2010[1]
Total Energy	**6.1**	**11.6**	**13.3**
Fugitive Fuel Emissions			
- Energy and Transformation	0.5	0.4	0.5
- Industry	0.1	0.1	0.1
- Residential and Commercial	0.1	0.1	0.1
- Transport	5.4	11.0	12.6
Industrial Processes	**16.4**	**19.1**	**21.6**
Total Agriculture	**22.1**	**17.7**	**16.7**
- Soils: Fertilizer Induced Emissions	8,3		
- Soils: Anthropogenic Background Emissions	13,8		
Total Waste	**4.1**	**6.9**	**7.6**
- Waste Incineration	0.1	0.1	0.2
- Waste Water Treatment Plants	4.0	6.8	7.4
Other	**10.9**	**6.9**	**5.9**
- Polluted Inland and Coastal Water[2]	10.9	6.9	5.9
Total	**59.6[3]**	**62.2**	**65.1**

Source: Amstel et al., 1994

[1] The 2010 figures are scenario results assuming unchanged NEPP 2 and SMEC policies after the year 2000.
[2] Contributing sectors: agriculture, energy, transport, industry, households.
[3] In contrast to policy documents (VROM, 1994; EZ, 1993), only anthropogenic emissions are taken into account in this table (see chapter 3.4).

5.5 EMISSIONS OF OTHER GREENHOUSE GASES

Figure 5.6 provides emission estimates for NO_X, CO and NMVOC in 1990 and 2000 based on the ER-High Scenario. A projection has been added with respect to emissions in 2010. From this figure, it can be seen that emissions of NO_X, CO and NMVOC will decrease considerably in the coming decades. A sharp decline is striking in the period up to the year 2000, in particular. In the year 2000, NO_X emissions are expected to be decrease by more than 30 % compared to 1990, and a further decrease of about 25 % compared to 1990 is expected in the period 2000-2010. CO emissions are expected to decrease by about 40 % and NMVOC emissions by about 45 %. CO and NMVOC emissions are expected to remain stable in the period 2000-2010. Projections of emissions of fluorocarbons are not yet available.

5.6 AGGREGATED EMISSIONS

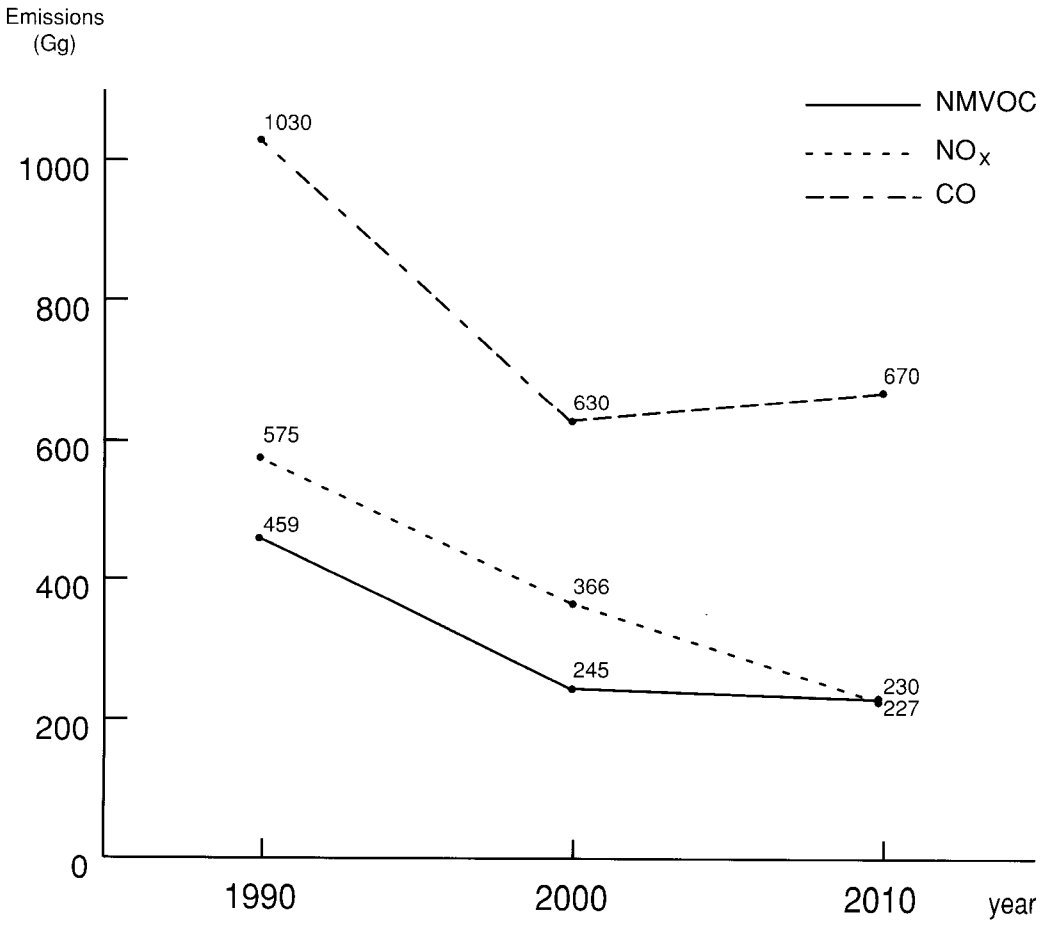
Figure 5.7 shows the aggregated emissions (direct effects) of CO_2, CH_4 and N_2O in 1990, 2000 and 2010. These figures indicate that total aggregated emissions are expected to decrease by approximately 4% in the year 2000 as compared to 1990 levels.

Taking into account a possible indirect GWP of methane of the order of the direct effect (IPCC, 1992) this would result in an aggregated emission reduction of 5-6% (201,600 Gg CO_2 equivalents in the year 2000 compared to 213,500 Gg CO_2 equivalents in 1990).

5.7 CONCLUDING REMARKS

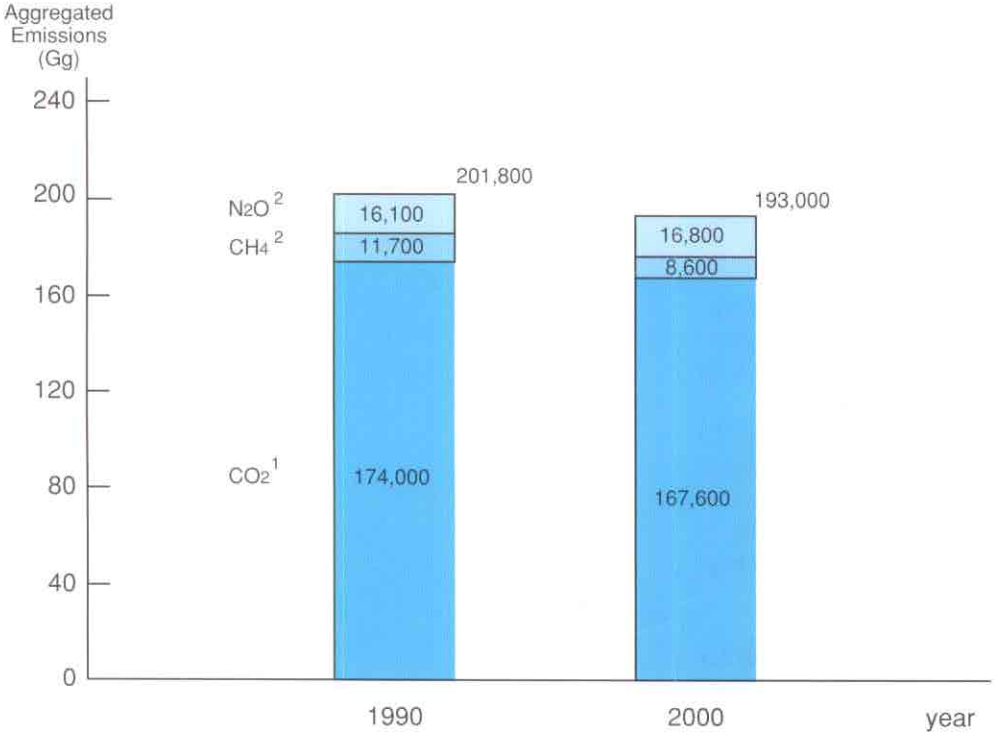
Several commitments are covered by Netherlands' climate change policy:

Figure 5.6 Emission estimates of NO_X, CO and NMVOC in 1990, 2000 and 2010, based on ER-High Scenario



Source: Amstel et al., 1994

Figure 5.7 Aggregated emissions (direct effects) of CO_2, CH_4 and N_2O in 1990 and 2000 (adopted policies)



[1] Temperature corrected

[2] Global Warming Potentials used were provided by the IPCC in its 1992 supplementary report. GWP's used are based on the direct effects of the greenhouse gases over a 100-year time horizon: GWP of CH_4 = 11; GWP of N_2O = 270.

a. national emission targets for CO_2, CH_4, N_2O (by the year 2000) and for NO_x and VOC (by 2000 and 2010);
b. a CO_2 stabilization target of the European Union as a whole by the year 2000 compared to 1990. This target is based on a general, and not a specific, burden-sharing concept. The Netherlands' activities towards realization of its 3% reduction target contribute to the realization of the EU target;
c. the commitments under the FCCC (covering all greenhouse gases not covered by the Montreal Protocol);
d. the Protocols under the Long Range Transboundary Air Pollution (LRTAP) (NO_x and VOC).

Given the current economic outlook and the effects of other policies, including the possible introduction of a CO_2 energy tax in the European Union or nationally, the CO_2 target of 3% reduction is within reach. In 1995, the Netherlands will decide whether the 5% emission reduction target should come into force, taking into account international developments and opportunities.

Compared to the inventory of greenhouse gas emissions and projections of emissions for the year 2000, the approach taken by the Netherlands to policymaking and evaluation differs from the IPCC methodology on some key points. For the time being, the Netherlands will use both the IPCC methodology and the Netherlands' policy approach. The Netherlands' CO_2 target is based on the latter approach.
The Second National Environmental Policy Plan (VROM, 1994) confirms the official Netherlands' target based on the Netherlands' policy for the base year 1989/1990: 182,000 Gg CO_2.
On the basis of policies implemented, CO_2 emissions will be reduced by about 1% by the year 2000 (179,600 Gg CO_2, figure 5.3) compared to 1989/1990 levels. If measures under consideration and sinks are taken into account, total reduction of net CO_2 emissions will amount to approximately 3% (177,000 Gg CO_2).

Using the IPCC methodology, 3.5% reduction in CO_2 emissions will be achieved by the year 2000: 174,000 Gg CO_2 by 1990 and 168,000 Gg CO_2 by the year 2000.

The Netherlands' national CO_2 target is, with the exception of the road transport sector, not subdivided into sectoral targets. The target for the road transport sector is to stabilize CO_2 emissions by 1995 at 1989/1990 levels, and achieve an emission reduction of 11% by the year 2000 compared to 1990. Implementation of some measures has not been finalized yet. In order to achieve the 11% emission reduction target by 2000 in the freight sector, additional measures may be required.

CH_4 emissions are expected to be reduced by about 25% by the year 2000, which is considerably more than the target of 10% reduction with respect to 1990.
N_2O emissions are expected to increase by 5% by the year 2000, instead of remaining stable at 1990 levels. Options to limit N_2O emissions in the Netherlands are currently being investigated.
Options to limit HFC and PFC emissions in the Netherlands are also being explored.

