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Fourth Netherlands' National Communication under the United Nations Framework Convention on Climate Change

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Introduction

This report describes the general circumstances, emissions and policies and measures with regard to climate change in the Netherlands, pursuant to article 4 and 12 of the United Nations Framework Convention on Climate Change (UNFCCC). It is the fourth National Communication of the Netherlands and mainly describes the developments since the previous third National Communication of the Netherlands (2001). In preparing this report, the UNFCCC guidelines have been followed. Since the Kyoto Protocol went info force beginning 2005, supplementary information has to be reported as well, as set down in article 7.2 of the Kyoto Protocol. The guidelines for this supplemental reporting have also been followed.

This report was written in parallel to the Netherlands' Report on Demonstrable Progress under article 3.2 of the Kyoto Protocol. In comparison, this 4th National Communication provides more detailed information on a wider range of subjects. It thus served as background information for the Report on Demonstrable Progress. In both reports, policies and measures are described and taken into account in the projections as known on 1 December 2004. This was done to maintain consistency with reports from the European Commission that are published in parallel and partly contain the same information. Since then, policy has developed further. These further developments have not been taken into account in the figures in this report and the Netherlands' Report on Demonstrable Progress, but have been taken into account in the second evaluation of the National Climate Policy Implementation Plan (NCPIP), that was sent to Parliament end of October 2005. For information, the main conclusions of the second evaluation of the NCPIP have been added to this report and to the Netherlands' Report on Demonstrable Progress.

National Circumstances

The Netherlands is a small and low-lying country with about 24% of the land below sea level. Its total area including inland and coastal waters amounts to 41,526 km^2, with the land area amounting to 33,784 km^2. In 2000 about 69% is agricultural land, 10% forest and 4% natural land and 14% for urban use and infrastructure.

The Netherlands has a temperate climate. Due to the maritime influences the climate is much milder than average conditions at the same latitute. An increase of around 1 degree has been measured over the last 100 years, with some of the warmest years occurring the last 10 years.

The population of the Netherlands increased with 15% since 1980 reaching about 16.3 million in 2004. With a population density of 481 persons per km^2, the Netherlands is one of the most densely populated countries in the world. The increase in population, life expectancy and number of household (with a decrease in number of persons per household) is a major driver for the increase in demand for space heating, growth in transport and growth in emissions of greenhouse gases.

The Netherlands has a Gross Domestic Product (GDP) of 454 billion Euros (2003) an increase of 35% since 1990. In the period 2001-2003 GDP has not grown. Its geographical location with the largest port in Europe (Rotterdam) and the economic structure contribute to an open economy. It ranks relatively high among agricultural exporters. The principal exports are machinery and transport equipment (29% of total value of exports in 2003), chemicals (13%) and food and livestock products (16%). Exports increased by around 97% between 1990 and 2003 (in constant prices).

The Netherlands has large natural gas reserves, one of the factors contributing to a relatively large chemical industry. This, together with the limited availability of non-fossil fuel resources, has determined the energy profile of the country.

In the period 1990-2003 the total industrial production (in constant prices) grew only marginally. As a result, the share of the industrial sector in GDP fell from 17% to 13%. In the same period, gross value added of commercial and public services grew more than 50%, resulting in a share of 68% in 2003. Compared to other EU countries the industrial structure of the Netherlands is relatively energy-intensive in terms of energy use per € production value. This is inter alia caused by the chemical industry, which produces a high share of base chemicals

The fuel mix in the Netherlands also differs substantially from that in many other countries. The share of natural gas in the

total end use for energy was nearly 50% in 2002, which is extremely high.

Although the overall energy intensity decreased in the period 1990-2003, electricity use in this period increased by 43%, thus exceeding the growth in GDP, which was 35%. An important cause was the penetration of electrical appliances. The share of electricity in the total energy demand in the Netherlands, has increased from 10% to 11% over the past decade, though this is still one of the lowest shares in the European Union (EU).

In the period 1990-2004 the production of renewable electricity has increased by a factor of 7, which resulted in a 4.5% share in the electricity use in 2004. Almost 60% of this stems from biomass combustion, and 38% from wind energy. The installed capacity of wind power amounted to approximately 880 MWe by the end of 2003. The growth was particularly high in recent years. This is clearly a result of the Dutch stimulation programme.

The Netherlands has six large refineries, with four of them located in Rotterdam. The refineries in the Netherlands produce many relatively light oil products (LPG, naphtha, gasoline) from heavier crude oil with a sulphur content of 1.5%. Between 1990 and 2003 the energy used to process a barrel of crude oil increased by 17% as a result of deeper conversion to lighter products, the use of heavier crudes and stricter legislation regarding the sulphur content of fuels.

The volume of transportation is influenced by demographic, economic, spatial and infrastructure factors. Air and international shipping are highly concentrated in Schiphol Airport and the port of Rotterdam. Between 1990 and 2003 the number of car-km of passenger cars increased by 22%, which was less than the increase in GDP. On the other hand, the increase in ton-kilometer road transport in period 1990-2000 was 44%, higher than the trend in GDP.

Between 1990 and 2002 the recycle rate increased from 60% to 77% of the total amount of waste. The amounts that are landfilled have been substantially reduced as a result of the policy on waste management. This focuses firstly on prevention, secondly on reuse and thirdly on waste incineration with energy recovery.

Agriculture in the Netherlands focuses on cattle breeding, crop production and greenhouse horticulture. The share of horticulture in total agricultural production is increasing over time. Between 1990 and 2004, the number of dairy and non-dairy cattle has fallen by 22% and 25% respectively, due to e.g. the quota system for milk production. Legislation concerning ammonia banned the surface spreading of manure and required manure injection and incorporation into the soil. This has resulted in more nitrogen being absorbed by grassland and cropland, supposedly leading to higher emissions of nitrous oxide.

Greenhouse Gas Inventory Information

The Netherlands has been working to timely establish the National System for the monitoring of greenhouse gas emissions by sources and removals by sinks under the Kyoto Protocol. Methods for monitoring greenhouse gases and the process of data assembly for the annual National Inventory Reports have been described in Monitoring Protocols, that are part of the National System and will be published on the internet-site *www.greenhousegases.nl*

An Act on Monitoring of Greenhouse Gases is currently in preparation and is expected to enter into force before the end of 2005. This Act empowers the Minister of Housing, Spatial Planning and the Environment to appoint an authority responsible for the National System and the National Inventory. Furthermore, the Act determines that the National Inventory shall be based on Monitoring Protocols. Adjustments to the Protocols will require official publication.

The government agency SenterNovem has been appointed as National Inventory Entity (NIE) by the Minister of Housing, Spatial Planning and the Environment until mid-2006. SenterNovem has been responsible for building up the National System. The appointment of SenterNovem ensures continuity during the first period the system is operational. In 2006 an evaluation will take place and a new decision will be taken on the appointment of the NIE.

Table ES.1 illustrates the greenhouse gas emissions between 1990 and 2003 (excluding LUCF). The share of the group of non-CO_2 greenhouse gases (methane, nitrogen oxide and fluorinated

Table ES.1 Total greenhouse gas emissions in CO_2-eq. and indexed 1990-2003 (no temperature correction)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Nat. Emissions (Tg CO_2-eq)														
CO_2 with LUCF	160,9	165,7	163,8	168,2	168,2	172,3	180,0	173,0	174,9	169,7	171,7	177,1	176,7	179,6
CO_2 excluding LUCF	**158,0**	162,9	161,1	165,5	165,5	169,7	177,3	170,2	172,2	166,9	168,9	174,4	173,9	176,9
CH_4	**25,6**	25,9	25,4	25,0	24,2	23,8	23,2	22,1	21,3	20,2	19,5	19,0	18,2	17,5
N_2O	**21,3**	21,7	22,4	23,1	22,3	22,4	22,2	22,0	21,7	20,9	19,9	18,9	18,0	17,3
HFCs	4,4	3,5	4,4	5,0	6,5	**6,0**	7,7	8,3	9,3	4,9	3,8	1,5	1,6	1,4
PFCs	2,1	2,1	1,9	1,9	1,9	**1,8**	2,0	2,2	1,7	1,5	1,5	1,4	1,4	1,4
SF_6	0,2	0,1	0,1	0,1	0,2	**0,3**	0,3	0,3	0,3	0,3	0,3	0,4	0,4	0,3
Total [group of six][1]	**211,7**	**216,2**	**215,4**	**220,7**	**220,6**	**224,0**	**232,7**	**225,0**	**226,5**	**214,8**	**214,0**	**215,5**	**213,5**	**214,8**
Index (1990=100)														
Index CO_2 [1]	100	103,0	101,8	104,5	104,5	107,1	111,9	107,5	108,7	105,5	106,7	110,1	109,8	111,6
Index CH_4	100	101,0	99,2	97,4	94,6	93,0	90,6	86,2	83,0	78,9	76,2	74,2	71,1	68,1
Index N_2O	100	101,9	105,1	108,5	104,5	105,2	104,1	103,0	101,8	98,3	93,3	88,6	84,3	81,3
Total [group of three][1]	**100**	**102,7**	**101,9**	**104,2**	**103,5**	**105,4**	**108,7**	**104,5**	**105,0**	**101,5**	**101,6**	**103,6**	**102,5**	**103,3**
Index HFCs	100	77,9	100,3	112,8	147,1	135,6	172,9	187,2	210,9	109,9	86,6	33,7	35,3	32,7
Index PFCs	100	99,0	90,1	91,1	87,6	85,4	94,6	102,9	81,8	69,3	71,9	67,0	66,9	66,0
Index SF_6	100	61,6	65,8	69,0	88,0	138,6	143,7	158,7	151,3	145,9	154,2	164,2	165,1	153,9
Index [group of six][1]	**100**	**102,1**	**101,8**	**104,3**	**104,2**	**105,8**	**109,9**	**106,3**	**107,0**	**101,4**	**101,1**	**101,8**	**100,8**	**101,5**
Index (1995 = 100)														
Index HFCs	73,7	57,4	74,0	83,1	108,4	100	127,5	138,0	155,5	81,0	63,9	24,8	26,1	24,1
Index PFCs	117,1	116,0	105,5	106,7	102,6	100	110,8	120,5	95,8	81,2	84,2	78,5	78,4	77,3
Index SF_6	72,1	44,5	47,5	49,8	63,5	100	103,7	114,5	109,2	105,2	111,2	118,5	119,1	111,0
Index [group of new gases]	83,3	70,0	80,0	87,1	105,5	100	122,9	133,2	140,5	81,9	70,2	40,2	41,2	39,2
Index [BY=100] [group of six][1, 2]	**99,4**	**101,5**	**101,1**	**103,6**	**103,6**	**105,2**	**109,2**	**105,6**	**106,3**	**100,8**	**100,4**	**101,1**	**100,2**	**100,8**
International bunker CO_2 [3]	34,3	35,4	35,7	37,0	35,1	35,5	36,3	38,5	39,0	40,3	42,8	47,2	46,6	43,6
Index bunkers CO_2 (1990 = 100)	100	103,2	104,0	107,8	102,2	103,5	105,7	112,2	113,5	117,4	124,8	137,4	135,7	126,9

1 National emissions excluding LUCF (category 5A)
2 Base year emissions are 1990 for CO_2, CH_4 and N_2O and 1995 for the F-gases **(coloured figures)**
3 Emissions from international marine and aviation bunkers are not included in the national totals.

gases) decreased relative to the base year (1990/1995). Total greenhouse gases are increasingly dominated by CO_2 emissions.

CO_2 emissions increased by about 12% from 1990 to 2003, mainly due to the increase in the emissions in the energy (14%, in the combination of combustion and fugitives) and transport sectors (31%). The doubling of import of electricity in 1999 from 10% to 20% only temporarily decreased CO_2 emissions from the energy sector and the total national CO_2 emissions; in 2000 the annual increase of the pre-1999 years has resumed. CO_2 emissions peaked in 1996 due to a very cold winter, as can be observed by a substantial peak in emissions in 1996 from 'Other sectors' (residential, services, agriculture/fisheries), that are particularly influenced by weather conditions.

CH_4 emissions decreased by 32% in 2003 compared to the 1990 level, mainly due to decrease in the waste (-43%), agricultural (-18%) and fugitive energy sectors (-39%).

N_2O emissions showed a decrease by about 19% in 2003 compared to 1990, mainly due to the decrease in the emissions from industrial processes (including indirect N_2O from non-agricultural sources) and agriculture. The decrease in industrial and agricultural emissions is partly compensated by increases of emissions from fossil fuel combustion, which stems mainly from transport.

Of the fluorinated greenhouse gases, for which 1995 is the base year, emissions of HFCs and PFCs have decreased in 2003 by about 75% and 25% respectively, while SF_6 emissions increased by 11%. Total emissions of all F-gases have decreased in 2003 by about 60% compared to the 1995 level.

Policies and measures

The greenhouse gas emission reduction target for the Netherlands under the Kyoto Protocol is 8% in the period 2008-2012 compared to base year emissions. As a result of the burden sharing agreement within the European Union, in which the common reduction target of 8% is divided amongst the Member States, the final reduction target for the Netherlands is 6%. Based on preliminary figures, this is assumed to be an average of 200 Mt CO_2 equivalents a year in 2008-2012.

Table ES.2 Sectoral target values for greenhouse gas emissions

Sector	Target value 2010	Responsible ministries
CO_2		
Industry and Energy	108.6	Economic Affairs
Agriculture	7.5	Agriculture, Nature and Food Quality
Traffic and Transport	38.7	Transport, Public Works and Water Management; Housing, Spatial Planning and the Environment
Buildings	28	Housing, Spatial Planning and the Environment
Subtotal	*182.8*	
non-CO_2 gases	35.4	Housing, Spatial Planning and the Environment
Total	**218.2**	

The Netherlands outlined its climate policy in 1999 and 2000 in its National Climate Policy Implementation Plan (NCPIP). It was decided that the Netherlands intends to achieve its Kyoto target both by domestic policies and measures and by using the Kyoto mechanisms. Currently, the domestic target is set at 220 Mt CO_2 equivalents in 2010. The intended use of Kyoto mechanisms totals 100 Mt CO_2 equivalents, that is on average 20 Mt CO_2 equivalents a year in the period 2008-2012.

In 2004, responsibility for achieving the domestic target was divided between the relevant ministries. This provides for clearly defined responsibilities and stimulates integration of climate policy in relevant policy areas. The domestic target of 220 Mt CO_2 equivalents in 2010 is divided amongst ministries in sectoral target values as shown in table ES.2.

In the NCPIP an extensive programme for monitoring and evaluation of progress in climate policy was established. Evaluations took place in 2002 and 2005. The conclusions of this latest evaluation are reported in section 5.5 of this report.

In the Netherlands, the general approach to achieving the domestic target consists of policies that greatly reduce emissions of the non-CO_2 greenhouse gases (CH_4, N_2O and the F-gases) on the one hand, and policies that aim at decoupling the growth in emissions of CO_2 from economic growth, on the other. Policies and measures affect all economic sectors and all greenhouse gases. They range from regulations to energy tax, subsidies, fiscal incentives, and voluntary agreements with (groups of) emitters. Since 2005, CO_2 emissions trading has been implemented as part of the European emissions trading system. This system affects both the Energy and the Industry sector. Examples of cross-sectoral policies, that affect all sectors, are the Energy Tax and the CO_2 Reduction Programme. The latter provides support to large-scale investment projects that contribute substantially to reducing national CO_2 emissions.

CO_2 policies relating to the Energy sector have traditionally fallen into three general categories: those aimed at encouraging the use of renewable energy (such as the special provisions under the Energy Tax, the Environmentally Friendly Electricity Production Programme, the Intergovernmental Wind Energy Agreement and the Coal Covenant), those aimed at increasing the penetration of combined heat and power (such as the special gas price, the energy tax exemption for combined heat and power) and those aimed at improving the efficiency of electric power plants. The Energy Investment Tax Deduction regime (EIA) supports measures in all three categories. In the Energy sector, in 2000 emission reductions resulting from policies since 1990 totalled 6.7 Mt CO_2 equivalent.

In the Industry sector, policies affecting CO_2 emissions are generally aimed at improving industrial energy efficiency. These include the Energy Efficiency Benchmarking Covenant, Long-Term Agreements with industrial sectors and the Energy Investment Tax Deduction regime. Furthermore the emissions of non-CO_2 greenhouse gases such as N_2O and F-gases are reduced. N_2O emission during nitric acid production will be reduced as a result of the European Integrated Pollution Prevention and Control directive. Emissions of HFC-33 have been reduced at the only producer of HCFC-22 in the Netherlands by installing an afterburner in 1997. This was partly supported by the government through the Reduction Programme for non-CO_2 Gases. PFC emissions have been reduced through an environmental covenant with the aluminium industry and support from the CO_2 reduction programme and the Reduction Programme for non-CO_2 Gases. In the Industry sector, in 2000 emission reductions resulting from policy since 1990 amounted to 9.7 Mt CO_2 equivalents.

In the Transport sector, policies that affect CO_2 emissions can be grouped into the following four main categories:

- policies aimed at improving fuel efficiency through technical measures on vehicles. This includes energy labelling of new vehicles, the ACEA (association of European automobile constructors) covenant with car manufacturers and various subsidy programmes;
- policies aimed at improving fuel efficiency through driving behaviour and discouraging vehicle use;
- policies aimed at encouraging modes of transport with smaller emission impacts;
- policies that have various types of effects, such as excise duties on motor fuels and the implementation of the European Union Biofuels Directive.

In 2000, reductions realised in the Transport sector as a result of policies since 1990 were 1.2 Mt CO_2 equivalents.

In the Agriculture sector, the largest source of CO_2 is the greenhouse horticulture sector, which is responsible for around 80% of emissions from this sector. The most important policies affecting CO_2 emissions from greenhouse horticulture are a covenant and regulations, that both aim at improving energy efficiency. The Netherlands has no specific policies aimed at reducing emissions of the non-CO_2 gases from the agricultural sector. However, since the dairy herd decreases because of milk quota, and the application of nitrogen to soil is regulated in manure policies, CH_4 and N_2O emissions do decrease. In the Agriculture sector, in 2000, the reduction as a result of policies since 1990 was 1.4 Mt CO_2 equivalent.

In the Waste sector, government policies aim at reducing the amount and composition of waste to be dumped and at collecting and utilising landfill gas for energy production. In 2000, reductions as a result of policies since 1990 totalled 4 Mt CO_2 equivalent.

The package of policies deployed in the Buildings sector has been designed to address specific issues in three segments of the target group: new buildings, retrofitting existing buildings, and appliances. The package consists of a mixture of regulations, economic instruments and information and outreach programmes, supported by the Energy Tax. Agreements have been negotiated with important intermediary parties in the residential sector (such as housing developers and local governments) and with branch organisations in the non-residential sector. The main policy instrument pertaining to new buildings in both residential and non-residential sectors is the Energy Performance Norm (EPN). The most important framework for encouraging energy conservation in existing residential buildings (including appliances) during the period 1990-2000 was the Environmental Action Plan (MAP) of the energy companies. After the MAP expired in 2000, financial support continued in a somewhat modified form under the Energy Premium Rebate (EPR) programme, which was in effect from 2000 to 2005. Information on energy-saving potential is currently provided through the Energy Performance Advice (EPA) programme. In the Buildings sector, reductions in 2000 as a result of policies since 1990 totalled 3.6 Mt CO_2 equivalents.

An estimation of emission reduction effects shows that, for all sectors together, domestic policies and measures between 1990 and 2000 reduced emissions by 26 Mt CO_2 equivalents in 2000.

The Netherlands intends to purchase 100 Mt CO_2 equivalent emission reductions based on the Kyoto mechanisms, i.e. on average 20 Mt CO_2 equivalents a year in the period 2008-2012. The clean development mechanism (CDM) is expected to provide about two thirds, Joint Implementation (JI) the remaining third. By 2005, the target is entirely covered by either framework agreements with intermediary organisations, participation in funds, or project contracts. Institutional and financial arrangements have been made. The Netherlands was a first-mover on the market for emission reductions based on Kyoto mechanisms, thereby contributing to the development of this market and the instrument itself. An analysis of the supplementarity of the Netherlands' climate policy shows that domestic actions exceed the use of CDM and JI, independent of the chosen indicator of effort.

The Dutch climate policy is embedded in a general policy for sustainable development, for which the Netherlands set up an action programme in 2003. In addition to the ongoing work within ICAO and IMO, the Netherlands' government would prefer the EU to also think about measures. The Netherlands strive at minimizing the adverse effects of climate change by implementing policies and measurs for all sectors, all gases and by making use of the Kyoto mechanisms. The Netherlands has several domestic programmes and legislative arrangements in place to enforce climate measures. The Dutch Registry for emission allowances has been online since February 2005.

Projections

Projections for future greenhouse gas emissions have been made for two scenarios: the Strong Europe scenario (SE), which assumes strong international co-operation and public responsibility with an average annual GDP growth of 1.7%, and the Global Economy scenario (GE), which is oriented sharply towards international trade but little political co-operation and assumes an average annual GDP growth of 2.7%. Projections 'without measures', 'with measures' and 'with additional measures' are made. In the 'with measures' projection measures as adopted or implemented as on 1 december 2004

are included. The additional measures projection reflects the range of impacts of six policies that are currently either in the planning or study stage in the Netherlands. These include for example a Tender scheme for energy savings in buildings, and a biofuels policy for transport.

A summary of the projections is presented in figures ES.1, 2 and 3. The 'with measures' projections show that until 2010, CO_2 emissions will continue to rise at a similar pace as before. Non-CO_2 emissions will continue to decrease further. The emissions of the Energy and Transport sectors will continue to rise, while Industry will increase slightly again from 2005 onwards, after a decline in the years before. The Agriculture, Buildings and Waste sectors will decrease further. Total greenhouse gas emissions will increase further until 2010, in the GE scenario somewhat more than in the SE scenario.

The projected effects of policies and measures between 2000 and 2010 are a reduction of about 22 Mt CO_2 equivalents in 2010. The largest contributions are from renewable energy, energy conservation and reduction of non-CO_2 greenhouse gases in industry, and reduction of CH_4 emissions at landfill sites. The additional measures are projected to have an effect of about 5.5 Mt CO_2 equivalents in 2010.

Based on the projections and the preliminary Kyoto target of, on average, 200 Mt CO_2 equivalents a year from 2008-2012, it is possible to preliminarily assess whether the Netherlands' climate policy will be sufficient for meeting its Kyoto target. Figure ES.4 illustrates how climate policy contributes to the Netherlands' meeting its Kyoto target.

The figure shows that the Netherlands is projected to meet its Kyoto target. Policies and measures implemented so far will reduce emissions by 22 Mt CO_2 equivalents (while policies and measures between 1990 and 2000, not shown in the figure, already reduced emissions by about 26 Mt). Additional measures may reduce emissions even further, while use of Kyoto mechanisms will fill the remaining gap. Depending on the scenario, it may or may not be necessary to implement all additional measures and/or purchase all 20 Mt CO_2 equivalents a year of emission reductions based on the Kyoto mechanisms. However, uncertainties should be considered with this conclusion.

The second Evaluation of the NCPIP assesses the uncertainties with regard to the achievement of the Netherlands' Kyoto target. It proposes actions to reduce the risks and secure achievement of the Kyoto target. According to the second Evaluation of the NCPIP, the chance of achieving the domestic target may be 90%, provided that the policy in preparation will be implemented and have effect, and the national emission ceiling for the European emissions trading system will not exceed the current one. Actions to secure achievement of both the domestic target and that for the Kyoto mechanisms are:

- the additional measures will be elaborated further and implemented;
- to limit risks, a set of domestic reserve measures is in preparation;
- the national ceiling for CO_2 emissions trading, to be determined in early 2006, will be taken into account;
- possible reserve measures to reduce risks for the Kyoto mechanisms will be assessed;
- from 2006 onwards, annual intermediary assessments will be held to judge uncertainties and decide on the use of reserve measures.

Vulnerability assessment, climate change and adaptation measures

The climate in the Netherlands will undergo significant changes in the coming decades. The most pressing consequences include wetter winters, drier summers, changes in biodiversity, rising sea level and increased river discharges. At the same time, the Netherlands is subsiding. These conditions in a country like the Netherlands - dominated by the sea and the delta of four great rivers, with a high population density and a competitive economy - will more frequently result in climate change impacts that have to be counteracted.

The geographical location of the Netherlands makes it highly susceptible to sea level rise and extreme weather events. The total coastline of the Netherlands is 350 km long, 300 km of which consists of dunes and beaches, while the remainder is protected by dikes and dams. Recent studies report a further increase in flooding risks due to the rise in sea level, climate change and further economic and social development.

Figure ES.1 CO_2 emissions (excl. LULUCF), with measures

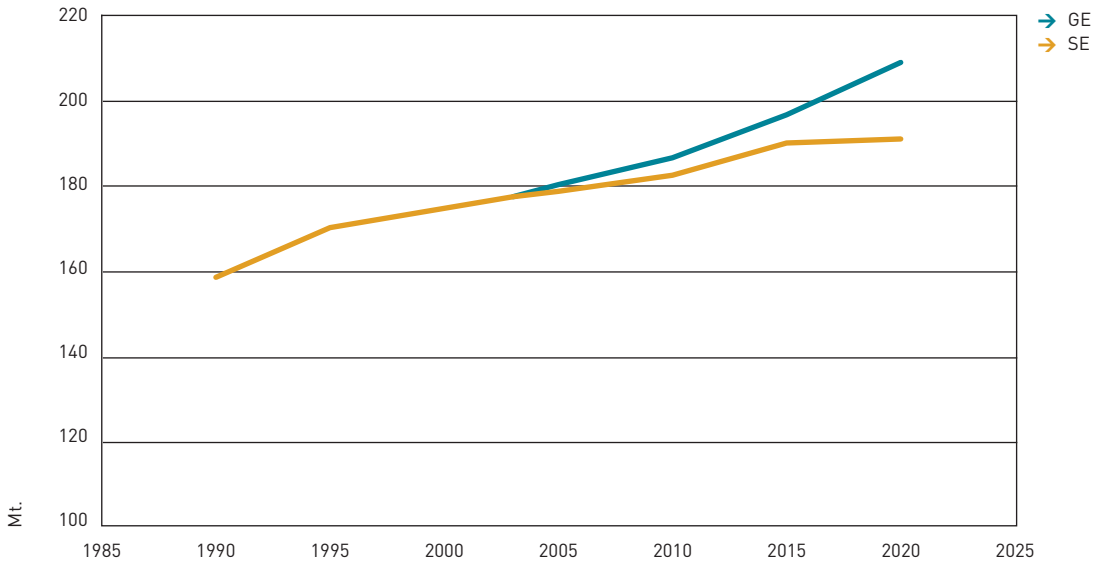


Figure ES.2 Non-CO_2 greenhouse gas emissions, with measures, GE scenario

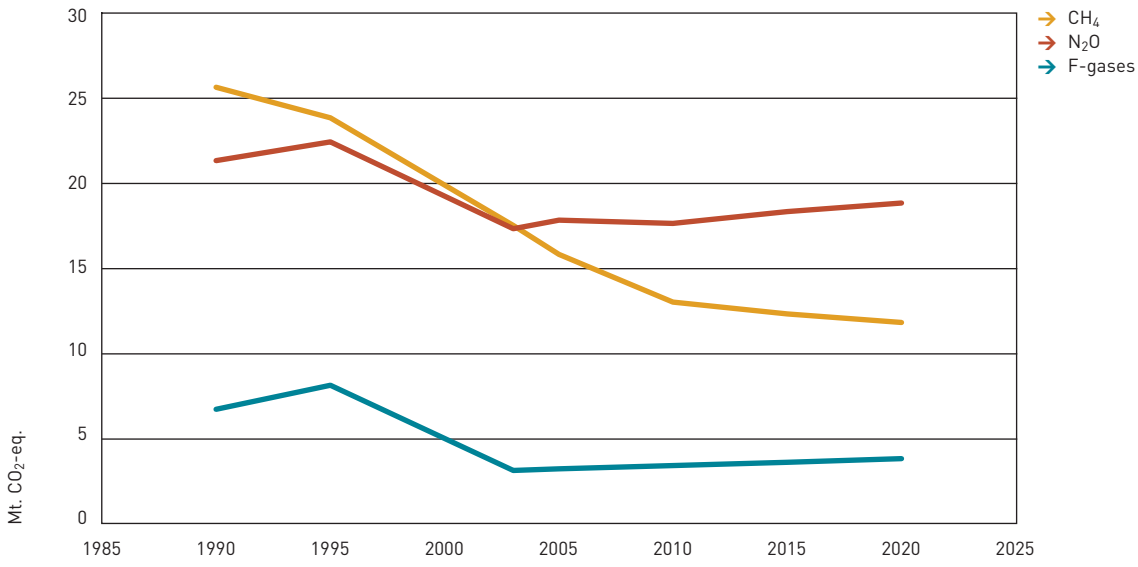


Figure ES.3 Total GHG emissions, (excl. LULUCF), with measure

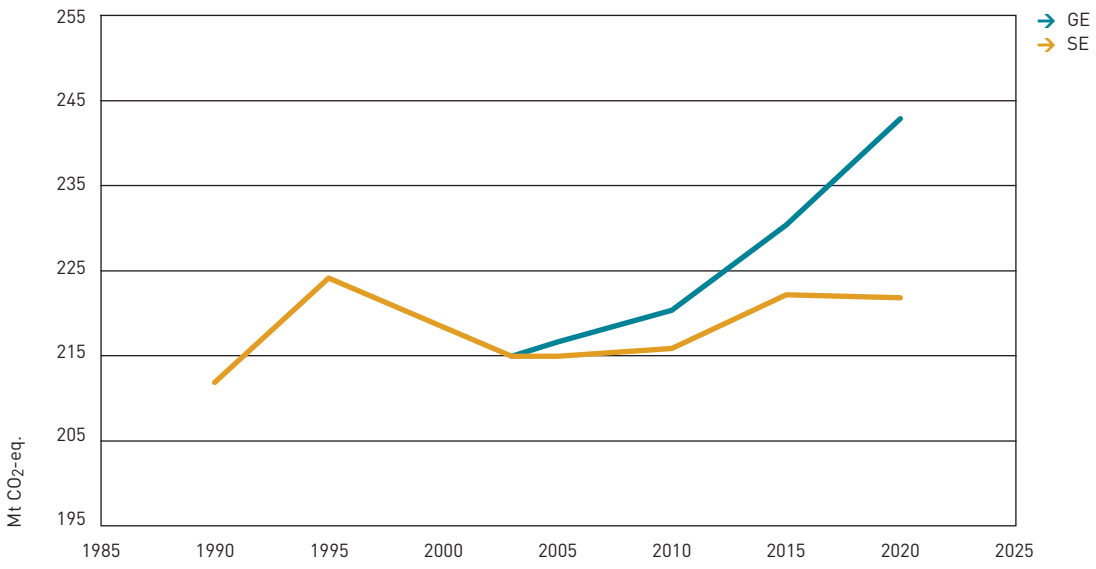
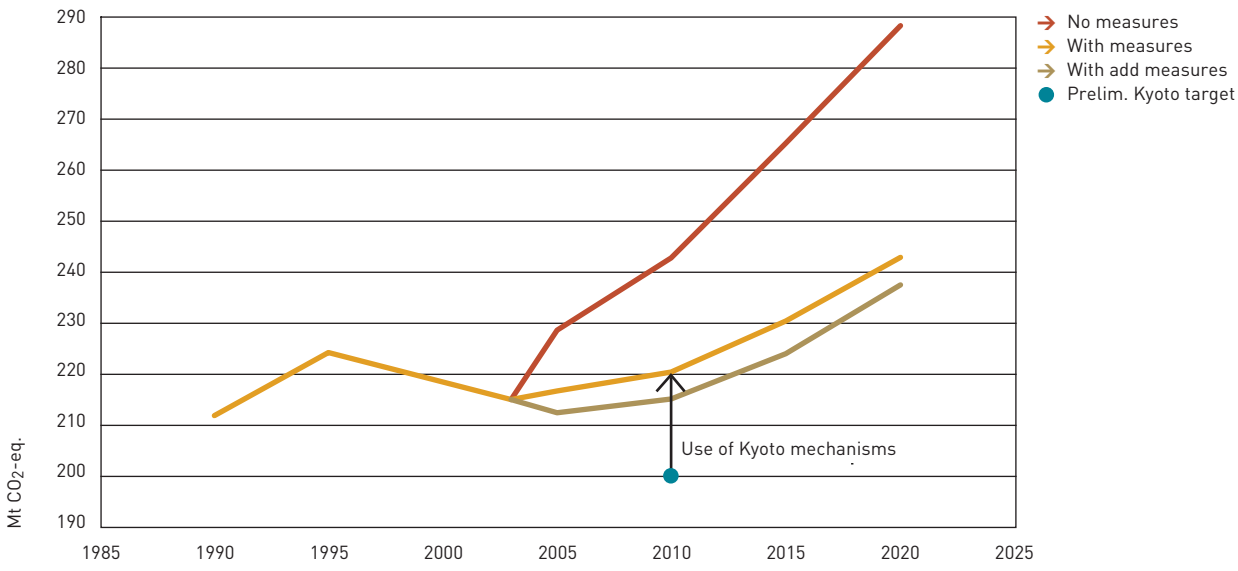


Figure ES.4 Effect of (additional) measures (GE scenario) on total GHG-emissions



Climate change also already has an impact on nature in the Netherlands. The growth season is longer and southern species have established themselves permanently. The impact and extent of these changes is uncertain, in part because of other human and natural factors e.g. fragmentation of natural areas. Impact studies have been commissioned by the national government, targeting specific policy areas, including e.g. into the effects of drought and of the impacts of sea live rise on the Wadden Sea, a wetland area of great natural and international value

Vulnerability assessments are generally realised through European research projects and studies. National efforts include e.g. the National Research Programme's impact study.

Adaptation to climate change impacts has gradually gained importance on the political agenda. Climate change impacts on water and ecosystems are already visible or have been accepted as nearly inevitable. Adaptation is most strongly developed in the water sector. The focus of climate change adaptation is on mainstreaming and "no-regret" strategies. The Dutch water policy recognises that in the coming years increasing water levels in the rivers and the accelerated rise in sea level will mean that technical measures, such as raising dikes, will no longer be sufficient. The policy is to give water more space. In order to prevent floods, rivers are allowed to expand into side channels and wetland areas. Greater emphasis is also placed on managing water levels rather than keeping the water out. Safety continues to be the top priority.

Implementation of the existing policy of realising green corridors and ecological zones and strengthening the resilience of ecosystems is seen as the most appropriate strategy to cope with the impacts of climate change on nature. Synergies with water management are considered, since both require space and could be combined in new ecological zones. The agricultural sector is invited to contribute to water storage, stimulated by an imbursement scheme to pay farmers, landowners and recreation for their contribution to water and ecosystem management.

Spatial planning is a cross cutting issue in adaptation. Water is recognised as one of the guiding principles for spatial planning. New large scale infrastructure and city planning have to compensate for potential losses in water quality or quantity.

Financial resources and transfer of technology

The Netherlands continues to allocate 0.8% of the GNP for Official Development Assistance of which at least 0.1% is earmarked for Agenda 21 issues. Within this budget, the expenditures for climate related activities - both mitigation and adaptation - was intensified in the period 2001-2004 as agreed in the Bonn Declaration at CoP6bis. Important elements of the climate change policy aimed at developing countries are assisting developing countries in coping with the adverse effects of climate change, capacity building, transfer of technology as well as involvement of the private sector. This is achieved within the three forms of cooperation, to name multilateral (e.g. GEF, World Bank, UN organisations and multilateral development banks), bilateral as well as private sector partnerships.

The Netherlands' general climate change policy for development co-operation has the following areas for support:

- adapting to the adverse effects of climate change;
- building capacity and developing institutes required for climate policy as well as for the clean development mechanism;
- transferring CO_2-reducing technologies;
- contributing towards providing access to energy services for the poor, where possible through low carbon development.

Table ES.3 shows relevant funding by Netherlands (in mln euro).

Research and systematic observation

Research activities in the Netherlands cover a range of climate system, impact and policy support studies. The activities are characterised by intensive participation in international and European programmes and clustering into a few larger national research programmes. The national research programmes actively seek private sector participation. Results from the international, European and national research programmes are made available through reports, publications and the internet.

The Netherlands research on climate change is well embedded in, acknowledged by and co-steered in the three large international scientific programmes in the field of global change research. Extensive support is also given to the work of the Intergovernmental Panel on Climate Change (IPCC) e.g.

Table ES.3 Amounts and categories of funding for the years 2001 to 2004 by the Dutch Minister for Development Co-operation (in mln €)

		2001	2002	2003	2004
Bilateral					
	Mitigation[1]	45.58	35.98	52.92	54.46
	Adaptation[1]	4.50	10.78	9.38	6.58
Multilateral					
	UNDP	0.16	0.53	0.84	1.31
	UNEP		0.60	3.53	2.10
	AsDB	0.94	1.69	1.48	0.69
	AfDB			1.66	1.30
	WB[2]	n.a.	n.a.	n.a.	n.a.
GEF		5.34	5.74	10.75	7.57
New funds					
	LDC				0.10
	SCCF				
	Adaptation Fund				
Total		**56.52**	**55.31**	**80.56**	**74.10**

1 Including 'Principal' and 'Significant' projects. A weight factor of 0.4 is applied for the financial contribution of 'Significant' projects following OECD-DAC guidelines.
2 The Netherlands and the World Bank have signed a partnership agreement. Figures on the direct contribution to climate change projects are not available.

expert contributions, office facilities, etc. Many of the leading Dutch institutions have research projects under the European Union Framework Programmes.

National research activities include inter alia the National Research Programme on Global Air Pollution and Climate Change (NRP-CC), the National Research Programme 'Climate changes spatial planning' (BSIK-KvR Programme) and R&D Programmes of different Ministries. The first two programmes are specifically focussed on climate change as such; they have combined their program offices, communication strategy and website for outreach *(www.klimaatportaal.nl)*. These programmes include a wide range of research projects in four clusters: climate scenario, mitigation, adaptation and integration/communication.

Most R&D programmes of the various ministries focus on mitigation technologies and options. One of the larger ones, concerns the energy transition approach, that was started after the publication of the Fourth National Environmental Policy Plan in 2001 by the Dutch Ministry of Economic Affairs. It distinguishes a number of preferable transition paths clustered in five main roadmaps (green resources, alternative motor fuels, chain efficiency, efficient and green gas and renewable electricity).

Education, training and public awareness

Within the Netherlands the majority of the general public are concerned about climate change. This is confirmed by various surveys and illustrated by the increased attention that the media are paying to climate change. A trend in public awareness that has been seen since 2001, concerns increased attention for the possible consequences of climate change and adaptation in the Netherlands.

All ministries involved in climate policy implement activities in education, training and public awareness in their respective fields of responsibility. They provide information on their websites and launch public information campaigns. These aim for example at increasing energy efficiency and use of renewable energy through easy to implement actions.
As part of their task in education, training and raising public awareness, the ministries involved in climate policy commission intermediary organisations to implement certain tasks. Government agency SenterNovem focuses on professional parties, such as industry, local governments and companies providing service in energy and the environment. MilieuCentraal concentrates on consumers. Communication activities are also implemented under the framework of 'Climate changes spatial planning' through the Platform Communication on Climate Change.

An example of a communication activity that illustrates the increased attention for adaptation to climate change impacts is the campaign 'The Netherlands lives with water', which was started in 2003 by the Ministry of Transport, Public Works and Water Management, together with provinces, water boards and municipalities. The campaign was initiated on the occasion of the new Dutch 'Water Policy in the 21st Century'. The aim of the campaign is to increase the awareness among the general public that the climate is changing and that the government is working to take measures to adapt to this, so that the Netherlands will remain a safe and comfortable place to live in.

The ministry of Housing, Spatial Planning an the Environment also contributes to education, training, and raising public awareness through the subsidy programme entitled Social Organisations and the Environment (SMOM). The scheme focuses on environmental projects and programmes by non-profit organisations. Several projects on climate change are approved each year.

1. Introduction

This report describes the general circumstances, emissions and policies and measures with regard to climate change in the Netherlands, pursuant to article 4 and 12 of the United Nations Framework Convention on Climate Change (UNFCCC). It is the fourth National Communication of the Netherlands and mainly describes the developments since the previous third National Communication of the Netherlands (2001). In preparing this report, the UNFCCC guidelines have been followed (FCCC/CP/1999/7). The chapters in the report are as prescribed by these guidelines. Since the Kyoto Protocol went info force beginning 2005, also supplementary information has to be reported, as set down in article 7.2 of the Kyoto Protocol. The guidelines for this supplemental reporting have been followed as well (FCCC/CP/2001/13/Add.3). The various issues are dealt with under the appropriate sections in the report. As an aid to the reader, annex 1 indicates where the supplementary information can be found.

In parallel to this report, the following other reports are published, which also contain information on the Netherlands' climate policy:

- the Netherlands' Report on Demonstrable Progress under article 3.2 of the Kyoto Protocol;
- the Greenhouse Gas Emission Trends & Projections in Europe 2005 report of the European Environment Agency (EEA);
- the annual report of the European Commission (EC) to the European Parliament and the Council on progress towards achieving the community's Kyoto target;
- the European Commission's Report on Demonstrable Progress;
- the European Commission's 4th National Communication;
- the second evaluation of the Netherlands' National Climate Policy Implementation Plan (NCPIP).

This report was written in parallel to the Netherlands' Report on Demonstrable Progress. In comparison, this 4th National Communication provides more detailed information on a wider range of subjects. It thus served as background information for the Report on Demonstrable Progress. The EEA and EC reports contain, apart from information on a European level, information specifically for the Netherlands on historical greenhouse gas emissions and projections. This is the same as used in this report and the Netherlands' Report on Demonstrable Progress. The reports are therefore consistent. Policies and measures are described and taken into account in the projections as known on 1 December 2004. Since then, policy has developed further. These further developments have not been taken into account in the figures in this report and the Netherlands' Report on Demonstrable Progress in order to maintain consistency with the EEA and EC reports. They have, however, been taken into account in the second evaluation of the NCPIP. For information, the main conclusions of the second evaluation of the NCPIP have been added to this report and to the Netherlands' Report on Demonstrable Progress. Overall, the general picture does not change significantly because of the further policy developments.

In the 3rd National Communication major attention was paid to the National Climate Policy Implementation Plan of the Netherlands (NCPIP, 1999). In here it was decided that the Netherlands intends to achieve its Kyoto target both by domestic policies and measures and by using the Kyoto mechanisms. This plan still forms the basis for Dutch climate policy. Since 2001, policy has developed further and several evaluations have taken place. These are taken into account in this report where relevant.

2. National circumstances relevant to greenhouse gas emissions and removals

2.1 Government structure

The Netherlands is a constitutional monarchy. The legislative powers are vested in the national government, the 12 provinces and the 467 municipalities (responsible, for example, for granting environmental licences and permits). The Netherlands Parliament consists of a First Chamber (75 members, elected by the provinces) and a Second Chamber (150 members, elected directly by the citizens). The legislative process is realised in a combined effort by the 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 Government Gazette ('Staatscourant'). Policies can also be formulated in memoranda to Parliament. Commitments in these documents are politically binding and can be elaborated by legislation e.g. a Decree or Order in Council or other binding agreements such as Long-Term Agreements.

The Environmental Management Act of March 1, 1993 stipulates that the government must draw up a National Environment Policy Plan (NEPP) every four years, as well as an annual Environment Programme. The government presents the NEPP to Parliament. If Parliament approves the Plan, it becomes permanent. Not every commitment (e.g. emission targets) in the Plan needs to be legislated.

The Ministry for Housing, Spatial Planning and the Environment (known as the Ministry of VROM) is responsible for the environmental legislation and policy development. Other Ministeries are responsible for integrating environmental policy targets and endorsing the NEPP within their respective fields. Many parties are involved in the policy-making process, e.g. economic sectors, consumers, advisory councils, research institutes, environmental protection organisations, and various trade unions and federations. The formulation and implementation of policy is usually carried out in collaboration or consultation with relevant 'target groups'. Good communication between government and market parties is given high priority. Environmental protection organisations also play an important role in the Netherlands, e.g. through participation in advisory councils.

Figure 2.1 Development of the total population, number of households and the number of singles' households in the Netherlands in the period 1980-2000 (Source: CBS, 2005)

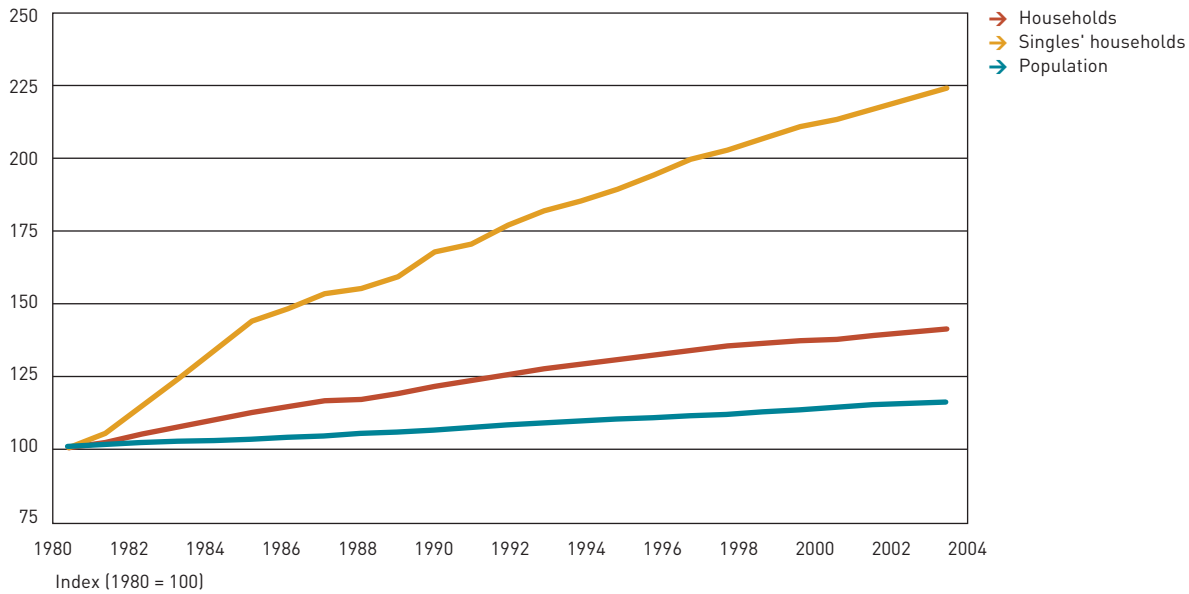
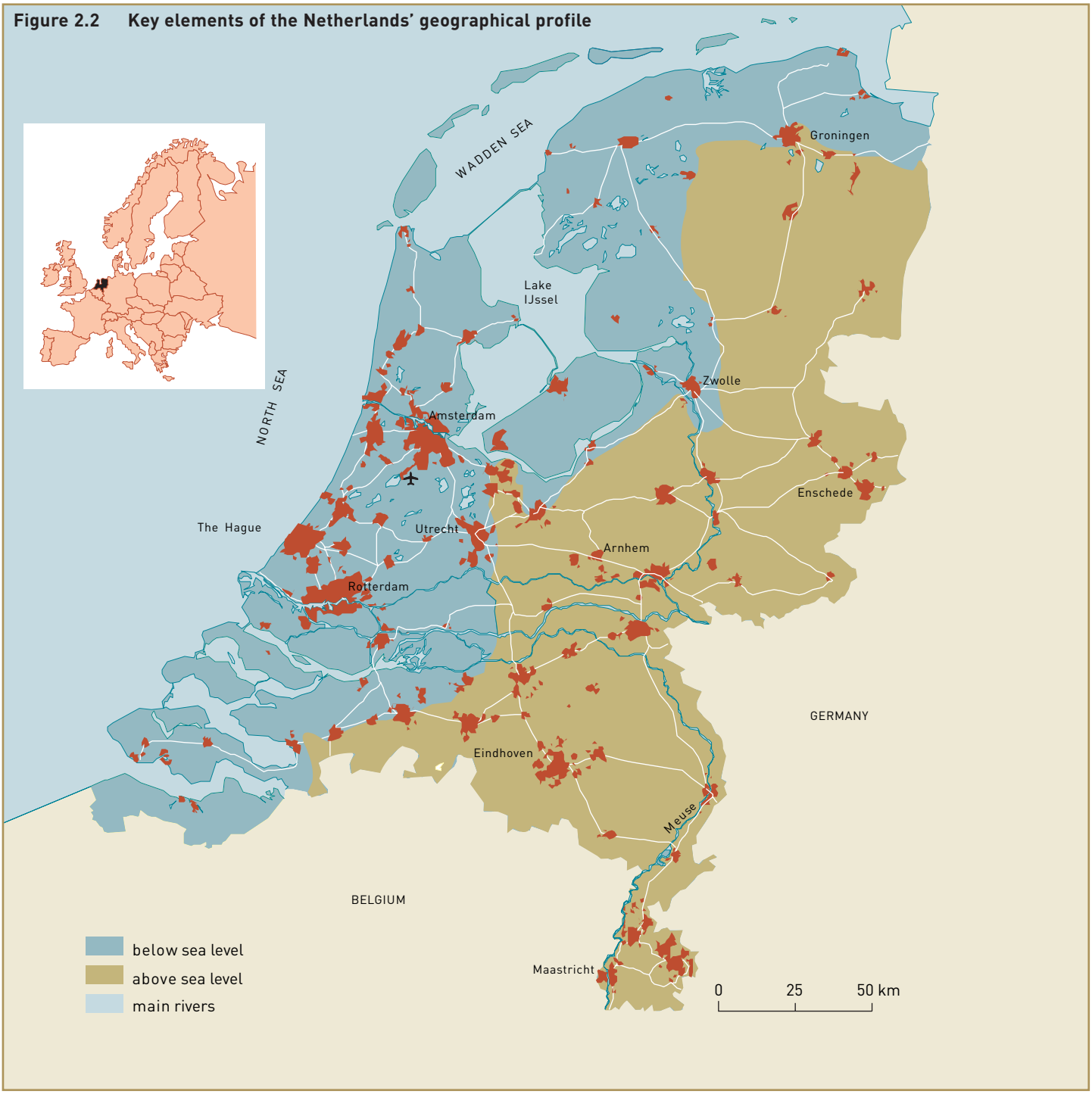


Figure 2.2 Key elements of the Netherlands' geographical profile



2.2 Population profile

The period 1980-2004 saw a 15% population increase in the Netherlands: from 14.1 million to 16.3 million inhabitants (Figure 2.1). Annual growth fell from 0.8% in 1980 to around 0.5% in 1996. Since 1998, annual growth has increased but, since 2002, the growth rate has dropped again to around 0.5% per year. The population density increased from 415 to 481 persons per km^2 (CBS/Statistics Netherlands, 2005). Another important demographic factor influencing the pressure on the environment is a decrease in the number of persons per household (from 2.8 in 1980 to 2.5 in 1990 and 2.3 in 2004). The number of households increased from 5 million in 1980 to almost 7.1 million in 2004, while the percentage of single-person households increased from 22% to around 34% (CBS, 2005).

2.3 Geographical profile

The Netherlands is a low-lying country situated in the delta of the rivers Rhine, IJssel and Meuse, with around 24% of the land 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 with controlled water levels have been created. The eastern part of the Netherlands includes Pleistocene ice-pushed ridges covered with wind-borne sand deposits. The southern part consists mainly of Meuse terraces with loess deposits or wind-borne 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. The surface area of the land plus inland and coastal waters amounts to 41,526 km^2. The land surface covers 33,784 km^2 and consisted in 2000 of 69% agricultural land, 10% forest, 4% natural land and 14% for urban uses and infrastructure. The population density is highest in the 'Randstad' (a cluster of cities in the western part of the country consisting of Amsterdam, Rotterdam, The Hague and Utrecht, and the towns in between). Rotterdam is important for its oil refineries and ports, which are among the largest in the world. Schiphol Airport near Amsterdam is important as an air transit point for the rest of Europe. Some geographic features are shown in Figure 2.2.

2.4 Climate profile

The Netherlands is located in the so-called 'temperate zone'. Due to strong maritime influences the climate is much milder than average conditions at the same latitude. The 30-year annual average temperature in the centre of the country is 9.8°C, while the mean annual average at 52°N is close to 4°C. Apart from this larger scale maritime, or rather oceanic effect, there is also a small effect caused by the bordering North Sea. This results in marked gradients in most climatologic elements within the first tens of kilometres from the coast. Inland gradients are generally small. Table 2.1 compares some climatologic characteristics of the coastal and inland climate of the Netherlands.

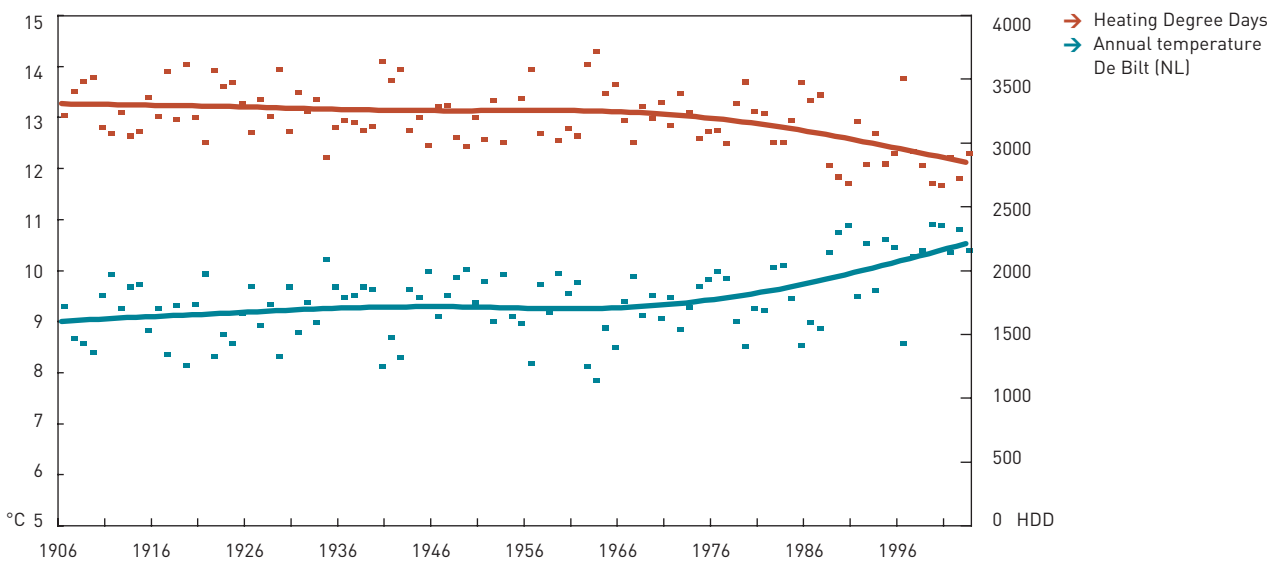
Throughout the country, mean winter temperatures are just above 0°C and mean summer temperatures are around 16°C. Coastal regions have more hours of sunshine than inland regions and a relatively small annual and diurnal temperature range. An increase of around one degree has been measured in the Netherlands over the last 100 years, with some of the

Table 2.1 Some climatological characteristics for De Kooy (coastal station) and Twente Airbase (around 150 km from the coast), based on observations for the period 1971 to 2000

	De Kooy (coastal station)	Twente Airbase (inland station)
Mean temperature (°C)		
- January / July	3.2 / 16.9	2.1 / 17.0
Mean daily temperature amplitude (°C)		
- January / July	4.4 / 6.4	5.0 / 10.2
Mean relative humidity (%)		
- January / July	88 / 82	89 / 78
Mean annual duration of sunshine (hr)	1,649	1,443
Mean annual wind speed at 10m h (m/s)	6	4
Mean precipitation (mm)		
- Annual	743	758
- Driest/wettest month	35 / 92	43 / 77

Source: KNMI (Royal Netherlands Meteorological Institute), 2005

Figure 2.3 Development of the average surface temperature and the number of heating degree days (HDD) in the Netherlands during the period 1906-2003 (Source: KNMI, 2005; Visser, 2005)



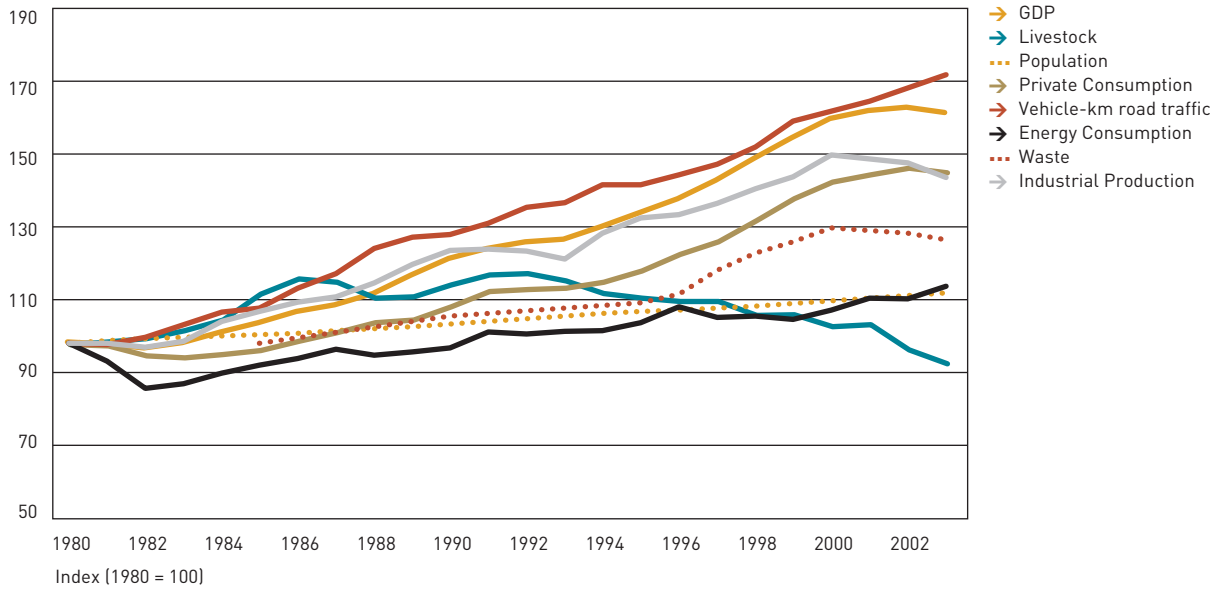
warmest years occurring in the last 10 years (KNMI, 2005). With an average temperature of 10.3°C, 2004 was the eighth year in a row with an average temperature above 10°C: the 30-year average being 9.8°C. This also translates into a drop in the annual number of so-called 'heating degree-days' (HDD), which is an indicator of the demand for space heating (Figure 2.3). Mean monthly precipitation exhibits a rather strong annual cycle; the driest months are February, April and May, the wettest are October and November. The variation in mean annual precipitation deviates locally by no more than 8% from the national mean of 771 mm (KNMI, 2005).

2.5 Economic profile

The Gross Domestic Product (GDP) of the Netherlands was € 337 billion in 1990 and € 454 billion (using 2003 prices) in 2003: an increase of 35% (CBS, 2005). During the period 1980-2001 real GDP increased annually, apart from 1981 and 1982 (see Figure 2.4), with annual growth rates of between 1% and 4%. The growth of GDP per capita was around 1% to 1.5% annually at the beginning of the 1990's, except for 1993 (0.1%). During the years 1996-2000 this increase was approximately 3% annually. However, GDP did not increase during the period 2001-2003. The years 2002 and 2003 showed a decrease in GDP per capita. From 1998-2001 economic growth in the Netherlands was somewhat higher than the average for European Union countries, but this situation has been reversed over the last few years.

However, the Netherlands still performs well on the world market and ranks relatively high on the list of agricultural exporters. The principal exports are machinery and transport equipment (29% of the total value of exports in 2003), chemicals (13%) and food and other livestock products (16%). Exports increased by around 97% between 1990 and 2003 (in constant prices). This growing export trend is inextricably linked to developments in the freight transport sector. Principal imports to the Netherlands in 2003 included machinery and transport equipment (33% of the total value), food and other livestock products (10%) and chemical products (10%). The transportation sector has traditionally been an important activity due to the country's favourable location for transporting

Figure 2.4 **Trends in volume development in the Netherlands during the period 1980-2003**
Sources: MNP (Netherlands Environmental Assessment Agency), 2005/ CBS, 2005



goods from the harbours to the EU inland destinations. The geographic situation also favours oil refineries in Rotterdam, from which large amounts of oil products are exported.

Another characteristic of the Netherlands is the availability of large domestic reserves of natural gas; this is one of the factors contributing to a relatively large chemical industry (using natural gas as chemical feedstock). The many refineries have also contributed significantly to this large industrial sector.

Over the last few decades the volume of many important variables, such as GDP, mobility, energy consumption and waste production, which strongly influence emissions development, has increased in the Netherlands, as illustrated in Figure 2.4. However, from 2001 onwards some indicators, e.g. industrial production, private consumption and waste, show a downward trend. For livestock numbers this downward trend started around 1990, due to the milk quota system and various animal diseases. The growth in mobility, i.e. road transport, expressed as vehicle-km (passengers and freight), seems unaffected by the economic stagnation that started around 2001. During the period 1980-2003, the GDP and consumer expenditure increased faster than the number of inhabitants, but the growth in energy consumption follows this number. Apart from transportation (and energy consumption in Belgium) the indicators presented in Table 2.2 show that the environmental pressure in the Netherlands, compared to neighbouring countries, ranks among the highest.

Private consumption increased by 36% over the period 1990-2003 (Figure 2.4). Over the last decade, households in the Netherlands have purchased a relatively high number of electrical appliances, e.g. the percentage of households owning a PC increased from 26% in 1990 to 74% in 2003 (CBS, 2005), while the ownership levels of washing machines, colour TVs, microwave ovens etc. are high. Combined with the increasing number of households this has led to a significant growth in residential electricity consumption.

Table 2.2 **Pressure on the environment per km² and per inhabitant by a number of social developments in the Netherlands compared with neighbouring countries in 2000, 2001 or 2002**

Index (NL = 100)	Population	GDP	Energy consumption (in cars)	Passenger cars	Passenger-km	Fertiliser	Cattle	Pigs
	per km²	per capita	per capita	per capita	per capita	per km²	per km²	per km²
Netherlands	100	100	100	100	100	100	100	100
Belgium	87	97	114	109	108	?	53	81
Germany	60	93	87	128	92	74	34	27
United Kingdom	62	93	79	105	110	79	24	8
Denmark	32	102	76	83	131	75	38	111

Source: Eurostat, 2005; IEA (International Energy Agency), 2004a

2.6 Energy

After a drop in domestic energy consumption during the economic recession at the beginning of the 1980s, energy consumption in the Netherlands increased by 2.4% annually during the period 1985-1990. From 1990-2003 the annual increase was around 1.1%, except for 1995 when it was 2.7%, which was partly due to the revival of organic chemistry. Between 1990 and 2003 energy consumption increased in all sectors, with the exception of the residential sector (see Table 2.3): approximately 21% in the transportation sector, 11% in industry, and 25% in the energy sector (mainly due to increased cogeneration and waste incineration).

Despite the increase in energy use, energy intensity (energy use per € GDP) fell during the period 1990-2003 by almost 15%, or 1.2% annually. This decline was mainly due to energy conservation, which amounted to 1.0% annually (Boonekamp, 2004) over the entire period. However, this decline occurred between 1990 and 2000: from 2000-2003 the energy intensity showed an upward trend due to increasing energy use and stagnation of GDP growth.

Although the overall energy intensity decreased during the period 1990-2003, electricity use for these years increased by 43%, thus exceeding the growth in GDP, which was 35%. The purchase levels of electrical appliances formed an important cause. In the residential sector electricity use increased by 2.7% annually from 1990 onwards. Industrial electricity consumption grew slower than GDP, on average by 1.5% annually over the period 1990-2003. The growth of electricity use in the service and construction sectors was around 3.5% during the period 1990-2003. The percentage of electricity (within the total energy demand in the Netherlands) has increased from 10% to 11% over the past decade, though this is still one of the lowest figures in the European Union (EU).

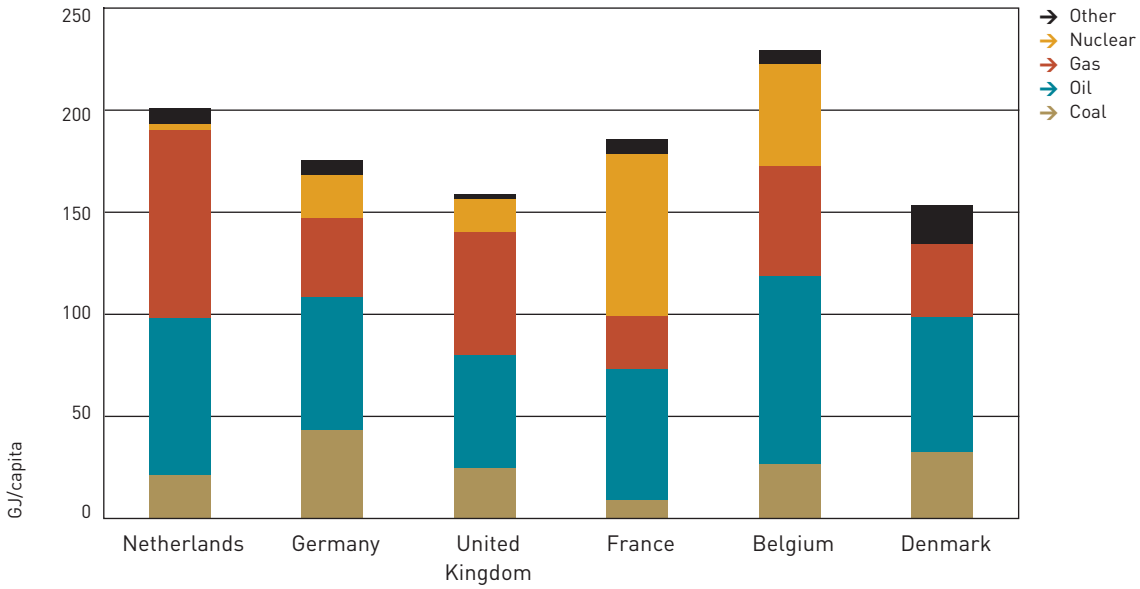
Energy intensity in the Netherlands is somewhat higher than the EU-15 average. This can be explained by the structure of the Netherlands economy, particularly the relatively high share of the basic materials processing industry. The fuel mix in the Netherlands also differs substantially from that in other countries (Figure 2.5). The percentage of natural gas in the total end-use for energy was nearly 50% in 2002, which is extremely high.

Table 2.3 **Energy use (total of all appliances and all energy carriers, including electricity) per sector in PJ (after temperature correction) for the period 1980-2003**

Target group	1980	1985	1990	1995	2000	2003
Residential sector	516	461	441	449	444	425
Transport	349	350	400	396	463	482
Industry	985	887	1003	1017	1052	1116
Other energy demand sectors	364	391	450	482	526	539
Energy sector	348	325	349	370	386	436
Refineries	151	111	151	173	180	183
Other energy supply sectors	8	-27	14	44	46	54
Total domestic consumption	**2721**	**2498**	**2808**	**2931**	**3079**	**3234**

(source: CBS, 2005)
Energy use of combined heat and power is assigned to the sector that owns the installation. However, in the case of 50/50 ownership (Joint Ventures), installations are assigned to the energy sector

Figure 2.5 **Energy use per inhabitant by fuel type in the Netherlands, compared with other countries in 2002**
Sources: IEA, 2004b



2.6.1 Gas production

Since 1980 natural gas production in the Netherlands has totalled approximately 80,000 million Nm^3 per year, but in recent years this has dropped to around 70,000 million Nm^3 per year. The policy of mitigating the depletion of the large Slochteren field to extend its use has increased the (mainly offshore) exploration and exploitation of other relatively small gas fields. Around half the initial reserves have now been used up, causing gas pressure in the fields to drop. To maintain the production rate the number of wells, pumps and compressors is steadily increasing, resulting in an energy use for gas production of over 1% of the total amount produced.

2.6.2 Electricity production

The increase in electricity use (43%) during the period 1990-2003 was mainly 'countered' by increased cogeneration and, from 1999 onwards, by increased electricity imports. Boosted by a doubling of the installed capacity, the amount of combined heat and power generation increased substantially from 1990 onwards, resulting in less fuel consumption for total power generation. Until 1999, imported electricity, mainly from Germany and France, contributed around 10-12% to domestic demand (Table 2.4). However, since 1999, the liberalisation of the European electricity market has resulted in the net import of electricity increasing to 15-16% in recent years.

New coal-fired power plants came into operation in 1993 and 1994. One of these was a 250 MWe coal gasification demonstration plant. Over the past 10 years the conversion efficiency of conventional gas-fired power plants has increased from 40% to 46% and the newest gas-fired STEG (steam and gas turbine) power plants have an efficiency of 55%. Over the same period the efficiency of coal-fired plants increased from 38% to 41%.

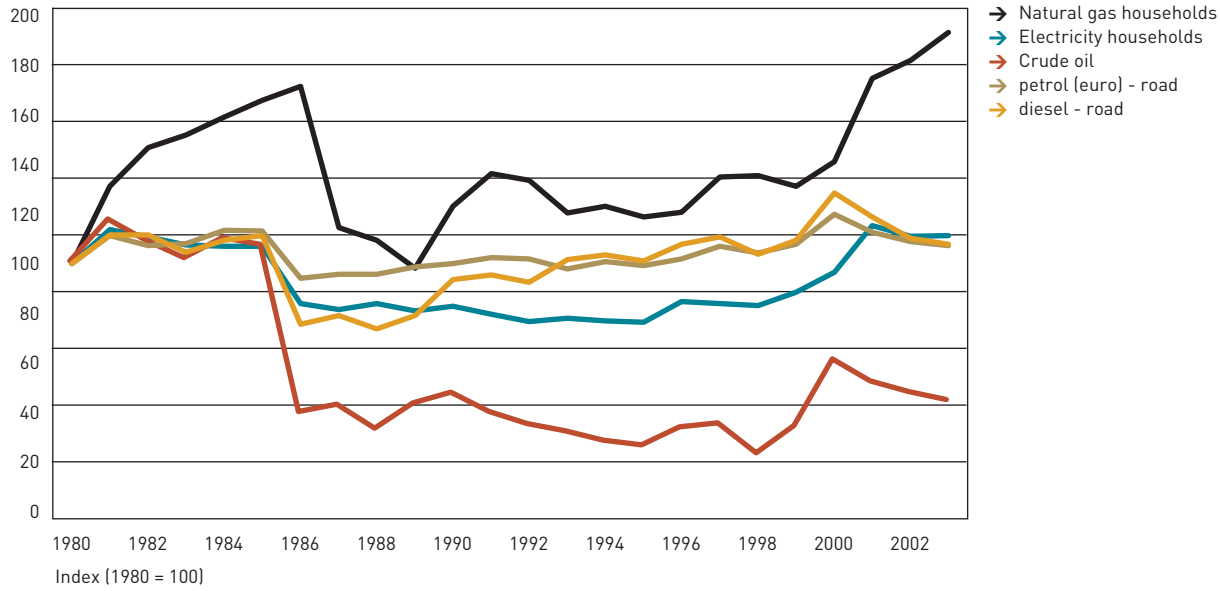
During the period 1990-2004 the production of renewable electricity has increased by a factor of 7, which resulted in a 4.5% share in electricity use in 2004. Almost 60% of this stems from biomass combustion, and 38% from wind energy. The installed capacity of wind power amounted to approximately 880 MWe by the end of 2003. The growth rate has been particularly high in recent years. This is clearly a result of the Dutch

Table 2.4 Electricity imports and exports in the Netherlands for the period 1990-2003

Electricity (in PJe)	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total final electricity	275.0	318.1	330.1	342.7	355.5	363.6	374.7	383.3	388	393.4
Total imports, of which:	34.8	43.1	40.6	47.2	44.0	80.7	82.6	77.4	75.1	74.9
France	16.3	19.2	12.3	12.2	11.7	22.6	18.9	11.1	7.0	2.2
Germany	18.1	20.8	26.3	32.8	29.0	49.1	51.6	29.3	20.0	23.6
Belgium/Luxembourg	0.4	3.1	2.1	2.1	2.5	3.4	8.2	9.3	21.4	25.8
UK	0	0	0	0	0	4.4	3.8	5.2	2.1	1.2
Other	0	0	0	0	0	1.1	0.1	22.4	24.7	22.1
Exports:	1.7	2.1	2.5	1.7	1.5	14.3	14.5	15.2	16.2	13.7
Net import	33.1	41.0	38.1	45.5	42.5	66.4	68.1	62.2	59.0	61.2
Net import as % of total	12%	13%	11%	15%	12%	18%	18%	16%	15%	16%

Source: CBS, Tennet

Figure 2.6 Development of energy prices in the Netherlands during the period 1980-2003, corrected for inflation
Source: www.energie.nl



Government's stimulation programme, which subsidises the extra production costs of renewable electricity (where these are higher than the costs of conventional electricity production).