The target for the year 2000 for NO_x will not be met, although a reduction of more than 30% will be achieved nevertheless. The freight transport sector makes a significant contribution to this deficit. There is also a deficit for the year 2010 in this category.
Government and freight sector will together investigate further measures to limit both CO_2 and NO_x emissions.
Options to further reduce CO emissions and NMVOC emissions are being studied.

6. VULNERABILITY AND ADAPTATION

6.1 INTRODUCTION

Given its geographical situation, the Netherlands is highly susceptible to changes in sea level and related changes caused by extreme weather conditions and hydrological conditions. The densely populated and industrialized delta of the Rhine, Meuse and Scheldt rivers is protected by a combination of natural dunes and solid constructions (dams, dykes) from a sea level which is expected to occur only once in 10,000 years. Sea level rise and changing extreme conditions may adversely affect natural beach and dune systems, and thus increase the country's dependency on solid constructions to maintain this level of protection.

6.2 VULNERABILITY ASSESSMENT

In a recent investigation of the effects of sea level rise in the Netherlands (VW, 1991; RWS, 1992) it is estimated that a 60 cm rise in sea level would lead to extra costs amounting to Dfl. 11 billion over a period of 100 years. These extra costs would arise from building dykes, protecting flood-prone infrastructure, preserving dunes, and adapting the water management system. A 100 cm rise in sea level is estimated to incur Dfl. 18 billion in costs. The study also showed that not only a sea level rise would lead to extra costs. An unfavourable change in wind direction combined with an 10% increase in wind intensity could also lead to costs of Dfl. 14 billion over a period of 100 years, due to increased wave run-up.

Although the Netherlands is geographically susceptible to climate change and sea level rise, the present institutional and economic situation enables the country to cope with the effects expected. However, this may be at the expense of nature value.

Recently, a survey was carried out on the potential effects of climate change in the Netherlands (Delft Hydraulics, 1993). This survey systematically, albeit qualitatively, analysed four types of effects on five seperate categories. The types of effects are (1) economic effects, (2) risk effects, (3) effects on nature, and (4) environmental effects. The separate categories are (1) safety and public health, (2) base material production and provision of services, (3) spatial planning and nature, (4) production sector, and (5) consumption sector. A first-order quantitative estimate has been made for a selected number of effects. The conclusions are preliminary estimates, first of all because it can only be speculated as to how climate change will manifest itself in the Netherlands, and secondly because it is difficult to predict future socio-economic development. Some of the quantitative results are listed below.

- It is estimated that a temperature increase of 3° C combined with a precipitation and evaporation increase of 10 % each will eventually lead to a decrease in the area of highly valuable nature reserves by about 90%.
- Warmer and dryer summers may lead to an increase in the mean annual demand for drinking water by 1-2 %. Increased demand and decreased availability (groundwater in particular) may lead to extra costs for providing a supply of drinking water of some tens of millions of guilders per year.
- Warmer summers may lead to increased demand for electricity for air conditioning in buildings and houses. A temperature increase of 1° C may lead to extra costs of Dfl. 10-100 million per annum for electricity generation.
- Warmer winters, however, may lead to a reduction in the use of energy. The estimated reduction in costs may amount to about Dfl. 200 million per year for a 1° C temperature increase.

In estimating the effects of climate change on agricultural production in the Netherlands, models for climate change have been linked with models for agricultural production (Wolf et al., 1993). It has been concluded that the impact of climate change on agricultural production would be positive as a whole. However, compared to the effects of various measures in agricultural policies, and in particular the European Common Agricultural Policy, climate change has a relatively modest impact on agricultural production.

6.3 ADAPTATION MEASURES

Coastal Zone Management

In 1990, the Netherlands' Government decided to preserve the status quo of the location of the coastline. In addition, the Government has acknowledged that planning of the coastal defence construction should take into account a possible sea level rise. Furthermore, spatial planning activities should also take into account a possible need for a strengthened sea-wall. The Netherlands' law requires that the safety of an embankment be tested every 5 years under present hydraulic conditions.

Water Management
A higher sea level may cause an increase in salt-water percolation in coastal zones. This can be prevented by flushing the area with fresh water, which requires an adequate source of fresh water. During summers, however, a discrepancy between demand and supply of available fresh water may arise. As a result of a changing hydrological cycle, this problem may extend to other parts of the country, thus affecting several economic sectors. This area has not been researched yet, hence no specific policies have been developed. Further and detailed studies are necessary.

Agriculture
Given the existing doubt with respect to the effects of climate change on the agricultural sector, no adaptation measures have been developed so far. It is expected that agricultural policies, and especially the European Common Agricultural Policy will have a greater effect on agricultural sector than possible climate changes. Furthermore, since the agricultural sector is largely dominated by technology, potential adverse effects due to climate change are expected to be limited e.g. by improvements in plant varieties and improved water management.

Nature conservation
In order to improve the ecological situation in the Netherlands, an 'Ecological Main Structure' has been developed (LNV, 1990). This structure consists of a number of (partially developed) nature conservation areas in the Netherlands, which are interconnected. The overlapping of these different zones provides natural species with the opportunity to migrate, which may also facilitate the adaptation of ecosystems to a change in climate.

Forest management in the Netherlands focusses on stimulating the stability and options for adaptation of forests. Measures taken to realize this stability are the stimulation of mixed forest-planting, making conscious choices with respect to different kinds of trees, disease prevention, and protection of genetic diversity. These measures also contribute to adaptation to climate change.

6.4 INTERNATIONAL ACTIVITIES

The Netherlands has considerable experience in the field of coastal zone management, and has strived to share this experience with other countries, in particular with those developing countries that are most vulnerable to the effects of climate change. Support in this respect involves dissemination of information on instruments and other knowledge with respect to coastal zone management, and the training of experts, from developing countries in particular. More detailed information on development assistance is given in chapter 8.

7. JOINT IMPLEMENTATION

7.1 NETHERLANDS' INITIATIVES ON JOINT IMPLEMENTATION

In 1993 the Government set up a research project on the legal and economic aspects of Joint Implementation (JI). The project was carried out by Netherlands' research institutes in cooperation with a Polish research institute. Part of the project involved the organization of workshops in the Netherlands and Poland. This project resulted in a book (Kuik et al., 1994). The Netherlands was also one of the sponsors of an international workshop on JI in Southampton (Bermuda) in January 1994. Proceedings from this workshop were published in January 1994 (WHRC, 1994). In June 1994, the Netherlands hosted an international conference on JI. The proceedings of this conference will be published in a book later this year. In a statement, the participants of the conference stated that JI could become an important means of achieving the Convention's objective in a cost-effective manner (see box 7.1). Participants also recommended the organization of the conference to explore the possibilities of setting up a JI newsletter and a network for the exchange of information on JI studies and projects. It was further recommended that a follow-up conference should be held in a developing country focussing on JI from the perspective of developing countries. A similar conference was recommended for countries in transition. At the moment these recommendations are being explored.

On a national level, a dialogue on JI has been instigated on the basis of a governmental discussion paper on JI. This document is open for public review until the end of 1994. Major advisory councils in the fields of socio-economic policy, the environment and developing cooperation have been asked for their responses. Consultations with the private sector will provide an opportunity for them to express their opinion on JI and explore their interest in JI participation. At the end of 1994, a national workshop will be organized to discuss the outcome of all the comments received. Taking all the comments into consideration, the Government will present its official CoP-1 position on JI to the Parliament at the beginning of 1995, some months before the CoP-1 discusses JI.

BOX 7.1 Groningen Statement on Joint Implementation

(main elements)

From 1-3 June 1994, an international conference on JI brought together more than 160 public officials, from government agencies as well as from international organizations, and representatives from science, industry and NGOs from 43 industrialized and developing countries from all continents of the world. 124 participants came from industrialized countries, including 28 from countries in a state of transition, and 37 came from developing countries; all of them attended in a personal capacity. Projects presented pointed to an important potential of JI to be a means to achieve the objective of the Convention in a cost-effective manner on a national and international level. Participants agreed that:

* JI should be on a voluntary basis and should respect the sovereignty of all States;
* given the urgency of the global situation, JI should supplement domestic action by developed Parties to combat emissions;
* JI projects would have to follow objective and verifiable criteria (through monitoring) in order to qualify for eventually crediting actual reductions to the cooperating Parties;
* these criteria, such as baselines, and a system for eventually crediting the investing and receiving Parties are still to be established by the Conference of the Parties;
* in the meantime, however, international cooperation to reduce or absorb emissions of greenhouse gases should be encouraged, to gain further experience with the strong and weak points of JI;
* the experience to be gained in this way should serve to gain insight and build confidence in the actual potential of JI and thus facilitate the intergovernmental negotiations that remain necessary.

7.2 NETHERLANDS' POLICY VIEW

The Netherlands emphasizes the importance of a limited trial period on the basis of preliminary criteria established by CoP-1. With respect to current commitments in the Convention (art. 4.2 a/b), no 'crediting' for JI reductions should be applied. These current commitments under the FCCC should be realized through domestic measures alone.

In the Second National Environmental Policy Plan (VROM, 1994), the Netherlands' Government announced the development of a programme of pilot projects (PPP) to gain experience with JI. Important aspects of pilot projects to be evaluated are:

- which emission reduction or sequestration effects result from the project. Attention should be given to direct and indirect effects and baseline development amongst other factors;
- transfer of technology and know-how. Diffusion effects;
- role of project in national development strategy;
- occurence of local benefits: less local environmental pollution, financial benefits;
- costs per unit of emission reduction;

- which costs can be attributed to the partners involved in the project;
- organization of monitoring and reporting;
- organization of the whole project.

The Netherlands intends to present its PPP following the CoP decision on the pilot phase and criteria. In elaborating the Netherlands' PPP, the progress to be made at INC10 and INC11 will be taken into account. Potential projects will be discussed by national governments and other participants. The Netherlands' PPP will last for a limited number of years after which the programme will be evaluated. The experience of the Netherlands' Electricity Generating Board (SEP) in implementing the Forests Absorbing Carbon dioxide Emission (FACE) programme will also be used in the evaluation (see Box 7.2).

To summarize the Netherlands' position on JI, it can be concluded that JI has the potential to bring benefits for all parties involved. Sound criteria have to guarantee that these benefits are indeed gained. The Netherlands will contribute to the development of such criteria.

Box 7.2 Carbon sequestration activities of the FACE Foundation

FACE (Forests Absorbing Carbon dioxide Emission) is a foundation set up by the Netherlands' Electricity Generating Board (SEP) in October 1990, which aims to encourage the planting of new forests to sequester CO_2 from the atmosphere. Forests planted with financial assistance from FACE are ecologically adapted to local conditions and co-ordinated with the project development for the region. FACE only provides assistance where there is a Memorandum of Understanding signed by the Government and the landowner has a real interest in the new forest. In this way FACE also contributes to solving economic or ecological problems in the project region. FACE's initial goal was to establish and maintain 150,000 ha of forests over a period of 25 years. At the end of 1993, more than 180,000 ha had been completed or virtually completely contracted. Including all items of expenditure, the average cost of the projects is about Dfl. 2 per ton of sequestered carbon dioxide. Projects are ongoing or in an advanced stage of preparation in the following countries: The Netherlands, Malaysia, the Czech Republic, Ecuador, Poland and Uganda. (FACE, 1994)

8. FINANCE AND INTERNATIONAL COOPERATION

8.1 INTRODUCTION

This chapter gives an overview of the Netherlands' contribution to development aid. Bilateral and multilateral aid to meet the costs of mitigation and adaptation to climate change are described. An overview is also given of the Netherlands' climate change-related cooperation programmes with countries with economies in transition.