2.6.3 Refineries

The Netherlands has six large refineries, with four of them located in Rotterdam. These refineries have a total capacity of 60 million tons of crude oil. In recent years, the degree of utilisation has been 100%. This high production level is related to the high efficiency rate, the proximity of many petrochemical industries and the influence of the German demand. This makes Rotterdam the world's largest supplier of bunker fuel oil and means that Amsterdam Schiphol Airport is amongst Western Europe's largest suppliers of jet fuel bunkers. The refineries in the Netherlands produce many relatively light oil products (LPG, naphtha, petroleum) from heavier crude oil with a sulphur content of 1.5%. Between 1990 and 2003 the energy used to process a barrel of crude oil increased by 17% as a result of deeper conversion to lighter products, the use of heavier crudes and stricter legislation regarding the sulphur content of fuels.

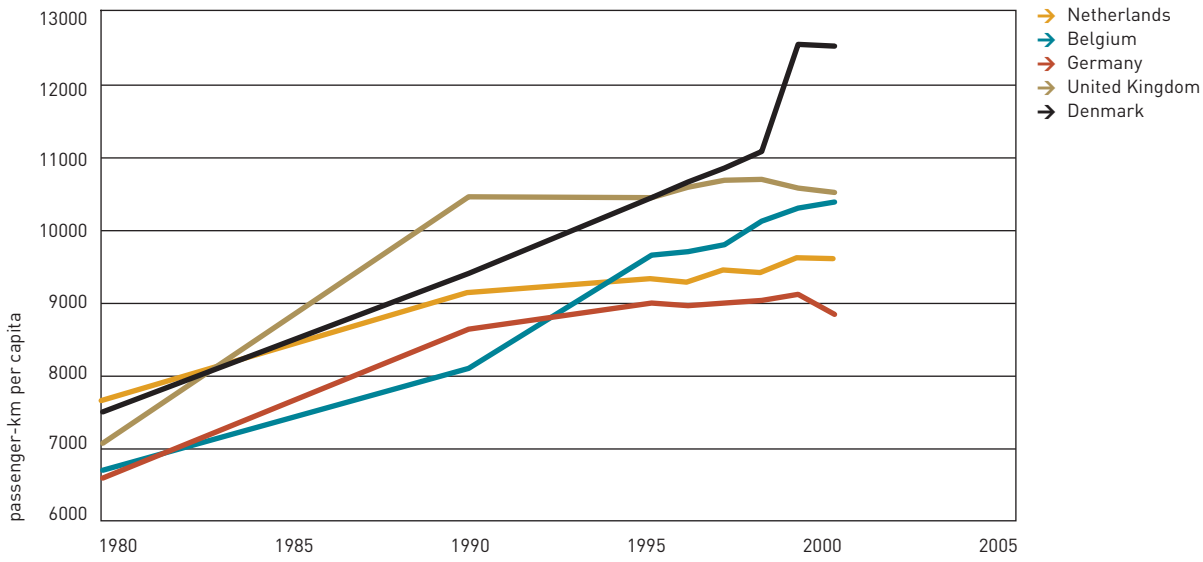
2.6.4 Energy prices

During the period 1986-1999, the real price of crude oil (i.e. corrected for inflation) showed a decreasing trend. However, prices since then have gone up considerably (Figure 2.6). End-user electricity and gas prices (also corrected for inflation) followed the crude oil price trend during the period 1985-1996 but, due to the 1996 introduction of a regulatory energy tax on natural gas, electricity, light fuel oil, heating oil and LPG, prices have since continued to increase (especially for households). The effect of this tax is illustrated in Figure 2.6. Despite this increase, household gas and electricity prices in 2004 were only slightly higher than the average for EU-15. For large consumers, differences between EU countries are even smaller (Eurostat, 2005).

2.7 Transportation

The volume of transportation is influenced by demographic, economic, spatial and infrastructure factors. Air and international shipping are highly concentrated: Schiphol Airport handles 95% of all air passengers and air freight, with the port

Figure 2.7 Development of passenger-km of passenger cars in the Netherlands, Belgium, Germany, UK and Denmark (period 1980-2000). Source: Eurostat



of Rotterdam handling 80% of the total freight in tonnage. Between 1990 and 2003 the number of car-km of passenger cars increased by 22%, which was less than the increase in GDP (CBS, 2005). On the other hand, the increase in ton-kilometre road transport during the period 1990-2000 was 44%, higher than the trend in GDP (Eurostat, 2005).
In 2000, passenger transport in cars per capita in the Netherlands was lower than in neighbouring countries, except Germany (Figure 2.7). This may be explained by the fact that fuel prices for end-users in the Netherlands are higher than in the other countries, due to the levy policy of the Netherlands government. The 44% increase in freight transport (in ton-km) for the period 1990-2000 is slightly higher than the average for the EU-15 countries.

2.8 Industry

Table 2.5 shows the structure of the economy and its development over the last decade. In 1990, commercial and public services accounted for around 60% and industry for 17% of GDP. The other sectors each accounted for less than 10% of GDP. During the period 1990-2003 the total industrial production (in constant prices) grew only marginally. As a result, the industrial sector's share fell from 17% to 13%. Over the same period, gross value-added of commercial and public services grew more than 50%, resulting in a 68% share in 2003. Compared to other EU countries the industrial structure of the Netherlands is relatively energy-intensive in terms of energy use per € production value. This is caused by several factors, including the chemical industry, which produces a high percentage of base chemicals compared to chemical industries in Germany, UK or Denmark.

2.9 Waste

The total amount of waste produced in 2002 (excluding polluted soil, dredging sludge and animal manure) amounted to 58 million tons. Figure 2.8 shows the main sources of waste in the Netherlands in 2002.
Between 1990 and 2002 the recycle rate increased from 60% to 77% of the total amount (Figure 2.9). This included 46% of residential and office waste, 83% of industrial waste and 94% of

Table 2.5 Development of GDP (in 2003 prices) and the breakdown per economic sector (1980-2003) (source: CBS, 2005)

		1980	1990	1995	2000	2003
Real GDP (in €1000 million; price level of 2003):		270	337	374	449	454
Total gross value added (market prices) in %:						
Mineral Production		5	3	3	2	2
Agriculture		4	4	3	2	2
Industry		16	17	17	15	13
of which:	Food and tobacco industry	3	3	3	3	3
	Chemical, rubber and synthetics industry	3	3	3	3	2
	Metals industry	8	6	5	5	4
	Other industry	3	5	4	4	4
Construction and installation firms		7	6	5	5	5
Energy and water suppliers		2	2	2	2	2
Refineries		2	1	1	1	1
Commercial and public services		58	60	64	66	68
of which:	Trade, hotels, catering and repair shops	13	15	14	14	13
	Transport, storage and communication	6	6	6	6	6
	Financial and business services	14	18	22	25	26
	Government	15	12	11	10	11
	Healthcare and other services	10	10	10	10	12
Unspecified		6	6	5	6	5

demolition waste. Waste products from agriculture and coal-fired power plants were almost fully recycled. However, some 13 million tons are not reused or recycled, of which residential waste has the largest share (35%), followed by industrial waste (23%) and office waste (19%). In 2002, almost 4 million tons of waste was disposed of in landfill sites. This waste contained around 10% degradable carbon, leading to methane emissions (a few megatons CO_2-equivalents). The residual waste that is not reused or landfilled is incinerated (8.6 million tons, almost half of which comes from the residential sector) or discharged into water (RIVM/CBS/WUR, 2000). Only clean water that remains from the treatment of watery waste is discharged.

The amounts of waste dumped on landfill sites have been substantially reduced as a result of the government's policy on waste management. This focuses firstly on prevention, secondly on reuse and thirdly on waste incineration with energy recovery. Separation of waste streams at the source for recycling purposes is a key factor, in particular for paper, glass and garden and food wastes (compost). As a result, the maximum target of 4 million tons of landfill waste was met in 2002.

Figure 2.8 Waste generation in 2002 by source category: gross generation excluding polluted soil, dredging sludge and animal manure). Source: RIVM/CBS/WUR (2005)

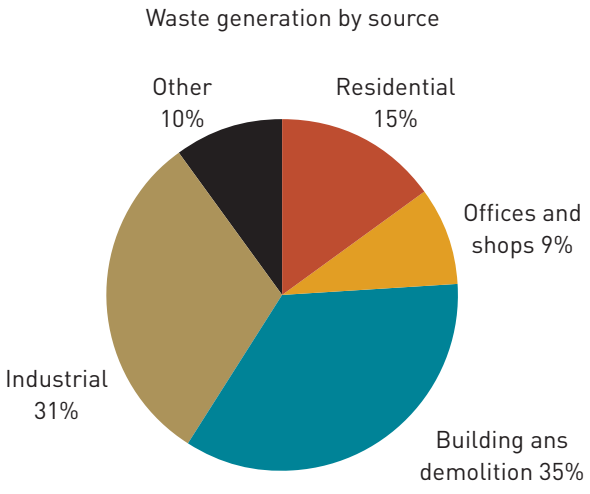
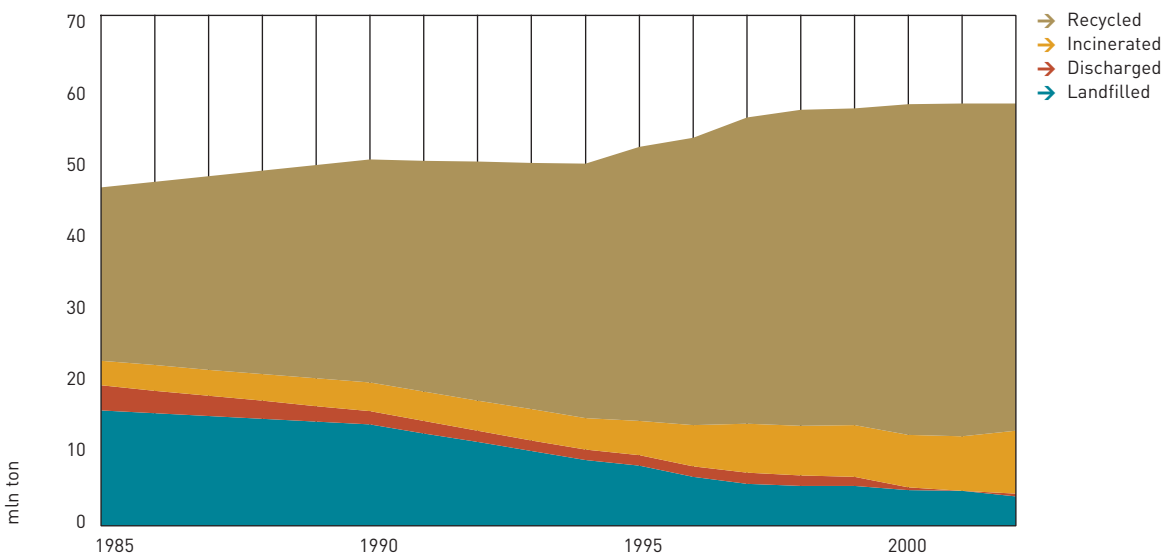


Figure 2.9 Waste generation and methods of disposal 1985-2002. Source: RIVM/CBS/WUR (2005)



2.10 Building stock and urban structure

In 2003 the number of residential homes totalled 6.8 million, of which 2.0 million were apartment buildings. Since 1990 an average of 80,000 new homes have been built annually. However, as of 1998 this construction rate is decreasing (Figure 2.10). In the year 2000, the total area used for residences in the Netherlands amounted to 2,211 km^2, an increase of 4% compared to 1989. The area used for industry and trade increased by 22% over the same period, to 820 km^2.

2.11 Agriculture

Agriculture in the Netherlands focuses on cattle breeding, crop production and greenhouse horticulture. The amount of horticulture in total agricultural production is increasing over time (Figure 2.11). The amount of fuel consumed by this sector is comparable to fuel consumption in the commercial and public service sector (taking cogeneration into account). Due to the quota system for milk production and animal diseases (such as BSE), the number of cattle being raised is steadily decreasing. Between 1990 and 2004, the number of dairy and non-dairy cattle fell by 22% and 25% respectively. The number of sheep farmed also fell by 27% over this period, while the number of pigs dropped by 20% (compared to 1990) due to an outbreak of classic swine fever and the subsequent restructuring of the pig-breeding sector. Poultry numbers increased by 9% during the 1990-2002 period, but have since dropped by more than 20% due to an outbreak of avian flu (CBS, 2005).

The most important agricultural crops are cereals, maize for fodder, potatoes and sugar beets. Legislation concerning manure has resulted in a more even distribution of manure over agricultural areas. Excess manure is increasingly being used on arable cropland. Legislation concerning ammonia banned the surface spreading of manure and required manure injection and incorporation into the soil. This has resulted in more nitrogen being absorbed by grassland and cropland, supposedly leading to higher emissions of nitrous oxide. A small fraction (6-8%) of the manure is exported.

Figure 2.10 Trends in total number of residences and annual production of new homes. Source: CBS, 2005

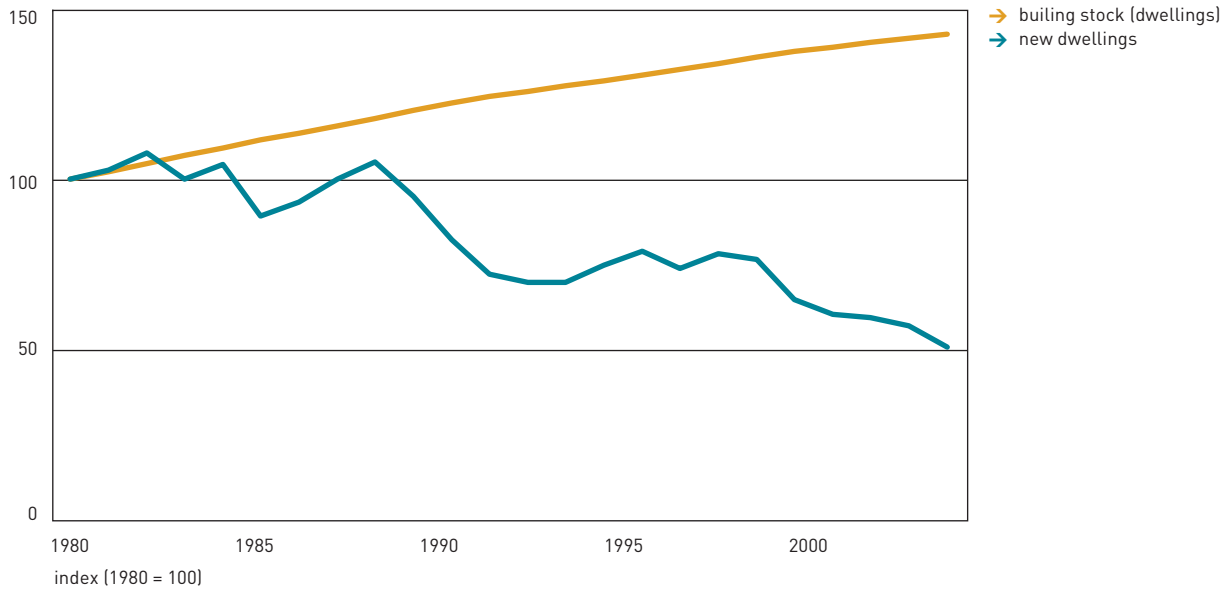
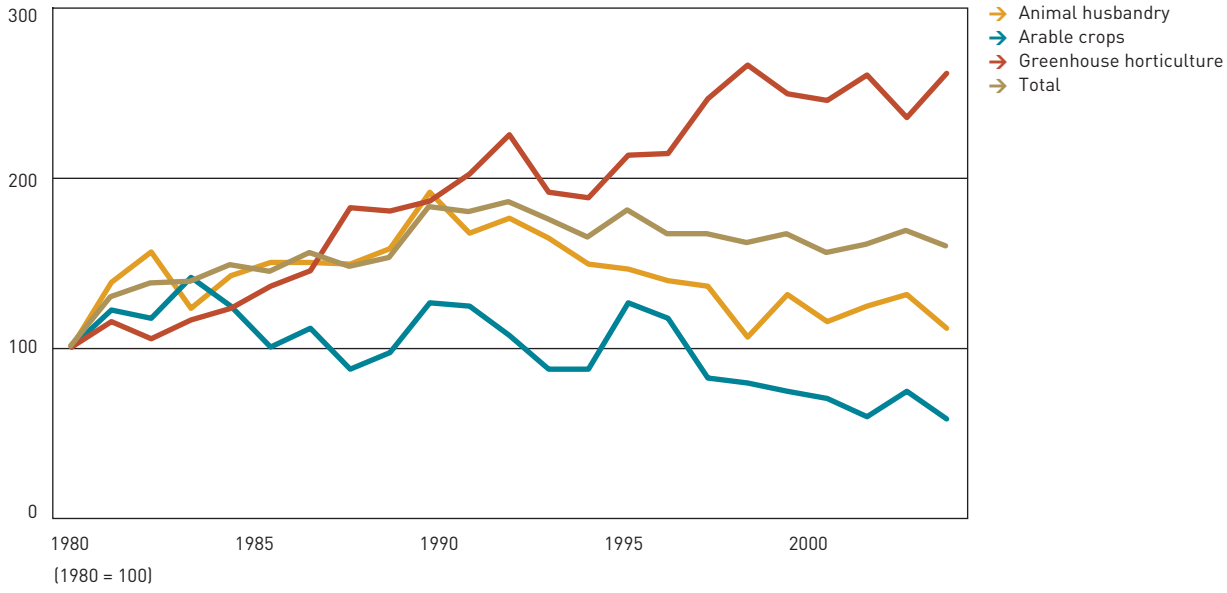


Figure 2.11 Trends in agricultural gross added value by subsector over the period 1980-2002 Source: RIVM/CBS/WUR (2005)



2.12 Forestry

According to the Forest Resources Assessment 2005 the forest area currently consists of 365,000 ha. The forest area therefore amounts to around 11% of the total land area. However, the demand for woodlands is growing even faster, and it is clear that this area is not sufficient to meet the existing demand for woodland and forestry services, such as recreation and nature conservation. Expansion of the area is therefore desirable. In its 2001 policy paper 'Nature for People, People for Nature' the government pledged to create 40,000 ha of new woodland between 2000 and 2020. Currently, some 500-1000 ha of new forest is being established each year. This means that strong additional measures will be necessary to achieve the targets. The greatest need for new woodland is found in urban areas. The government has therefore decided to concentrate woodland expansion in the large urban areas. A new subsidy programme has lifted a major barrier to new planting. However, in a densely populated country with intensive land use, such as the Netherlands, there are many restrictions to new forest plantations.

Originally the largest part of the forest area in the Netherlands was planted using regular spacing and just one or two species in even-aged stands, with wood production being the main purpose. A rapid change towards multi-purpose forests (e.g. nature, recreation), which was first started in the 1970s, had an impact on the management of these even-aged stands. Most of the forest area in the Netherlands is currently managed according to Sustainable Forest Management principles. Newly established forests are also planted according to these principles. The positive results of this management style are clearly shown from the National Forest Inventory, which compares figures over the past 20 years. Unmixed coniferous stands decreased by 10% in favour of mixed stands. Table 2.6 shows the composition of forests in the Netherlands. In broadleaf and mixed stands the average age increased 10 years, and the amount of dead wood remained proportional compared with natural references. Natural regeneration plays an important role in the transformation process from the even-aged, pure stands into those with more species and more age classes. This is why most of the forest area in the Netherlands can be considered 'semi-natural'.

Table 2.6 Composition of forests in the Netherlands in 2001

Type of forest	Share
Unmixed coniferous	30%
Mixed coniferous	6%
Mixed coniferous/broadleaf	21%
Unmixed broadleaf	22%
Mixed broadleaf	15%
Open/young forest	6%
Clear-cut area	0%
Total	**100%**

Source: LNV (Ministry of Agriculture, Nature and Food Quality), 2002

3. Greenhouse gas inventory information

3.1 Introduction

The Netherlands has worked over the past years to timely establish a National System for monitoring of greenhouse gases (GHG) that meets the requirements under the Kyoto Protocol. This system is based on the pollutant emissions inventory process, that is in operation since 1974. Section 3.2 provides a brief description of the National System, using the structure taken from the reporting guidelines. Section 3.3 includes summary information on the (trends in) greenhouse gas emissions and removals since 1990. Annexes 3.1 and 3.2 provide more detailed information on the respective topics.

3.2 Summary description of National System

3.2.1 Institutional and organisational aspects

The Ministry for Spatial Planning, Housing and the Environment (VROM) has overall and coordinating responsibility for climate change policy, including for the monitoring and reporting thereof. Specific responsibility for the monitoring of the LULUCF (land use, land-use change and forestry) sector rests with the Ministry of Agriculture, Nature and Food Quality (LNV).

The Ministry (VROM) has assigned the government agency SenterNovem with the tasks of National Inventory Entity[1] (at least) until April 2006 and the overall coordination of QA/QC (Quality assurance and quality control). In 2006 these arrangements may change.

Actual emission calculations are the responsibility of the Emissions Registration (ER), an annual project aiming at producing emission estimates for some 170 substances. Since April 1, 2004, VROM has assigned the coordination of the ER to MNP. Much basic data and emission estimates are supplied under arrangements that are not specifically GHG-related. These include:

- general statistical data, supplied by Statistics Netherlands (CBS) under its legal tasks and under priorities set by a commission;
- emissions data for sinks and agricultural soils, supplied by the Alterra research institute as part of their 'legally required research activities' for the Ministry of Agriculture (LNV);
- waste statistics supplied by the Waste Coordination Platform (AOO; recently merged with SenterNovem) under a broad contract with the Ministry of Environment (VROM).

The provision of these data and supporting tasks in emission calculations is ensured via covenants between the ER and the institutes involved.

The various roles and responsibilities of each organisation involved in emission estimates are further detailed and stipulated in monitoring protocols for emission estimates. Towards the end of 2005, a Monitoring of Greenhouse Gases Act should come into force. This Act will empower the Minister of Housing, Spatial Planning and Environment (VROM) to appoint an authority responsible for the National System and the National Inventory, and will determine that the National Inventory shall be based on methodologies and processes as laid down in the monitoring protocols. Adjustments to the protocols will need to be announced in the official Government Gazette (the Staatscourant).

3.2.2 Methodological and process aspects

The protocols describe the process for collecting activity data, selecting emission factors and methods, and developing emission estimates. To develop these protocols, methods and working processes have been reviewed over the past years and, where needed, these have been improved. Other key processes, e.g. key source identification, uncertainty analyses, documentation and archiving, recalculations, are described in process descriptions. Background documents provide relevant information e.g. on the results of key source and uncertainty analyses.

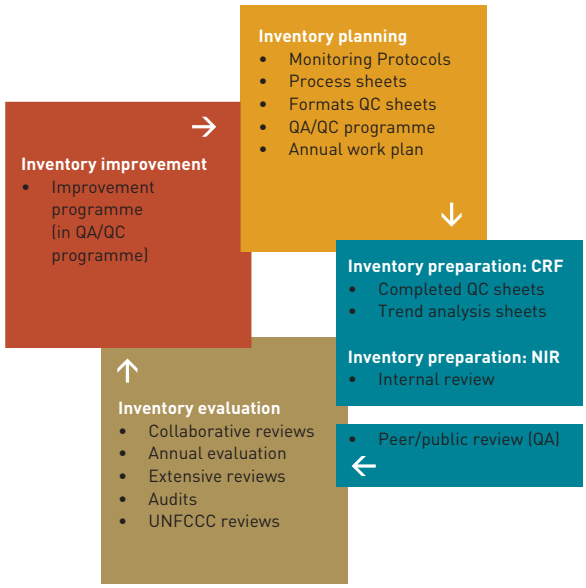
The inventory process is a cyclic process, in line with the Deming Cycle (Plan-Do-Check-Act) for quality management. Figure 3.1 illustrates the process and the main QA/QC tools.

3.2.3 Quality management aspects

The QA/QC activities are elaborated in the QA/QC programme. This describes quality objectives, the QA/QC plan and the time schedule, tasks and responsibilities for implementation. The programme will be updated annually as part of the evaluation and improvement cycle.

1 Also referred to as single national entity in the guidelines under Art.5.1. Contact information: SenterNovem, PO Box 8242, 3503 RE Utrecht, the Netherlands. Phone: + 31 30 2393431

Figure 3.1 Inventory process management cycle in the Netherlands



Besides the tools indicated, the current QA/QC programme includes inter alia:

- quality control activities, aimed at maintaining a transparent process and integrating Tier 1 QC procedures into normal work processes;
- quality assurance through annual basic peer and public reviews. In addition, a mutual review of the NIR 2005 with Belgium is implemented and options for verification and auditing are reassessed;
- documentation and archiving procedures, using an annual catalogue of key documents;
- an improvement programme, encompassing an annual evaluation and improvement cycle and an update of the Tier 2 uncertainty analyses.

A description of the process for official consideration and approval of the inventory is included in the National System's set of key process descriptions.

Over the past years a monitoring improvement programme has been implemented to bring the National System in line with Kyoto Protocol requirements by the end of 2005. This programme has been based on the results of expert workshops, EU workshops, UNFCCC and other review activities and an extensive assessment of the various sectoral methodologies. As a result, crucial improvement options have been implemented, including e.g. a more transparent method for estimating CO_2 emissions from combustion, improved emission factors for agriculture and energy carriers, a monitoring system for the LULUCF sector and an improved method for fisheries. Annex 3.1 provides more detailed information on internal and external evaluation and review processes and their results.

3.3 Summary tables, trends in emissions

The trend in total CO_2-equivalent emissions of greenhouse gases has been calculated using the IPCC Global Warming Potentials (GWP) (UNFCCC, 1999) for a time horizon of 100 years. Table 3.1 summarises the trends in national total CO_2-equivalent emissions for 1990-2003; these are further visualised in Figures 3.2 and 3.3, which show the relative contribution of each gas to annual total emissions. Annex 3.2 provides more detailed information in the CRF (common reporting format) trend tables.

3.4 Descriptive summary, trends in emissions

This section briefly describes major trends in greenhouse gas emissions. For information on associated uncertainties and for more detailed information reference is made to the Netherlands National Inventory Report (Klein Goldewijk et al, 2005).

3.4.1 Emission trends for aggregated greenhouse gas emissions

In 2003 the total CO_2-equivalent emissions of the six greenhouse gases together were 1% point higher than the base year 1990 (1995 for fluorinated gases). The 2003 emissions were 1% point higher (1.5 Tg CO_2) when corrected for temperature (the mild winter). Using temperature-corrected CO_2 emissions in 1990 and 2003, the structural anthropogenic trend of total greenhouse gas emissions over the past 13 years is estimated to be -1%, i.e. 2% points lower than the actual trend of around 1% increase.

The percentage of non-CO_2 greenhouse gases (methane, nitrogen oxide and fluorinated gases) decreased relative to the base year (1990/1995). Consequently, total greenhouse gases in the Netherlands are increasingly dominated by CO_2 emissions.

Table 3.1 Total greenhouse gas emissions in CO_2-eq. and indexed 1990-2003 (no temperature correction)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Nat. Emissions (Tg CO_2-eq)														
CO_2 with LUCF	160,9	165,7	163,8	168,2	168,2	172,3	180,0	173,0	174,9	169,7	171,7	177,1	176,7	179,6
CO_2 excluding LUCF	**158,0**	162,9	161,1	165,5	165,5	169,7	177,3	170,2	172,2	166,9	168,9	174,4	173,9	176,9
CH_4	**25,6**	25,9	25,4	25,0	24,2	23,8	23,2	22,1	21,3	20,2	19,5	19,0	18,2	17,5
N_2O	**21,3**	21,7	22,4	23,1	22,3	22,4	22,2	22,0	21,7	20,9	19,9	18,9	18,0	17,3
HFCs	4,4	3,5	4,4	5,0	6,5	**6,0**	7,7	8,3	9,3	4,9	3,8	1,5	1,6	1,4
PFCs	2,1	2,1	1,9	1,9	1,9	**1,8**	2,0	2,2	1,7	1,5	1,5	1,4	1,4	1,4
SF_6	0,2	0,1	0,1	0,1	0,2	**0,3**	0,3	0,3	0,3	0,3	0,3	0,4	0,4	0,3
Total [group of six][1]	**211,7**	**216,2**	**215,4**	**220,7**	**220,6**	**224,0**	**232,7**	**225,0**	**226,5**	**214,8**	**214,0**	**215,5**	**213,5**	**214,8**
Index (1990=100)														
Index CO_2 [1]	100	103,0	101,8	104,5	104,5	107,1	111,9	107,5	108,7	105,5	106,7	110,1	109,8	111,6
Index CH_4	100	101,0	99,2	97,4	94,6	93,0	90,6	86,2	83,0	78,9	76,2	74,2	71,1	68,1
Index N_2O	100	101,9	105,1	108,5	104,5	105,2	104,1	103,0	101,8	98,3	93,3	88,6	84,3	81,3
Total [group of three][1]	**100**	**102,7**	**101,9**	**104,2**	**103,5**	**105,4**	**108,7**	**104,5**	**105,0**	**101,5**	**101,6**	**103,6**	**102,5**	**103,3**
Index HFCs	100	77,9	100,3	112,8	147,1	135,6	172,9	187,2	210,9	109,9	86,6	33,7	35,3	32,7
Index PFCs	100	99,0	90,1	91,1	87,6	85,4	94,6	102,9	81,8	69,3	71,9	67,0	66,9	66,0
Index SF_6	100	61,6	65,8	69,0	88,0	138,6	143,7	158,7	151,3	145,9	154,2	164,2	165,1	153,9
Index [group of six][1]	**100**	**102,1**	**101,8**	**104,3**	**104,2**	**105,8**	**109,9**	**106,3**	**107,0**	**101,4**	**101,1**	**101,8**	**100,8**	**101,5**
Index (1995 = 100)														
Index HFCs	73,7	57,4	74,0	83,1	108,4	100	127,5	138,0	155,5	81,0	63,9	24,8	26,1	24,1
Index PFCs	117,1	116,0	105,5	106,7	102,6	100	110,8	120,5	95,8	81,2	84,2	78,5	78,4	77,3
Index SF_6	72,1	44,5	47,5	49,8	63,5	100	103,7	114,5	109,2	105,2	111,2	118,5	119,1	111,0
Index [group of new gases]	83,3	70,0	80,0	87,1	105,5	100	122,9	133,2	140,5	81,9	70,2	40,2	41,2	39,2
Index [BY=100] [group of six][1, 2]	**99,4**	**101,5**	**101,1**	**103,6**	**103,6**	**105,2**	**109,2**	**105,6**	**106,3**	**100,8**	**100,4**	**101,1**	**100,2**	**100,8**
International bunker CO_2 [3]	34,3	35,4	35,7	37,0	35,1	35,5	36,3	38,5	39,0	40,3	42,8	47,2	46,6	43,6
Index bunkers CO_2 (1990 = 100)	100	103,2	104,0	107,8	102,2	103,5	105,7	112,2	113,5	117,4	124,8	137,4	135,7	126,9

1 National emissions excluding LUCF (category 5A)
2 Base year emissions are 1990 for CO_2, CH_4 and N_2O and 1995 for the F-gases **(coloured figures)**
3 Emissions from international marine and aviation bunkers are not included in the national totals.

Figure 3.2 Shares of greenhouse gases in total emissions for 1990 (left) and 2003 (right). Source: NIR 2005

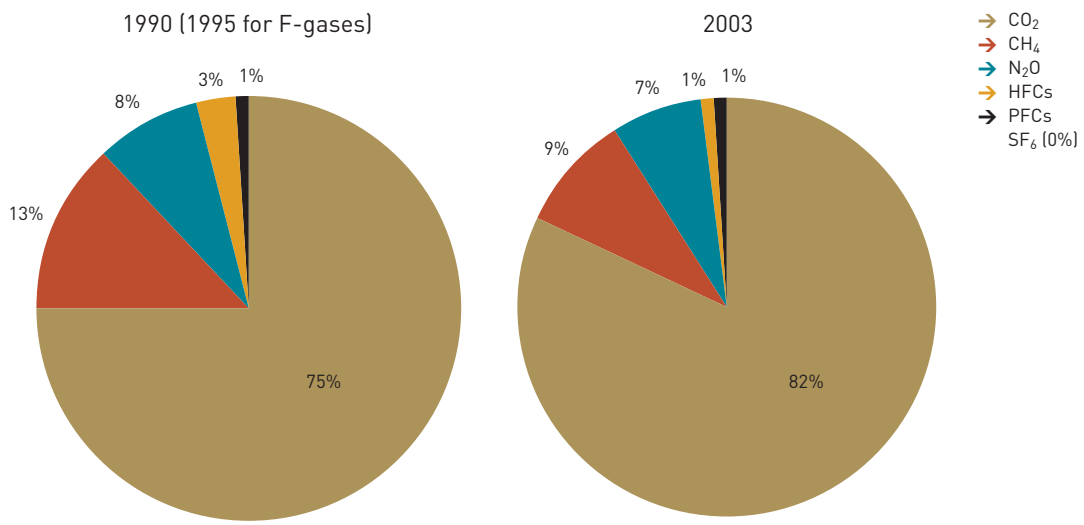


Figure 3.5 shows the trends per sector. The trends per gas are summarised briefly below. More information on trends per sector and per gas can be found in the annual NIR.

3.4.2 CO_2 emissions

CO_2 emissions (excl. LUCF (land-use change and forest)) increased by around 12% between 1990 and 2003, mainly due to emission increases of almost 15 Tg (37%) from the electricity and heat production sector and 8 Tg (31%) from the transport sector. The decrease in fuel combustion emissions under sector 1A2 ('Manufacturing industry') appears to be caused by 'moving' cogeneration plants to the sector 1A1a ('Public electricity and heat production'), due to a change of ownership (joint-ventures). This also explains a large part of the emissions increase under category 1A1 'Energy industries'. The decrease in CO_2 emissions under 1A1 'Energy industries' in 1999 is due to the marked increase in imported electricity and to the relatively large shift from coal to residual chemical gas and natural gas in 1999. Imported electricity almost doubled in 1999 compared with 1998: from 10% to 20% of the domestic electricity consumption. This higher import only temporarily reduced CO_2 emissions from the energy industries and total national CO_2 emissions. In 2000 the annual increase of around 1-2% resumed, as was the case before 1999.

CO_2 emissions peaked in 1996 due to a very cold winter. The higher emissions are mainly caused by the increased energy use for space heating in the residential sub sector of category 1A4 'Other sectors'.

3.4.3 Methane emissions

CH_4 emissions decreased by 32% in 2003 compared to the 1990 level. Sectors that contributed most to this decrease were the waste sector (-43%), agricultural sector (-18%) and the 1B fugitive energy sector (-39%).

3.4.4 N_2O emissions

N_2O emissions decreased by around 19% in 2003 compared to 1990, mainly due to decreased emissions from industrial processes (including indirect N_2O from non-agricultural sources) and agriculture. This decrease in industrial and agricultural emissions is partly compensated by increased

Figure 3.3 CO_2-eq. trends and shares in 1990

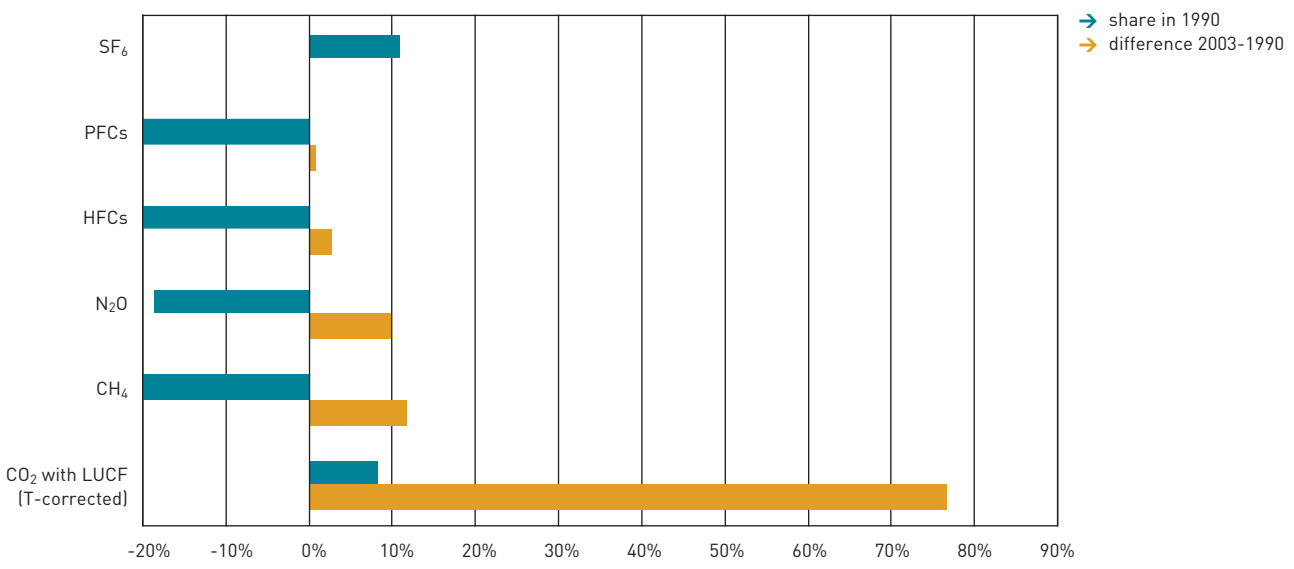


Figure 3.4 Trend in greenhouse gas emissions per gas (no temperature correction). Source: NIR 2005

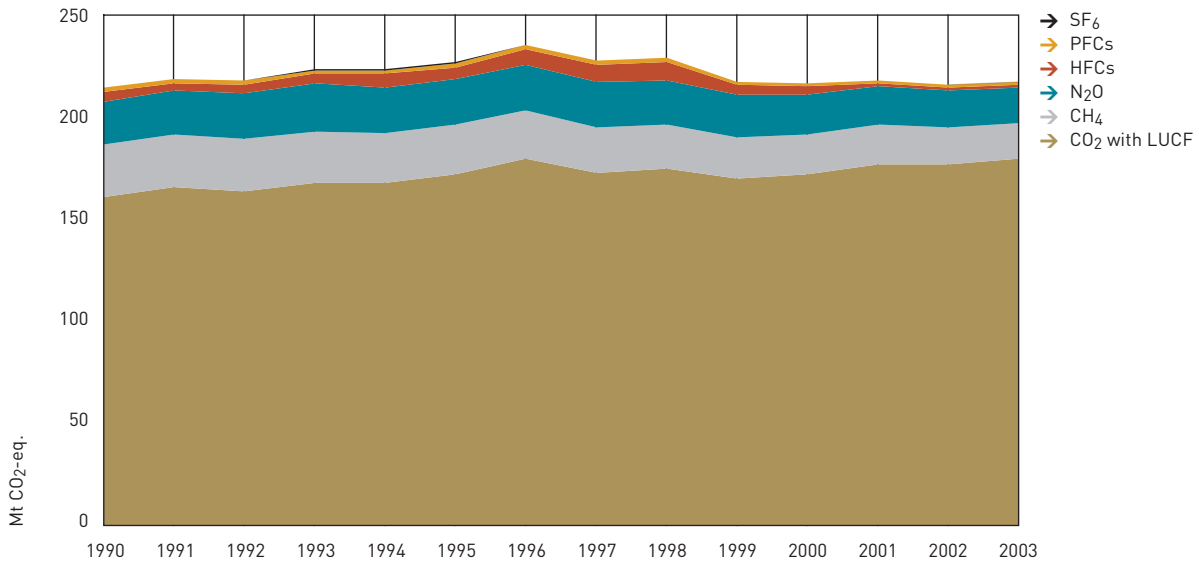
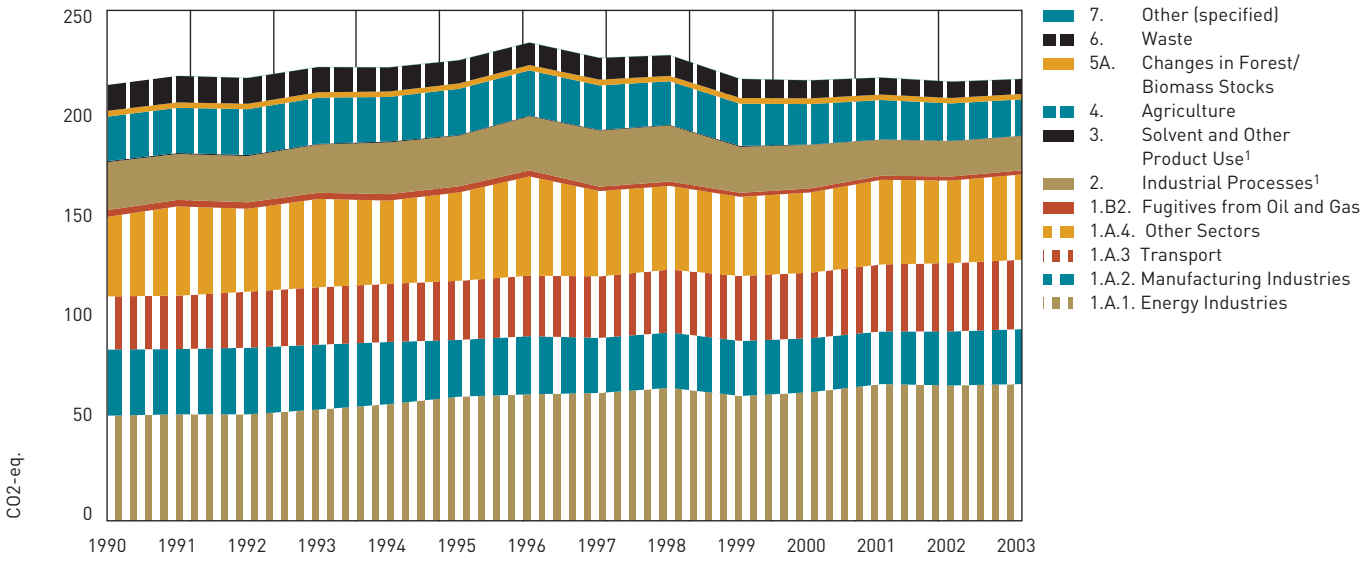


Figure 3.5 Trend in CO_2-eq. emissions per sector (no temperature correction).Source: NIR 2005



emissions from fossil fuel combustion, which stems mainly from transport.

3.4.5 F-gas emissions

Of the fluorinated greenhouse gases, for which 1995 is the reference year, emissions of HFCs (hydro fluorocarbons) and PFCs (per fluorocarbons) decreased in 2003 by around 75% and 25% respectively, while SF_6 (sulphur hexafluoride) emissions increased by 11%. Total emissions of all F-gases decreased by approximately 60% compared to the 1995 level.

4. Policies and measures

4.1 Introduction

This chapter provides an overview of climate change related policies and measures in the Netherlands, focusing on the emission reduction efforts necessary to comply with the commitments under the Kyoto Protocol.

Section 4.2 describes the overall policy context. The main policies and measures implemented are outlined in Section 4.3. Section 4.4 describes policies and measures that are no longer in place, since the previous national communication. Sections 4.5 and 4.6 are devoted to the participation in the mechanisms under Articles 6,12 and 17 of the Kyoto Protocol and the supplementarity of the Netherlands' climate change policies and measures. Sections 4.7 and 4.8 report on other issues required under Art. 7.2 of the Protocol, i.e. 'policies and measures in accordance with Article 2' and 'domestic and regional programmes and/or legislative arrangements, and enforcement and administrative procedures'.

4.2 Policy-making process

4.2.1 The Netherlands' emissions reduction target for the Kyoto Protocol

The Netherlands ratified the Kyoto Protocol on May 31, 2002. The greenhouse gas emissions reduction target for the Netherlands under the Kyoto Protocol is 8% less than greenhouse gas emissions in the base year, for the period 2008-2012. For the Netherlands, the base year for CO_2, CH_4 and N_2O emissions is 1990, while for F-gases this is 1995. The Netherlands is a Member State of the European Union (EU). The 8% reduction percentage was agreed for all countries that were Member States when the Kyoto Protocol was signed, and for the EU as a whole. Within this group of EU Member States, this common reduction percentage was divided amongst the various countries in the so-called 'burden-sharing agreement' (European Council decision 2002/358/CE). For the Netherlands this resulted in a 6% reduction percentage rather than the original 8%. Based on a preliminary assessment of the assigned amount for the Netherlands, and using this percentage and preliminary figures for greenhouse gas emissions in the base year, an average level of 200 Mt CO_2-eq. per year (over the period 2008-2012) is assumed as Kyoto target in designing climate policy in the Netherlands.

4.2.2 National Climate Policy Implementation Plan

The National Climate Policy Implementation Plan (NCPIP, issued in two parts in 1999 and 2000) outlines how the Netherlands intends to meet its emissions-reduction commitments under the Kyoto Protocol. An important aspect of the Netherlands' climate policy is the fact that the Kyoto target will be achieved both by domestic policies and measures as well as through the use of the Kyoto mechanisms, JI (joint implementation) and CDM (clean development mechanism). This is currently elaborated into a domestic target of 220 Mt CO_2-eq. in 2010, and a target for the purchase of emission reductions based on Kyoto mechanisms of 20 Mt CO_2-eq. per year from 2008-2012 (100 Mt CO_2-eq. in total).

The NCPIP provides for evaluations for progress in climate policy in 2002, 2005 and 2008 and a package of reserve measures to be implemented if the evaluations reveal a need for additional steps. The 2005 evaluation was sent to Parliament end of October 2005. The NCPIP describes measures, the system of evaluations, reserve measures and sectoral target values that the Netherlands has in place to ensure compliance with its emissions-reduction target under the Kyoto Protocol. The NCPIP was described extensively in the 3rd National Communication of the Netherlands.

4.2.3 Relevant inter-ministerial decision-making processes: sectoral target values

A major change in the Netherlands' approach to its national climate change policy aimed at achieving the domestic target occurred in January 2004 with the adoption of target values for CO_2 emissions from four major sectors and for total emissions of non-CO_2 gases in 2010 (see Table 4.1). The sectors with a CO_2 target are energy and industry, agriculture, traffic and transport, and households, trade and services (referred to in the Netherlands as the Buildings Sector). The sectoral target values add up to 218 Mt CO_2-eq. in 2010. Together with the government purchases of emission reductions based on the Kyoto mechanisms (average of 20 Mt CO_2-eq. per year from 2008-2012) the target values for domestic sectors result in (somewhat less than) this preliminary Kyoto target.

The responsibility for meeting the sectoral target values is delegated to the relevant departments as indicated in Table 4.1. This inter-ministerial agreement thus provides a system with

Table 4.1 Sectoral target values in 2010, in Mtonne CO_2-eq.

Sector	Target value 2010	Responsible ministries
CO_2		
Industry and Energy	108.6	Economic Affairs
Agriculture	7.5 (8.1)[1]	Agriculture, Nature and Food Quality
Traffic and Transport	38.7[2]	Transport, Public Works and Water Management; Housing, Spatial Planning and the Environment
Buildings	28	Housing, Spatial Planning and the Environment
Subtotal	*182.8 (183.4)*	
non-CO_2 gases	35.4	Housing, Spatial Planning and the Environment
Total	**218.2 (218.8)**	

1 If the area for greenhouse horticulture exceeds 11,500 acres, the target value for agriculture will be raised by 0.6 Mt at maximum.
2 Implementation of the EU Biofuels Directive in the Netherlands is taken into account.

clearly defined responsibilities for meeting the commitment to reduce emissions by 6% over the period 2008-2012. This agreement also enhances that climate policy is integrated in other policy areas. With the introduction of the CO_2 target values the government also agreed to a monitoring system, and to an approach to be followed if any of the sectors appears to be off track for meeting its target. This approach aims to reduce uncertainty regarding realisation of the Kyoto target.

The various government departments are required to take the actions necessary to meet the target values. The departments themselves must initiate action if the target value for their sector seems in danger of being exceeded. This is a departure from the previous situation in the Netherlands because departments must now direct their efforts towards achieving a certain emissions level. In the past the objectives of the various policy instruments were generally expressed in terms other than CO_2, such as improvements in energy efficiency. This meant that it was possible for CO_2 emissions to continue increasing even when departments had achieved all their policy objectives.

4.2.4 Monitoring and evaluation of progress with climate policies and measures

The target value approach includes a monitoring system based on an annual assessment of progress. Emission levels for the sectors are determined based on a rolling three-year average. Should the rolling average indicate growth that puts the target value at risk, then it is up to the department responsible to develop proposals to remedy the situation.

As previously mentioned, the NCPIP also provides for progress evaluations in 2002, 2005 and 2008. When establishing the sectoral target values it was agreed that one sector would be selected each year for an in-depth ex post evaluation of (cost) effectiveness. So far the buildings and transport sectors have been evaluated.

The impact on the sectoral target values, of definition and methodological changes made when preparing the National System, is taken into account in the described evaluations. It is expected that, once the National System is in place, adaptations due to such changes will no longer be necessary.

4.2.5 The European policy context

As an EU member state, the Netherlands is also subject to EU climate policy and applies EU Common and Coordinated Policies and Measures (CCPM's) relevant for climate change. These include inter alia the European Council Decision 2002/358/CE on the burden sharing of the EU emission reduction target for the Kyoto Protocol, Decision 280/2004/EC on the so called Monitoring Mechanism, which ensures that progress of the EU towards meeting the Kyoto targets is assessed annually and that Member States provide sufficient information to the European Commission to this aim, and Directive 2003/87/EC introducing the European system for CO_2-emissions trading. Other CCPM's stimulate combined heat and power production, the introduction of biofuels in transport and the reduction of CH_4 emissions from landfill waste sites.

CCPMs have several types of impacts in the Netherlands, which can be roughly divided into three main categories. The first group of CCPMs (such as the agreement with car manufacturers and the biofuels directive) reduce emissions beyond what can be achieved by purely national policies. The second group contains CCPMs that do not lead to any additional emission reductions beyond those generated by national policies in the Netherlands, but do have other benefits which contribute to the effectiveness and efficiency of national policies. These benefits include:

- improving the 'level playing field' and addressing competitive distortions which might otherwise result from unilateral introduction of policies (such as the energy tax);
- facilitating national policies that lead to emission reductions (such as the energy labelling of appliances, which led to the introduction in the Netherlands of the Energy Premium Rebate (EPR) scheme for energy efficient household appliances during the period 1999-2004);
- lowering the costs of achieving the same emission reductions which would otherwise have been achieved by purely national policies (such as CO_2 emissions trading).

The final category includes the CCPMs that have no impacts beyond national policies already in place before adoption of the CCPM.

4.3 Policies and measures and their effects

This section describes policies and measures implemented since 1990 that have had, or are expected to have, a large impact on greenhouse gas emissions in the Netherlands, even if the primary objective of the policy is (or was) not directly related to climate change. It also describes cross-sectoral policies and measures. The scope of the section is limited to domestic and EU policies and measures implemented or planned in the Netherlands. Policies and measures described are as known on 1 december 2004, as explained as well in chapter 1.

Most policies and measures described in the Netherlands' 3rd National Communication have been continued and are therefore included in this 4th National Communication as well. In addition, the most important new policies and measures since the 3rd National Communication are the following: In 2003, the fiscal stimulation of the production of renewable energy and energy from combined heat and power through the 'regulatory energy tax' has been changed into the subsidy program MEP (Environmentally Friendly Electricity Production Program). This change affects the energy sector. The MEP is described in paragraph 4.3.2. Furthermore, since 2005, the European CO_2 emissions trading system has come into force. This affects both the energy and the industry sector. This is described in paragraph 4.3.1. Finally, an important new measure for the transport sector will be the implementation of the European biofuels directive. This is further described in paragraph 4.3.4. Policies and measures that have been repealed and are no longer in place are listed in Section 4.4.

This section is organized by sector using the sectoral definitions requested by the UNFCCC guidelines (Energy, Transport, Industry, Agriculture, Forestry and Waste). Due to the model used for emissions projections, in this report these sectors are defined on the basis of economic activities within sectors, not, as in the IPCC source categories, on the basis of the processes that are the sources of greenhouse gas emissions. Furthermore, the sector Buildings is added. Table 4.2 presents an overview of how the sectors in this report can be transposed into the IPCC source categories. Some additional sector differences occur due to the fact that all mobile sources are put in the transport sector and emissions from flue gas

Table 4.2 Sectors used in this report related to IPCC source categories

Sector	Activity	IPCC source category
energy	centralized and own generation of power, energy distribution, oil and gas production, refineries, cokes factory	1A1, 1B, small part of 2[1]
industry	chemicals, foodstuffs and luxury items, paper, basic metals, construction materials, other metals, other industry, cokes manufacturing, construction	main part of 2[2], main part of 1A2[3]
transport	transport incl. mobile equipment and off-road vehicles from construction, agriculture and services	1A3, small part of 1A4c, small part of 1A2f, small part of 1A4a[4]
agriculture	agriculture and horticulture excl. mobile equipment and off-road vehicles	main part of 1A4c[5], 4
waste	waste incineration[6] and landfills	6
buildings	solvents, households, services excl. mobile equipment and off-road vehicles	3, main part of 1A4a[7], 1A4b

1 emissions due to flue gas desulfurization in coal power plants. This is the main part of the emissions reported under 2A3 "lime stone and dolomite use".
2 excluding the part included in energy.
3 off-road vehicles of industry and construction (part of 1A2f) are included in transport.
4 transport includes off-road vehicles of industry and construction (part of A2f), agriculture tractors (part of 1A4c) and mobile equipment form the service sector (part of 1A4b).
5 agricultural tractors (part of 1A4c) are included in transport.
6 when electricity is generated by waste incineration, the emissions are allocated to the energy sector.
7 mobile equipment from the service sector (part of 1A4a) is included in transport.

desulfurization are allocated to the energy sector. IPCC category 5 is not included in the emissions projections. Policies and measures regarding forestry are described under Agriculture.

Each section describes groups of policies and measures organised by greenhouse gas; only the most important being described in detail. The paragraphs need to be read in conjunction with Table 4.3, which provides the following information by sector in tabular form:

- greenhouse gas affected;
- name of policy;
- objective or activity affected;
- type of instrument;
- status;
- implementing entity;
- quantitative estimate of emission reduction impacts in 2005, 2010 and 2015;

Each section closes with a summary table showing the effects realised in the sectors, in terms of avoided emissions in the year 2000 as well as projected effects in the years 2005, 2010, 2015 and 2020. The projected effects have been estimated against the background of the Global Economy (GE) scenario described in Chapter 5.

The effects are presented for clusters of policies and measures affecting the different sectors rather than for individual measures. In analyses performed at a fairly high level of aggregation, it is often neither possible nor meaningful to separate out the impacts of individual instruments and programmes that aim at the same emission source or activity. In order to gain insights into the relative merits of different policies at a less highly aggregated level, each year one sector is chosen for an in-depth ex post evaluation of (cost) effectiveness. The government has completed two such in-depth evaluations, for the transport and buildings sectors. The results are presented in the respective sections.

The descriptions of policies in the main text include the actual and expected interaction with other relevant policies and measures and with Common and Coordinated Policies and

Measures of the European Union (CCPMs). Impacts other than emission reductions (including economic impacts to the extent feasible, costs, non-greenhouse gas mitigation benefits and interactions with other policies and measures) are described in the text where possible, but are not presented in the Summary Table. The cost calculation methods used in the Netherlands are described below.

Methods for calculating costs

The Financial Costs Method expresses costs as they are perceived by market parties such as households and businesses. This method works with the different energy prices paid by final users of energy in the various sectors, including distribution margins, taxes, excise duties and VAT (where relevant). Annual capital costs are calculated with the (estimated) interest rates that are paid, on average, by the various sectors of the economy. Cost-effectiveness may be presented either including or excluding the effect of tax schemes and other government policies that affect capital outlays differently in individual sectors.

The National Costs Method, on the other hand, presents the costs and benefits of measures for the Netherlands as a whole. This method is used to provide a consistent basis for comparing the cost-effectiveness of measures regardless of who implemented or paid for them. Costs for one sector are often benefits for another. While this information is certainly relevant for the sectors involved, the costs and benefits cancel each other out at the national level. The method uses national shadow prices for energy and a social discount rate is used in calculating capital costs.

Government costs are simply the outlays made by the government in connection with the policy in question (subsidy budgets or foregone tax revenues, administrative and enforcement costs, and costs incurred for monitoring, reporting and outreach programmes). Government expenditures are translated into annuities in order to enable comparisons between one-time outlays and recurring yearly benefits. The annuities are calculated for a period of 10 years using a social discount rate of 4%.

Table 4.3 Policies and Measures in the Netherlands

Cluster	GHG affected	Name of policy measure	Objective and/or activity affected	Type of instrument	Status	Implementing entity	Estimate of mitigation impact per year, in Mtonne CO_2-eq.		
							2005	2010	2015
Energy sector									
Combined heat and power (CHP)	CO_2	MAP BSET NEWS EIA Vamil special gas price energy tax exemptions MEP	encourage construction and use of CHP by lowering investment costs [1-5] and operating costs [6-8]	1-8. economic	disc. disc. disc. impl. disc. disc. disc. impl.	1-8. national government	1.0	1.9	1.6
Renewable energy	CO_2	Coal Covenant BLOW Covenant EIA Vamil energy tax exemptions MEP	5% renewable energy in 2010; 10% in 2020; 9% renewable electricity in 2010	1-2. negotiated agreement 3-6. economic	impl. impl. impl. disc. disc. impl.	1. national government and coal-fired power plants 2. national and provincial governments 3-6: national government	1.5	4.1	9.4
Energy Efficient Power Generation	CO_2	Benchmark Covenant	participating companies become among the most energy efficient in the world by 2012	negotiated agreement	impl.	national government, provincial governments, firms from energy and industry sectors	0	0	0
CO_2 emissions trading	CO_2	CO_2 emissions trading scheme	reduce CO_2 emissions from large energy-intensive companies in most cost-effective way	other	impl.	national government	0.3	1.1	3.6
Low methane oil and gas production	CH_4	Environmental covenant with oil and gas sector	reduce CH_4 emissions from oil and gas production by 10% in 2000 relative to 1990	negotiated agreement	impl.	national government	0.3	0.3	0.3

Cluster	GHG affected	Name of policy measure	Objective and/or activity affected	Type of instrument	Status	Implementing entity	Estimate of mitigation impact per year, in Mtonne CO_2-eq.		
							2005	2010	2015
Industry sector									
Energy Efficiency	CO_2	LTA's Benchmark Covenant Environmental permit EIA Vamil	to promote energy conservation and efficient use of energy	1-2. negotiated agreement 3. regulation 4-5. economic	1-5. impl.	1-5. national government	0.9	1.4	2.1
CO_2 emissions trading	CO_2	CO_2 emissions trading scheme	cost optimisation of CO_2 reduction efforts	other	impl.	national government	0	0.3	0.5
Low HFC HCFC production	HFC	Afterburner HCFC production	reduction in emissions of HFCs	regulation (environmental permit)	impl.	provincial government	1.9	1.9	1.9
Low PFC aluminium production	PFC	Environmental Covenant Environmental permit CO_2 Reduction Program/general Non-CO_2 Reduction Program	reduction in emissions of PFCs	1. negotiated agreement 2. regulation 3-4. economic	impl.	1, 3, 4. national government 2. provincial government	1.1	1.1	1.1
Low N_2O nitric acid production	N_2O	Catalytic reduction nitric acid production	reduction in emissions of N_2O	still under development	pln.	not yet determined	--	--	--
Reduction Programme Non-CO_2 Gases	HFC/PFC	F-gas reduction foams, spray cans, stationary cooling, incl. emission ceiling semiconductor industry	reduction in F-gas emissions from products and semi-conductor industry	regulations and agreements	impl.	national government	0.5	1.0	1.0

Cluster	GHG affected	Name of policy measure	Objective and/or activity affected	Type of instrument	Status	Implementing entity	Estimate of mitigation impact per year, in Mtonne CO_2-eq.		
							2005	2010	2015
Transport sector									
Fuel efficiency through technical vehicle measures	CO_2	energy labelling cars tax rebate efficient cars ACEA agreement CO_2 Reduction Program/ freight transport Quieter, Cleaner, More Fuel Efficient Programme	increasing fuel efficiency and reducing CO_2 emissions through technical vehicle measures	1. information 2. fiscal 3. negotiated agreement 4. economic and information 5. economic	1. impl. 2. disc. 3. --- 4. impl. 5. impl.	1, 2. national government 3. European Commission 4, 5. national government, SenterNovem	0.2	0.4	0.4
Fuel efficiency through driving behaviour and discouraging vehicle use	CO_2	KZRZ, The New Driving Force stepped up enforcement of speed limits in-car equipment REV, EBIT Transaction Chain mobility Transport prevention Kilometre Charge	1-3. increasing fuel efficiency and reducing CO_2 emissions through optimisation of driving behaviour 4-7.discourage vehicle use through logistical improvements 8. reduce congestion	1. information/ education 2. regulation 3. fiscal 4-7. information/ education and economic (subsidy) 8. economic (users charge)	1. impl. 2. impl. 3. disc. 4-7.impl. 8. pln.	1. national government, SenterNovem 2-8. national government	0.5	0.9	0.9
Other	CO_2	Excise duties CO_2 Reduction Programme/Passenger Transport EU Biofuels Directive	1. raise revenue 2. reduce CO_2 emissions through investments in material 3. target: 2%	fiscal economic diverse	1. impl. 2. impl. 3. pln.	1, 3. national government 2. national government and SenterNovem	--	--	--

Cluster	GHG affected	Name of policy measure	Objective and/or activity affected	Type of instrument	Status	Implementing entity	Estimate of mitigation impact per year, in Mtonne CO_2-eq.		
							2005	2010	2015
Agriculture sector									
Energy savings in greenhouse horticulture	CO_2	Glami Greenhouse Horticulture Orders in Council	1. increase energy efficiency by 65% 1980-2010	1. negotiated agreement 2. regulation	1. impl. 2. impl.	1.national government and greenhouse horticulture sector 2. national government	0.2	0.4	0.8
Livestock Reduction	CH_4	Milk quota	--	--	--	--	0.1	0.3	0.15
Manure Management	CH_4, N_2O	1. manure application norms 2. nitrogen norms	reduce nitrates in soil and emissions of NH_3	1-2. regulations	1-2. impl.	1-2. national government	0.4	0.6	0.3
Forestry Sector									
Afforestation	CO_2	National Ecological Network Day recreation facilities in urban areas	1. conservation, restoration, development and sustainable use of nature to aid biodiversity 2. realisation of recreation areas in the urban environment to counter continuing shortage of day recreational facilities	1, 2. other	1, 2. impl	1. provincial governments 2. major cities and provincial governments	--	--	--
Waste Sector									
Landfill Policy	CH_4	Decree on Soil Protection from Landfills Decree on Waste landfills and Waste Landfill Bans Landfilling Tax	1. Reduction in amount of landfilled waste 2. Reduction of CH_4 emissions from landfill sites	1-2. regulations 3. fiscal	1-3. impl.	1-3. national government	3.0	4.0	5.0

Cluster	GHG affected	Name of policy measure	Objective and/or activity affected	Type of instrument	Status	Implementing entity	Estimate of mitigation impact per year, in Mtonne CO_2-eq.		
							2005	2010	2015
Buildings sector									
Energy performance new buildings	CO_2	1. Energy Performance Norm 2. Energy Performance Coefficient 3. Energy Tax	improve energy performance of new residential and non-residential buildings	1. regulation 2. regulation 3. fiscal	1. impl. 2. impl. 3. impl.	1-3. national government	0.3	1.1	2.2
Retrofit existing buildings	CO_2	1. EPA 2. EPR 3. CO_2 Tender Scheme for Buildings 4. Energy Tax 5. EINP	improve energy performance of existing residential and non-residential buildings	1. information 2. economic 3. economic 4. fiscal 5. economic	1. impl. 2. disc. 3. pln. 4. impl. 5. disc.	1-5. national government	0.5	1.0	1.5
Energy efficiency appliances	CO_2	1. Energy Labelling Appliances 2. Energy Premium Rebate appliances	improve market penetration of energy efficient appliances	1. information 2. economic	1. impl. 2. disc.	1-2. national government	0.3	0.6	0.8
Total							13.0	22.5	33.6

Definitions used in summary table are taken from UNFCCC guidelines for National Communications (FCCC/CP/1999/7). For explanation of the abbreviations see glossary
Type of instrument: economic, fiscal, negotiated agreement, regulatory, information, education, research, other
Status:
pln = planning = the measure is in the planning stage, i.e. either political interest has been expressed in the measure and modalities are being worked on, or measure is in preliminary study phase. This does not necessarily imply that a decision has been taken to implement the measure.
adop = adopted = measure has been proposed and accepted but is not yet in effect.
impl = implemented = measure is in effect.
disc = measure was previously in effect but is no longer in force as of January 1, 2005 due to its having expired or been repealed. The effects of discontinued measures may continue to be felt into the future. Where this is the case, the table reflects these effects.

4.3.1 Cross-Sectoral Policies

Some policies apply to more than one sector. Existing instruments that are cross-sectoral include: Energy Investment Tax Deduction (EIA), CO_2 Reduction Programme/General, Reduction Programme Non-CO_2 Gases, Energy Tax, Environmentally Friendly Electricity Production Programme (MEP), Long-Term Agreements, Benchmark Covenant, CO_2 Emissions Trading and the Climate Covenant with provinces and municipalities. Table 4.4 shows the sectors affected by these policies. The policies are described in the sections where their impacts are greatest (indicated in Table 4.4), except for the CO_2 Reduction Programme, the Reduction Programme for Non-CO_2 Gases, and CO_2 Emissions Trading, which are described in this section.

The summary tables present the emission-reduction effects of these cross-sectoral instruments in the sectors where the effects occur.

- CO_2 Reduction Programme/General (status = implemented)

The CO_2 Reduction Programme provides support to large-scale investment projects that contribute substantially to reducing national CO_2 emissions. The programme aims to encourage investment in projects that are not yet profitable enough for independent market introduction. Cost-effectiveness is the chief criterion for assessing projects; the avoided emission per euro of subsidy must be as large as possible. The programme also makes the information and experience acquired through these projects available to a broader public, such as research institutes and institutions of higher learning. The budget for the programme is € 351 million. The goal is to reduce such emissions by 4-5 Mtonne CO_2-equivalents per year in 2008-2012, as a result of these investment projects.

- Reduction Programme for Non-CO_2 Gases (status = implemented)

The Reduction Programme for Non-CO_2 Gases (known by its Dutch acronym ROB) was set up in 1999 and is expected to run until 2012. Its goal is to reduce Dutch emissions of the non-CO_2 greenhouse gases to an average level of 33 Mtonne CO_2-equivalents over the period 2008-2012. SenterNovem manages the ROB programme using an approach based on close

Table 4.4 Cross-sectoral policies and measures

	Sector affected					
Instrument	**Households**	**Services**	**Agriculture**	**Industry**	**Energy**	**Transport**
Energy tax	■	■	■	■		
Climate Covenant	■	■	■	■	■	
EIA		■	■	■	■	■
Long-Term Agreements Energy Efficiency		■	■	■		
Benchmark Covenant				■	■	
CO_2 Reduction Programme / General			■	■	■	
Reduction Programme Non-CO_2 Gases			■	■	■	■
MEP			■	■	■	
CO_2 Emissions Trading				■	■	

cooperation between the government and the private sector. Its activities, divided among 14 projects, include improving information on emission factors and emission levels, subsidising research into and development of new emission-reduction methods and techniques, and encouraging the implementation of measures. The government has made approximately € 200 million available over the period 1999-2012 for subsidies, grants and tax advantages in this area. The ROB subsidy budget in 2004 amounted to €1.5 million.

- CO_2 Emissions Trading (Status = implemented)

As prescribed by Directive 2003/87/EC, a trading system for CO_2 emissions started within the EU on January 1, 2005. Its initial focus is on CO_2 from large industrial emitters. It is a 'cap and trade' system, where participants are assigned a set amount of allowances up front and are required to annually submit allowances that are equal to their actual emissions. Companies are allowed to use credits from Kyoto mechanisms for compliance with their obligations (see also 4.5). Member States are required to develop a national allocation plan stating the total number of allowances allocated in the first trading period 2005 to 2007, and how many each installation covered by the scheme would receive. The Dutch Allocation Plan was finalised in August 2004, and the allocation decision was completed in October 2004. Allocations have been made to 206 installations, which together emit around 40% of the total CO_2 emissions in the Netherlands. Excluded from the allocation decision are 150 installations for which the Commission has agreed to an opt-out. The national allocation decision is final and is no longer open to appeal. The registry is operational. Emission permits have been granted to almost all installations concerned, which means that their monitoring protocols have been verified and approved by the Netherlands Emission Authority.

4.3.2 Energy

CO_2

CO_2 policies relating to the energy sector have traditionally fallen into three general categories: those aimed at encouraging the use of renewable energy (such as the special provisions under Articles 36o, 36i, and 36r of the Energy Tax, the Environmentally Friendly Electricity Production Programme,

Table 4.5 Subsidy rates for environmentally friendly electricity generation (MEP)

Subsidy granted in 2004	Type of installation	€/kWh Jan 1, 04- June 30, 04	€/kWh July 1, 04- Dec 31, 04	€/kWh from Jan 1, 05
	< 50 MW capacity, non-contaminated biomass	0.067	0.082	0.097
	< 50 MW capacity, contaminated biomass	0.029	0.029	0.029
	> 50 MW capacity, non-contaminated biomass	0.04	0.055	0.07
	> 50 MW capacity, non-contaminated biomass	0.029	0.029	0.029
	Landfill gas in power plant	0.0	0.006	0.21
	Landfill gas in waste incinerator, efficiency > 26%	0.029	0.029	0.029
	Onshore wind power	0.048	0.063	0.078
	offshore wind power	0.067	0.082	0.097
	Solar	0.067	0.082	0.097
	Wave, tidal power	0.067	0.082	0.097
	Hydropower	0.067	0.082	0.097
	Combined heat and power, delivered to the grid[1]	0.0057	0.026	0.022

1 The advantage of the energy tax exemption on own use is accounted for. As of July 2004, only electricity produced in a CO_2-neutral manner is subsidised. This is roughly 19%.

the Intergovernmental Wind Energy Agreement (known as BLOW) and the Coal Covenant), those aimed at increasing the penetration of combined heat and power (such as the special gas price, the energy tax exemption for combined heat and power (CHP) gas and own use of CHP electricity, the CO_2 Reduction Programme) and those aimed at improving the efficiency of electric power plants (electric power producers and refineries participating in the Benchmark Covenant, which aims at achieving the world top in energy efficiency, described further in Section 4.3.3). The Energy Investment Tax Deduction (EIA) supports measures in all three categories.
As of January 1, 2005, CO_2 emissions trading entered into force in the Netherlands, as prescribed by EC Directive 2003/87/EC.

A number of the most important policy instruments currently in effect are described below.

- Coal Covenant (status = implemented)

The government and the owners of existing coal-fired power plants signed this negotiated agreement in 2002. The companies committed themselves to increasing the amount of biomass used in their plants, with the goal of reaching an average during the period 2008-2012 that corresponds to 503 MWe of installed biomass-capacity, which should result in 3.2 Mtonne of CO_2 emissions reduction. In 2003 (the last year for which a monitoring report is available) their use of biomass resulted in 0.7 Mtonne of CO_2 reduction, corresponding to 121 MWe of installed biomass capacity. The companies also agreed that both their coal-fired and gas-fired power plants would participate in the Benchmark Covenant to improve energy efficiency. As part of this agreement, the government changed the fuel tax on fuel inputs to electricity production into a tax on kWh-output as part of the energy tax. This change came into effect on January 1, 2001.

- Intergovernmental Wind Energy Agreement (BLOW) (status = implemented)

The Intergovernmental Wind Energy Agreement (known by its Dutch acronym BLOW) was signed in July 2001. It contains agreements between central government, the provinces and the municipalities aimed at realising 1500 MW of onshore wind power capacity in 2010.

- Environmentally Friendly Electricity Production Programme (MEP) (status = implemented)

This subsidy programme was introduced in July 2003 and replaced special provisions in the energy tax designed to encourage the supply of renewable energy. The MEP programme provides subsidies for environmentally friendly electricity generation, specifically that based on renewable energy and combined heat and power. This subsidy is granted for a maximum period of 10 years and the amount of the subsidy depends on both when the investment is made and the type of installation. Table 4.5 presents the current subsidy rates.

CH_4

- Low CH_4 oil and gas production (status = implemented)

In 1995 the Dutch government negotiated an environmental covenant with oil and gas producers with the aim of reducing methane emissions from their activities by 10% in 2000 (relative to 1990). This target was exceeded, with reductions of 65% being achieved in 2001. The environmental covenant was reinforced by long-term energy efficiency agreements with the

Table 4.6 Summary of emission reductions in the energy sector, in Mtonne CO_2-equivalent avoided emissions per year

Policy cluster	Gas	Realised	Projected			
		2000	2005	2010	2015	2020
Combined heat and power	CO_2	4.2	1.0	1.9	1.6	1.3
Renewable energy	CO_2	1.0	1.5	4.1	9.4	18.8
CO_2 emissions trading	CO_2	--	0.3	1.1	3.6	1.0
Low-methane oil and gas production and distribution	CH_4	1.5	0.3	0.3	0.3	0.3
Total		**6.7**	**3.1**	**7.1**	**14.9**	**21.4**

companies in the sector. Besides energy savings these agreements also stimulated the implementation of measures that led to CH_4 emission reductions, such as less venting of natural gas. As of 2000 all installations within the oil and gas industry are required to install state-of-the-art technology by the Netherlands' Emissions Regulations (NeR).