8.2 FINANCIAL RESOURCES

For 1994, the Netherlands has committed itselfs to contributing 1.5% of its Net National Income to development aid[1]. Later this year, the new Government is expected to establish the norm for 1995 and thereafter. At UNCED, the Netherlands announced that the part of the budget allocated as the financial resources available for the promotion of environmentally-sound development in developing countries will reach a total of almost Dfl. 450 million per annum by 1997. The Netherlands also committed itself to provide, in addition to current commitments for development cooperation which now substantially exceed the 0.7% GNP target, new and additional financial resources up to a maximum of 0.1% GNP for the implementation of global environmental agreements, including the UN-FCCC, provided that other countries take a similar course in generating resources for an earth increment. It is expected that the new Government will review these issues later this year.

8.3 BILATERAL ASSISTANCE TO MEET THE COSTS OF MITIGATION AND ADAPTATION TO CLIMATE CHANGE

A programme exists to assist developing countries to prepare a national policy on climate change and assist them in the implementation of i.a. Articles 4.1, 4.4, 4.5 and 12.1 of the FCCC. As a first step towards these objectives, this programme seeks to assist developing countries in compiling national inventories of net greenhouse gas emissions, in preparing vulnerability assessments of potential impacts of climate change on natural and human systems, as well as assessing technical and policy options (and associated costs) to prevent, mitigate and/or adapt to climate change, making full use of the relevant IPCC guidelines prepared.

As part of this programme, vulnerability assessments have been completed in Egypt and Bangladesh. These projects are presently being followed up with assistance in developing integrated planning for coastal zone management, taking into account potential long-term effects of climate change such as rise in sea level. A similar vulnerability assessment is being conducted in Vietnam and is to be completed by 1996.
This year, preparatory work is being carried out for a number of additional country studies (inventories of greenhouse gas emissions, vulnerability assessments, assessments of technical and policy options) in a further eight developing countries. These studies are expected to be launched in the course of 1995.

A policy on environment and energy was prepared and adopted in 1992. This policy serves as the basis for a Netherlands' programme of cooperation with a number of developing countries in the field of energy efficiency, technology transfer, institutional development, capacity building and renewable energies. In the early nineties, activities were initiated in Bolivia and Southern Africa and preparations are being made for cooperation with Peru, Nicaragua, Mali and India. The deployment of renewables and of energy efficient technologies in developing countries is being promoted through subsidies for investments.
To protect all forests in a sustainable way, the Netherlands favours an international forest treaty. The Netherlands gives, based on its Tropical Rainforest Policy Paper, special attention to those forests. A Netherlands' Framework Agreement on Tropical Timber was signed in 1993 by the Government, associations and individual companies representing trade, industry and retail business, labour unions and environmental organizations. 90% of the Netherlands' tropical timber market has joined the agreement. The aim is that by the end of 1995 the trade in tropical timber for the Netherlands' market will consist solely of sustainably-produced tropical timber. Parties hope that this will be an effective incentive for the achievement of sustainable tropical forest management. Concrete bilateral agreement and cooperation with the major suppliers of tropical timber to the Netherlands' markets (Malaysia, Indonesia, Cameroon and Gabon) are being discussed amongst other things. In 1993, more than Dfl. 90 million was spent on forestry and biological diversity activities. In the near future, this amount will increase to Dfl. 140 million per annum.

[1] In 1993 Netherlands' Net National Income was approximately Dfl. 524 billion, while its Gross National Product was Dfl. 591 billion.

8.4 MULTILATERAL AID TO MEET THE COSTS OF MITIGATION AND ADAPTATION TO CLIMATE CHANGE

The Netherlands contributes to a number of multilateral and intergovernmental organizations for the benefit of developing countries:

1. The Global Environment Facility. A contribution of approximately Dfl. 90 million was made to the pilot phase up to 1994. The Netherlands' contribution to the second stage (1994 to 1996) will be 3.57 % of the total target amount of approximately US $ 2 billion, i.e. approximately Dfl. 125 million.

2. The Intergovernmental Panel on Climate Change. Annual contributions are made to the IPCC Trust Fund for the participation of developing countries. In addition, through "in kind" support, the Netherlands contributes to the IPCC Working Group I Technical Support Unit in Bracknell and to the IPCC/OECD Greenhouse Gas Inventory Programme. Furthermore, a special contribution was made to the Fund in order to enable official representatives and NGOs from developing countries to participate in the World Coast Conference 1993. This conference focussed on potential impacts of climate change on coastal areas and response options, and was organized and financed by the Netherlands' Government under the auspices of the IPCC. Additional financial support was also given to participants from developing countries for a number of IPCC-related workshops in the Netherlands.

3. The Intergovernmental Negotiating Committee for a Framework Convention on Climate Change (INC-FCCC). Annual contributions are made to the Voluntary Fund of the INC-FCCC for the participation of developing countries in the negotiating process. Financial support is also given to the UNEP/WMO Information Unit on Climate Change for the dissemination of specific and background materials on the Climate Convention and the issue of climate change. In addition, "in kind" support has been provided to the interim INC secretariat.

4. Other non-bilateral contributions:
   - aid to developing countries to participate in the Conference on Sustainable Development of Small Island Developing States, which addressed, inter alia, the issue of potential effects of climate change;
   - aid for education in Thailand on coastal zone management planning and rises in sea levels for developing countries from Asia and Africa;
   - sponsoring of an international conference on 'Joint Implementation' in the Netherlands, with financial aid for the participation of developing countries;
   - participation in the preparation of an action plan for the Aral Sea region with a view to providing assistance to the countries concerned;
   - participation in, and aid to, programmes of the World Bank, the Inter-American Bank, the Asian Development Bank and the African Development Bank which facilitate investments in sustainable energy systems.

8.5 COOPERATION PROGRAMMES WITH COUNTRIES WITH ECONOMIES IN TRANSITION

The Netherlands' general support for countries with economies in transition includes both multilateral and bilateral aid. Multilateral aid includes, inter alia, the European Union PHARE programme (for Central and Eastern Europe) and TACIS programme (for former Soviet republics). Bilateral aid is funded through several programmes. Furthermore, several Netherlands' ministries have bilateral cooperation programmes with their counterparts in Central and Eastern Europe.
With respect to bilateral assistance in the field of energy and climate change policy, the Netherlands' PSO programme (Central and Eastern Europe) and the Netherlands' TAGOS programme (former Soviet republics) should be mentioned. The total 1993 PSO budget amounted to Dfl. 69 million and included 120 projects in various policy areas (including energy policy). The budget for TAGOS amounted to Dfl. 52 million. Since January 1994 TAGOS has become part of the PSO programme. In the energy field, support is provided in developing national and local energy efficiency policy plans (Poland and Hungary, amongst others). Projects are supported with a view to improving energy efficiency in the industry, housing and transport sectors (see chapter 9). Furthermore, support for the implementation of commitments under the FCCC is given.

9. RESEARCH AND SYSTEMATIC OBSERVATION

9.1 INTRODUCTION

In the Netherlands, research on climate change and climate related issues is carried out by universities, governmental and non-governmental research institutes and large technical institutes. Research focuses on the climate system, causes and effects of climate change, and possible solutions. Several national research programmes have been developed, and close relationships with international research programmes have been established. There are currently about 250 research projects, (SPA/HCG, 1993) (excluding the technical research projects mentioned in section 9.6), which can be divided into five categories.

Climate system
About 40% of the research projects focus on various aspects of the climate system. These research projects are conducted by universities, governmental and non-governmental institutes. Studies are being carried out on chemical composition and processes in the atmosphere, atmosphere-ocean interaction and the carbon cycle. In the modelling work, close affiliation exists with leading modelling groups in Germany (Hamburg, Mainz), the United Kingdom (Hadley Centre) and the USA (National Centre for Atmospheric Research).

Causes
Although research focussing on causes of climate change makes up a relatively small part of total climate change related research (15%), the Netherlands plays a very active role in identifying and quantifying sources and sinks of greenhouse gases. A valuable contribution has been made towards the IPCC/OECD Greenhouse Gas Inventories Programme, especially with respect to CH_4 and N_2O.

Effects
Research on the impact of climate change (20% of total research) is mainly carried out as part of university and national institutes' research programmes. It focusses on the impact on terrestrial ecosystems, hydrology (rivers) and wetlands (Wadden Sea). Research on effects includes both site-specific studies for the Netherlands (e.g. as part of the regional hydrology of a catchment area) and studies that will contribute to the international data bank.

Solutions
This category covers a broad area of research activities (25% of total) including technological, social and behavioural factors for consideration when addressing climate change. Research within this category involves all scientific disciplines. It includes research regarding energy supply, energy and material savings, mobility and transport, consumption and lifestyle patterns, economic and financial instruments, development of a basis in society for preventive measures and the development of an international climate policy as well as international cooperation.

Integration/Assessment
This relatively small area of research (5% of total) fulfils two objectives:

- to provide a framework for the integration of research results;
- to develop scientifically supported environmental standards and integrated greenhouse gas reduction strategies that comply with the objectives of the FCCC (art. 2).

Research activities include: assessment, modelling and simulation; integration studies; risk analysis; and policy options.

9.2 TOOLS

A broad variety of models and databases are being developed and applied in the Netherlands. These models and databases serve as tools for better scientific understanding and improved socio-economic analysis. Box 9.1 provides an overview of the various policy and planning models and data bases which are available in the Netherlands.

Box 9.1 Policy/planning models and databases in the Netherlands

IMAGE:	Integrated Model for the Assessment of the Greenhouse Effect. A worldwide dynamic simulation model for quantitative policy assessment (RIVM)
EDGAR:	Emission Database for Global Atmospheric Research. Contains figures for emissions of greenhouse gases and ozone depletion compounds (RIVM), amongst other data.
MARKAL:	An IEA LP planning model for energy production, technology and end use markets (ECN)
SELPE:	LP energy supply model (ECN)
SAVE:	Energy demand simulation model (ECN)
ICARUS:	Information system on energy conservation and application of resources based on a sectoral approach. The database and scenario model contain energy saving and CO_2 reducing measures (University of Utrecht)
NEEDIS:	Sectoral database containing data on energy consumption, efficiency and intensity (ECN)

ER

WORLD-SCAN:	Macroeconomic world model generating economic growth figures for regions (CPB)
CENECA:	Econometric model relating energy consumption to data on economic and technological development and energy policy (CPB)
RIM+	Emission calculation model (RIVM)

Systematic observation
In the Netherlands, greenhouse gas emissions are monitored by national institutes such as the National Institute for Public Health and Environmental Protection (RIVM), the Netherlands' Organization for Applied Scientific Research (TNO) and the Central Bureau for Statistics (CBS). The most important databases can be found in box 9.1. Progress in technology development is generally monitored by periodical updating of technology data bases that provide the basis for economic and scenario models.

9.3 NATIONAL PROGRAMMES

The Netherlands' climate change research is directly funded by universities and the Government, or indirectly by the Government through grants and contracts from specific programmes (both national and international). National research programmes are listed below. International cooperation is described in the next section.

The National Research Programme on Global Air Pollution and Climate Change
This National Research Programme (NRP) was founded in 1989 to lay a firm foundation for the development of climate policy. It also aims to step up the Netherlands' involvement in national and international research programmes.

The NRP is managed by a Programme Bureau and a Programme Committee. These are responsible to a Steering Group in which seven ministries, environmental groups and the industry are represented.

An evaluation of the NRP showed that the strongest feature of the NRP is its ability to provide policy-relevant outputs (SPA/HCG, 1992). The total budget for the first phase of the NRP (1990-1994) was Dfl. 75 million. The second phase will start in 1995 and continue until the year 2000. The budget for the second phase amounts to over Dfl. 80 million. Although the research themes are similar in the first and second phase, there is a shift from system research to policy-oriented research. Providing scientific support for climate change policy becomes more and more important as policy making shifts from a conceptual to an operational stage.

Global Change Programme NWO
The largest funder of scientific research in the Netherlands is the Netherlands' Organisation of Scientific Research (NWO). In 1990, apart from general university funding, it also developed a Global Change Research Priority Programme as a follow-up to research on CO_2 carried out in the eighties. The main objective of this programme is to strengthen the structure of scientific research in the Netherlands. The Global Change Programme and the NRP have pooled their findings, especially with respect to the NRP categories climate system and effects.

Other related programmes are the Netherlands Antarctic Research Programme, a coordinated programme on glaciology, ecology, geology and climatology, and the 'Tropenbos' (tropical forest) Programme to develop a sustainable management system for the exploitation of tropical rainforest resources.

The total budget for NWOs Global Change Research Priority Programme amounts to Dfl. 7 million for the period 1994 - 1999.

Remote Sensing Programme
In 1986, the Netherlands' Government started a five year National Remote Sensing Programme (NRSP) to stimulate the development and use of operational remote sensing systems. This programme was renewed for another 5 years in 1990. It focuses on four areas:

- meteorology and oceanography;
- water management;
- land use and nature management;
- climate change and environmental management.

The NRSP is coordinated by the Ministry of Transport and Public Works and is steered by seven ministries.

National Support Programme for Earth Observation
In 1992, the Government started a special user support programme to initiate and support the development and use of earth observation data from ESA and EUMETSAT-satellites. The main priorities of this programme are atmospheric and oceanographic research related to global climate research.

9.4 LINKS WITH INTERNATIONAL RESEARCH EFFORTS

The main associations of Netherlands' scientific research with international research are in the International Geosphere Biosphere Programme (IGBP), the World Climate Research Programme (WCRP), and the Human Dimensions of Global Environmental Change Programme, and multinational programmes financed by the EU (Framework Programme).

International Geosphere Biosphere Programme (IGBP)
Netherlands' scientists are involved in several IGBP subprogrammes (SPA/HCG, 1993). The international programme office for the core project on Land Ocean Interactions in the Coastal Zone (LOICZ) is in the Netherlands. In the Joint Global Ocean Flux Study (JGOFS), substantial contributions made include the provision of seagoing facilities. The Netherlands not only contributes to scientific activities, but also to programme management of, for example, the International Global Atmospheric Chemistry Project (IGAC) and the Biospheric Aspects of the Hydrologic Cycle (BAHC) (KNAW, 1994).

World Climate Research Programme (WCRP)
The Netherlands is involved in subprogrammes of the WCRP and participates in steering committees for the International Satellite Land Surface Climatology Project (ISLSCP) and the Joint WCRP/IGBP Working Group on Land Surface Experiments. The main objective is to improve coordination between the WCRP Global Energy, the Water Cycle Experiment (GEWEX) and IGBP-BAHC.

Human Dimensions of Global Environmental Change Programme (HDP)
The Netherlands is becoming actively involved in the HDP. Given the extent of Netherlands' research regarding the human dimensions of climate change, the Netherlands can play an important role in the HDP. The Netherlands offers, among other things, expertise in social and behavioural sciences as well as environmental economics.

EPOCH (EU)
Netherlands' scientists participate actively in a large number of multinational ('twinned') projects financed through the EU-Framework Programmes, in particular EPOCH and MAST. Moreover, Netherlands' representatives play an active role in management and review committees. At a national level, a support group has been developed to support and coordinate the Netherlands' activities in EU research.

Intergovernmental Panel on Climate Change (IPCC)
Since the establishment of the IPCC, the Netherlands has taken an active role as member of the IPCC Bureau. The Netherlands also contributes to the scenario work of the IPCC and supports the IPCC Working Group I Technical Support Unit in Bracknell and the IPCC/OECD Greenhouse Gas Inventory Programme (see chapter 8).

Global Climate Observing System (GCOS)
The Netherlands attaches great importance to the development of a Global Climate Observing System (GCOS). It contributes to GCOS through WMO's World Weather Watch (WWW), Global Atmospheric Watch (GAW), Global Ocean Observing System (GOOS) and through a variety of terrestrial observations. Moreover, the Netherlands contributes actively and to a substantial financial degree to the European Earth Observation programmes of ESA and EUMETSAT. A national GCOS committee has recently been established. Representatives of the Netherlands also participate actively in WWW, GAW and GCOS panels and committees.

9.5 OTHER CONTRIBUTIONS TO THE NETHERLANDS' CLIMATE CHANGE RESEARCH INFRASTRUCTURE

Commissions of the Royal Netherlands' Academy of Arts and Sciences (KNAW)
Committees of the Royal Netherlands' Academy of Arts and Sciences (KNAW) include these:

- the Climate Committee advises the Netherlands' Government on matters relating to climate change. The Committee also acts as the national WCRP Committee;
- the MAB/SCOPE/IGBP Committee coordinates the national activities within the framework of international programmes on Man and Biosphere (MAB), the Scientific Committee on Problems of the Environment (SCOPE) and IGBP;
- the HDP Committee will be established in 1994. It advises the Netherlands' Government on matters of human dimensions of global change and coordinates Netherlands' scientific input into the HDP of the International Social Science Council (ISSC), amongst other bodies.

Climate Research Centre
The Institute for Marine and Atmospheric Research (IMAU) at Utrecht University, the Royal Netherlands' Meteorological Institute (KNMI) and the National Institute of Health and Environmental Protection (RIVM) have decided to establish a Centre for Climate Research to coordinate their respective climate research programmes.

Change Newsletter
'Change' is a bimonthly research and policy newsletter on Global Change issues published by the NRP and distributed to roughly 4000 interested parties throughout the world.

International Cooperation
The Netherlands is committed to assisting developing countries through:

- funds for the participation of scientists and policy makers in international meetings;
- support for the preparation of national surveys for greenhouse gas emissions and the development of scenarios for future emissions;
- cooperation in preparing national studies on potential effects of climate change, including socioeconomic effects; assistance for research and monitoring programmes generating climate-related data.

A more detailed description of development assistance is given in chapter 8.

In the framework of cooperation programmes with several Eastern European and CIS countries (Poland, Slovak Republic, Hungary, Russian Federation, Ukraine), projects have been set up to improve energy efficiency and energy technology and to reinforce management and infrastructure for implementing energy policies (see also chapter 8).

These programmes, in which Netherlands' scientists and consultants cooperate with officials and scientists from Eastern Europe and CIS countries (administration and energy production and distribution companies), aim to transfer knowledge and support on policy advice and scientific research and studies on investment projects. In the 1990-1993 period, Dfl. 17 million was spent on these programmes.

9.6 TECHNOLOGY RESEARCH AND DEVELOPMENT

Expenditures on energy RD&D and climate policy-related energy RD&D is more than Dfl. 700 million a year. Figure 9.1 provides a breakdown of RD&D programmes in various sectors. These figures do not include the expenditures of independent company RD&D.

The Government biggest contribution to RD&D is for longer-term options, including renewables and nuclear options, this being a reflection of Government priority.

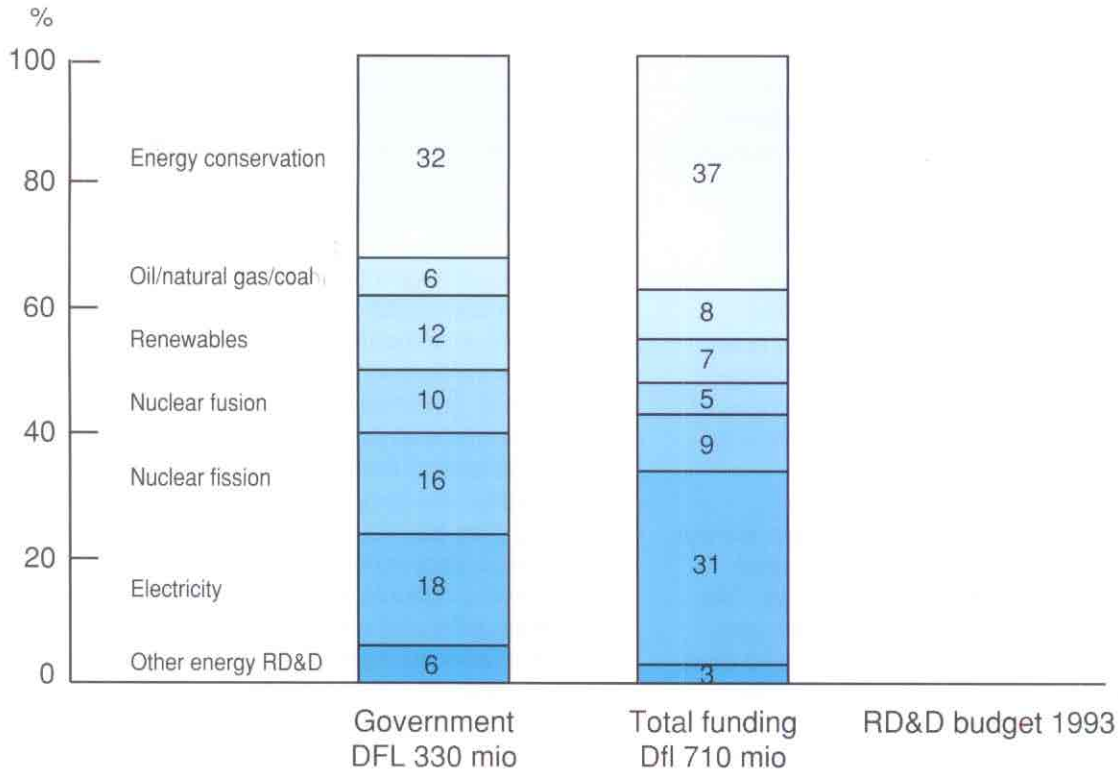
Government funding of energy RD&D aims to

1. maintain and surpass the level of development of a high quality knowledge infrastructure (in which institutes such as ECN and TNO play a major role),
2. implement a number of specific programmes for energy conversion and conservation. Most of the programmes in which research institutes and industry cooperate are managed by NOVEM.

Priorities in energy RD&D policy are fuel cell technology, wind energy, coal gasification, photovoltaic solar energy, small-scale gas conversion technology, and energy conservation.
About 15-20% of RD&D budgets for energy are spent on financing projects in international programmes such as EU and IEA programmes.