Summary energy sector
Table 4.6 presents a summary of the emission-reduction impacts of the policies and measures affecting emissions from the energy sector in the period 1990-2020.

Table 4.7 Budget EIA, in million euro per year

1997	1998	1999	2000	2001	2002	2003	2004	2005
20	63	70	90	144	253	153	169	137

4.3.3 Industry

CO_2
Policies affecting CO_2 emissions are generally aimed at improving industrial energy efficiency. These include the Energy Efficiency Benchmarking Covenant, Long-Term Agreements (LTAs) with industrial sectors backed up by environmental permits based on the Environmental Management Act, and the Energy Investment Tax Deduction regime within the corporate income tax system (known as EIA). The CO_2 Reduction Programme/General, a cross-sectoral subsidy scheme described in Section 4.3.2, is also available to firms in the industrial sector.

With the introduction of CO_2 emissions trading as of January 1, 2005, the impact of policies aimed at encouraging energy savings is expected to decline as the market price of CO_2 allowances becomes the driving force behind investments in energy efficiency by the companies falling under the trading scheme. The CO_2 emissions trading system is described under the cross-sectoral policies and measures.

- Benchmarking Covenant (status = implemented)

The Benchmarking Covenant between national/provincial governments and industrial representatives dates from 1999. It is a negotiated agreement in which participating firms (energy-intensive companies with annual energy consumption of 0.5 PJ or more) are committed to achieving (and/or maintaining) a position among the most energy-efficient in their sector, in the world, no later than 2012. International comparison standards (benchmarks) have been developed for each industrial process covered by the agreement. An independent Verification Bureau Benchmarking (VBE) facilitates and monitors the process. The benchmarks (and long-term agreements, see below) are also taken into account in allocating emission allowances under the CO_2 Emissions Trading System.

- Long-Term Agreements on Energy Efficiency and Environmental Permits (status = implemented)

Negotiations between the government and less energy-intensive industries have resulted in a second generation of Long-Term Agreements on energy efficiency. The government supports these agreements with fiscal incentives such as the EIA, described below, and enforces them with environmental permits. Measures agreed under these agreements are incorporated into the permit. Companies that do not participate in the agreements are required (in their permits) to take all energy-saving measures with an internal rate of return of at least 15% after taxes. Since 2001 the national government has devoted € 14 million to enable permit authorities to step up their activities to reinforce the role of energy measures in environmental permits.

- Energy Investment Tax Deduction (EIA, status = implemented)

The Energy Investment Tax Deduction allows entrepreneurs who invest in relatively innovative energy-efficient technologies or in renewable energy to deduct (under certain conditions) part of their investment costs from their corporate income tax. The scheme was introduced in 1997. Lists of eligible technologies and equipment are updated annually. The annual budgets for the scheme are presented in table 4.7.

N_2O

- Low N_2O nitric acid production (status = planned)

There are two companies producing nitric acid in the Netherlands, emitting on average 5.3 Mtonne CO_2-eq. of N_2O emissions per year. The National Climate Policy Implementation Plan identified N_2O reduction from these plants as a reserve measure, to be prepared for future implementation should circumstances warrant such action. In 2002 the Netherlands Government decided to 'activate' this measure, and put it into effect regardless of whether it would be necessary for achieving the Kyoto objectives. A Best Reference Document (BREF) pursuant to Directive 96/61/EC (Integrated Pollution Prevention and Control) is currently being drafted for the fertiliser industry. The BREF (entitled Large Volume Inorganic Chemicals - Ammonia, Acid and Fertilisers) should be completed in mid-2005. The permitting authorities will then have to amend the permits of the installations involved to bring them in line with the BREF by 30 October 2007. The total emission reduction potential of measures concerning nitric acid production plants has been estimated at 4 Mtonne CO_2-eq. in 2010. How much of this potential will actually be captured will depend on how the BREF defines Best Available Technology for this process. Several promising technologies are currently under development.

HFC

- Low-HFC, HCFC production (status = implemented)

There is only one producer of HCFC-22 in the Netherlands. The environmental permit for this plant required installation of an afterburner to reduce emissions of HFC-33. More than € 10 million has been invested in this afterburner since 1997, with the government contributing around € 0.25 million in subsidy for the reserve unit (from the Reduction Programme for Non-CO_2 Gases). The cost-effectiveness of the afterburner has been estimated at € 0.30/tonne CO_2-equivalent (Harmelink et al., 2005).

- Reduction Programme for Non-CO_2 Gases (status = implemented)

Within the context of the Reduction Programme for Non-CO_2 Gases agreements have been reached between government and industry to reduce emissions of HFCs and PFCs resulting from their use in stationary cooling equipment, car air-conditioning systems, foams, spray cans and the semiconductor industry. The environmental permit for the semi-conductor industry sets a ceiling of 0.44 Mtonne of SF_6/PFC emissions.

PFC

- Low-PFC aluminium production (status = implemented)

The Dutch Government has negotiated an environmental covenant with the aluminium industry that incorporates emission-reduction targets for a large number of pollutants, including both PFCs and CO_2. The government has also provided financial support (amounting to € 1.5 million from two subsidy programmes: the CO_2 Reduction Programme and the Non-CO_2 Reduction Programme) for modernising one of the two production plants. This resulted not only in a reduction of PFC emissions, but also in decreased electricity use and reduced emissions of fine particulates. As of 2003, both the two aluminium production plants located in the Netherlands have switched from Side-Worked Prebake to Pointfeeder Prebake. The environmental permits for the installations concerned set a maximum level of PFC emissions.

Table 4.8 Summary of emission reductions in the industry sector, in Mtonne CO_2-equivalent avoided emissions per year

Policy cluster	Gas	Realised	Projected			
		2000	2005	2010	2015	2020
Energy efficiency	CO_2	3.2	0.9	1.4	2.1	2.1
CO_2 emissions trading	CO_2	-	-	0.3	0.5	0.3
Low-HFC, HCFC production	HFC	5.4	1.9	1.9	1.9	1.9
Reduction Programme for Non-CO_2 Gases	HFC/ PFC	--	0.5	1.0	1.0	1.0
Low-PFC aluminium production	PFC	1.1	1.1	1.1	1.1	1.1
Total		**9.7**	**4.4**	**5.7**	**6.6**	**6.4**

Table 4.9 Cost-effectiveness of the policies in the transport sector 1999-2003

Instrument	Mtonne avoided emission in 2003	Government costs, million euro	Annuity, million euro per year[1]	Cost-effectiveness, euro/tonne
The New Driving Force	0.17	13.8	1.7	7 – 14
EU Agreement with car manufacturers	0-0.3	0	0	0
Energy labelling of cars and energy premium	0.12	+50	6.2	+50[2]
Transaction Modal Shift	0 – 0.1	13.3	1.6	16 - ∞
Energy investment tax deduction, EIA	0.1 – 0.2	33	4.1	20 – 40

1 10-year depreciation period, 4% interest.
2 The reported costs are for the energy premium only, while the avoided emissions pertain to both the label and the premium. The cost-effectiveness of the premium alone is therefore likely to be higher than the € 50/ton reported.

Summary industry sector
Table 4.8 presents a summary of the emission reduction impacts of the implemented policies and measures affecting emissions from the industry sector in the period 1990-2020.

4.3.4 Transport

CO_2
Policies and programmes that affect CO_2 emissions in the transport sector can be grouped loosely into four main categories. Some of the policies are intended (either directly or indirectly) to reduce emissions of CO_2, while others are aimed primarily at other policy goals but also generate CO_2 reduction as a welcome side effect. They include:

- policies aimed at improving fuel efficiency through technical measures on vehicles, including energy labelling of new vehicles, a rebate on fuel-efficient cars (which was in effect in 2002), the ACEA (association of European automobile constructors) covenant with car manufacturers and various subsidy programmes such as 'Quieter, Cleaner and More Economical Traffic and Transport in Urban Areas' (Stiller, Schoner en Zuiniger Verkeer en Vervoer in Stedelijk Gebied, SSZ) and the CO_2 Reduction Programme/Freight Transport;
- policies aimed at improving fuel efficiency through driving behaviour and discouraging vehicle use, such as the programme Buy Fuel Efficient! Drive Fuel Efficient! (Koop Zuinig! Rij Zuinig!, KZRZ) and its successor after 1999 ('The New Driving Force'), stepped up enforcement of speed limits, various tax measures aimed at stimulating econometers, onboard computers and cruise control, as well as programmes aimed at logistical and other measures (such as the programmes Rational Energy Use in Traffic and Transport (REV) followed by Energy Savings in Transport (EBIT), Transactie, Ketenmobiliteit (Chain mobility) and Transport prevention);
- policies aimed at encouraging modes of transport with smaller emission impacts, such as Transactie/Modal Shift, programme 'Korte Ritten'(short journeys) and fiscal measures encouraging bicycle use and public transportation.

A fourth group is more difficult to categorise since it includes policies with various types of effects. Excise duties on motor

fuels primarily have a revenue-raising function, but also impact on CO_2 emissions through their effect on fuel prices. The CO_2 Reduction Programme/Passenger Transport aims to support investments in materials and the training of municipal officials, while the objective of the EU Biofuels Directive is to encourage the use of renewable energy in the transport sector.

Table 4.9 shows the cost-effectiveness (for the government) of the policy instruments deployed in the transport sector during the period 1999-2003. For a description of cost estimating methods, see the text box in the introduction part of section 4.3.

A number of the policies and programmes currently in effect or in the planning stage are described in greater detail in the following sections.

- The New Driving Force (status = implemented)

The New Driving Force programme has been introduced in two phases, thus expanding on a previous programme called Buy Fuel Efficient! Drive Fuel Efficient! The programme's objective is to reduce CO_2 emissions through changes in driving behaviour. The programme includes four modules: in-car apparatus, licensed drivers, driver education and research. In 1999 the government made € 11 million available for this programme, plus an additional € 10 million for a second phase in the period 2004-2006. Results from the year 2004 indicate that emissions savings of around 0.2 Mtonne have been achieved. Projections indicate avoided emissions of about 0.9 Mtonne in 2010.

- CO_2 Reduction Program/Passenger Transport (status = implemented)

The objective of the subsidy programme, which was launched in 2000, is to reduce CO_2 emissions by means of investments in material. The programme also covers projects to train municipal officials in the application of energy-aware design methods for dealing with traffic in residential neighbourhoods. The government has reserved € 4 million per year for this programme.

- CO_2 Reduction Programme/ Freight Transport (status = implemented)

This programme makes subsidies available to a wide variety of projects that concern freight transportation, and which save fuel and thereby reduce CO_2 emissions. Costs incurred in connection with investment in technology, utilisation of technology and outreach activities that reduce CO_2 emissions from transport can be eligible for subsidy under this programme. The government has reserved € 3.5 million per year for this programme.

- Energy Labelling of Vehicles (status = implemented)

Energy labels on vehicles were first introduced in the Netherlands in 2001, pursuant to European Directive 1999/94/EC. These labels indicate both fuel consumption and CO_2 emissions from new passenger cars. The Netherlands' scheme goes further than that required by Directive 1999/94/EC, since fuel consumption is reported in terms of relative fuel consumption compared to other types of cars (of similar size) as well as in absolute terms.

- EU Biofuels Directive (status = planned)

The government announced its intentions regarding the Biofuels Directive in its Traffic Emissions Policy Document issued in 2004. It is doing its utmost to introduce an incentive scheme for biofuels from 2006. The necessary research and preparation, including the funding, are underway. The results of these preparatory activities will be announced this year. The 2% biofuels target includes niche markets. In addition to reducing CO_2 emissions, another important objective is setting in train innovations which target second generation fuels. Preparations are currently being made in cooperation with the market stakeholders (oil companies, chemicals companies etc.) and non-governmental organisations in order to avoid lock-in effects (holding on to first-generation biofuels for too long).

- CO_2 differentiation in vehicle purchase tax (status = planned)

The Traffic Emissions Policy Document announced that the government is examining how the amount of purchase tax levied on passenger cars and motorcycles can be linked to vehicle fuel efficiency, with a view to introducing this measure from January 1, 2006. A precondition is that the measure should be budget-neutral. The possibility of exempting hybrid and hydrogen-powered cars (that meet certain requirements) is also being examined.

N_2O

The Netherlands has no policies aimed specifically at N_2O

emissions from the traffic sector. NOx policies have led to more petrol-driven passenger cars being equipped with catalytic converters, resulting in higher N_2O emissions per kilometre. Since the percentage of petrol-driven cars with catalytic converters has increased substantially since 1990, the average N_2O emission factor also rose dramatically during the period 1990-1999 (from 9 to 15 mg/km), dropping again slightly to 12 mg/km in 2003.

Summary transport sector
Table 4.10 presents a summary of the emission-reduction impacts of the policies and measures affecting the transport sector in the period 1990-2020.

4.3.5 Agriculture

CO_2
The largest agricultural source of CO_2 emissions in the Netherlands is the greenhouse horticulture sector, which is responsible for around 80% of emissions from this sector. The most important policies affecting CO_2 emissions from greenhouse horticulture are the Glami Covenant and regulations referred to as the Orders In Council Greenhouse Horticulture. These policies aim at improving energy efficiency and are described in greater detail in the following paragraphs. In addition Long-Term Agreements on Energy Efficiency have also been negotiated with a number of other agricultural sub sectors. The cross-sectoral policies MEP, EIA and the CO_2 Reduction Programme also affect CO_2 emissions in the agricultural sector.

Table 4.10 Summary of emission reductions in the transport sector, in Mtonne CO_2-eq. avoided emissions per year

Policy cluster	Gas	Realised	Projected			
		2000	2005	2010	2015	2020
Technical measures in vehicles	CO_2	--	0.2	0.4	0.4	0.4
Driving behaviour/ discouraging vehicle use/ shifting modal split	CO_2	--	0.5	0.9	0.9	0.9
Other (chiefly excise duties)	CO_2	1.2	--	--	--	--
Total		**1.2**	**0.7**	**1.4**	**1.3**	**1.3**

Table 4.11 Development of the energy-efficiency index in the greenhouse horticulture sector

	1980	1990	1995	1996	1997	1998
Energy-efficiency index	100	67	60	63	58	60
	1999	**2000**	**2001**	**2002**	**2003**	
	57	56	52	52	50-51	

2003: estimate
Source: (LEI, 2004)

- Glami Covenant (status = implemented)
Within the context of the Glami covenant, agreed with the government in 1997, the greenhouse horticulture sector is striving to improve its energy-efficiency index by 65% in 2010 relative to the baseline of 1980. The energy-efficiency index is defined as primary fuel use per unit product. This means that the index can be improved by a fall in primary fuel consumption, a rise in physical production or a combination of both. Results from the monitoring of the covenant are presented in table 4.11.

- Orders in Council Greenhouse Horticulture (status = adopted)
In addition to the general objective of the Glami Covenant described in the previous paragraph, crop-specific energy norms at individual company level have also been defined in Orders in Council. Greenhouse operators are required to register their energy use per m^2 of greenhouse floor space.

CH_4
The Netherlands has no specific policies aimed at reducing emissions of the non-CO_2 gases from the agricultural sector, although there are programmes that subsidise research and development and practical experimentation. As yet these

Table 4.12 Summary of emission reductions in the agriculture sector, in Mtonne CO_2-equivalent avoided emissions per year

Policy cluster	Gas	Realised	Projected			
		2000	2005	2010	2015	2020
Energy savings in greenhouse horticulture	CO_2	0.9	0.2	0.4	0.8	0.7
Livestock reduction	CH_4	2.0	0.1	0.3	0.15	--
Manure management	N_2O	-1.5	0.4	0.6	0.3	--
total		**1.4**	**0.7**	**1.3**	**1.25**	**0.7**

programmes have had no measurable effect on emissions. The milk quota, which is part of the EU Common Agricultural Policy, has had an impact on the size of the dairy herd in the Netherlands and on the associated CH_4 emissions. Manure policies that regulate the application of nitrogen to the soil also impact the size of the livestock population.

N_2O

While there are no specific policies aimed at reducing N_2O emissions from the agricultural sector, the norms concerning the application of manure to the soil and the nitrogen norms applying to total use of manure and artificial fertilisers do have an impact. N_2O emissions, and to a lesser extent CH_4 emissions, fall as these norms become more stringent. However, manure management rules aimed at reducing emissions of ammonia (NH_3) have the opposite effect on N_2O emissions. Injecting manure into the ground results in sub-optimal nitrification and higher N_2O emissions than simply spreading manure on the surface, but is necessary in order to keep NH_3 emissions in check.

Summary agriculture sector

Table 4.12 presents a summary of the emission reduction impacts of the policies and measures affecting the agriculture sector in the period 1990-2020.

4.3.6 Forestry (CO_2)

The National Ecological Network and the creation of recreational facilities are the most important goals of the national forestry strategy. Combating climate change is just one of the benefits of this strategy.

The creation of around 728,500 hectares of National Ecological Network by 2018 is a central theme of the nature policy. The National Ecological Network is a cohesive network of high-quality nature reserves, both on land and in the water. Around 275,000 hectares need be added to the current area of nature reserves to complete the network. Only a part of this area will be afforested.
To counter the continuing shortage of daytime recreational facilities in urban areas, around 20,000 hectares of large-scale green areas will be created by 2013. Only a part of this area will be afforested.

4.3.7 Waste (CH_4)

Government policies include those aimed at reducing the amount and composition of waste to be dumped as well as those aimed at collecting and utilising landfill gas for energy production.

The general objective of waste policies is to reduce the amount of waste generated and dumped. Waste should be dumped at landfill sites only when there is no other waste treatment option available. The amount of dumped waste has fallen, from 14 Mtonne in 1990 to around 5 Mtonne in 2000, and is still decreasing. It has been estimated that this reduction in the amount of waste dumped has reduced methane emissions by 4 Mtonne CO_2-equivalents in 2000 (Jeeninga et al., 2002). This was achieved through a variety of policies and measures, such as separate collection of vegetable, fruit and garden (compostable) waste from other household waste, useful application of waste, the expansion of incineration capacity, as

well as discouraging waste dumping through landfill bans and high dumping tariffs contained in environmental taxes.

Policy instruments deployed to encourage the collection and utilisation of landfill gas include regulations as well as economic instruments (subsidy programmes and tax incentives). The regulations (Environmental Management Act, (NeR, 1994), Decree on Soil Protection from Landfills (1993) and Decree on Landfills and Waste Landfills Bans (1997)) are all aimed at both reducing methane formation and reducing emissions; both whilst the landfill site is in operation and after it has been closed.

Total investment costs for landfill gas collection and utilisation projects in the period 1990-2003 have been estimated at € 35 to 55 million (Harmelink et.al., 2005). Financing of these investments is very site specific. The landfill gas extraction part of the project is generally financed from dumping revenues. Financial support has also been obtained from governmental programmes and energy companies for projects that utilise landfill gas in energy production. Table 4.13 provides an overview of this financial support.

Table 4.14 Summary of emission reductions in the waste sector, in Mtonne CO_2-equivalent avoided emissions per year

policy cluster	gas	realised	projected			
		2000	2005	2010	2015	2020
landfill policies	CH_4	4.0	3.0	4.0	5.0	6.0

Summary waste sector

Table 4.14 presents a summary of the emission reduction effects of the policy measures affecting the waste sector in the period 1990-2020.

4.3.8 Buildings sector (households and services, CO_2)

The package of policies deployed in this sector has been designed to address specific issues in three segments of the target group: new buildings, retrofitting existing buildings, and

Table 4.13 Financial support programmes for landfill gas collection and utilisation (Source: Harmelink et al., 2005)

Programme name	Type of programme	Period	Financial support
Environmental Action Plan of the energy companies (MAP)	Subsidy for utilisation of landfill gas for energy production	1990-2000	€ 2-4 million
Energy Tax Exemption	Energy production from landfill gas defined as renewable energy and exempted from the Energy Tax	1996-2003	Value of the exemption estimated at € 10-15 million
Energy Investment Tax Credit (EIA)	The EIA is available for landfill gas collection and utilisation projects	1997 – present	Financial support in period 1997-2003 € 0.6 million
Environmentally Friendly Electricity Production Programme (MEP)	The MEP provides operating subsidies for electricity produced from renewable sources. It replaced the Energy Tax Exemption in 2004	2004 – present	July 1, 2004 saw the start of a a subsidy available for electricity generated from landfill gas, amounting to € 0.006/kWh
Non-CO_2 Reduction Programme	This programme has provided financial support for demonstration projects involving increasing landfill gas production from sites and methane oxidation in top layers.	1999 – present	The total budget for demonstration projects amounts to € 0.7 million

appliances. The package consists of a mixture of regulations, economic instruments and information and outreach programmes, supported by an energy tax. Agreements have been negotiated with important intermediary parties in the residential sector (such as housing developers and local governments) and with branch organisations in the non-residential sector.

The main policy instrument pertaining to new buildings in both residential and non-residential sectors is the Energy Performance Norm (EPN).

The most important framework for encouraging energy conservation in existing residential buildings (including appliances) during the period 1990-2000 was the Environmental Action Plan (MAP) of the energy companies, which provided both information and financial support for energy-saving measures. After the MAP expired (in 2000), financial support continued in a somewhat modified form under the Energy Premium Rebate (EPR) programme, which was in effect from 2000 to 2005. The EPR has now been repealed but may be replaced with a scheme for subsidising large-scale projects in existing buildings through a system of tenders, for which the government has made up to € 34.5 million available. Information on energy-saving potential is currently provided through the Energy Performance Advice (EPA) programme. The MAP and EPR schemes built upon the EU directives on energy labelling of appliances, through which the most energy-efficient appliances can be recognised by their so-called A-label. The government has given energy conservation in buildings an extra boost through agreements signed with provincial and municipal governments (Climate Covenant) and umbrella organisations of housing developers (Sustainable Buildings Covenant). The Energy Tax increases the impact of programmes and policies aimed at increasing energy conservation in existing buildings because it improves the cost-effectiveness of energy-saving measures for the owners.

Various policies have been introduced to encourage energy savings in non-residential buildings. Financial support has been available, first through the MAP (1990-2000) and since 1997 also through the Energy Investment Tax Deduction (EIA) for commercial firms (1997-present) and the Energy Investment Subsidy Programme for Non-Profit Organisations (EINP, 1997-2002). Variable depreciation of energy investments under the corporate income tax (Vamil) was possible from 1997 until 2002. Long-term agreements on energy efficiency (LTAs) have been signed with a number of sub sectors and a start has been made on setting energy-use standards based on the Environmental Management Act. The Energy Tax increases the impact of these programmes and policies, as well as making investments in energy savings more cost-effective for building owners.

An ex post evaluation of the climate change policies in the buildings sector carried out in 2003[2], estimated the cost-effectiveness of the policies in effect in the buildings sector in the period 1995-2002. Cost-effectiveness was estimated using three different methods, namely the government costs approach, the financial costs approach (also called the final users approach) and the national costs method. These methods are explained further in the text box in the introduction of section 4.3.

Table 4.15 shows the results of this study.

A number of policies and measures affecting the buildings sector are described in greater detail in the following paragraphs.

- Energy Performance Norm (EPN, status = implemented)
In December 1995 the Building Code in the Netherlands was amended to allow possible tighter regulations pertaining to energy use in new residential buildings. The object was to realise energy savings of 15-20% relative to the standards that existed before the Building Code was amended. The standard is expressed as a coefficient. The lower the value of the coefficient, the better the energy performance in the buildings. The coefficient for residential buildings was originally set at 1.4 or lower (approximately equivalent to 1400 m^3 natural gas use per home, per year), and tightened to 1.2 or lower as of January 1, 1998 (approximately 1200 m^3 per year) and to 1.0 or lower as of January 1, 2000 (approximately 1000 m^3 per year). The government has announced that, from 2006 onwards, the coefficient for residential buildings will be reduced to 0.8. The EPN for non-residential buildings differs according to the type of building and has been tightened twice since its introduction

2 Joosen et al., 2004

Table 4.15 Cost-effectiveness of policies in the buildings sector, 1995-2002

	Mtonne avoided emissions in 2002	Government costs euro/tonne	Financial costs euro/tonne	National costs euro/tonne
Residential Buildings				
Energy Performance Norm (EPN)	0.1 – 0.2	4 – 14	-210 – -6	51 – 121
Energy Premium Rebate (EPR) and Energy Performance Advice (EPA)*	0.2 – 0.3	285 – 322	-238 – -155	45 – 117
Environmental Action Plan (MAP)	0.3 – 0.5	32 – 69	-53 – -5	36 – 69
Energy tax	0.8 – 2.4	--	--	--
Non-Residential Buildings				
EPN	0.1 – 0.3	3 – 12	-146 – +18	-51 – +39
Energy tax	0.1 – 0.6			
EIA/Vamil	0.1 – 0.5	13 – 67	-206 – +6	-71 – +26
EINP	0.2 – 1.0	8 – 47	-49 – +53	-7 – +38
LTA	0.0 – 0.1	60 – 191	-309 – +52	-115 – +39
MAP	0.2 – 0.4	27 – 69	-164 – +110	-34 – +137

* The relatively high cost-effectiveness numbers for the EPR are largely due to the fact that the scheme was intended not only to reduce CO_2 emissions, but also to increase penetration of renewable energy options in buildings. Photovoltaic solar panels were heavily subsidised under the programme. Renewable energy in buildings is generally much less cost-effective than energy conservation when measured against avoided CO_2 emissions.

Table 4.16 EPC standards for non-residential buildings

In force from	Dec 15, 1995	Jan 1, 2000	Jan 1, 2003
Type of building			
Meeting (e.g. theatre, museum)	3.4	2.4	2.2
Prison	2.3	2.2	1.9
Non-clinical healthcare	2.0	1.8	1.5
Clinical healthcare	4.7	3.8	3.6
Hotel, restaurant, café	2.2	1.9	1.9
Office	1.9	1.6	1.5
Accommodation	2.4	2.1	1.9
Education	1.5	1.5	1.4
Sport	2.8	2.2	1.8
Retail sales	3.6	3.5	3.4

in 1995, as shown in table 4.16. The government is currently investigating whether the standard for certain types of buildings can be tightened even further.

- Energy Tax (status = implemented)

This tax on natural gas and electricity has been in effect since 1996. Called the regulatory energy tax when it was first implemented, since 1994 it has become known simply as the Energy Tax. It was introduced as part of an operation to 'green' the tax system in the Netherlands. The revenues raised by the tax are returned to taxpayers through reduced income tax. The objective of the tax was therefore twofold: to encourage the efficient use of energy and reduce CO_2 emissions from small-scale energy users, and to provide revenues to cover the costs of lowering direct taxes. The tax rates have been raised several times since 1996, and other modalities of the tax have also been changed. Some of these changes were made as part of the implementation of the EU energy tax (Directive 2003/96/EC) in the Netherlands. Current tax rates are presented in Table 4.17.

Table 4.17 Energy tax rates as of January 2005

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Natural gas (€ct per m³)										
1-5000 m³	1.45	2.89	4.33	7.17	9.46	12.05	12.40	12.85	14.29	14.94
5001-170,000 m³	1.45	2.89	4.33	4.65	5.20	5.63	5.79	6.00	7.27	10.19
170,001-1 mln m³	0	0	0	0.32	0.70	1.05	1.07	1.11	2.27	3.11
1 mln – 10 mln m³	0	0	0	0	0	0	0	0	1.13	1.15
>10 mln m³ non-commercial	0	0	0	0	0	0	0	0	1.06	1.07
>10 mln m³ commercial	0	0	0	0	0	0	0	0	0.75	0.76
Electricity (€ct per kWh)										
1-10,000 kWh	1.34	1.34	1.34	2.22	3.73	5.84	6.01	6.39	6.54	6.99
10,001-50,000 kWh	1.34	1.34	1.34	1.43	1.61	1.94	2.00	2.07	2.12	2.63
50,001-10 mln kWh	0	0	0	0.10	0.22	0.60	0.61	0.63	0.65	0.86
>10 mln kWh non-commercial	0	0	0	0	0	0	0	0	0.10	0.10
>10 mln kWh commercial	0	0	0	0	0	0	0	0	0.05	0.05

This tax is based on degressive tax rates, but the tax is paid over every bracket. E.g., if a company uses 200,000 m³ of natural gas per year, they pay €ct 14.29 per m³ over the first 5000 m³, €ct 7.27 per m³ over the m³ used between 5000 and 170,000, and €ct 2.27 per m³ over the amount between 170,000 and 200,000 m³.

- Climate Covenant with provinces and municipalities (status = implemented)

The Climate Covenant is an agreement between central government, the provinces and the municipalities (signed in 2002) regarding efforts to be undertaken by the lower governments in support of the national climate change policy. This instrument aims to encourage government efforts to reduce emissions, particularly through their housing programmes and the use of renewable energy. The agreement is coupled to a subsidy programme that makes funds available for governmental initiatives in these areas. The budget for this scheme is around € 35.6 million. As of December 31, 2004, some 204 municipalities and 9 provinces had submitted subsidy applications under this programme.

- EU Directive on Energy Performance of Buildings (EPBD)(status = adopted)

Several of the requirements contained in the EPBD, such as the setting of energy standards for new construction and major renovation, have already been implemented in the Netherlands. Those still remaining to be implemented generally require only marginal changes to existing policies, such as the EPA and the EPN. The energy certificate required by the EPBD is not expected to generate any direct CO_2 effect in the Netherlands, but it will contribute to awareness building, as will the mandatory renewable energy feasibility study for large buildings.

Summary buildings sector

Table 4.18 presents a summary of the emission-reduction effects of the policy measures affecting emissions from the buildings sector in the period 1990-2020.

Tabel 4.18 Summary of emission reductions in the buildings sector, in Mtonne CO_2-equivalent avoided emissions per year

Policy cluster	Gas	Realised	Projected			
		2000	2005	2010	2015	2020
Energy performance of new buildings	CO_2	0.8	0.3	1.1	2.2	3.7
Retrofit of existing buildings	CO_2	1.8	0.5	1.0	1.5	1.9
Energy efficiency of appliances	CO_2	1.0	0.3	0.6	0.8	1.0
Total		**3.6**	**1.1**	**2.7**	**3.5**	**6.6**

4.3.9 How policies and measures modify longer-term trends in greenhouse gas emissions

As presented in the summary tables concluding the previous paragraphs, with the emission reduction effects per sector, policies and measures are projected to have effects in the years after the first commitment period of the Kyoto Protocol as well, i.e. in 2015 and 2020. In the projections of which these effects have been derived it is assumed that policies and measures are continued till then. The aggregate effects are assessed in chapter 5.

4.4 Policies and measures no longer in place

The list below provides a summary of policies that have been repealed or have expired since the Netherlands' 3RD National Communication.

Policies that have expired or been repealed:

- the Energy Premium Rebate (EPR) has been discontinued; if needed, it may be (partly) replaced with a CO_2 Tender Scheme in the Buildings Sector, as described in paragraph 5.2.2;
- the Energy Investment Subsidy Program for non-Profit Organizations (EINP) was repealed in 2002;
- article 36i of the Energy Tax, which allowed for a reduced tax rate on green electricity, was eliminated as of January 1, 2005; other articles of the (then) regulatory energy tax, aimed at stimulating the production of renewable energy and energy from combined heat and power, have been replaced by the MEP, as described in section 4.3;
- as part of the introduction of CO_2 emissions trading pursuant to Directive 2003/87/EC, the Environmental Management Act was amended to eliminate energy requirements in environmental permits for installations falling under the trading system;
- a payment discount in the Energy Tax intended to accelerate afforestation was dropped in the 2003 Tax Plan;
- a reduction in the purchase tax on new cars for in-car instruments was repealed in 2005.

4.5 Participation in the mechanisms under Articles 6, 12 and 17 of the Kyoto Protocol

4.5.1 Institutional arrangements

- Government use of the project-based mechanisms

The target for government use of the project-based mechanisms is 100 Mtonne CO_2-eq. over the commitment period 2008-2012 (an average of 20 Mtonne per year). The clean development mechanism (CDM) is expected to provide around two-thirds of the emission reductions, with Joint Implementation (JI) providing the remaining one-third.

The Ministry of Housing, Spatial Planning and the Environment (VROM) was designated as National Authority (DNA) for CDM and JI in the Netherlands on September 10, 2002. The DNA approves CDM project proposals before submission to the CDM Executive Board. VROM has delegated the selection of projects and the purchase of emission reductions from JI projects to the Ministry of Economic Affairs, which acts as the Netherlands JI Focal Point. The Focal Point approves JI project proposals.

- Clean Development Mechanism

Various types of instruments are being deployed by the government in order to acquire Certified Emission Reductions (CER's). In order to stimulate the implementation of CDM

Table 4.19 Status of CDM and JI instruments as of January 1, 2005, Mtonne CERs and ERUs included in framework agreements with intermediary organisations

Instrument	Clean Development Mechanism		Joint Implementation	
	Organisation	Mtonnes contracted	Organisation	Mtonnes contracted
Tenders	CERUPT	around 2.5	ERUPT	15.5
Contracts with multilateral financial institutions	IFC	10	EBRD	6
	IBRD	32	IFC/IBRD	10
	CAF	10		
Contracts with private financial institutions	Rabobank	10	--	
Participation in carbon funds	CDCF	around 1	Prototype Carbon Fund	2.5
Bilateral purchase agreement	Indonesia	2		

projects, voluntary and not legally binding Memoranda of Understanding (MoUs) have been signed with some potential host countries, such as Argentina, Bolivia, Brazil, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Indonesia, Mexico, Nicaragua, Panama and Uruguay. For the selection of CDM projects and the purchase of CERs that meet the quality specifications of the government, various intermediairy organisations have been contracted along five tracks:

1. the governmental agency SenterNovem to conduct a public procurement procedure called CERUPT;
2. facilities with multilateral and regional financial institutions: the International Finance Corporation (IFC), the International Bank for Reconstruction and Development (IBRD), and Corporacion Andina de Fomento (CAF);
3. facility with a private international bank: the Rabobank;
4. bilateral purchase agreement with a host country: Indonesia;
5. participation in carbon funds: the Prototype Carbon Fund (PCF) and the Community development Carbon Fund (CDCF).

- Joint Implementation

The Netherlands has developed three instruments for obtaining Emission Reduction Units. First, the Emission Reduction Units Procurement Tender (ERUPT) is a tender scheme through which the government acquires ERUs directly from projects via a public procurement process: the scheme is operated by SenterNovem (a government agency). Second, the Ministry of Economic Affairs has signed a contract with the Prototype Carbon Fund (PCF), by which the PCF endeavours to acquire cost-effective ERUs for the Netherlands in exchange for a contribution to the fund. And finally, framework contracts have been signed with the World Bank (a cooperative arrangement between the International Bank for Reconstruction and Development (IBRD) and the International Finance Bank) and the European Bank for Reconstruction and Development (EBRD). Under the terms of these contracts the banks endeavour to deliver ERUs at agreed prices and times. Voluntary and non-legally-binding Memoranda of Understanding for cooperation on the implementation of JI projects are concluded with: Bulgaria, Croatia, Estonia, Hungary, Romania, Slovakia, New Zealand.

- Situation as of January 1, 2005

Table 4.19 shows the situation as regards each of the instruments on January 1, 2005. Framework agreements with intermediary organisations and projects selected via CERUPT and ERUPT account for 99 of the 100 Mtonne of ERUs and CERs that the government intends to purchase. An overview of projects contracted by the Netherlands is presented in Annex 4.1.

- Use of the project-based mechanisms by other legal entities

In a letter regarding implementation of Directive 2004/101/EC (the so-called Linking Directive) sent to Parliament in February 2005[3], the Dutch government announced its intention to allow companies participating in CO_2 emissions trading to have unlimited use of CERs during the period 2005-2007. The government also proposed limiting the use of JI and CDM during the period 2008-2012 to 8% of the allocated allowances. Each EU Member State will determine a maximum per installation. A level playing field for all European companies as regards access to JI and CDM is considered very important. The Dutch Government therefore considers that its proposal provides a contribution to the European discussion regarding the maximum per installation.

4.5.2 Financial arrangements

The government has reserved roughly € 606 million for acquisition of CERs and ERUs (€ 204 million for JI and € 402 million for CDM).

4.5.3 Decision-making procedures

Decision-making responsibility for CDM rests with the Ministry of Housing, Spatial Planning and Environment (VROM).

In general, each CDM project should serve all three CDM goals:
- to contribute to sustainable development in non-Annex I countries;
- to contribute to the ultimate objective of the United Nations Framework Convention on Climate Change (UNFCCC): the absolute mitigation of climate change;
- to assist Annex I parties in complying with their emission-reduction commitments.