Other programmes not included in the above overview aim to develop clean and efficient transport technology, including improving the national public transport network (in particular rail transport) and promoting high speed international rail links.
The National Research Programme on Recycling relates to waste in terms of climate change. This programme is managed by NOVEM and funded by the Government (Dfl. 10 million).
The Netherlands' Government contributes about Dfl. 7.5 million per year to another NOVEM-managed programme on technology on the use of waste and biomass for energy purposes.
Technology development in coastal defence and water management also has high priority in the Netherlands.

Figure 9.1 Government funding and total funding in 1993 (in %) for climate policy-related RD&D energy programmes



Source: M+I, 1994

10. EDUCATION, TRAINING AND PUBLIC AWARENESS

10.1 INTRODUCTION

Informing and communicating with citizens and target groups about climate change is a fundamental component of climate policy in the Netherlands. Measures for reducing greenhouse gas emissions require cooperation from citizens as well as from companies. Since those measures entail (im)material contributions in the personal sphere, it cannot be assumed that they will be generally accepted. Necessary changes in behaviour cannot just be induced by regulation, financial incentives or voluntary agreements. Matters such as the separation of wastes, economical use of energy and water, and environmentally-friendly transportation behaviour, will have to become common goods through the active support of the general public.

In the Netherlands, information campaigns are the most important tools for involving the general public in issues concerning climate change. The next section describes various awareness campaigns currently taking place. Education and training are, where appropriate, part of these information campaigns. A description of the role of intermediary organizations concerning the public discussion about climate change follows. A specific project is explained in this chapter, focussing on how high-energy consumption lifestyles can be changed. The last section focusses on the communication between researchers, policymakers and the general public.

10.2 INFORMATION CAMPAIGNS

The climate change campaign
In the autumn of 1990, the Ministry of Housing, Spatial Planning and Environment (VROM) started a multi-year awareness campaign on climate change aimed at the general public. This thematic campaign is part of a much broader environmental awareness campaign based on the principle: 'A better environment starts with you'.

The overall objectives of the climate change campaign were:
- to put climate change on peoples' agendas;
- to increase knowledge on this matter;
- to influence attitude to Government measures and behavioural changes;
- to create willingness for adaptation of personal habits.

The climate campaign consisted of three phases with a term of one year each. Over time, the emphasis shifted from agenda-setting and knowledge, to possible changes in attitude and possible plans of action.

Additional specific objectives in the second stage (1991 - 1992) were to enhance general public awareness of the effects on climate change of tropical deforestation and the extensive use of energy. Also, specific attention was given to the population group least aware of climate change: young people in the 12-19 age group.

The climate change campaign made use of the following mass media instruments: a television feature with accompanying brochure ('PO Box 51' Government information, available in libraries and post offices), advertisements in general magazines, and king-size posters on billboards, and bus and tram shelters. Additional creative instruments were used for the target group of young people: a pop song (see box 10.1) and an education package for secondary schools. The education package for secondary schools was developed for the biology, geography and social science lessons. It consists of a video tape with a user's guide for teachers, and information brochures from Government and environmental organizations.

Box 10.1 How to reach young people?

The Ministry of VROM cooperated with the well known artist Tony Scott (son of Indians from the Surinam rainforest) to produce a rap song: 'Stop the Greenhouse Effect'. By doing so, the greenhouse effect received a lot of free publicity. The song was in the charts for several weeks and non-profit organizations used it in their promotional activities.

The third phase (1992 - 1993) of the climate change campaign consisted of a joint campaign by the Ministries of VROM and Economic Affairs (EZ). This campaign focused on reduction of greenhouse gas emissions as one of the motives for energy conservation. The campaign also provided energy saving ideas and measures. A point of interest is that the campaign provided feedback to the public about achievements on energy saving and environmentally conscious behaviour. By means of a series of radio messages with the jingle 'And now the good news about the environment', the desired behaviour was confirmed and people were encouraged to build on the achievement.

Evaluation of results
All the stages of the climate change campaign have been evaluated by means of an inquiry. The

results of the evaluation show that the campaign has been successful and achieved its goal. In the Netherlands, the acceptance of measures to addressing climate change is quite high. In general, people feel involved, and the percentage of highly-involved people has increased from 33 to 38% since the pilot study of the campaign in 1990.

However, since 1992 it seems that this trend has reversed (down to 29% in 1993). In part, this may be explained by the more general fact that social and economic issues have become more urgent to people than environmental problems. Furthermore, it has been found that a fairly high level of involvement is difficult to maintain when financial incentives are not a strong enough motivation. The evaluation also shows that during the second phase of the campaign, young people caught up (the number of young people highly involved increased from 11 to 14%), but the over-50 age group was lagging behind. The evaluation also showed that awareness of the climate change issue had risen by means of the campaign. Causes and effects of climate change are known by 34% of the people (compared to 26% before the campaign). For the group of young people, these figures amount to 32% compared to 23% before the campaign.

Although people generally take the climate change problem seriously, recognition of the need of Government action has declined slightly. Respondents say that measures should be directed more towards what they perceive as the biggest polluters: industry, traffic and other countries. It is found that households are quite willing to cooperate if the desired behaviour is made attractive and as long as big personal sacrifices are not required. On the basis of the evaluations, it has been concluded that continuation of the climate change campaign will only have further effects on general public awareness if the campaign can be directly linked to policy measures.
Besides the evaluation process described above, multidimensional indicator tests (MDI) are regularly carried out. These tests also provide important information on the importance the general public gives to the climate change issue. Finally, the so-called monitor for environmental behaviour provides useful information on personal energy consumption in the Netherlands.

Energy conservation campaigns
Since 1990, the Ministry of Economic Affairs (EZ) and joint energy distribution companies have conducted multi-annual public awareness campaigns on energy conservation.

The campaigns take place within the framework of the environmental action plans (MAP) drafted by the energy distribution sector. While the climate campaign by the Ministry of VROM highlights the connection between climate change and energy use, the objective of the energy campaigns by the Ministry of EZ is to emphasize the broader link between environment and energy conservation. The MAP campaign provides the practical content for the campaigns of both the Ministry of EZ and the Ministry of VROM by supplying various options for energy conservation, such as energy-efficient light bulbs and heating apparatus, water-saving showers and insulation options.

The main instruments of the EZ and MAP campaigns are television and radio features, brochures, billboards, advertisements in newspapers and door-to-door delivery of weekly newsletters. In order to improve the coherence of the different public information and awareness campaigns, they all use the same catchphrase and logo ('A better environment starts with you'). Moreover, preparation of the campaigns is coordinated between the relevant ministries and the energy distribution companies.

Future climate and energy information activities
From the autumn of 1994, the style of the mass media campaigns by the Ministries of VROM and EZ will be altered. As soon as the decision on a national or an EU-wide incentive levy on energy is taken, a joint awareness campaign will be prepared in order to explain the motives and details and thereby enhance the acceptance of the energy levy. The energy distribution companies will continue their mass media campaigns as a means of supporting the implementation of their environmental action plans, which are an ambitious follow-up on 1993's plans.

Awareness-building campaigns on traffic and transport
In the policy field of traffic and transport, three public awareness campaigns have been developed which are also relevant to the reduction of greenhouse gas emissions.
The campaigns are part of the traffic and transport policy formulated in the Second Transport Structure Plan (VW, 1990). One of the objectives of the campaigns is to influence the driving behaviour of car users. Other objectives are to increase road safety, reduce traffic jams and improve the local air quality.

As regards climate change, the campaigns aim to:
- encourage car pooling;
- enforce speed limits; and
- reduce the number of short unnecessary car trips.

Like the other mass media campaigns by the Government, media used are, for example, television and radio features, a brochure, billboards, posters on bus and tram shelters and advertisements. The brochure, issued in cooperation with the Royal Netherlands Tourist Association (ANWB), was sent to their 2.5 million members.

The campaigns initially addressed all motorists, but focussed on specific subgroups. Humour plays an important role in putting the matter into perspective. For example, the campaign aimed at reducing unnecessary car trips was given the catchphrase: 'The car can easily last a day without you'. Since many car drivers have a certain affection for their vehicle, the funny side of this catches their attention.

10.3 INTERMEDIARY ORGANIZATIONS

Since 1992, the Ministry of VROM has financed a number of projects by intermediary organizations to facilitate discussions about climate change between the members of the participating organizations. The main objectives of these projects are to reach specific target groups in an appealing manner and to gain more insight into the opinions of these target groups. It is expected that the total effect of several simultaneous communication projects will be higher than the sum of the individual effects.

The participating organizations in the projects are the following: the trade unions, the Centre for Agriculture and Environment, the Friends of the Earth Netherlands, Foundation for Nature and Environment, the Netherlands' Association of Housewives, Netherlands' Council of Churches, the regional centres for development cooperation, and the Institute for Public and Politics. The coordination of the communication projects has been undertaken by the International Centre for Water Studies.

Preliminary results of the projects show that, for at least some of the participating organizations, structural consideration is being given to the subject of climate change. Furthermore, more cooperation between the organizations has been achieved, resulting in several joint initiatives.

10.4 ENERGY-EXTENSIVE LIFESTYLES

In 1992, the Ministry of VROM started a project to explore trends in the direct and indirect energy use of consumers. It is expected that the purchasing power of consumers will continue to increase steadily over the next few decades. The main objective of the project is to determine how rising incomes can be used in such a way that total energy use will decrease. The project also aims to increase the awareness of the general public concerning practical energy-extensive lifestyles.

The project consists of two phases; research into the energy intensiveness of increasing the numbers of products and services, and a pilot project in which ten households will experiment in extensifying the energy component of their behaviour (or lifestyle). The research phase has been completed and the pilot phase is currently being prepared for a start in 1995.

10.5 THE COMMUNICATION TRIANGLE BETWEEN POLICY MAKERS, RESEARCHERS AND THE GENERAL PUBLIC

For the continuing development of climate change policy, especially with a post year 2000 perspective in mind, it is important that decision makers in Government institutions, politics and industry are adequately informed about the state of public awareness regarding climate change.
Therefore, the Ministry of VROM attaches great importance to communicating research findings to policy makers and the general public. It is currently formulating a communication plan in cooperation with the programme bureau of the National Research Programme on Global Air Pollution and Climate Change (NRP). This multi-annual research programme is policy oriented and includes the synthesis, integration, and communication of research results. As part of the communication plan, an important international conference on NRP I will take place from 6 to 9 December 1994 in Maastricht. The follow-up research programme, NRP II, will start in 1995.

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LIST OF ACRONYMS

ANWB	Royal Netherlands Tourist Association
AS	Advisory Centre for Landfill Gas Recovery
AVV	Netherlands Transport Research Centre
BAHC	Biospheric Aspects of the Hydrologic Cycle
BSET	Subsidy Scheme for New Energy Conservation Techniques
CAP	Common Agricultural Policy (EU)
CBS	Central Bureau of Statistics
CENECA	CPB model on ENergy use in relation to EConomic Activities
CFL	Compact Fluorescent Lamp
CIS	Commonwealth of Independent States
CoP	Conference of the Parties under the FCCC
CORINAIR	CORINE AIR emissions inventory (EU)
CPB	Central Planning Bureau
ECE	United Nations Economic Commission for Europe
ECN	Netherlands Energy Research Foundation ECN
EDGAR	RIVM Emission Database for Global Atmospheric Research
EMA	Energy Conservation and Environmental Consultancy Support Scheme
EPA	Environmental Protection Act
EPOCH	European Programme on Climatology and Natural Hazards
ER	European Renaissance
ESA	European Space Association
EU	European Union
EUMETSAT	European Meteorological Satellite
EWAB	Netherlands Programme on Energy from Waste and Biomass
EZ	Ministry of Economic Affairs
FACE	Forest Absorbing Carbon Dioxide Emission
FCCC	Framework Convention on Climate Change
GAO	General Administrative Order
GAW	WMO Global Atmospheric Watch
GCOS	Global Climate Observing System
GEWEX	Global Energy and Water Cycle Experiment
GNP	Gross National Product
GOOS	WMO Global Ocean Observing System
GS	Global Shift
GWP	Global Warming Potential
HDP	Human Dimensions of Global Environmental Change Programme
ICARUS	Database and Scenario Model containing Energy Saving and CO_2 Reducing Measures
IEA	International Energy Agency
IGAC	International Global Atmospheric Chemistry Project
IGBP	International Geosphere Biosphere Programme
IMAU	Institute for Marine and Atmospheric Research Utrecht
INC	Intergovernmental Negotiating Committee
IPCC	Intergovernmental Panel on Climate Change
ISLSCP	International Satellite Land Surface Climatology Project
ISSC	International Social Science Council
JGOFS	Joint Global Ocean Flux Study
JI	Joint Implementation
KNAW	Royal Netherlands' Academy of Arts and Science
KNMI	Royal Netherlands' Meteorological Institute
LOICZ	Land Ocean Interactions in the Coastal Zone
LPG	Liquified Petroleum Gas
LTA	Long-Term Agreement
MAB	Man and Biosphere
MAP	Environmental Action Plan of the Energy Distribution Sector
MARKAL	IEA LP Planning Model for Energy Production, Technology and Use Markets
MAST	EU Programme on Marine Science and Technology

MDI	Multi-Dimensional Indicator Test
MPI	Environmental Plan for Industry
NEEDIS	Nationwide Databank on Energy Consumption and Conservation
NEPP	National Environmental Policy Plan
NEPPP	National Environmental Policy Plan Plus
NEPP2	Second National Environmental Policy Plan
NGOs	Non-Governmental Organizations
NOH	Netherlands' Research Programme on the Recycling of Waste Substances
NOVEM	Netherlands' Organization for Energy and Environment
NRP = NOP	The Netherlands' National Research Programme on Global Air Pollution and Climate Change
NRSP	National Remote Sensing Programme
NWO	Netherlands' Organization for Scientific Research
MEC	Memorandum on Energy Conservation
OECD	Organization of Economic Cooperation and Development
PHARE	EC Programme on Eastern Europe (Poland and Hungary Assistance for the Reconstruction of the Economy)
PPP	Programme of Pilot Projects on Joint Implementation
PSO	Programme on Cooperation with Eastern Europe
RD&D	Research Development and Demonstration
RIM	RIVM Emissions Calculation Model
RIVM	National Institute of Public Health and Environmental Protection
RUU	State University of Utrecht
SAVE	ECN Energy Demand Simulation Model
SCOPE	Scientific Committee on Problems of the Environment
SELPE	Statistical ESC Linear Programming Energy model
SEP	Netherlands Electricity Generating Board
SMEC	Second Memorandum on Energy Conservation
SVV IId	Second Transport Structure Plan (part d)
TACIS	EU Programme on Technical Assistance Commonwealth of Independent States
TFAP	Tropical Forestry Action Plan
TIEB	Tenders for Industrial Energy Conservation Scheme
TNO	Netherlands' Organization for Applied Scientific Research
TNO-ER	TNO - Emission Registration
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
VAMIL	Accelerated Depreciation of Environmental Investment Scheme
VROM	Ministry of Housing, Spatial Planning and Environment
VvAN	Association of Waste Processors
VW	Ministry of Transport and Public Works
WCRP	World Climate Research Programme
WMO	World Meteorological Organization
WORLDSCAN	CPB Macro Economic World Model Generating Economic Growth Figures for Regions
WWW	WMO World Weather Watch

LIST OF CHEMICAL SYMBOLS AND UNITS

CHEMICAL SYMBOLS

CFCs	Chlorofluorocarbons
CH_4	Methane
CO	Carbon monoxide
CO_2	Carbon dioxide
HFCs	Non-fully halogenated carbon compounds containing fluorine only, with a maximum of three carbon atoms
N	Atomic nitrogen
N_2O	Nitrous oxide
NH_3	Ammonia
NO_x	Nitrogen oxides
PFCs	Perfluorocarbons
VOC	Volatile Organic Compounds
(NM)VOC	(Non-Methane) Volatile Organic Compounds

UNITS

Gg	Gigagram	(10^9 gram)
GJ	GigaJoule	(10^9 Joule)
ha	hectare	(10^4 m^2)
kg	kilogram	(10^3 gram)
km	kilometre	(10^3 m)
mm	millimetre	(10^{-3} m)
MW	MegaWatt	(10^6 Watt)
PJ	PetaJoule	(10^{15} Joule)

CURRENCY

$ 1 = Dfl 1.78 (approximately) on August 8, 1994

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APPENDIX 1. METHODOLOGIES APPLIED IN THE NETHERLANDS' INVENTORY OF GREENHOUSE GAS EMISSIONS

In the Netherlands' inventory, greenhouse gas emissions were mostly estimated according to the draft 'IPCC methodology for greenhouse gas inventories'. This appendix provides additional information on differences between the methods applied in the Netherlands' inventory and the IPCC methodology. More detailed information can be found in the background document (Amstel et al., 1994).

Carbon dioxide
The aggregated fuel approach from the IPCC methodology was applied, since it was found that the results from the aggregated approach did not notably differ from the detailed fuel approach. Differences amounted to less than 0.1%. Default emission factors from the IPCC were used. For policy reasons, emission estimates have been adjusted for temperature influences (see appendix 3).

Methane
The methodologies to estimate methane emissions are similar to the IPCC methodology. For most categories, specific Netherlands' emission factors have been applied.

Oil and Gas: Netherlands' emission factors are somewhat higher than IPCC default values proposed by the IPCC. Uncertainty is estimated at 50%.

Enteric Fermentation: A detailed categorization of animal types was used. Specific values for the feeding level were calculated, while default values were used for the maintenance level. Uncertainty is estimated at 15%.

Landfills: A time-dependent method was applied. The amount and composition of waste varies over time, thanks to the successful separate collection of glass, paper, textiles and organic wastes. Based on measurements, a constant degradation rate of 0.1/year was assumed. Earlier inventories assumed a rate of 0.0365/year. This means that in the present inventory it is assumed that it will take 7 years to convert half of the degradable organic carbon into landfill gas, compared to 19 years in earlier inventories. It is expected that the fraction of degradable organic waste will decrease further (from 17% in 1990 to 5% in 2000) thanks to the separate collection of organic waste. The uncertainty is estimated at 50%, due to differences in composition and oxidation in the top soil layer of landfills.

Nitrous Oxide
The main difference between the Netherlands' approach to estimating N_2O emissions and the IPCC methodology is that the Netherlands' approach distinguishes between more sources. This leads to a relatively large difference in the results: the Netherlands' approach estimates N_2O emissions at 59.6 Gg, while the IPCC methodology estimates them at 25 Gg. Therefore, the Netherlands proposes improving the IPCC methodology and including more source categories for N_2O emissions.

Energy: The IPCC methodology was applied. The emission factors used to estimate emissions from transport (based on measurements) are somewhat lower than the default values of the IPCC.

Industry: The IPCC methodology was applied to estimate N_2O emissions from nitric acid production. Measurements also showed that the production of caprolactam leads to N_2O emissions. N_2O emissions from caprolactam were included in total N_2O emissions.

Waste Water Treatment: N_2O emissions from waste water treatment were estimated. This source is not included in the IPCC methodology.

Agriculture: The Netherlands' approach to estimating N_2O emissions from soils takes both the anthropogenic background emissions as well as fertilizer-induced emissions into account. This leads to a much higher estimate than that based on the IPCC methodology.
Polluted Surface Waters: N_2O emissions from polluted surface waters were estimated. This source has not yet been identified in the IPCC methodology. Emissions are a result of run-off and leaching of fertilizers and manure used in agriculture, and of the effluent of sewage water treatment.

APPENDIX 2. FULL SUMMARY TABLES OF NETHERLANDS' INVENTORY OF GREENHOUSE GAS EMISSIONS (CO_2, CH_4, N_2O, NO_x, CO, NMVOC), 1990

Table A.2.1 Short summary report for the Netherlands' Greenhouse Gas Inventory 1990

Greenhouse Gas Source and Sink Categories	CO_2 Actual emission	CO_2 Corrected for temperature	CH_4	N_2O	NO_x	CO	NMVOC
Total National Emissions	167600	174000	1067	59.6	575	1030	459
1 All Energy (Fuel Combustion + Fugitive)							
A Fuel Combustion	164800	171200	28	6.1	575	1030	459
B Fugitive Fuel Emission			149				
2 Industrial Processes	1900	1900		16.4			
3 Solvent and Other Product Use							
4 Agriculture							
A Enteric Fermentation			402				
B Animal Wastes			106				
C Rice Cultivation							
D Agriculture Soils				22.1			
E Agriculture Waste Burning							
F Savannah Burning							
5 Land Use Change & Forestry	(-120)[1]	(-120)[1]					
6 Waste	900	900	380	4.1			
7 Other			2	10.9			

[1] Not included in Total National Emissions.