All intermediary organisations are contractually obliged to select, contract and purchase emission reductions only from projects that comply with the Ministry's CDM project criteria, the CDM requirements as defined in the Kyoto Protocol, the Marrakech Accords, the guidance provided by the CDM Executive Board, the approval criteria of the host country and the intermediary's own project selection criteria, plus environmental and social safeguard policies. The minimum criteria applied to projects submitted under the framework of the Netherlands' CDM programme are described in Annex 4.1.

Decision-making responsibility for JI rests with the Ministry of Economic Affairs. JI projects are eligible for selection if they comply with the requirements as defined in the Kyoto Protocol and the Marrakech Accords and, depending on the instrument used, if they comply with the ERUPT Terms of Reference or the intermediary's (i.e. the bank's) own project selection criteria. To date, in the absence of the Supervisory Committee's authority, the guidance provided by the CDM Executive Board has been used in the selection criteria by the various instruments.

The Kyoto Protocol (KP) defines a JI Project as a project that generates a reduction in emissions of greenhouse gases that is additional to any reduction that would otherwise occur, i.e. reductions that would not be achieved in the absence of the project. JI projects can only be undertaken in Annex I countries as listed in the Framework Convention on Climate Change. Criteria for successful JI projects are described in Annex 4.1.

Examples of JI and CDM projects are:
- renewable energy (e.g. solar, wind, biomass, hydro);
- the replacement of CO_2-intensive fuels (e.g. oil-to-gas, coal-to-gas);
- energy efficiency (e.g. CHP, lighting, insulation, process optimisation);
- waste processing (e.g. landfill gas extraction, waste incineration).

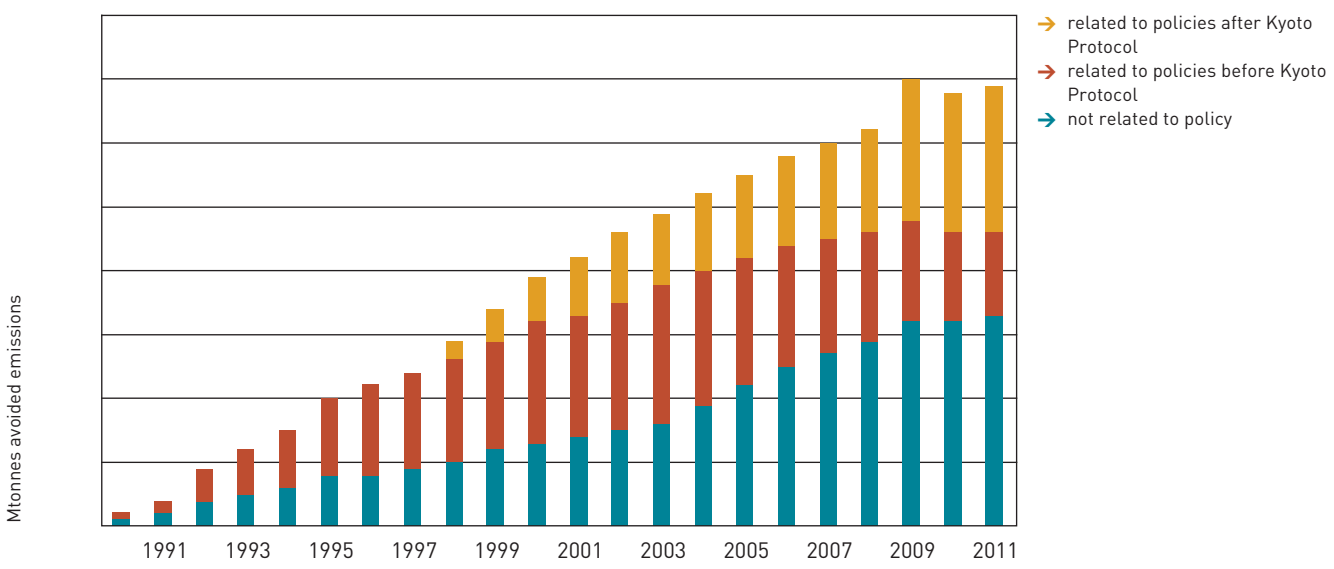
4.6 Supplementarity relating to the mechanisms under Articles 6, 12 and 17 of the Kyoto Protocol

4.6.1 Assumptions

In this analysis, domestic actions are defined as measures taken by companies, private citizens and government which

3 Available in Dutch from the website *www.Parlement.nl* as Kamerstukken II 2004-2005, 28240, no. 18.

Figure 4.1 Avoided emissions due to domestic actions



lead to lower emissions of greenhouse gases in the Netherlands than would have occurred in the absence of those measures.

'Avoided emissions' is used as the primary indicator of effort. Emission reductions provide after all a common denominator allowing for comparison between the effects of domestic actions and the effect of using the project-based mechanisms. However, insight is also provided into 'costs incurred' and 'investments' as indicators of effort, since the ratio between domestic action and use of the project mechanisms changes considerably depending on which indicator is used.

In assessing how 'significant' such actions are, in this analysis three sets of domestic actions are distinguished. The largest set of actions encompasses all measures taken since 1990 which still have an impact on emissions in 2010. Within this set of total measures a subset is identified consisting of those which can be linked to government policies (for example, because they are taken in order to comply with regulations or because they are financed partly through subsidy programs or prefential tax treatment). The set of policy-related actions is then further subdivided according to the period in which the policy in question was introduced, either before or after the Kyoto Protocol was signed in 1997. This distinction makes it possible to separate the stepped up policy efforts made in response to the Kyoto Protocol from those, that were already being made before the protocol was signed.

Figure 4.1 aids in visualising the distinctions drawn by these definitional issues. The figure presents, in a stylised form, the indicator 'avoided emissions' for the years 1990 through 2012. The figure shows that emissions are avoided every year as a result of measures taken in the past.

4.6.2 Results

In quantifying the indicators of domestic effort, a methodological distinction was made between efforts realised in the period 1990-2003, and efforts projected for the period 2004-2010. Specific studies (Boonekamp et al., 2005 and Harmelink et al., 2005) were commissioned to determine ex post the quantity of emissions avoided by domestic actions

Table 4.20 Avoided emissions in 2010 due to domestic efforts in the period 1990-2012

Type of effort	Mtonne avoided CO_2-equivalents in 2010		
	CO_2	Non-CO_2	Total
Related to policies instituted after the signing of the Kyoto Protocol	18	4	22
Related to policies instituted before the signing of the Kyoto Protocol	10	5	15
Not policy related	32	0	32
Total domestic efforts	60	9	69

taken in the period 1990-2003. The projections of future emission reductions were based largely on (Dril et al., 2005). The Global Economy scenario formed the background for the projections and the policy variant used was the 'with measures' projection (see Chapter 5). The results are presented as avoided emissions in the year 2010, chosen because it is considered representative of the commitment period 2008-2012. The results are presented in Table 4.20.

The Dutch Government intends to use the project-based mechanisms to purchase 100 Mtonne of CO_2-equivalent emission reductions during the commitment period; an average of 20 Mtonne per year. The following figure indicates how those 20 Mtonne compare to the indicators of domestic effort. The figure also presents the emission reductions achieved in the year 2003 separately, to illustrate the difference between the actual efforts thus far and the projected efforts during the coming years. (The figures for 2010 already reflect the realised effects in 2003. The two sets of figures can therefore not be added together.)

The effect of CO_2 emissions trading in the projections of avoided emissions requires special attention when interpreting the results of Figure 4.2. Based on assumptions about the CO_2 price in Europe during the period 2008-2012 (described further in Chapter 5), the analysis identifies cost-effective investments in CO_2 reduction within the Netherlands. The effect of these investments is expressed as avoided emissions and is included in Figure 4.2.

As Figure 4.2 shows, the ratio between domestic actions and use of the project-based mechanisms depends on which domestic actions are included in the comparison. Avoided emissions due to total domestic efforts leads to a ratio of 69/20, while policy-related efforts result in a ratio of 37/20. If only the efforts relating to policies introduced after the signing of the Kyoto Protocol are included, then the ratio drops to 22/20.

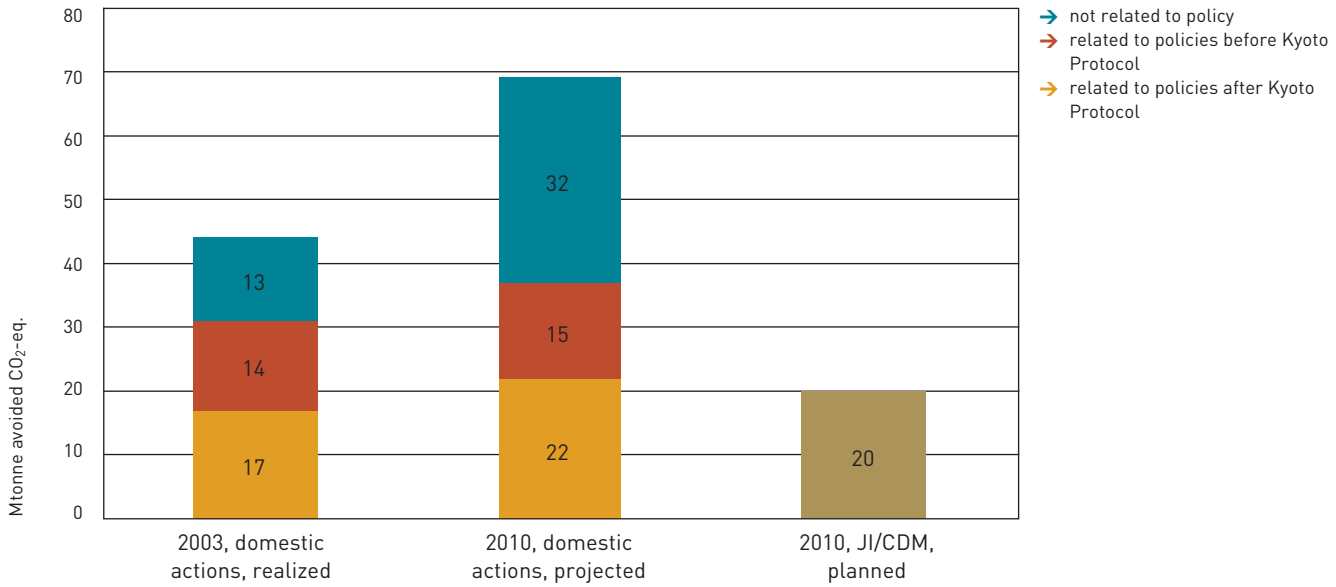
When costs or investments are used as an indicator of effort rather than avoided emissions, the ratio of 'domestic efforts' to 'use of the project-based mechanisms' becomes even greater. The government has reserved around € 600 million for purchasing emission reductions via the mechanisms during the period 2008-2012, or an average of € 120 million per year. The annual net cost of total domestic actions affecting CO_2 in 2010 has been estimated in (Boonekamp, 2005) at € 2900, more than a factor 20 higher, while total investments affecting CO_2 over the period 1990-2010 have been estimated at € 57 billion.

4.7 Policies and measures in accordance with Article 2 of the Kyoto Protocol

4.7.1 Promoting sustainable development

Following the UN World Summit on Sustainable Development in Johannesburg in 2002, in 2003 the Netherlands established its action program for sustainable development. The program consists of a national and an international part. The national part shows what the Netherlands' government will undertake to stimulate sustainable development in the Netherlands. The international part describes the Netherlands' activities that address sustainable development abroad. According to the Netherlands' government, sustainable development should be based on the integration of economic, socio-cultural and environmental policies with an emphasis on investing for future generations and on the wish to eradicate poverty in the world.

Figure 4.2 Domestic actions related to government use of JI and CDM in 2010



Examples of issues addressed abroad are clean drinking water and access to energy.

Sustainable development is a central theme in the environmental policy of the Netherlands. The current basis for the Netherlands' environmental policy is the 4th National Environmental Policy Plan (NEPP4, 2001). One of the main issues addressed is climate change.
One of the outcomes of the NEPP4 is transition policy. According to the NEPP4 the Netherlands must become sustainable within the coming decennia. To achieve this, transitions are needed for several policy areas. One of these is the energy supply. Therefore, the transition to a sustainable energy supply has been initiated. The aim is both to reinforce the Netherlands' economy by improving energy efficiency and by reducing the dependency on foreign energy sources, as to reduce the emission of greenhouse gases. In the transition, businesses, NGO's and the government cooperate. In 2004, 5 themes on which will be focused have been identified: new gas, chain efficiency, green resources, sustainable mobility and sustainable electricity.

The Netherlands has concluded agreements for environmental cooperation with several countries and has grants available for projects that contribute to sustainability goals following the several UN conferences on sustainable development. Furthermore the Netherlands contributes to sustainable development in other countries through the purchase of emission reduction allowances from CDM projects, for which contribution to sustainable development is a precondition.

4.7.2 Steps related to emissions of greenhouse gases from aviation and marine bunker fuels

Article 2.2 of the Kyoto Protocol states that the Parties included in Annex I shall pursue limitation or reduction of emissions of greenhouse gases not controlled by the Montreal Protocol from aviation and marine bunker fuels, working through the International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO), respectively. Since 1997 ICAO and IMO have not been able to agree on limitation or reduction measures. Both organisations are still studying possible ways forward. Because of the limited progress within ICAO and IMO, the Netherlands' government stated in a policy

document to Parliament (Beleidsnota Verkeersemissies, 2004) that it would prefer the EU to also think about measures. In this document it is also stated that the emissions from international aviation and maritime transport should be part of a future climate change regime. Under the Netherlands' EU Presidency (second half of 2004) the Environmental Council of the European Union recalled the need for urgent action to reduce greenhouse gas emissions related to the use of the international bunker fuels, taking into account the agreement in the Sixth Environment Action Programme (EAP: commits the Commission to identify specific action to reduce greenhouse gas emissions from aviation and shipping if no such action is agreed with ICAO or IMO by 2002 or 2003), ... and reiterated its invitation to the Commission ... to make proposals in 2005 (Council conclusions October 14, 2004, 13531/04). The Council furthermore emphasised its desire for an early discussion with all Parties on a future climate change regime, ..., taking into account all important greenhouse gases, sectors and mitigation options, including emissions from international aviation and maritime transportation (Council conclusions December 21, 2004, 16298/04).

ICAO

The Netherlands has been pushing for international market-based measures within the ICAO context, e.g. taxes, emission-related levies and open emissions trading. To facilitate the decision-making process, the Netherlands Ministry of Transport developed the AERO model (Aviation Emissions and Evaluation of Reduction Options). AERO is able to model the environmental and economic effects of the various market-based measures. It has been used in 1997 for an analysis by the Committee Aviation Environmental Protection (CAEP) under ICAO on, inter alia, the effects of charges. Since then the model has been further improved. In 2000 it was used for a study commissioned by the EU to analyse the consequences of a European kerosene tax, and later for an analysis for CAEP/5. Results:
The last ICAO Assembly resolution:

- encourages Contracting States and other parties to limit or reduce international aviation emissions, in particular through voluntary measures;
- urges Contracting States to refrain from unilateral implementation of greenhouse gas emissions charges prior to the next Assembly in 2007;
- endorses the further development of an open emissions trading system for international aviation and requests the Council to focus on two approaches: a voluntary trading system and a system where ICAO would provide guidance for use by Contracting States' emissions trading schemes consistent with the UNFCCC process.

ICAO will not come up with concrete international measures, but will provide guidance when Contracting States will take measures.

IMO

Under the IMO, the Marine Environment Protection Committee (MEPC) established a correspondence group under its Working Group on Air Pollution from Ships. In 2003, this resulted in an Assembly resolution A.963(23). This resolution urges the MEPC to establish a GHG emission baseline, to develop a methodology to determine a GHG emission index for ships, to develop guidelines for practical implementation of the GHG emission indexing scheme, and to evaluate technical, operational and market-based solutions. The Netherlands participated in both the working group and the correspondence group. Document MEPC 51/4 contains the Netherlands' comments submitted to the correspondence group. The main message of these comments was that it needs to be prevented that the elaboration of the index results in endless academic discussions. The index needs to be kept as simple as possible in order to be practically applicable. Furthermore, the Netherlands stated that the technical, operational and market-based solutions should be evaluated.

MEPC53 (2005) approved Interim Guidelines for Voluntary Ship CO_2 Emission Indexing for use in trials. Industries, organizations and interested administrations were invited to use the Interim Guidelines on a trial basis and to submit their experiences and data obtained to the MEPC. So far it has not been possible to reach consensus on how to deal with the emissions.

4.7.3 Minimization of adverse effects

The Kyoto Protocol was adopted in pursuit of the ultimate objective of the Convention. Its full implementation by Annex I Parties is thus intended to contribute to preventing dangerous anthropogenic interference with the climate system and thus contribute to minimising the adverse effects of climate change

on other Parties, especially developing country Parties identified in Article 4, paragraphs 8 and 9, of the Convention.

The Kyoto Protocol is, in principle and in general, designed to minimize adverse effects on specific sectors, specific industries or specific trade partners of a Party, including the adverse effects of climate change, on international trade, and social, environmental and economic impacts on other parties, especially developing country Parties etc. This is due to fact that the Protocol does not target a single gas - but covers the Kyoto 'basket' of six gases. It also foresees the use of carbon sequestration by means of CO_2 sinks. All this ensures a distribution and sharing of the efforts to reduce emissions across various fields of action, thereby limiting the depth of any specific effect of a particular measure targeting a specific gas.

The Kyoto Protocol does not limit action to a specific sector or to reducing greenhouse gases only by domestic efforts - instead the Protocol foresees flexible mechanisms. Emissions Trading, Joint Implementation and the clean development mechanism are all tools designed into the Protocol in order to share efforts in reducing greenhouse gases, ensuring that investment is made where the money has optimal greenhouse gas reducing effects, thus ensuring minimal impact on the world economy. Moreover, the CDM, with its dual aim of promoting sustainable development and reducing GHG emissions, is important for countries with continuing development needs. The implementation and comprehensive use of flexible mechanisms guarantees that possible impacts are distributed over various fields of action and ensures that the depth of any specific effect of a particular measure targeting a specific sector or trade partner is minimized, while still meeting the overall target of minimizing the adverse effect of climate change.

Action to support the least-developed countries is addressed by responsibilities for the developed countries to cooperate in technology transfer, scientific and technical research, national capacity building and in providing financial resources (Articles 10 and 11 of the Kyoto Protocol).

It therefore follows that the Kyoto Protocol already has the tools for ensuring that effects on international trade, and social, environmental and economic impacts on other Parties, especially developing country Parties (particularly those identified in Article 4, paragraphs 8 and 9, of the Convention) are minimized as integral features. By striving to comprehensively and thoroughly implement all the features integrated into the Protocol (i.e. target all gases, include sinks, extensive use of the flexible mechanisms) a Party is naturally working to minimize any adverse effects due to the reduction of greenhouse gases. As described in Sections 4.3 and 4.5, the Netherlands has implemented all features by implementing policies and measures for all sectors, all gases and by making use of the Kyoto mechanisms to achieve its emission-reduction target under the Kyoto Protocol, and is thereby minimizing adverse effects.

4.8 Domestic programmes and/or legislative arrangements and enforcement and administrative procedures

4.8.1 Arrangements and procedures

Section 4.2 describes the general policy programme and inter-ministerial arrangements the Netherlands has in place to ensure compliance with its emissions-reduction target under the Kyoto Protocol. Besides these institutional arrangements, which are made explicitly in response to the Netherlands' signing of the Kyoto Protocol, there are also more general legislative arrangements and enforcement and administrative procedures in place to ensure compliance with environmental rules and regulations. These arrangements pre-date the Netherlands' ratification of the Kyoto Protocol.

The Environmental Management Act provides the legal basis for most environmental regulations that affect emissions of greenhouse gases (for example, in the fields of waste prevention and landfill policy, environmental permits and CO_2 emissions trading). The Environmental Management Act also provides the framework for enforcing commitments undertaken in Long-Term Agreements and the Benchmarking Covenant by companies that do not participate in emissions trading.

Chapter 18 of the Environmental Management Act contains the enforcement provisions. It notes, among other things, which authorities are responsible for enforcement and requires them to designate officials to be charged with monitoring compliance. Authorities have several possibilities for imposing sanctions if violations occur. They may, for example, order that the situation be brought into compliance at the expense of the violator or

impose a pecuniary penalty or withdraw a license. The possibility of criminal sanctions also exists. Public prosecutors may bring cases against offenders in criminal court, which can result in high financial penalties or even imprisonment (for a maximum of six years).

The statutory basis for the energy performance standards (EPN and EPC), which apply to new buildings, is the Housing Act rather than the Environmental Management Act. The standards themselves are set down in a decree pursuant to this Act, i.e. the Buildings Decree. The Buildings Decree also empowers municipal authorities to grant building permits when the building design is judged to meet the standards in the Decree. Compliance and enforcement authority also rests with municipal authorities. If violations of the building permit occur, municipal authorities have recourse to administrative sanctions based on Article 25 of the Municipalities Act and to criminal sanctions based on Article 108 of the Housing Act.

4.8.2 Provisions to make arrangements and procedures publicly accessible

In the Netherlands, all laws and underlying legislative arrangements are published after adoption in one of several official government bulletins, as indicated in section 2.1. They are then made publicly accessible at several locations, including the website *www.overheid.nl.* The Freedom of Information Act and the Environmental Management Act also provide for public access to information regarding the enforcement of environmental rules and regulations, most recently through amendments contained in the Act concerning Implementation of the Arhaüs Treaty, which entered into force on February 14, 2005 (Staatsblad 2005, 519).

4.8.3 Arrangements and procedures related to participation in the mechanisms under Articles 6, 12 and 17 of the Kyoto Protocol

Section 4.5 describes arrangements and procedures relating to the use of the flexible mechanisms. Furthermore, the Netherlands' Emission Authority was created and appointed official national registry for the purposes of the Kyoto Protocol and the EU Directive on CO_2 Emissions Trading via amendments to the Environmental Management Act (Staatsblad 2004, 511).

4.8.4 Description of the National Registry

In 2004 the Netherlands joined GRETA (Greenhouse Gases Registry for Emission Trading Arrangements) in developing a registry for GHG emissions trading. This registry has been built and complies with all requirements for the European CO_2 emissions trading as well as the UN emissions trading under the Kyoto Protocol. The Dutch registry has been online since February 28, 2005 and is connected to the CITL (Community Independent Transaction Log).

Additional Kyoto functionality has been identified and needs to be developed for this registry and tested against the ITL test system. The release of this new version of the registry is planned to take place in the middle of 2006, but this also depends on the development of the ITL. The European Commission approved the register for CO_2 emissions trading in December 2004. It hereby also complies with the requirements of the Kyoto Protocol. For a detailed description of the National Registry, see Annex 4.2.

4.8.5 Arrangements and procedures related to implementation of Articles 3.3 and 3.4 of the Kyoto Protocol

Most of the forest area in the Netherlands is managed according to the principles of Sustainable Forest Management (SFM). Newly established forests are also planted according these principles. The Forest Act, the Flora and Fauna Act and the Nature Conservation Act dictate which conditions for deforestation apply. Deforestation is only allowed when the negative consequences for biodiversity are minimised. The SFM principles and the three aforementioned Acts ensure that the implementation of Article 3.3 activities contributes to the conservation of biodiversity and sustainable use of natural resources.

5. Projections and the total effect of policies and measures

5.1 Introduction

The projections described are taken mainly from the new projections made early in 2005, the so-called Referentieraming (Dril et al., 2005). Emissions associated with two socioeconomic scenarios (given the names Strong Europe and Global Economy) are presented for three different policy variants ('without measures', 'with measures' and 'with additional measures').

Section 5.2 presents results for the years 2005, 2010, 2015, and 2020, subdivided by gas and by sector. Aggregate effects are presented in Section 5.3.1. Emission projections for precursor gases and for international marine and aviation bunkers are described in Sections 5.3.2 and 5.3.3 respectively, while Section 5.3.4 is devoted to uncertainty and sensitivity analyses. Section 5.3.5 describes the preliminary results of projections of the carbon balance in Dutch forests. The methodologies and assumptions underlying the projections are described in more detail in Section 5.4 and Annex 5.1.

5.2 Projections

5.2.1 Description of scenarios

The scenarios underlying the emission projections have been derived from two of the four economic scenarios described in (Bollen et al., 2004)[4]. These projections are based on a further elaboration for the Netherlands of two of these European scenario's, namely Strong Europe (SE) and Global Economy (GE). While both scenarios reflect a world with broad international cooperation, their orientations differ.

International cooperation is coupled to public responsibility in the SE scenario. European institutions are reformed and the EU grows into a stronger economic and political block. The United States becomes part of a worldwide climate coalition pursuing successful policies that make extensive use of the Kyoto mechanisms. The public responsibility orientation is expressed though relatively even income distribution, greater social security and investments in education and research. A reasonable rate of economic growth is achieved, mainly due to the larger markets. The annual average growth in Gross Domestic Product between 2002 and 2020 amounts to 1.7%.

The GE scenario is oriented sharply towards international trade, but little political cooperation. A strong emphasis on the personal responsibility of citizens and corporations results in relatively high economic growth and material welfare. Population growth is highest in the GE scenario. Environmental awareness is not translated into strong regulations and international climate policies fail over the longer term, although in Western Europe climate policy remains strong until 2020. Gross Domestic Product grows by 2.7% per year between 2002 and 2020.

Assumptions regarding nuclear energy differ after 2013 in the two aforementioned scenarios. The Netherlands' single remaining nuclear plant is assumed to close in 2013 under SE, but continues to operate after 2013 in GE.

Another important difference between the two scenarios is the amount of new coal capacity. Under SE, power companies expect the CO_2 price to rise and therefore invest in renewable energy and gas rather than in coal; while in GE, investors assume that emission ceilings will not be tightened over time and that the CO_2 price will not rise. This assumption leads to investment in 2000 MW of new powder coal capacity after 2010.

The projections are based on the use of various models. Section 5.4 provides more details on the models used.

Table 5.1 provides summary information on the variables in both scenarios. Annex 5.1 provides (in tabular form) more detailed information on parameters for descriptions of projections.

- Changes relative to previous projections

Several important changes have been introduced into the approach for projecting future emissions since the publication of the previous projections, such as the previous Reference Projection in 2002. It is important to keep these changes in mind when comparing the projections reported in this submission to those reported previously, for example in the 3rd National Communication, or to inventory data as reported in the Netherlands National Inventory Report 2005. The approaches

4 Except for the transport sector, which relies on the emissions projections underpinning the Traffic Emissions Policy Document issued by the Dutch Government in 2004. More information on projections for the transport sector can be found in (Brink, 2003).

Table 5.1 Summary of key variables and assumptions in the projections analysis: General Economic Parameters (Annex 5.1. lists further detailed variables and assumptions)

Parameter	Value in 2000	Annual growth in %/yr 2002-2010		Annual growth in %/yr 2011-2020	
		SE	GE	SE	GE
GDP, in million euro	402 291	1.8	2.9	1.8	2.9
		Value in 2010		Value in 2020	
Population, in millions	15.9	16.8	16.8	17.6	17.9
International coal price, in €/GJ	1.50	1.70	1.70	1.70	1.70
International oil price, in €/GJ	5.36	4.41	4.41	4.72	4.72
International gas price, in €/GJ	3.06	2.89	2.89	3.39	3.39

Prices are in real euro, at 2000 level

used in (Dril et al., 2005) are consistent with those applied in the National Inventory Report 2005 (NIR, 2005). However, due to the late finalisation of the NIR2005, the projections are based on preliminary NIR2005 figures.

The most important changes in the approach include:
- sectoral definitions have shifted slightly to align more closely with the IPCC;
- the projections now take account of the trend towards rising outside air temperature, observed in the past decades;
- adjustments to data regarding historic emissions as a result of recalculations in the inventory, using the IPCC guidelines.

Section 5.4 describes these changes in more detail.

5.2.2 Description of policy variants

Annex 5.2 provides an overview of how each policy measure is included in the three policy variants, 'with measures', 'without measures' and 'with additional measures'. The policy names used are the same as those used in Chapter 4 on Policies and Measures.

- The 'with measures' variant

Existing Dutch and EU policies on energy and climate are assumed to continue in the 'with measures' variant in both SE and GE. Existing policies are those that have been either adopted or implemented as of December 1, 2004. Where existing policy instruments are tied to an expiration date, such as with long-term agreements and covenants, it is assumed that the policy pressure that they represent will be continued after the expiration date. Where policy instruments are still in a very early stage of development, such as CO_2 emissions trading, plausible developments in these instruments are assumed. These assumptions are described in detail in (Dril et al., 2005) and in Annex 5.2.

Policies included in the 'with measures' variant are:
- CO_2 Emissions Trading
- Energy Tax
- EPA, EPR
- EPN, EPC
- EIA, Vamil, EINP
- CO_2 Reduction Programme/General

- Benchmarking Covenant
- LTAs, environmental permits
- Glami Covenant, Orders in Council Greenhouse Horticulture
- MEP, Coal Covenant, BLOW Covenant
- EU Agreement with car makers
- Energy labelling of cars and appliances
- Excise duties on motor fuels
- Enhanced enforcement of speed limits
- The New Driving Force
- CO_2 Reduction Programmes/Passenger and Freight Transport, SSZ
- Reduction Programme for Non-CO_2 Gases
- Covenant with oil and gas producers
- Milk quota, manure management
- Landfill policies
- Low-HFC, HCFC production
- Low-PFC aluminium production

- The 'without measures' variant

The 'without measures' variant shows how emissions would develop in the absence of all climate change policies since 2000. The policy effects already realised before 2000 are included in the baseline scenarios. The summary tables presented for each sector in Chapter 4 on Policies and Measures provide an indication of the magnitude of the effects already realised.

- The 'with additional measures' variant

The 'with additional measures' variant reflects the range of impacts of six policies that are currently either in the planning or study stage in the Netherlands. These policies, if implemented, would generate impacts that are additional to those already reflected in the 'with measures' variant. Table 5.2 describes the six additional policies considered in this variant as well as the status of each policy.

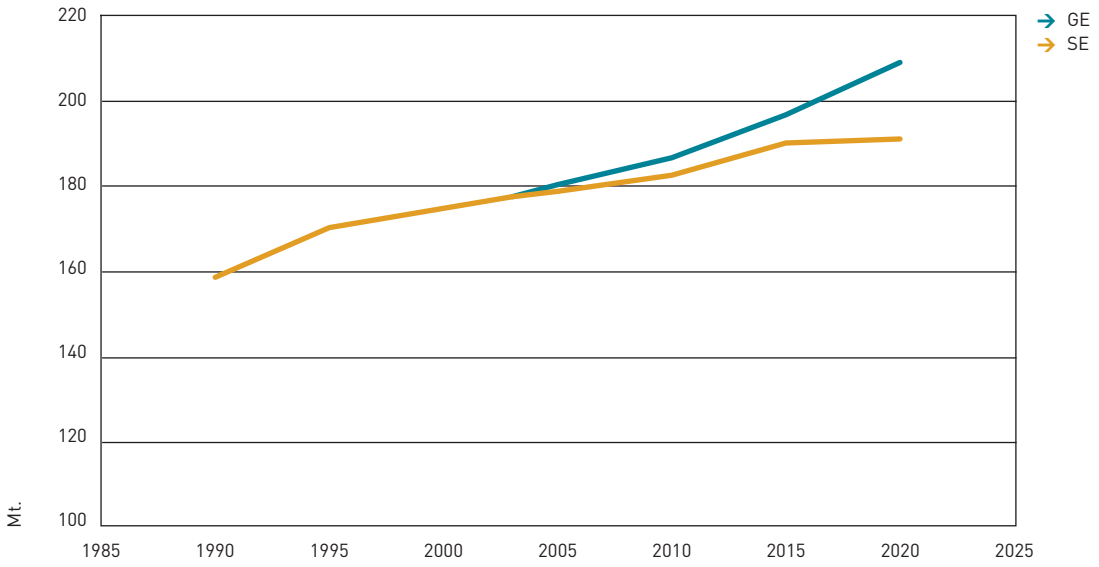
5.2.3 Projections by sector and gas

Annex 5.3 presents the emissions projections by sector and gas for each scenario, policy variant and year following the template produced by the UNFCCC Workshop on Emissions Projections held in Bonn (September 6-8, 2004). The following paragraphs provide a summary of the results.

Table 5.2 Policies included in the 'with additional measures' variant

Policy	Status
CO_2 Tender Scheme for Buildings, with a budget of € 34.5 million, to support large-scale projects in the buildings sector	Implementation depends on the need for extra measures in order to meet CO_2 target for buildings sector
CO_2 differentiation in purchase tax on new cars and purchase tax exemption for hybrid cars, as announced by the government in the Traffic Emissions Policy Document in 2004.	Uncertain whether this instrument will be introduced. The Traffic Emissions Policy Document announced that the instrument would be studied with an eye to implementation in 2006.
Kilometre charge. The Mobility Policy Document (issued by the government in 2004) noted two price variants to be studied. The 'additional measures' variant therefore presents a range of possible emission impacts.	Uncertain whether this measure will be introduced before 2010. Effect depends on variant chosen.
Biofuels policy, assuming a target of 2% in 2010.	Uncertain whether this measure will be introduced before 2010.The Traffic Emissions Policy Document announced a target of 2% in 2006.
Technical measures to reduce N_2O emissions from the nitric acid production industry.	Effect will depend on Best Reference Document pursuant to IPPC Directive, expected to be completed in mid-2005.
Implementation of the EU F-gases regulation.	Autonomous improvements in leakage rates from car air-conditioning systems are already assumed in the scenarios; extra impact expected from regulation after 2015.

Figure 5.1 Actual and projected CO_2 emissions, excl. LULUCF, with measures



- CO_2 emissions

The 'with measures' variant projects that domestic CO_2 emissions will increase by an average of 0.6% per year until 2015 in the SE scenario, and then stabilise at around 220 Mtonne per year. In the GE scenario CO_2 emissions growth is relatively constant between 2000 and 2020, at around 0.9% per year, slightly less than the growth in total energy use. It should be noted that the projected CO_2 emissions in the 'with measures' variant are higher in 2010 than the actual emissions in 1990 and 2003. This is possible, due to the Dutch Government's decision to purchase 100 Mtonnes of emissions reductions via the Kyoto mechanisms and the projected reduction of the non-CO_2 emissions. The growth occurs largely in the electricity production sector, the industry sector and the transport sector.

- CH_4 emissions

Both SE and GE scenarios expect CH_4 emissions to fall by around 20-25% between 2003 and 2010. This drop is due to a decline in the amount of offshore gas production (30% less between 2000 and 2010) and to measures taken to reduce emissions from gas production. The scenarios also reflect policies aimed at reducing the amount and changing the composition of waste to be landfilled, which also contributes to the fall in CH_4 emissions. Both scenarios assume continuation of the milk quota and increased productivity until 2010, leading to a drop in the numbers of dairy cattle and in CH_4 emissions. After 2010 the milk quota is repealed in both scenarios, but the GE scenario shows greater opportunities for growth in dairy cattle herds and enhanced productivity, thus leading to greater manure production and higher emissions.

- N_2O emissions

N_2O emissions remain more or less constant until 2010 in both scenarios, but rise again after 2010 in the GE scenario due to developments in the agricultural sector.