Table A.2.2a Greenhouse gas emissions in the Netherlands in 1990 (Gg/yr full molecular weight). Fuel combustion activities

Source categories		Activity data	Emissions				Aggregate emission factors		
		PJ	uncorr. for temp. CO_2 Gg	temp. corr. CO_2 Gg	CH_4 Gg	N_2O Gg	CO_2 kg/GJ	CH_4 kg/PJ	N_2O kg/PJ
I A	Fuel combustion activities (excl. bunkers)	2219	164800	171200	28	6.1			
	Oil	654	47700		2		73	3000	
	Gas	1208	67600		21		56	17000	
	Coal	357	33600		5		94	10000	
	Biomass	NE	NE		NE	NE			
I A 1	Energy and transformation activities	**693**	**51400**	**51400**	**NE**	**0.5**		**NE**	**657**
	Oil	152	11100				73		
	Gas	278	15600				56		
	Coal	263	24700				94		
I A 2	Industry (ISIC)	**509**	**33400**	**34100**	**NE**	**0.1**		**NE**	**265**
	Oil	83	6100				73		
	Gas	334	18700				56		
	Coal	92	8600				94		
I A 2 a	Actual from feedstocks		**14800**	**14800**					
	Coal		800						
	Gas		4400						
	Petrocokes		400						
	Monom./solvents		9200						
	Lubricants		400						
I A 3	Transport	**368**	**26900**	**26900**	**NE**	**5.4**		**NE**	**1452**
	Oil	368	26900				73		
	Gas	0	0				56		
	Coal	0	0				94		
I A 4	Commercial/Institutional	**163**	**9500**	**10900**	**NE**	**0.04**		**NE**	**193**
	Oil	20	1500				73		
	Gas	141	7900				56		
	Coal	2	200				94		
I A 5	Residential	**339**	**19200**	**22300**	**NE**	**0.06**		**NE**	**192**
	Oil	10	700				73		
	Gas	329	18400				56		
	Coal	0	0				94		
I A 6	Agriculture/Forestry	**147**	**8600**	**9700**	**NE**	**NE**		**NE**	**NE**
	Oil	21	1500				73		
	Gas	126	7100				56		
	Coal	0	0				94		
I A 7	Other	0	0	0	NE	NE			
I A 8	Statistical differences; rounding		**1000**	**+1100**					
I A 9	Bunkers marine	466	35900	NA	NE	NE	77	NE	NE
	Bunkers aviation	61	4500	NA	NE	NE	73	NE	NE

NE not estimated
NA not applicable

Table A.2.2b Greenhouse gas emissions in the Netherlands in 1990 (Gg/yr full molecular weight). Fuel combustion activities, sector totals

Source categories		Activity data	Emissions							Aggregate emission factors						
			uncorr. for temp.	temp. corr.												
		PJ	CO_2 Gg	CO_2 Gg	CH_4 Gg	N_2O Gg	NO_x Gg	CO Gg	NMVOC Gg	CO_2 kg/GJ	CH_4 kg/PJ	N_2O kg/PJ	NO_x kg/PJ	CO kg/PJ	NMVOC kg/PJ
I A	Fuel combustion activities															
	Total (excl. bunkers)	2219	164800	171200	28	6.1	575	1030	459		12600	2740	259000	464000	207000	
I A 1	Energy and transformation activities	693	51400	51400	NE	0.5	72			74	NE	657	103900			
I A 2	Industry (ISIC)	509	33400	34100	NE	0.1	106	229	123	66	NE	265	208250	449900	241650	
I A 2 a	Actual from feedstocks		14800	14800						70						
I A 3	Transport	371	26900	26900	NE	5.4	351	716	195	73	NE	14520	946100	1930000	525600	
I A 4	Commercial/Institutional	187	9500	10900	NE	0.04			15	58	NE	193			80200	
I A 5	Residential	339	19200	22300	NE	0.06			15	57	NE	192			44250	
I A 6	Agriculture/Forestry	147	8600	9700	NE	NE				59	NE	NE				
I A 7	Other	0	0	0	NE	NE	47	85								
I A 8	Statistical differences; rounding		+1000	+1100												
I A 9	Bunkers marine	466	35900	NA	NE	NE	NE	NE	NE	77	NE	NE	NE	NE	NE	
	Bunkers aviation	61	4500	NA	NE	NE	NE	NE	NE	73	NE	NE	NE	NE	NE	

NE not estimated
NA not applicable

Table A.2.3 Greenhouse gas emissions in the Netherlands in 1990 (Gg/yr full molecular weight). Fugitive fuel emissions

	Activity data	Emission			Aggregate emission factors		
		CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
	PJ	Gg	Gg	Gg	kg/GJ	kg/PJ	kg/PJ
I B Fugitive fuel emissions Total			**149**				
Crude oil production	170		19			102500	
Natural gas total	2286		130			56800	
Natural gas production	2286		52			22900	
Natural gas transport	2286		6			3200	
Natural gas distribution	660		72			110000	

Table A.2.4 Greenhouse gas emissions in the Netherlands in 1990 (Gg/yr full molecular weight). Industrial processes

	Activity data	Emission			Aggregate emission factors		
		CO_2	CH_4	N_2O	CO_2	CH_4	N_2O
	Gg	Gg	Gg	Gg	Gg/Gg	kg/Gg	g/Gg
2 Industrial processes Total		**1850**		**16.4**			
a Iron and steel							
b Non-ferrous metals							
aluminum production	258*						
c Inorganic chemicals							
nitric acid (HNO3-N/yr)	545			14.6			27
d Organic chemicals							
adipic acid	0			0			
other (measured)				1.7			NE
e Non-metallic mineral products Total	**2340**	**1850**			**0.8**		
Portland cement lime base	1000	800			0.8		
Iron and steel lime addition	900	700			0.8		
Glass manufacturing lime addition	250	200			0.8		
Flue gas desulphurization	190	150			0.8		

* Aluminium production: CF_4 emission: 0.5 Gg (emission factor: 2 kg/ton). C_2F_6 emission: 0.05 Gg (emission factor: 0.2 kg/ton).

Table A.2.5 Greenhouse gas emissions in the Netherlands in 1990 (Gg/yr full molecular weight). Livestock

	Activity data Number of animals (x1000)	Aggregate emission factor kg CH_4/head/yr	Emission Gg CH_4
Agriculture			
4 A Enteric fermentation			
Livestock total	**20674**		**401.9**
Cattle total	4926	74.2	365.7
Dairy total	3607	80.6	290.8
Beef total	1320	56.7	74.9
Dairy young <1 yr	806	49.3	39.7
Dairy young female	880	62.8	55.3
Dairy female	1878	102.1	191.8
Dairy male >1 yr	43	93.2	4.0
Beef calves	602	17.7	10.6
Beef young	598	87.0	52.0
Beef female > 2 yr	120	102.1	12.3
Sheep total	1702	8.0	13.5
: male	28	8.0	0.2
: female	790	8.0	6.3
: fattened lamb	884	8.0	7.0
Goats total	61	8.0	0.5
: male	23	8.0	0.2
: female	38	8.0	0.3
Pigs total	13915	1.5	20.9
Horses total	70	18.0	1.3

	Activity data Number of animals (x1000)	Manure production 10^6 ton slurry	Aggr. emission factor kg CH_4/head/yr	Emission Gg
4 B Manure				
Livestock Total	**113369**	**89.6**		**106**
Cattle total	4926	65.5	0.5	31
Cattle dairy	3607	60.9		
: of which in stable	3607	27.9	5.3	19
Cattle beef	1320	4.6	9.1	12
Sheep and goats	1763	1.9	3.4	6
Pigs	13915	19.8	4.3	60
Poultry	92765	2.4	0.1	10

Table A.2.6 Greenhouse gas emissions in the Netherlands in 1990 (Gg/yr full molecular weight). Soils

	Area (1000 ha)	Emission factor (kg N_2O/ha)	Emission Gg N_2O
4 D Soils "background"			
Grassland	1096	12.5	13.7
Arable land	877	2.9	2.6
Legumes	32	3.0	0.1
Natural terrain	485	0.8	0.4
Total soils "background"	2491	6.8	16.8
o.w. natural "background"	2491	1.2	3.0
Soils "fertilizer induced"	Gg N/yr applied	kg N_2O/kg N applied	
Art. fertilizer use	412	0.007	2.7
Manure application	596	0.009	5.6
Total "fertilizer induced"	1008	0.008	8.3
Total soils excl. natural			**22.1**

Table A.2.7 Greenhouse gas emissions in the Netherlands in 1990 (Gg/yr full molecular weight). Waste and other

		Activity data	Emission			Emission factor		
		Gg	CO_2 Gg	CH_4 Gg	N_2O Gg	CO_2 kg/kg	CH_4 kg/ton	N_2O kg/ton
6	Waste Total		900	380	4.1			
	Landfills	13900 (waste landfillled)		377			27*	
	Sewage treatment	315 (sludge)		3			10	
	Sewage treatment	34 (Nitrogen-removed)		4				0.12
	Waste incineration	3413 (waste incinerated)	900	0	0.1	0.26	0	0.02
7	Other							
	Drinking water treatment	847000		2				
	Polluted surface waters	258 (N-load)			10.9			42.2

* Net emissions excluding 26 Gg CH_4 actually recovered. Emission factor time dependent.

APPENDIX 3. TEMPERATURE CORRECTION IN THE NETHERLANDS APPROACH TO ESTIMATING CO_2 EMISSIONS

A significant part of gas consumption in the Netherlands, and hence total CO_2 emissions, stems from space heating (approximately 50 %). In cold winters, the total amount of energy used for space heating will be considerably higher than in mild winters. For instance, CO_2 emissions from space heating will be at least 30 % higher in a winter with an average outside temperature of 0° C than in a winter with an average temperature of 5° C (with all other influencing factors remaining constant, such as the degree of insulation, efficiency of furnaces, and other economic and human activities).

Without any adjustments, normal fluctuations between cold and mild winters could easily lead to inaccurate interpretations of trends in CO_2 emissions. Without adjustments, it is not clear what fraction of the change in CO_2 emissions is induced by policy measures or economic developments, and what fraction is due to variations in the outside temperature.

A simple but effective approximation for outside temperature correction is based on the degree-day method. The following correction procedure has been applied to the Netherlands' inventory.

Step 1
For each economic sector, the ratio of gas consumption for space heating to total gas consumption in that economic sector is determined. Nearly 100% of space heating in the Netherlands is based on natural gas. It is assumed that only gas consumption for space heating is sensitive to the outside temperature. These ratios of gas consumption are called the temperature correction application factors, or simply application factors. The application factors can be derived from energy and weather statistics. The application factors of various economic sectors are provided in table A.3.1. The application factors are periodically reviewed.

Step 2
Energy use for space heating is directly proportional to the difference between the inside temperature of houses and buildings and the ambient temperature outside. Furthermore, the energy use is proportional to the time period of the temperature differences.

This can be expressed by the following equation:

Energy Use (degree-days) = Temperature Difference Inside/Outside (° C) x Time (days)

The temperature difference is expressed in degrees Celsius. An average inside temperature of 18° C is assumed. The time is expressed in days. Hence, the energy use for space heating is proportional to the number of degree-days during a certain period.
Box 1 provides a calculation example.

Box A3.1: Calculation of the number of degree-days

Example
Day 1 has an average outside temperature of 0° C. This can be expressed in
18-0=18 degree-days. Day 2 has an average outside temperature of -10° C, corresponding to 18 - (-10) = 28 degree-days. The energy consumption on day 2 will be 28/18=1.55 times higher than on day 1. The total degree-days during the period day 1 and 2 amount to 18 + 28 = 46 degree-days.

In the Netherlands, the average annual number of degree-days is about 3200 (averaged over the previous period of 30 years). For the inventory base year, the number of degree-days can be derived from weather statistics.

Table A.3.1 Temperature correction application factors for various economic sectors

Sector	Application factor
Energy Sector	5 %
Large Industries	10 %
Small Industries	50 %
Trade and Service Sector	82.5 %
Agriculture	82.5 %
Residential Sector	85 %

Step 3
The following formula expresses the level of temperature-corrected CO_2 emissions:

Temperature corrected CO_2 emissions =
$e \times F \times a \times DD_a/DD_b$

e	=	CO_2 emissions/unit of fuel
F	=	actual fuel consumption in base year
a	=	application factor
DD_a	=	average number degree-days
DD_b	=	actual number of degree-days in base year

In a relatively cold winter, the actual number of degree-days in the base year will be higher than the average number of degree-days over the past period. Therefore, the temperature-corrected CO_2 emissions will be lower than the actual emissions. In a relatively warm winter, the actual number of degree-days in the base year will be lower than the average number of degree-days over the past period. In this situation, the corrected CO_2 emissions will be higher than the actual emissions.

By means of the temperature correction, emissions in the base year are adjusted to the average temperature. It can therefore be seen whether trends in CO_2 emissions are caused by policy measures, economic developments, or other human behaviour, or by weather influences.

The Netherlands considers that temperature correction is relevant for the development of adequate climate change and energy policies. In cases of uncorrected emission figures, the impact of CO_2 emission reduction efforts, for example, in the year 2000, may be offset if the year 2000 was characterised by very low temperatures.

Further development and improvement of the methodology to correct CO_2 emissions is currently under consideration. The current method does not account for alternative factors, such as the increase over time of the average outside temperature due to global warming, changes in solar radiation and wind, influences on the application factor, energy for cooling and air conditioning, and behavioural influences on the average inside temperature.

However, it is assumed that for short-term policy-making, the influence of these factors will be relatively small compared to the influence of fluctuations in outside temperature.

APPENDIX 4. SCENARIOS AND MODELLING TOOLS

Scenarios

Scenarios have been an important tool for assessing recent developments in the Netherlands' climate and energy conservation policies, as presented in the Second National Environmental Policy Plan (NEPP 2; VROM, 1993) and the Second Memorandum on Energy Conservation (SMEC; EZ, 1993). Scenarios provide a consistent framework of assumptions about economic, social and other developments as a basis for generating projections for future emissions of greenhouse gases and for the assessment of the effects of policy measures.

The National Institute of Public Health and Environmental Protection (RIVM), in collaboration with five other independent research institutes, played a key role in constructing the scenarios that formed the basis for the projections and policy assessments in chapter 5. These scenarios have their origin in four scenarios which were developed by the Netherlands' Central Planning Bureau (CPB) (CPB, 1992b). Each of these four scenarios described a possible direction of development of the world economy between 1990 and 2015, taking into account the forces behind the process of economic development, on the basis of assessments of the economic potential of various world regions and an analysis of the long-term trends influencing the development of the world economy in the next 25 years. Three of those scenarios were elaborated on for the specific case of the Netherlands on the basis of an analysis of the relative strengths and weaknesses of the Netherlands' economy (CPB, 1992a).

For the purpose of preparation of NEPP 2 and SMEC, the two most plausible scenarios, European Renaissance (ER) and Global Shift (GS) have been selected as a basis for further elaboration and analysis. They also provide the framework for the construction of a third scenario, geared to CO_2 and energy conservation policy.

ER and GS present contrasting views of the future. ER presents the future of the Netherlands optimistically. It describes a development characterized by a high rate of economic growth, a shift towards a more energy-extensive economic structure, and favourable developments in the employment situation. GS tends towards a pessimistic view, with the economies of the Netherlands and other European countries stagnating as they are no longer able to compete with suppliers such as countries in South East Asia, Japan and the USA. Hence, GS shows a rather low rate of economic growth, no tendency towards a more energy-extensive economic structure, and a high tax burden.

The scenarios do not just provide descriptions of possible economic trends and underlying mechanisms, but also descriptions of e.g. technological, social, political and other developments which

Table A.4.1 Scenario data and social developments in the European Renaissance (ER) and Global Shift (GS) Scenarios[a]. Two values are provided for oil prices and energy consumption, reflecting the high and low energy prices variants of the scenarios. Base year 1990 = 100

	1985	1990	2000 ER	2000 GS
SCENARIO DATA				
Population	97	100	106	107
GNP	88	100	131	116
Use of primary raw materials by industry	95	100	113	106
Price crude oil	78	100	100-145	100-145
SOCIAL DEVELOPMENTS				
Private vehicle traffic	85	100	109	105
Road Haulage	81	100	128	112
Energy Consumption (temp. corrected)	88	100	109-116	103-109
Livestock units	103	100	85	85
Manure production (phosphate)	115	100	78	78
Water consumption	92	100	96	92

[a] incl. effects of NEPPP and MEC policies, excl. effects of NEPP2 and SMEC policies.

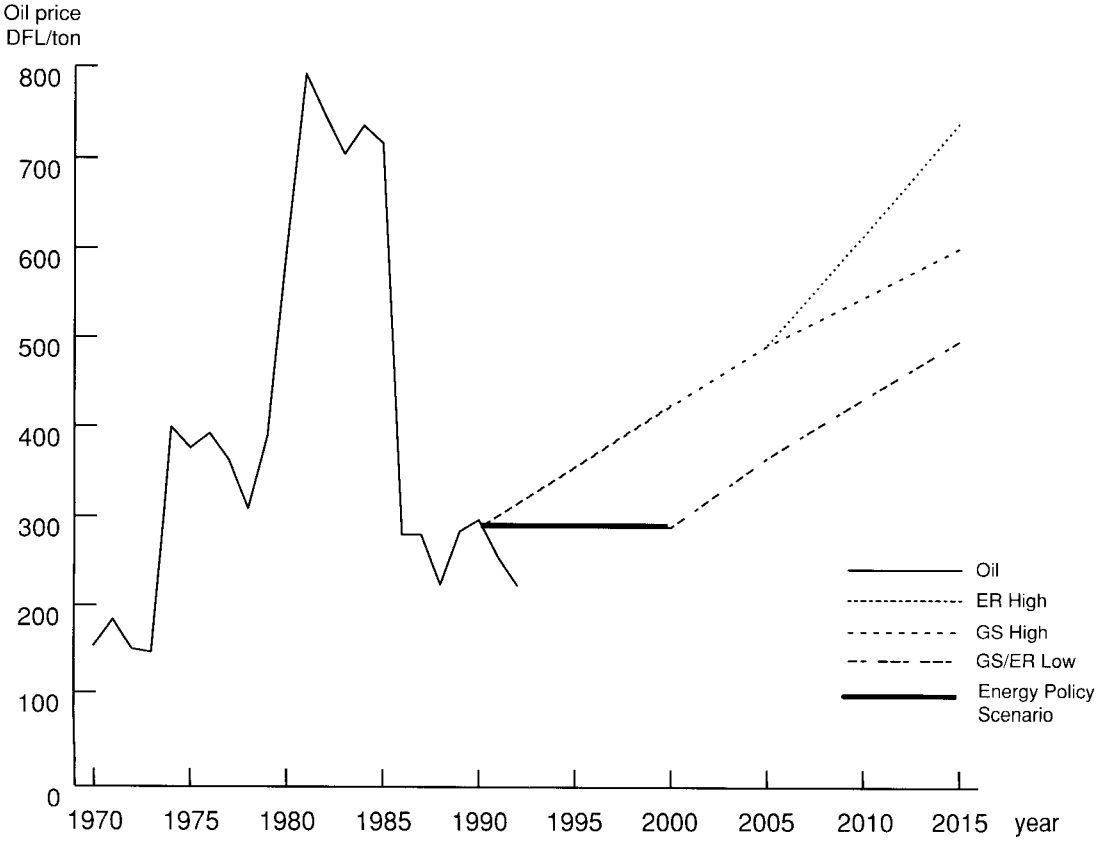
Table A.4.2 Growth assumed in various economic sectors, according to ER and GS. Index 1990 = 100

Value added	1990	2000 ER	2000 GS
Chemicals	100	154	123
Iron and Steel	100	163	122
Other industry	100	122	114
Agriculture	100	114	116
Commercial/Institutional	100	158	126
World Trade of the Netherlands	100	139	119
Physical Growth			
Chemicals	100	119	102
Iron and Steel	100	107	91
Other industry	100	112	106
Agriculture	100	95	98
Commercial/Institutional	100	109	106

may shape the future. Table A.4.1 shows a number of basic assumptions and results in the two scenarios taking account of the effects of National Environmental Policy Plan Plus (NEPPP; VROM, 1990) and Memorandum on Energy Conservation (MEC; EZ, 1990) policies. These scenarios provide the general background for projections and assessments of NEPP 2 and SMEC policies (see chapter 5: section 5.2.1 and figure 5.1). Table A.4.2 shows the economic and physical growth for the various economic sectors.

The original versions of ER and GS both assumed rising energy prices. Taking into account more recent expectations about trends in energy prices, low energy price variants of ER and GS have

Figure A.4.1 Development of world oil prices in the period 1970 - 2015 for the Energy Policy Scenario, ER and GS



been developed assuming constant (real) energy prices up to 2000 with a subsequent rise (figure A.4.1). Relatively low oil prices will lead to a higher energy consumption.

For greenhouse gases other than CO_2, projections and policy assessments on the basis of ER-High (ER with rising energy prices) are considered a balanced representation of the probable developments in the emissions of these gases. Calculations based on GS-Low (GS with constant energy prices up to 2000) give an indication of the range of the projected emissions. However, taking into account new insights on trends in economic growth, energy prices, and energy supply and demand, a third scenario had to be drawn up for the update of CO_2 and energy conservation policy and the forecasting of CO_2 emissions. This scenario, the Energy Policy Scenario, which forms the basis for the CO_2 projections in chapter 5, falls between ER-High and GS-Low. Its main assumptions are:

- a GNP growth rate of 1.9%;
- constant real energy prices between 1990 and 2000;
- a minor shift towards a more energy-extensive economic structure.

Table A.4.3 illustrates these main assumptions in comparison with those of ER-High and GS-Low.

Modelling tools

The processes of making projections and assessing the effects of policy measures overlap. Policy measures are incorporated in a set of models which are used to generate the emission projections.
The six institutes involved in assessing the policy measures each use their own set of models, something which requires a close coordination so as to adjust the input and output of the range of models to each other. The main models used in the development of the CO_2 projections are:

LMS, FACTS and ATTACK; The first model is run by the Transport Research Centre (AVV), the latter two are run by the RIVM. In an interaction between the AVV and the RIVM models, projections are made for the mobility of passenger and freight transport. The economic development per sector and the expected income per household and energy process are inputed into the models. What the models produce is the energy consumption of the transport sector, which is used as input for the CENECA-model.

ICARUS; a database on energy saving technologies, developed by the University of Utrecht (RUU). This database is used in an aggregated way by the CENECA model and the RIVM. This database is used to assess the effect of regulation and technology stimulation programmes in addition to the CENECA model.

CENECA; an econometric model which relates energy consumption of industrial sectors, households and other economic sectors to economic development data. The model is run by the Central Planning Bureau (CPB). The capital stock and energy process are important factors influencing the need for energy as well as technological development.

SELPE; run by the Netherlands Energy Research Foundation (ECN) and is used for modelling the energy supply system. It is a linear optimalization model which gives a detailed description of the energy supply system. The input is the energy demand given by the CENECA model. On the

Table A.4.3 Some key assumptions in various scenarios

	Energy Policy Scenario	ER-High Scenario	GS-Low Scenario
Annual rate of economic growth (%) 1990-2000 period	1.9	2.7	1.5
End user prices of energy in the year 2000 (1990=100)	100	123	100
Effects of structural change[1] (%)	-0.1	-0.2	0.2

[1] Annual rate of change in the ratio 'energy consumption/GNP' due to changes in economic structure.

basis of energy prices, technological development, investment and production costs, a cost-effective energy supply system is generated.

RIM-plus; an integrating model of the National Institute of Public Health and Environmental Protection (RIVM). In this model, emissions are calculated on the basis of the economic and social developments towards emissions. The energy supply system from the SELPE model and the mobility projections of LMS, ATTACK and FACTS are the inputs. Outputs are emissions, not only of CO_2 but also of other greenhouse gases.

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