- Emissions of the F-gases

Emissions of HFCs increase by around 20% between 2002 and 2010 in both scenarios, due partly to the transition from using HCFC22 to HFCs as coolants and partly to growth in construction, where HFCs are used in hard foam insulation

Figure 5.2 Actual and projected CH_4 emissions, with measures

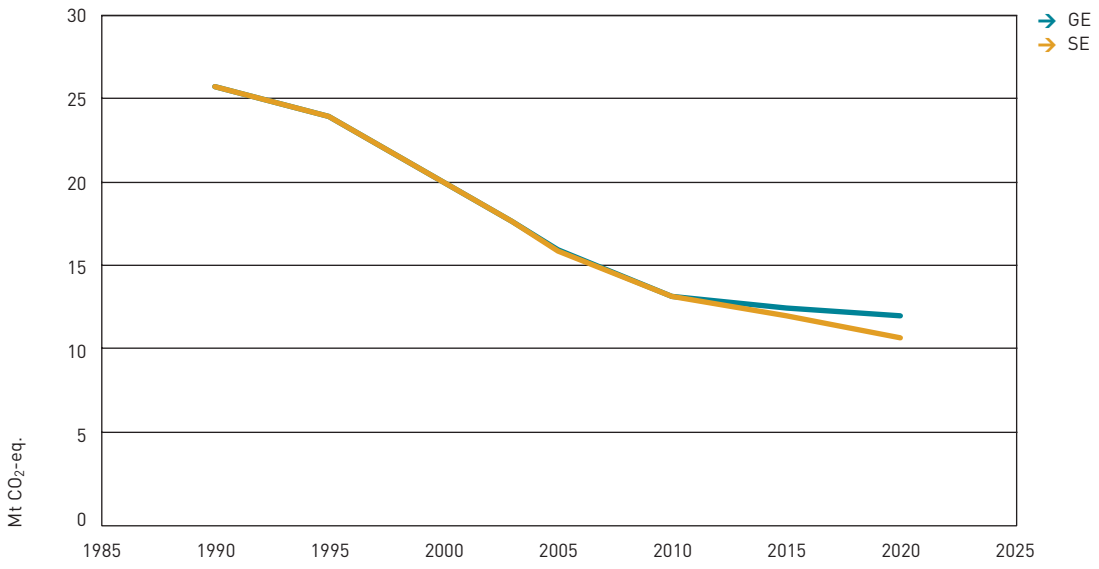


Figure 5.3 Actual and projected N_2O emissions, with measures

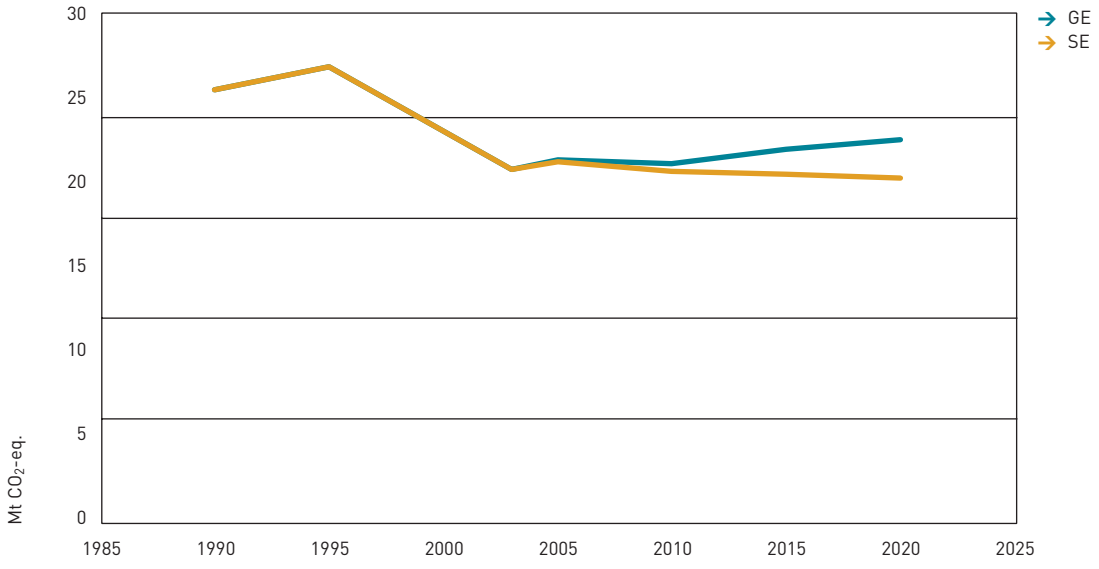


Figure 5.4 Actual and projected F-gas emissions, with measures

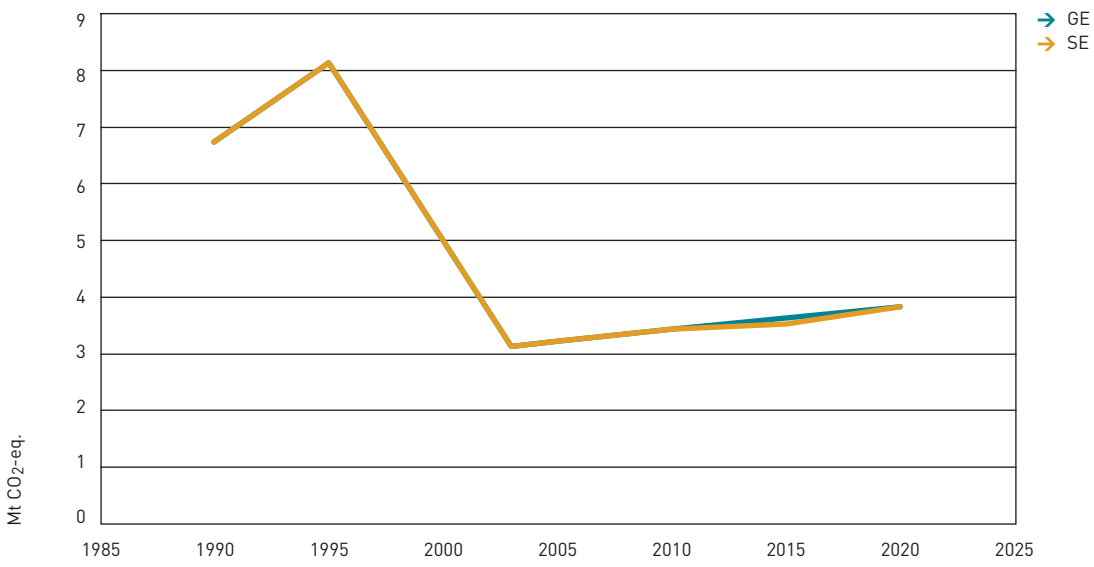


Figure 5.5 Total GHG emissions per sector, with measures, GE scenario

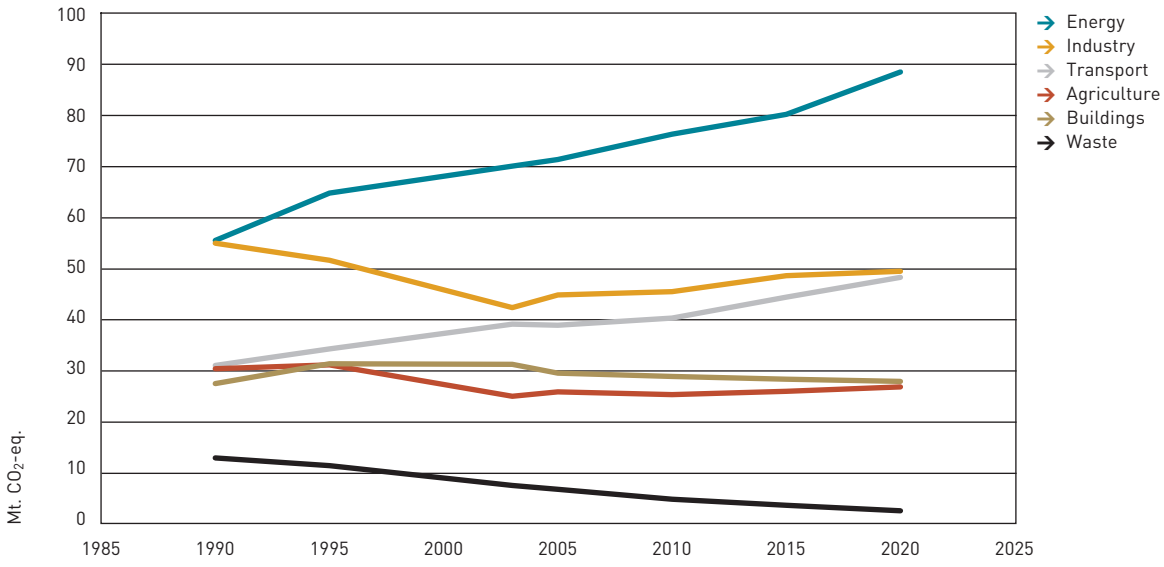
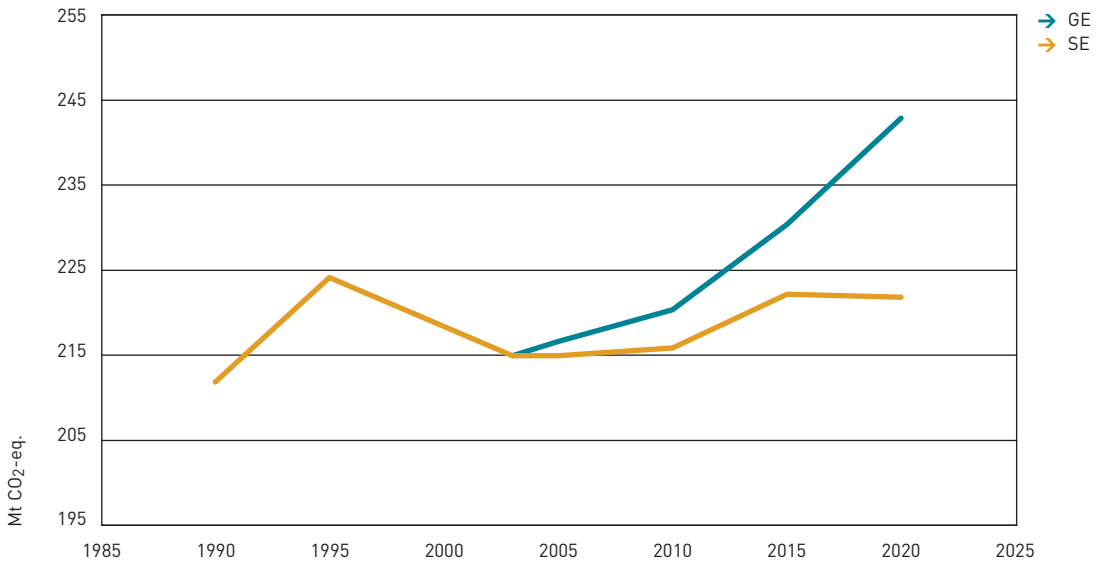


Figure 5.6 Actual and projected total GHG emissions, excl. LULUCF, with measures



materials. PFCs decline by around 50% as a result of measures taken in aluminium production plants and the ceiling on emissions in the semiconductor industry.

- Emissions per sector

The sectors Energy and Transport show increasing greenhouse gas emissions, due to increased energy use. Industry shows a less continuous development, due to measures to reduce N_2O and F-gases. The sectors Agriculture and Waste show declining emissions due to reduced CH_4 emissions from manure and landfill sites. Buildings show a more stable, somewhat declining development.

- Total emissions of greenhouse gases

Under the SE scenario, total emissions of greenhouse gases in 2010 will be similar to their 2002 level (the fall in non-CO_2 greenhouse gas emissions is sufficient to compensate for the growth in CO_2), while the GE scenario expects total emissions to increase by 2-3% between 2002 and 2010. Both scenarios expect further growth in total emissions after 2010.

Figure 5.6 shows the projected developments in total emissions for both scenarios, relative to actual developments since 1990.

5.2.4 Emissions of NOx, NMVOC and SO_2

(Dril et al., 2005) also provides projections for emissions of NOx, NMVOC and SO_2 for the SE and GE scenarios[5] as shown in Table 5.3. These projections reflect the impact of continuing the policies currently in force in the Netherlands.

5.2.5 International bunkers

(Dril et al., 2005) also provides an estimate for the bunkering of oil products in the Netherlands based on historical data and scenario characteristics in order to project emissions from the Dutch refinery sector. Projections of emissions due to international bunkering in the Netherlands are presented in Annex 5.4.

5 Except for the transport sector, which is based on (Brink, 2003).

Figure 5.7 CO_2 **emissions from international bunkering in the Netherlands**

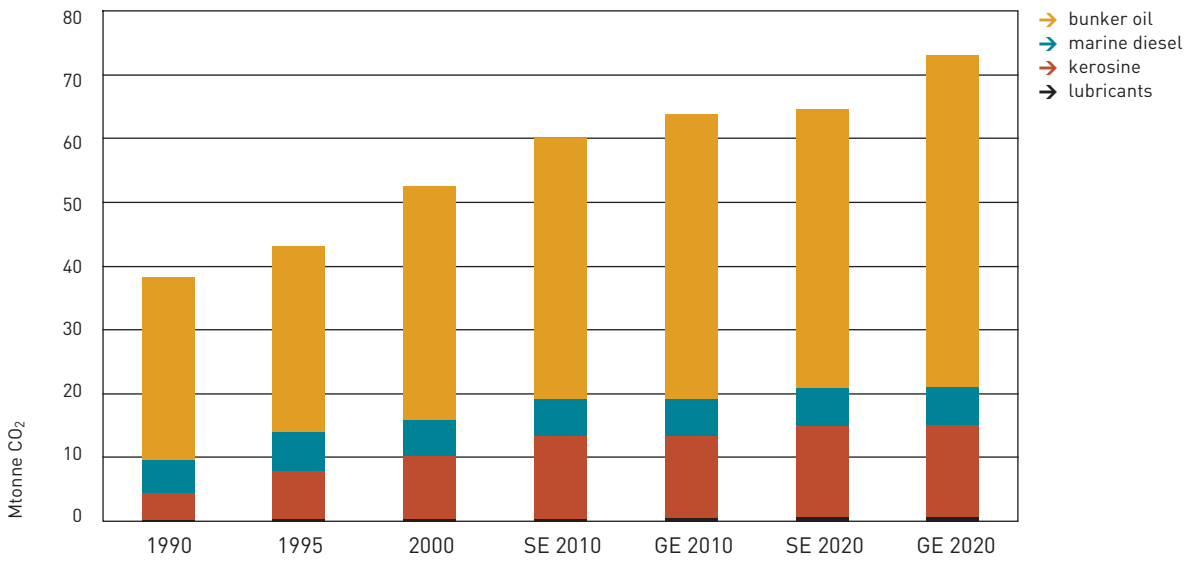


Table 5.3 **Estimated emissions of NOx, NMVOC and SO_2 in ktonne**

Gas	1990*	2002*	2010		2020	
			SE	GE	SE	GE
NOx	598	415	284	288	262	272
NMVOC	488	233	173	176	171	182
SO_2	200	79	66	66	64	80

* Source: National Institute of Public Health and Environment (2004): Milieubalans 2004. Bilthoven 2004.

Rotterdam harbour plays an important role in fuelling the worldwide maritime fleet. Bunkering of heavy oil (bunker oil) for sea-going vessels depends greatly on prices in the Dutch harbour and has little to do with the Netherlands' transportation sector. Heavy oil is also exported to the Netherlands from other countries to be sold here.

The demand for kerosene is tied more clearly to developments around Amsterdam Schiphol Airport, particularly with respect to flights made by aircraft that are leaving the Netherlands. In the absence of data from the Netherlands, which takes account of the stabilisation between 2000 and 2003, data from international studies has also been used in making the projections. No distinction is made between the SE and GE scenarios. See figure 5.7.

The uncertainties connected with the projections of bunker emissions are fairly large. If the market situation improves for competitors of Rotterdam harbour, then sales could stabilise at 2000 levels. Experience in recent years has also made clear that the growth in aviation bunkering can be significantly disturbed by unexpected developments. The most important uncertainty is the growth factor.

5.2.6 Sensitivity analysis and uncertainty

(Dril et al., 2005) follows two approaches for gaining an overview of the uncertainties associated with the projections. First, working with two scenarios provides insight into how fundamentally different developments in socioeconomic parameters (such as internationalisation and public responsibility) influence emissions and policy effectiveness.

Table 5.4 Most important uncertainty factors in projections of greenhouse gas emissions

Gas	Factor	Correlation
N_2O	Measure at nitric acid plants*	0.40
N_2O	Agricultural emissions monitoring (direct emissions)	0.37
CO_2	Transport	0.36
CO_2	Balance of trans-boundary electricity trade and price relative to other countries	0.19
CO_2	Development of demand for heat/steam (CHP)	0.19
CO_2	Final electricity demand	0.18
N_2O	Fertiliser demand (industry)	0.15
F-gases	Estimation uncertainty	0.15
CO_2	Economic growth industry, location choices, and distribution of growth across activities	0.13
CH_4	Estimation uncertainty waste disposal companies	0.12
CH_4	Waste disposal plants emissions monitoring	0.12
CO_2	Lifestyle behaviour of households	0.12

* This measure is not included in the 'with measures' policy variant. However, the uncertainty analysis takes account of a 50% chance that the measure (with an emissions reduction effect of 4 Mtonne CO_2-equivalent) is taken anyway. This is also the reason why the range around the estimate of the non-CO_2 gases is asymmetric.

Second, bottom-up analyses of uncertainties in energy market developments and structural physical and technological developments on a sector-by-sector basis provide information regarding the impacts of those uncertainties on emissions.

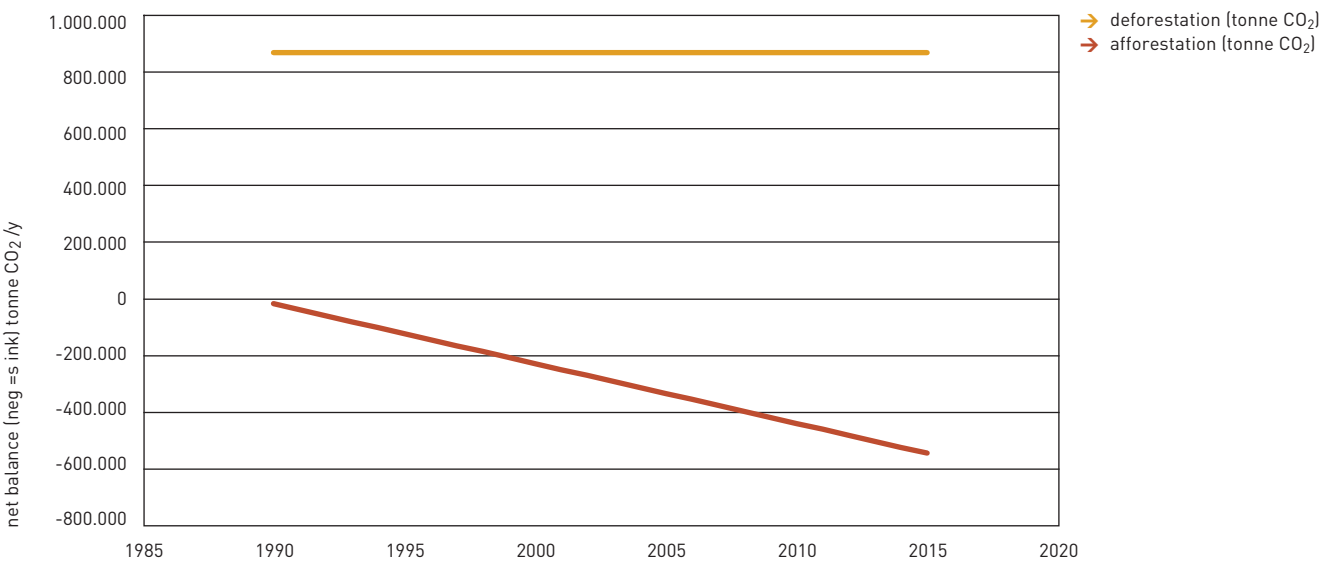
The purpose of the uncertainty analysis is threefold, i.e. to provide:
- insight into uncertainty regarding the realisation of policy goals in 2010;
- insight into how the different sources of uncertainty contribute to the overall uncertainty of the projections;
- information that can help in developing robust strategies which limit the uncertainties surrounding policy results.

Four main sources of uncertainty have been identified. First, uncertainties in monitoring and historic data carry through into projections. Examples of such uncertainties include incomplete or incorrect information regarding historic starting points or emission factors. These uncertainties are described in detail in the National Inventory Reports of the Netherlands. Second, simulation models themselves consist of simplifications that may not do justice to complex reality. Third, policies change over time under the influence of European policies, political preferences and new information, and may not be captured adequately in the analyses. And finally, there are uncertainties associated with future economic, social and technological developments that are the driving forces in the scenarios. These include, in particular, uncertainties relating to international energy price developments, growth in world trade, the behaviour of the 'actors' in the market, technological developments and the effectiveness of policies. These are generally the uncertainties with the greatest impacts on the overall uncertainty margins.

- Ranges

The inventory of uncertainties has been used to determine a range around the emissions projections in the SE scenario. The methodologies used are those applied in (IPCC, 2000). Use of these methodologies results in a 95% confidence interval around the projections. Details about this approach and the results can be found in (Gijsen and Seebregts, 2005). The uncertainty range around the estimate of CO_2 emissions in the

Figure 5.8 Projection of annual CO_2 sinks and sources due to afforestation and deforestation in the Netherlands



SE scenario is +17 Mtonne (+10%) in 2010. For the non-CO_2 gases the uncertainty range amounts to around +7 - 12 Mtonne (+20%, -35%).

- Results

Table 5.4 presents the factors with the greatest impact on the uncertainty ranges. The correlation indicates the extent to which the range in the uncertainty factor contributes to the total range in the emissions projections.

Table 5.5 Annual net carbon emissions due to deforestation and afforestation

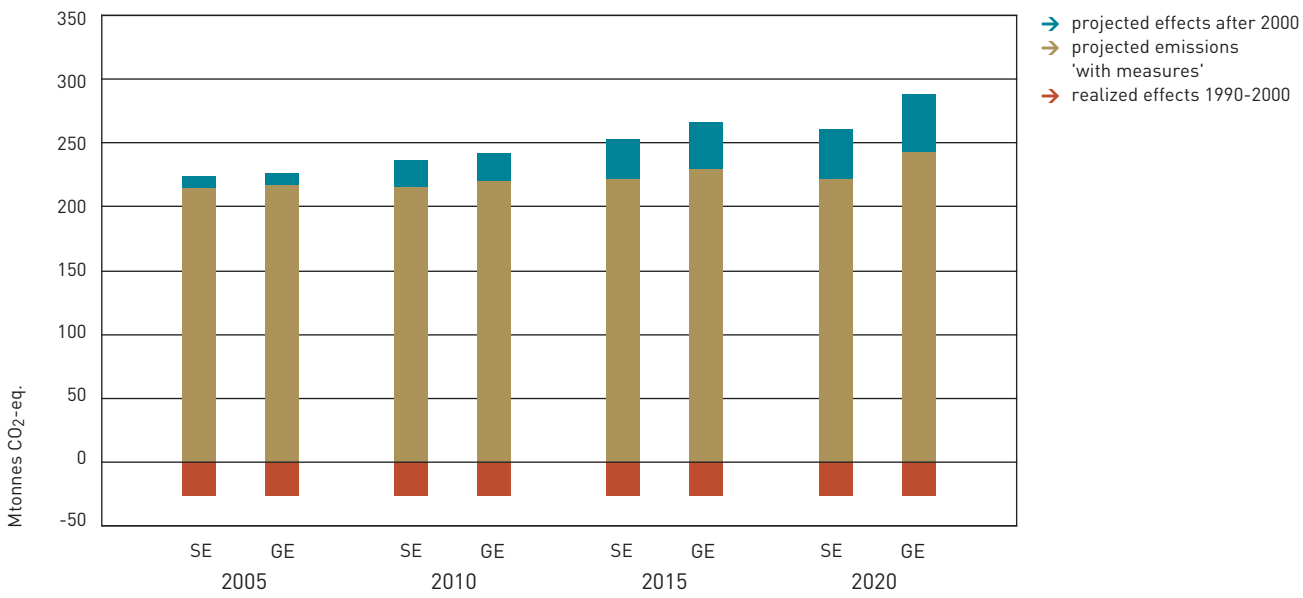
	2005	2010	2015
Mtonne CO_2	0.528	0.423	0.318

5.2.7 Projecting the forest carbon balance for the Netherlands

This section presents the results of preliminary projections of the forest carbon balance in the Netherlands. The results should be considered provisional, as the Netherlands is continuing to improve and refine the methodologies and data used for projecting the forest carbon balance. The results presented here are based on forest definitions and assumptions that are described further in Annex 5.1 on Variables and Parameters. The results for the years 2005, 2010 and 2015 are presented in this section.

In 1990, the forest area within the Netherlands amounted to 362,000 hectare. According to an analysis of topographical land-use maps the forest area amounted to 368,000 hectare in 2000. Approximately, 8% of this is unmanaged. The map analysis showed that the Netherlands annually deforests 2500 hectare, and afforests 3120 hectare. This results in a net afforestation of 620 hectare per year. Given the Dutch Government's active policy to further expand this forest area, it has been assumed that the net expansion rate of 620 hectare per year will continue. It has also been assumed that the ratio of unmanaged

Figure 5.9 Impacts of policy measures on emissions, in Mtonne avoided CO_2-equivalents



forest will stay the same. The estimated effect of this net afforestation is presented in the table 5.5.

The carbon projection considers only the deforested and afforested area since 1990 (i.e. existing forest is excluded). The analysis takes into account the full loss of biomass when a forest is deforested, and a slow regrowth rate when a new forest is established. It is assumed that no soil carbon changes take place due to afforestation or deforestation. The results are given in figure 5.8.

Deforestation through settlement expansion, road building, urban sprawl etc. leads to an annual source of 865,000 tonnes of CO_2 per year. The afforestation effect (since 1990) is slow, as regrowth only starts to pick up some five years after planting. The sink through afforestation increases to 548,000 tonnes of CO_2 in 2015. The net effect over the period 1990-2015 is thus a source of around 15 Mtonne CO_2.

Table 5.6 Projected effects of policies in force since 2000 on national emissions of greenhouse gases, in Mtonne avoided emissions per year

	SE scenario				GE scenario			
	2005	2010	2015	2020	2005	2010	2015	2020
CO_2	5	12	22	29	5	13	26	35
Non-CO_2	7	9	10	10	7	9	10	10
Total	12	21	32	39	12	22	36	45

5.3 Assessment of aggregate effects of policies and measures

5.3.1 Total effect of policies

The total effect of current policies and measures has been determined by comparing the 'with measures' and 'without measures' variants as described above. The total impact of the policies in effect since 2000 is projected as 21-22 Mtonne in 2010, or around 10% of projected emissions. Table 5.6 indicates that policies are especially effective in reducing emissions of

Figure 5.10 Emission projections 'without measures', 'with measures' and 'with additional measures' in 2010

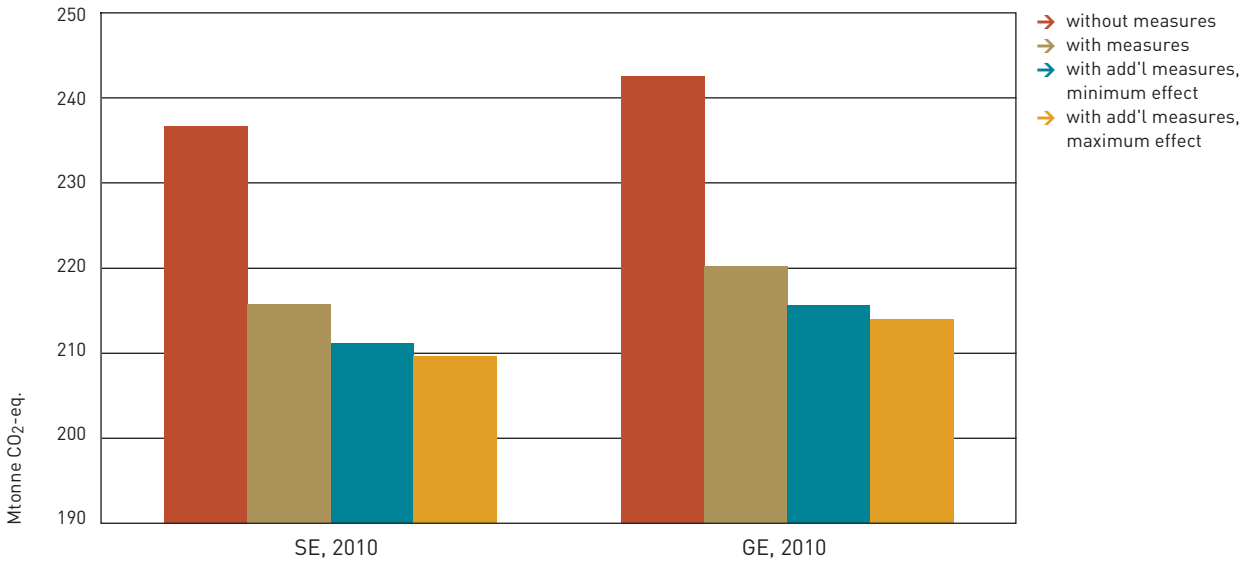


Table 5.7 Effect of additional measures in Mtonne avoided CO_2-equivalent emissions in 2010

Policy	Effect in Mtonne CO_2-eq.
CO_2 tender scheme for buildings	0-0.7
CO_2 differentiation in purchase tax on new cars; purchase tax exemption for hybrid cars	PM (no estimate available)
Kilometre charge	0 – 0.9
Biofuels policies, assuming a target of 2% in 2006	Approx. 0.7*
Technical measures at nitric acid production plants	Approx. 4
EU F-gases regulation	No effect in 2010

* If achieved, the 2% target would reduce emissions by around 0.7 Mtonne CO_2 in 2010. However, this estimate is not well-to-wheel. This means it does not reflect possibly higher emissions in the agricultural sector from cultivating crops to be used in the manufacture of biofuels.

the non CO_2-gases. However in the longer term the marginal effects of these policies decline, while the effects of policies aimed at reducing CO_2 increase. The total effect of the policies in effect since 2000 reaches a level of around 40-45 Mtonne in 2020, i.e. around 20% of projected emissions.

Figure 5.9 shows the projected effects in the two scenarios relative to the projected emissions and the realised effects in the year 2000, estimated in (Jeeninga, 2002) at 26 Mtonne CO_2-equivalents. These 26 Mtonne are already included in the baseline of both the 'with measures' and 'without measures' variants. This means that emissions in 2000, the starting point for both variants, would have been 26 Mtonne higher had these policies not been pursued in the years 1990-2000.

5.3.2 Effect of additional measures

The total effect of the extra policies analysed in the 'with additional measures' variant is estimated at a maximum of 6.3 Mtonne avoided CO_2-equivalent emissions in 2010. Table 5.7 indicates the estimated impact of each measure in 2010. Figure 5.10 illustrates the impact relative to 'without' and 'with' measures projections.

5.4 Description of methodology

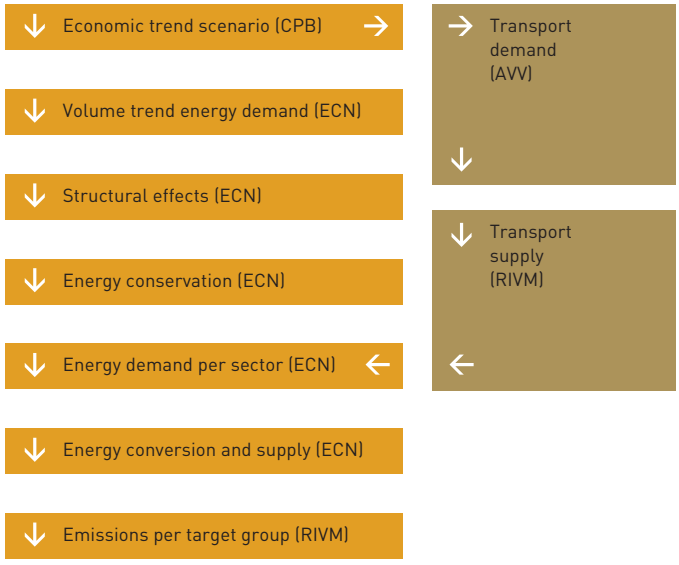
Autonomous social developments are reflected in growth series for activity data (industrial production, passenger-km, livestock numbers, etc.). In turn these developments result in a demand for energy, including non-energy-use of fuels (e.g. feedstock). Efficiency improvements also play an important role. These are modelled, based on assumptions concerning technological progress, policies and developments in energy prices and the incentive that these produce for investing in energy conservation. Subsequently the energy supply is modelled. The final step is to calculate emissions.

Macroeconomic and sectoral growth projections are derived from modelling exercises performed by the Netherlands' Bureau for Economic Policy Analysis (CPB) using the Athena model (Vromans, 1998). This model determines economic growth in approximately 20 sectors. Macroeconomic consistency is assured based on data regarding population and the labour market. Information on the international demand for products and prices is based on calculations carried out using the Worldscan general equilibrium model (Geurts, 1993) and is used as an input to Athena.

The economic growth output of the Athena model is further differentiated into approximately 60 subsectors that are important for emissions and, together with information on developments in physical production capacity, are used as input for the SAVE model by the Netherlands' Energy Research Centre (ECN) (Boonekamp, 1994). SAVE was originally designed to project energy use and energy efficiency improvement, with both key economic parameters and structural developments as input. Results from earlier runs of the SAVE model have been compared with the CPB's NEMO model. The comparison between NEMO, a top-down model, and SAVE, a bottom-up model, resulted in improvements to both models.

The SAVE model contains submodules for the sectors households, services, industry and agriculture. These modules simulate final energy use based on extensive information concerning technologies. The SAVE model also takes the effect of environmental and energy policies into account. The development of energy demand can be split into a volume, a structural, a climate, and an energy-saving effect.

Figure 5.11 Sequence of calculations and input from various institutes



ECN uses several models for energy supply. Simulation models comparable to SAVE are used to project renewable energy, production of natural gas, and growth in combined heat and power. Road and rail traffic is simulated using the Transport Research Centre's (AVV) national system of models, based on a spatial planning model and economic data from the CPB. Energy used by the transport sector is calculated by the Environmental Assessment Agency (MNP/RIVM), taking into account information from Netherlands Railways, the Netherlands Aviation Safety Board and the Transport Research Centre. ECN uses the linear programming model SERUM to calculate production streams in the petroleum-refining sector. The POWERS model, which was recently developed in cooperation with Erasmus University of Rotterdam (Rijkers, 2001), generates equilibrium in the electricity market based on final demand for electricity and determines electricity supply and prices simultaneously. POWERS is a multi-actor adaptive model of the Dutch electricity market. This means that the decisions regarding production volume, allocation of the plants, and price setting made by each market player are based on information from the previous period. Finally, the linear

Table 5.8 **Impact of the new method of accounting for rising temperatures, expressed as changes in Mtonne CO_2 emissions per year, relative to the former method**

		SE		GE	
	2000	2010	2020	2010	2020
Direct impact on installations used for space heating	-3.0	-4.3	-5.4	-4.3	-5.5
Impact of additional investment in and use of cooling equipment	0.0	0.6	1.6	0.7	1.8
Reflected in the scenarios	-3.0	-3.7	-3.9	-3.6	-3.7
Estimated impact of fewer investments in insulation	0.0	0.0–0.1	0.0–0.2	0.0–0.1	0.0–0.2
Estimated impact of car air conditioning and other effects	0.0	-0.2–+0.2	-0.5–+0.5	-0.2–+0.2	-0.7–+0.7

programming model SELPE is used to generate physical equilibria for all energy streams.

The outputs from SELPE (fuel combustion and the non-energy-use of fuels per sector) are used to calculate the energy-related CO_2 emissions per sector. Based on sectoral figures from CPB, ECN and MNP/RIVM (transport), MNP/RIVM also calculates the non-CO_2 greenhouse gas emissions per sector, whereby climate policy affecting non-CO_2 greenhouse gases is taken into account.

Several important changes have been introduced into the approach for projecting future emissions since publication of earlier projections, such as the previous Reference Projection in 2002.

The most important changes in the approach include the following. First, sectoral definitions have shifted slightly to align more closely with IPCC source categories and Dutch Government departments' policy responsibilities for certain sectors. Where combined heat and power joint ventures were formerly allocated to the industry sector actually using the heat, these are now included under electricity production in the energy sector. Off-road vehicles and mobile equipment such as tractors, earth moving equipment etc., are now included under the transport sector, rather than in the sector where they are used, as was the case in the past. Table 4.2 shows the relation between the sectors used in this report and the IPCC source categories.

Second, the projections now take account of the trend towards rising outside air temperature, as observed over the past decades. In the past, projections of future energy use for space heating were based on the assumption that future temperatures would remain constant at the average level of the past 30 years. Now it is assumed that there will be a structural rise in outside air temperatures in the future. The effect of this new method for dealing with expected outside air temperature is presented in the following table. More information about this 'climate change correction' is presented in the text below. The increase in Gross Domestic Product between 2002 and 2020 amounts to 1.7%.

Adjustment to the method of correcting for climate change

During the past 20 years winters have become much warmer, on average, than they were earlier in the 20th century. However, previous projections of future emissions were unable to take this structural warming into account. In estimating future energy use, it was assumed that winters would follow the same temperature patterns that they had in the past. In the last Reference Projection 2001-2010, energy use in the base year was corrected on the basis of a 30-year progressive average over the period 1972-2001. The use of this approach meant that some account was taken of the fact that winters are generally becoming warmer. However, the same approach was also used in projecting the future, which implicitly meant that the warming trend was not assumed to continue into the future. A recent study (Visser, 2005) by the National Institute for Public Health and Environment (RIVM) has provided a statistically reliable method for projecting the warming trend into the future. The results are compatible with calculations made by the Royal Netherlands Meteorological Institute (KNMI) using climate models for the near future (up to 2020). The projections presented in the Reference Projections 2005-2020 use this new

method, which means they reflect the assumption that winters will continue to become warmer in the future. They also reflect the assumption that summers will also become warmer, resulting in increased demand for cooling.
These assumptions affect the results of the projections. The most important impacts have been quantified and included in the new projections. Other impacts have been inventoried and roughly estimated. The impacts are:

- decreasing use of space heating equipment in homes, non-residential buildings and greenhouses. This effect has already occurred and is therefore reflected in historic data;
- more investments in cooling equipment. This impact is relatively uncertain and occurs through both purchases of cooling equipment and installation of heat pumps in new buildings;
- more intensive use of cooling equipment in buildings. This impact occurs mostly in non-residential buildings that already have cooling equipment;
- fewer investments in insulation and efficient boilers since these investments become less attractive with warmer temperatures. This has a limited impact on energy savings in existing buildings;
- greater use of air conditioning in cars. This impact has been estimated at no more than 0.1 Mtonne in 2010;
- other impacts, such as more cooling of products, changes in consumption patterns, and changes in the efficiency of electricity generation, are small compared to the impact on space heating and cooling.

Finally, adjustments have been made to data regarding historic emissions as a result of new insights acquired during the preparation of the Netherlands' National System under Article 5 of the Kyoto Protocol. The most important changes relative to the National Inventory Report 2004 are described in the National Inventory Report 2005. On balance the adjustments have little impact on the total emissions of greenhouse gases in the base year. However, they do result in a shift between CO_2 and the non-CO_2 gases, with CO_2 being lower than previously thought and the non-CO_2 gases being higher.

5.5 Projections and the Netherlands' Kyoto target

5.5.1 Meeting the Netherlands' Kyoto target

Based on the projections presented above, it is possible to preliminary assess whether the Netherlands' climate policy will be sufficient for meeting the Netherlands' Kyoto target. This is provisionally assumed to be, on average, 200 Mt CO_2-eq. per year from 2008-2012. Table 5.9 shows how projected emissions for both the SE and the GE scenarios relate to this target. It should be noted that these projections include uncertainties, which are analysed further in Section 5.3.4.

Table 5.9 Relation between projected emissions and preliminary Kyoto target

2010 (all figures in Mt CO_2-eq.)	SE	GE
Projected emissions:		
With measures	215.7	220.2
With additional measures	210.3	214.9
Projected use of Kyoto mechanisms	20	20
'Kyoto emissions' (taking into account use of Kyoto mechanisms)		
With measures	195.7	200.2
With additional measures	190.3	194.9
Preliminary Netherlands' Kyoto target	200	200

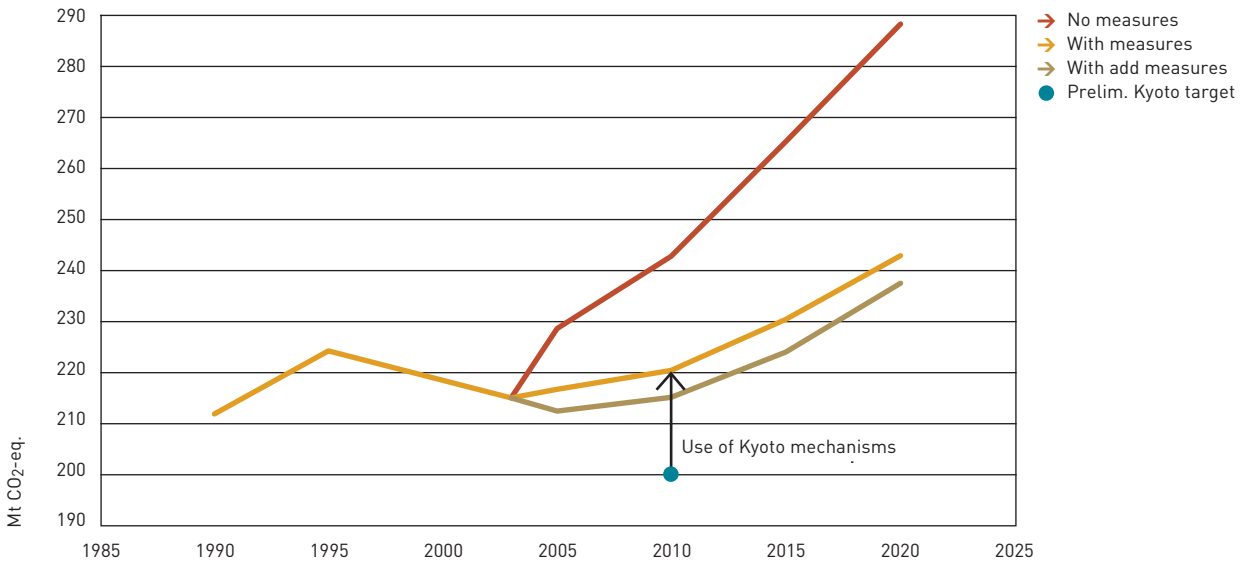
Figure 5.12 illustrates the assessment for the GE scenario, the scenario that causes most emissions.

Table 5.9 and Figure 5.12 show that in both scenarios the Netherlands is projected to meet its Kyoto target. Depending on the scenario, it may or may not be necessary to implement all the additional measures and/or purchase all 20 Mt CO_2-eq. emission reductions based on the Kyoto mechanisms. However, with this conclusion, the following remarks should be considered:

5.5.2 Policies and measures as of December 1, 2004

In the first place, the projections in this report take into account

Figure 5.12 Effect of (additional) measures on total GHG emissions, GE scenario



the policies and measures as known on December 1, 2004. Since then, policy has developed further. However, these further developments could not be taken into account in this report. As explained as well in chapter 1, the projections had to be submitted also to the EC at the beginning of 2005 for use in the various EC and EEA reports. In order to maintain consistency with these reports, the same version of the projections is used in this report. More recent policy developments have been taken into account in the second evaluation of the National Climate Policy Implementation Plan (NCPIP), which was sent to Parliament end of October 2005. In this report, the 'with measures' projections have been adjusted slightly, and the 'additional measures' taken into account differ at some points. However, this does not change the general picture of emission projections.

5.5.3 Importance of the national cap for ETS

In the second place, the national cap for the European emissions trading system (ETS) for the period 2008-2012 will influence the conclusion. This cap covers around half of the total CO_2 emissions in the Netherlands, mostly from installations in the sectors Energy and Industry. This cap has not yet been determined. The Netherlands must submit its proposal to the EC mid-2006, and will therefore finally determine the cap at the beginning of 2006. The EC will finally establish all national caps. The current cap, for the period 2005-2007, is 92 Mt CO_2-eq. The national cap for ETS determines the room that is left for emissions from sectors that are not covered by the ETS. After all, adding all these figures up (national cap for ETS, plus room for non-ETS sectors, minus the use of Kyoto mechanisms) they should result in the Netherlands' Kyoto target. Therefore, when the Netherlands' national cap for ETS is determined, it will be assessed whether the room for the emissions of the non-ETS sectors should be adjusted by adjusting the sectoral target values and/or planned use of the Kyoto mechanisms. Policies and measures may have to be adjusted accordingly.

5.5.4 Conclusions of the second evaluation of the NCPIP

As described in 5.3.4, the projections include uncertainties. The second evaluation of the NCPIP describes how the Netherlands will reduce the risks that result from these uncertainties.

According to this second evaluation of the NCPIP, there is a 50% chance that the domestic target (on average 220 Mt CO_2-eq. per year for the period 2008-2012) will not be exceeded, when implemented policy is taken into account (the 'with measures' projections). When additional measures are also taken into account, this chance may increase to 90%. This is on the condition that the policies in preparation (the 'additional measures') will be implemented and have the projected effect, and that the national cap for ETS does not exceed the current cap.

With regard to the purchase of emission reductions based on the Kyoto mechanisms it is too early to draw conclusions with regards to uncertainty. The target of 100 Mt CO_2-eq. is covered entirely by either framework agreements with intermediary organisations, participation in funds or project-contracts. At the end of 2006 it will be clear whether sufficient project-contracts have been concluded.

Uncertainties remain that may have either a negative or a positive impact. With regard to the domestic target these concern mostly socioeconomic factors, e.g. growth of mobility. For the Kyoto mechanisms, possible uncertainties are connected to upward pressure on prices (due to increased demand), the rules and institutions for the Kyoto Protocol that are still under development (e.g. the JI Supervisory Committee), and the risk of project failure.

The second evaluation of the NCPIP concludes that it is justified to have confidence that the Netherlands will meet its Kyoto target, also because extra measures, divided over all sectors, are implemented or planned. However, to secure achievement of both the domestic target and that for the Kyoto mechanisms, the following activities are proposed:

- the additional measures will be elaborated further and implemented;
- to limit risks, a package of domestic reserve measures is in preparation;
- the national cap for ETS will be determined at the beginning of 2006. Following that, the sectoral target values will also be finally determined. The process will be flexible. Shifting targets between sectors, or between the domestic target and the Kyoto mechanisms, will be possible;
- possible reserve measures to reduce risks for the Kyoto mechanisms will be assessed.

In the NCPIP, the following evaluation is planned for 2008. This is the first year of the commitment period for the Kyoto Protocol. It may then be too late to implement reserve measures. However the Netherlands will not wait until then to judge uncertainties and decide on the use of reserve measures. In addition to the procedures for evaluation described in Section 4.2, an intermediary assessment will be held every year in conjunction with the preparation of the following year's budget. Aspects taken into consideration will include: the rolling three-year average for the sectoral target values based on actual greenhouse gas emissions, the development of relevant socioeconomic factors, the further development of climate policy, development of reserve measures and the development of the Kyoto mechanisms.

6. Vulnerability assessment, climate change impacts and adaptation measures

6.1 Introduction

The climate in the Netherlands is expected to undergo significant changes over the coming decades. The most pressing consequences include wetter winters, drier summers, changes in biodiversity and a rising sea level. At the same time, the Netherlands is subsiding. These conditions, in a country such as the Netherlands - dominated by the sea and the delta of four great rivers, with a high population density and a competitive economy - will more frequently result in climate change impacts that need to be counteracted.

Adaptation to climate change impacts has gradually gained importance on the political agenda. Climate change impacts on water and ecosystems are already visible or have been accepted as nearly inevitable. Adaptation is most strongly developed in the water sector. This chapter reports on climate change impact studies (Section 6.1), vulnerability assessments (Section 6.2) and adaptation strategies (Section 6.3) in the Netherlands. Where applicable, a distinction is made between issues relating to 'water and water management', 'coastal areas and coastal defence', 'nature' and 'agriculture, food security and health' respectively. Under adaptation measures, a special section is dedicated to the role of spatial planning. Details on international cooperation and capacity building can be found in Chapter 7.

6.2 Expected impacts of climate change

The possible consequences of climate change for the Netherlands have been identified in various studies, including the Environmental Balance (MNP, 2005), the Climate Policy Report commissioned by Parliament (Rooijers, 2004) and the Climate Report (KNMI, 1996, mentioned also in the 3rd National Communication). Impact assessments are often sectoral (e.g. Roos et al., 2004 and MNP, 2004) or focused on specific climate variables, such as temperature change (Visser, 2005).

6.2.1 Impacts on water and water management

Water management will become more complex as a result of climate change. Next summary illustrates the major water-related impacts of climate change (Ministry of Transport, Public Works and Water Management, 2000).

The sea level is rising: the sea level has risen 20 centimetres over the past century and will rise even further by an expected average of 60 centimetres in the next century. This will also lead to a rise in the water level of the IJsselmeer Lake.
River discharges are increasing: climate changes will lead to a 40% increase in river discharges in winter and 30% lower discharges in summer.
The land is subsiding: in the low-lying parts of the Netherlands soil subsidence will average between 2 and 60 centimetres by 2050.
Precipitation increases: until 2050, precipitation volumes in winter will increase by approx. 10% and decrease in summer by a few percent.

The greatest concern is flooding or breaching of water-retaining structures along the coast (see also next section), of the rivers Rhine and Meuse or in the IJsselmeer lake region. Flooding may cause casualties and economic damage. The cost of current safety and protection measures are already high and will increase in the near future.

Drought is also a problem and can result in significant economic loss by affecting drinking water supply, energy production, nature, agriculture and shipping (RIZA, 2004). For example, during the extreme hot and dry summer of 2003 a dyke broke at the town of Wilnis because of dehydrated embankments; brackish water was allowed into fresh water systems to fight desiccation, endangering agricultural crops. Such examples illustrate that water management will become more complicated.

The current water policy 'Water Policy in the 21st century' (Ministry of Transport, Public Works and Water Management, 2000) uses predictions of maximum river discharges from the rivers Rhine, Meuse and Scheldt, simulated with regional climate models, taking the IPCC scenarios as a boundary condition (KNMI scenarios: *http://www.knmi.nl/voorl/nader/klim/klimaatrapportage.html*). Scenarios have a time horizon of 100 years. These show that, in the short term, groundwater deficiency and surface water shortage cause climate change impacts on agriculture and nature that are more severe than for water transport, recreation and electricity production. However, this may change in the longer term.

6.2.2 Impacts on the coastal areas and coastal defence

The geographic location of the Netherlands makes it highly susceptible to rises in sea level and extreme weather events. The total coastline of the Netherlands is 350 km long: 300 km of which consists of dunes and beaches, while the remainder is protected by dykes and dams. Recent studies report a further increase in flooding risks due to the rise in sea level, climate change and further economic and social development (Brinke, 2004).

Higher sea levels, together with summer droughts, will also result in increased salt intrusion in the low-lying part of the Netherlands. Salt intrusion will have an impact on agriculture, nature and drinking water supply. Recent climate impact studies show that, in dry years, salt intrusion is strongest in the northern provinces (Friesland and Groningen) and in the IJsselmeer Polder, the Haarlemmermeer Polder and the polders in Zeeland Province. In an extremely dry year salt concentrations in these regions can increase to 2000 mg/l and locally to 5000 mg/l (RIZA, 2004).

6.2.3 Impacts on nature

Climate change has already made an impact on nature in the Netherlands. The growth season is longer and southern species have established themselves permanently. The impact and extent of these changes is uncertain, in part because other human and natural factors also play a role, e.g. fragmentation of natural areas. Prolonged droughts will also have a bearing on the resilience of ecosystems and cause an increased risk of forest fires. Differentiated changes in the seasonal cycles of plant and animal species can disturb the mutual dependencies in the food chain. As a result, for example, migratory species may face unanticipated disturbances such as a mismatch of migrating birds and food availability.
There are also 'positive' impacts. Some plant and animal species will be able to move to new habitats and establish themselves in the Netherlands. A longer growth season may also increase carbon sequestration. Plants can use water more efficiently at increased CO_2 levels. The net impact on the Netherlands is uncertain. At a gradual and limited temperature rise (2°C in 2100) the impact may be neutral, though there is an increased risk of certain species becoming extinct. The faster and stronger that the temperature increases, the more negative impacts will prevail.

Impact studies have been commissioned by the national government, targeting specific policy areas. These include an extensive study into the effects of drought (RIZA, 2004) and modelling studies of the morphological changes in the protected RAMSAR (Convention on wetlands) and Habitat Directive mudflat areas of the Wadden Sea. This is a wetland area of great natural and international value. Its morphology is sensitive to changes in sea levels and water-flow patterns. The impact on the Wadden Sea will depend on the rate at which the sea level rises. The average rate is close to the threshold above which the impacts will be negative.

Given its impact on nature, climate change has also been recognised as an additional motivation for realising the Dutch Ecological Network (EHS, a coherent system of high-biodiversity areas and migration zones), and studies are underway to assess and, where necessary, strengthen its robustness for climate change.

6.2.4 Impacts on agriculture, food security and health

Climate change in the Netherlands may stimulate crop growth. Yet, damage from water and drought may also increase, as well as the risk of plagues and diseases. The latter may especially impact biological farmers. Groundwater may increasingly become brackish in the coastal zones, due to the rise in sea level, further threatening agricultural activities. Climate change and increased climate variability also cause higher insurance rates due to the increasing number of extreme weather events. Further effects include increased pressure on fisheries.

However, the net impact on the Dutch economy is expected to be limited because agriculture accounts for only a small percentage of the overall economy (Rooijers et al., 2004). For example, the average drought damage for agriculture ranges from € 253-286 million yearly, while in an extremely dry year, e.g. the summer of 2003, this damage increased to € 477 million (RIZA, 2002; RIZA, 2004).

The impacts of climate change on human health have been studied e.g. as part of the European cCASHh (Climate Change and Adaptation Strategies for Human Health) project (see Chapter 8). Health hazards increase as a consequence of increased flood risks, heat waves and the spread of infectious diseases.

6.3 Vulnerability assessment

Vulnerability assessments are generally realised through European research projects and studies (e.g. EEA, 2005; see also Chapter 8). National efforts include the National Research Programme's (NRP) impact study that was being developed at the time of the 3rd National Communication.

National Research Programme (NRP) Impact

This project assessed the impacts, vulnerabilities and adaptation options to climate change in the Netherlands. It was carried out between 2000 and 2001 by two Dutch research institutes, in close cooperation with policy makers, experts and other stakeholders. The project's main aims were to:

- provide an overview of scientific insights, expert judgements and stakeholders' perceptions of current and future impacts (positive and negative) of climate change for several economic sectors, human health, and natural systems in the Netherlands, considering various cross-sectoral interactions;
- develop a set of adaptation options for these sectors through a participatory process with the main stakeholders;
- perform an integrated assessment of cross-sectoral interactions of climate change impacts and adaptation options.

Climate change impacts and adaptation options were investigated for several important economic sectors (including agriculture, forestry, fisheries, industry, energy, transport, insurance and recreation/tourism), human health and natural systems (including soils, water and biodiversity issues). For these sectors, both scientific knowledge and stakeholders' perceptions on the impacts and adaptation options were assessed in order to provide an overview of the main issues at stake, taking into account leading opinions within sectors. The assessment used scenarios for future climate change, socioeconomic developments and environmental issues for the Netherlands in the context of Western Europe. Climate scenarios were based on information produced by the IPCC (IPCC, 2001) the Hadley Centre in the United Kingdom and the Royal Dutch Meteorological Institute (Können et al., 1997). The scenarios of the Central Planning Bureau (CPB) (CPB, 1997) provided socioeconomic developments. Environmental issues are based on the Dutch 5th National Environmental Assessment (RIVM, 2000).
Climate change impacts and adaptation options were identified through literature research and the expert judgement of a wide variety of stakeholders. The vulnerability assessment recognises that the elements and processes in human society and in natural systems are closely interlinked and climate-induced impacts and adaptation options in one sector have consequences (positive or negative) for other sectors. To provide a more detailed insight into the many interactions that occur between climate change impacts and adaptation options, the vulnerability assessment addressed seven key-issues in an integrated assessment study: (1) Safety in the coastal zone and riverine areas, (2) Water availability and quality, (3) Biodiversity, (4) Energy, (5) Food and fibre production, (6) Human health and (7) Land-use change and spatial planning. More information: *www.dow.wau.nl/msa/nopimpact.htm*

In practice it is difficult to distinguish between impact and vulnerability studies. The use of climate scenarios and vulnerability assessments is most common in water management. The government works from a basis that uses the climate scenarios of the IPCC and those of a national Water Policy Advisory Committee (Water Management in the 21st Century Advisory Committee). Research projects and other policy plans tend to make their own sector-specific vulnerability assessments. Where quantitative studies are not available, impact and adaptation options are assessed qualitatively in dialogues between scientists, experts and stakeholders. These assessments express expert-judgement and stakeholders' perceptions of risks and impacts rather than a quantitative analysis of vulnerability. They have been instrumental in raising climate change awareness, resulting in quantitative scenario research and vulnerability assessments in national research programmes.

6.4 Adaptation measures

As previously mentioned, adaptation to climate change impacts has gradually gained importance on the political agenda. For example, Parliament recently requested to be informed of the current status of climate research and specifically on adaptation (Dutch Parliament, 2004). In addition the Dutch Senate requested the government to take climate change into

account in its long-term policy plans and investment strategies (Dutch Senate, 2005). Ministries increasingly consider adaptation measures for integration into their sectoral policies.

The focus of climate change adaptation is on mainstreaming and 'no regret' strategies. Adaptation is most strongly developed in the water sector and in the policy documents of the Ministry of Transport, Public Works and Water Management. In other sectors the focus is, as yet, more on research and (small-scale) demonstration activities. Insight into the costs of adaptation is currently rather limited. Adapation measures are not included in the assessment of the costs of implementing climate change policy. As an indication, at present around 1% of GDP is spent annually on water management, including adaptation measures. Expenses in the agricultural sector to counter desiccation amount to 0.1% of GDP annually; these also include cost of adaptation measures.

Society mainly considers adaptation to be the government's responsibility. Actual implementation is often passed on to local authorities (project implementation). The Ministry of the Interior and Kingdom Relations ('Binnenlandse Zaken') is responsible for coordinating response strategies in the event of a (threatening) crisis.

Experiments with public-private cooperation for specific adaptation measures are, as yet, rare. Such cooperation typically plays a role in related policy areas, e.g. transport, infrastructure and economic development. A few subsidies exist that encourage private sector initiatives, e.g. the WaterINNovation program WINN *(www.waterinnovatiebron.nl/)*, and the green and blue services that are realised to pay farmers, landowners and recreation organisations for their contribution to water and ecosystem management, including adaptation measures. Initiatives from the private sector (e.g. floating greenhouses) are typically not explicitly labelled as adaptation activities.

The following sections summarise how the most affected policy sectors deal with adaptation, inter alia in recent national policy plans.

6.4.1 Adaptation for water and water management

Overall national policy issues

Climate change and adaptation measures are strongly integrated into the water policy agenda. The Dutch water policy (Ministry of Transport, Public Works and Water Management, 2000) recognises that in the coming years increasing water levels in the rivers and the accelerated rise in sea levels will mean that technical measures, such as raising dykes, will no longer be sufficient. The policy is to allow more space for water. In order to prevent floods, rivers are allowed to expand into side channels and wetland areas. Greater emphasis is also placed on managing water levels rather than keeping the water out.

Safety continues to be the top priority. Other goals are to avoid destruction of the considerable cultural-historical and natural value of the river landscapes. Guiding principles are:

- anticipating instead of reacting;
- following a three-step strategy (first retention, then storage and, as a last resort, drainage);
- allocating more space for water (e.g. assigning emergency flood areas) in addition to implementing technological measures (e.g. dyke reinforcement);
- raise beach levels (see also coastal policy).

The present water policy aims to prepare and protect the Netherlands by 2015 for discharges from the river Rhine of up to 16,000 m^3/s. A follow-up programme is to defend against discharges up to 18,000 m^3/s after 2015. The Dutch government has reserved € 1.9 billion for these programmes. At present the average discharge is 2200 m^3/s at Lobith, where the Rhine enters the Netherlands. The highest measured discharge at Lobith is 12,600 m^3/s, in January 1926. In 1995 a discharge of 11,885 m^3/s was reached.

The policy document 'Room for the River' (Ministry of Transport, Public Works and Water Management, 2000b), further elaborates on planning for adaptation with regard to the river Rhine. In April 2005, the Dutch Cabinet presented the implementation plan for this policy document. After public consultations the Cabinet expects to submit the Key Decision to Parliament in 2006, allowing a budget of € 2.2 billion to be invested in improving safety against flooding in river areas.

Dredging has been introduced as a way of dynamically managing the main rivers and ports. It offers the opportunity to flexibly interact with, and intervene in, the natural regime of a river. Some € 700 million has been reserved for maintenance of the inland waterways for the period 2004-2010. In the period after 2010, a total of €10.3 billion will become available, of which 3 billion will be used to widen and deepen the waterways, and 7.5 billion will go towards management and maintenance (Ministry of Transport, Public Works and Water Management, 2004).

To secure drinking water supply throughout periods of hot weather, possibilities for fresh water storage in Lake IJsselmeer are being investigated.

The national government facilitates information sharing and capacity building for adaptation. Activities include frequent publications (e.g. Opgewarmd Nederland *www.opgewarmdnederland.nl*), pilot projects (e.g. supported through the WaterINNovation fund *www.waterinnovatiebron.nl)*, plus a number of websites (e.g. *www.nederlandleeftmetwater.nl*) and public information campaigns published in national newspapers (see also Chapter 9).

Responsibilities in implementation
Arrangements for cooperation and implementation of the water policy are detailed in an Administrative Agreement (Nationaal Bestuursakkoord Water) between government, provinces, water boards and municipalities. The national government (Ministry of Transport, Public Works and Water Management) is responsible for the main waterways: the major rivers, the coast and the IJsselmeer area. Water boards hold the first line of responsibility for the regional water management systems. The provincial authorities are charged with spatial incorporation of water management policy measures. They supervise the municipal authorities in adjusting their zoning plans. These administrative arrangements and an obligatory water assessment ('watertoets'; see below) ensure that the water policy is integrated into other policy areas, such as spatial planning. The mandatory Water Assessment ('watertoets') was introduced in 2000 for all larger infrastructure and spatial plans that may affect water management. Local authorities implement the Water Assessment under the supervision of the ministry. The Water Assessment requires, for example, that where water storage or infiltration capacity is lost these must be compensated for. Adaptation has been an important argument for introducing the water assessment.

Regional authorities and water boards translate the national water policy into so-called 'Catchment Area Strategies' ('Stroomgebiedsvisies') and Provincial Water Plans. These include the assignment of emergency flood retention areas. Integral provincial water plans envisage increased budgets for adaptation. Pilot projects have been implemented that provide information on costs and effectiveness of adaptation measures. Generally speaking, the focus is on large-scale solutions because of the potential synergies with other policy goals, e.g. combining water storage and combating desiccation. However, the advantage of small-scale solutions could be the limited demand on stakeholders.

Municipalities are encouraged to write a water plan. At present, around 25% of the Dutch municipalities do have such a plan. An increasing number of municipalities also include adaptation measures in their water plans. Measures focus on separating runoff from rainfall and sewerage. They include increased infiltration of precipitation, retaining groundwater at levels beneficial to the ecosystem and increased capacity to remove excess water. Municipalities are legally required to compensate for lost infiltration capacity. Large projects are subjected to a water assessment. The national government's adaptation fund (€ 100 million) was rapidly exhausted. Recently, municipalities have been allowed to charge for their water plans through their sewer tax. An example of an adaptation measure for rivers can be found in Hengelo, where - by storing water in two retention areas - the peak flow of the Woolderbinnen Creek can be reduced by 60% to prevent the downstream agricultural land and town centres from becoming flooded *(www.reggeendinkel.nl)*.

6.4.2 Adaptation for the coastal areas and coastal defence
The current Dutch coastal policy plan (Ministry of Transport, Public Works and Water Management, 2000) strongly emphasises the new challenges caused by climate change, especially the rise in sea level and an increase in the number of storms. Three sea-level-rise scenarios are detailed, based on the IPCC reports. Which scenario should be used depends on the application. E.g., for short-term or low-cost investments the

lowest scenario can be used. For high cost and inflexible infrastructure the highest scenario should be used.

Sand supplements were introduced in 1990 as a way of dynamically managing the coast. These sand supplements involve millions of cubic metres of sand being added to coastal areas. In 2002, the Ministry (V&W) further intensified sand supplements as the most appropriate way of adapting to future climate change. Its projected costs amount to € 45 million yearly. The survival of wetland and mudflat areas of the Western Scheldt and Wadden Sea receives special attention.

Risk assessments are made for coastal areas. Risk assessments of flooding and coastal damage have a bearing on spatial planning and decisions concerning engineering projects in the coastal zone. Areas are identified for potential (land inward) reinforcement of the dunes.

Regional governments develop their own coastal strategies to meet long-term challenges. The maintenance of dykes and dunes is typically the responsibility of regional water authorities, whereas combating structural coastal erosion is the responsibility of the national government.

Safety standards are laid down in legislation. Presently, these standards do not take future climate change into account. Procedures to recurrently update these standards are being studied (e.g. Brinke, 2004).

6.4.3 Adaptation for nature

Implementing the existing policy of realising green corridors and ecological zones and strengthening the resilience of ecosystems is seen as the most appropriate strategy to cope with the impacts of climate change (Ministry of Agriculture, Nature and Food Quality, 2004). Synergies with water management are considered, since both require space and could be combined in new ecological zones. The agricultural sector is invited to contribute to water storage. The aforementioned green and blue services imbursement scheme is implemented to pay farmers, landowners and recreation organisations for their contribution to water and ecosystem management.

The most recent policy document 'Agenda for a Living Countryside' (Ministry of Agriculture, Nature and Food Quality, 2004) announces a study that will assess:

- whether climate change requires a different spatial distribution of ecological zones and green corridors;
- whether desiccation, salt intrusion and fresh-water shortage intensify under climate change and require additional policy measures;
- the effect of climate change on tourism.

National research programmes also look into strategies for optimising the Dutch Ecological Network under different climate change scenarios (see also Chapter 8).

6.4.4 Adaptation for agriculture, food security and health

Impact studies at the time of the 3rd National Communication suggested that, in the agriculture sector, most effects of climate change can be tackled without large structural changes and that variations in climate are part of the common risks in agriculture (Ierland et al., 2001). However, more recent studies have (are) reassessing this, especially in relation to drought stress. Recent research initiated by the Ministry of Agriculture, Nature and Food Quality has a clear adaptation focus. The potential impacts of drought on agriculture are well documented (RIZA, 2004) and are gradually being incorporated into agricultural policy, both at the national and regional levels.

Adaptation strategies include improved forecasting of extreme weather events to enable farmers to adjust their management practices. Other options that are being studied include crop improvement (with the help of biotechnology or otherwise), changing planting and harvesting schedules, relocating farms, and insurances. Triggered by extreme rainfall events, in 2005 the insurance company InterPolis started an insurance scheme named AquaPol, offering farmers an insurance against damage from rainstorms.

Blue services are a relatively new instrument for achieving water policy objectives by paying farmers or other private stakeholders for taking necessary measures. Blue services aim to avoid having to buy farmers out and redevelop an area. Although not specifically introduced for adaptation purposes, blue services can include adaptation measures, together with rural area development (a new source of income for farmers).

For the Wadden Sea area, climate change contributed to the decision to reduce shellfish fisheries. Research was commissioned by the national government into the effect of climate change on fish stocks and the location of spawning areas and breeding grounds (see also Section 6.1).

The policy document 'Health and Environment' (Ministry of Health, Welfare and Sport, 2001) recognises that climate change may change the incidence of diseases and infections. New diseases and other climate-related challenges will be tackled, along with other health issues, as they emerge. For example, medical staff and the public are informed about the increased number of ticks that are spreading Lyme's disease. A number of climate-sensitive diseases (such as malaria) are required to be reported and their frequency is monitored. Studies are continuing regarding whether or not further action is required in order to adapt to climate change in the health sector (see also Chapter 8).

6.4.5 Adaptation for spatial planning and housing

Spatial planning is a cross-cutting issue with respect to adaptation. The latest Dutch Spatial Policy Paper (Ministry of Housing, Spatial Planning and the Environment, 2004) recognises the need for adaptation in water management, coastal zone management, agriculture, nature protection and city planning. The impacts of climate change are to be reduced by tuning spatial planning to the characteristics of the surface (water and soil). This policy plan consolidates initiatives from the relevant sectoral policies. Water is recognised as one of the guiding principles for spatial planning. New infrastructure and city planning must e.g. compensate for potential losses in water quality or quantity. Multifunctional land use is encouraged. This policy plan by the national government includes guidelines for spatial plans. Detailed planning is the responsibility of regional and local authorities.

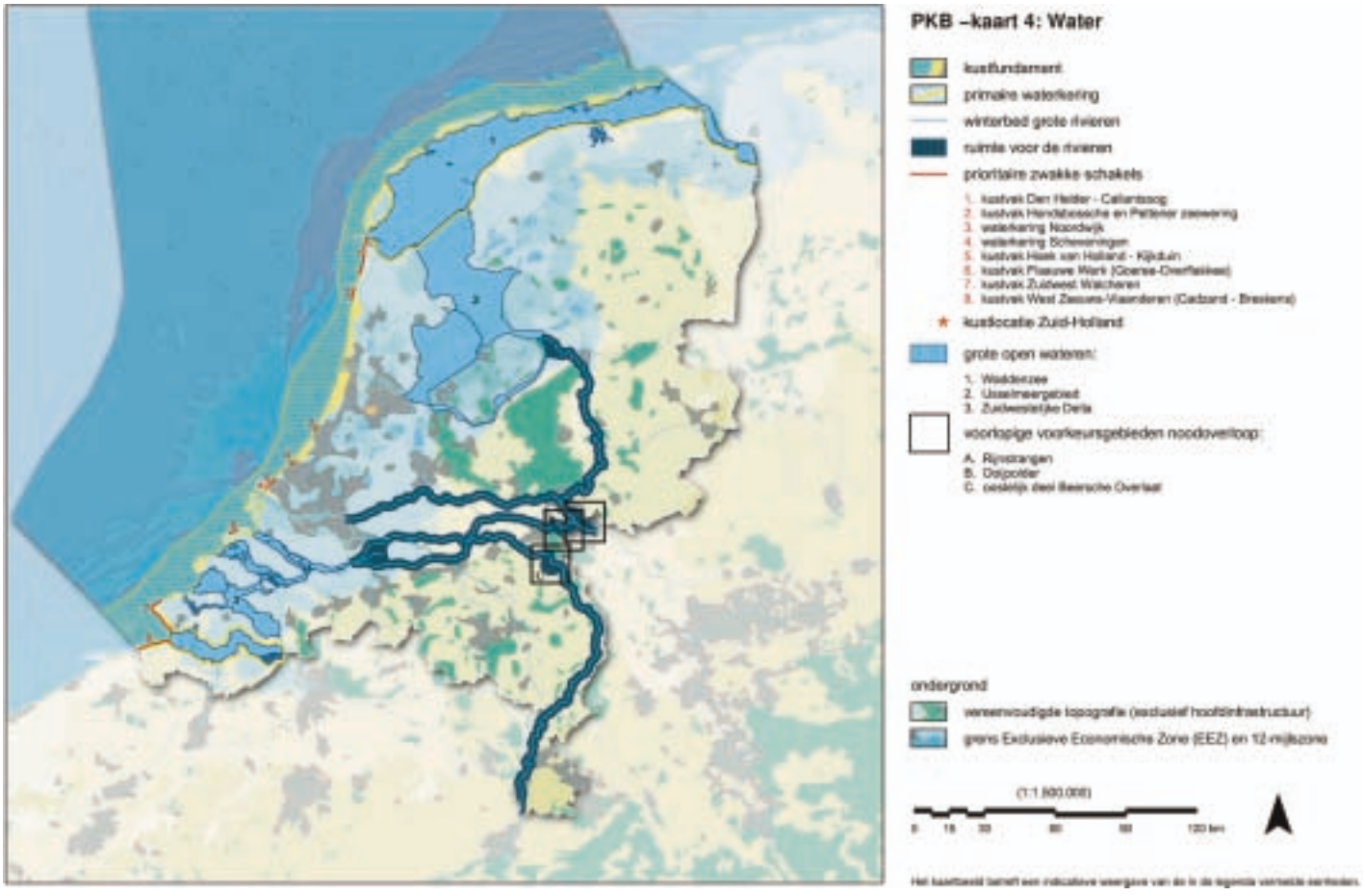
Explicit spatial reservations, functional restrictions and actions related to adaptation (see also Figure 6.2), are proposed for:

- retention areas along the main rivers (in agreement with the provisions in the national water policy);
- broadening flood plains of the main rivers;
- coastal foundation zone[6] (in line with the national coastal policy, with 'sand' as the guiding principle);
- securing freshwater storage in the IJsselmeer and Markermeer lakes;
- connecting and expanding nature areas (Dutch Ecological Network (EHS)).

Special attention is given to the transition zones between the city and rural areas. Here creative solutions are encouraged that combine nature, water and living. Small-scale building may be allowed if publicly accessible nature is created at the same time. Similarly, wetlands and retention areas may be funded through allowing housing. The first floating houses have been built. Here emphasis is on the upper segment of the housing market. Governments can decide to include adaptation measures in the guidelines for sustainable building practises ('duurzaam bouwen'). The organisation SenterNovem runs small-scale pilots schemes such as floating houses, thus encouraging living with water and heat/cold storage to prepare for warmer summers *(www.amfibischwonen.nl/)*. Engineers that design sewers increasingly pay attention to forecasts of rainstorms and run-off (RIONED, a centre of expertise in sewer management and urban drainage, *www.riool.net*).

6 zone between 20m depth contour and inner dune boundaries

Figure 6.1 Reservation of space for coastal zone and water management



7. Financial resources and transfer of technology

7.1 Introduction

Acknowledging the support that developing countries and countries with economies in transition need to mitigate climate change and to adapt to its adverse effects, the Netherlands provides assistance to these countries through a variety of programmes and projects. These programmes and projects encompass activities on aspects such as education, capacity building, institutional set-up and selecting and implementing mitigation and adaptation activities.

Apart from supporting public organisations, the Dutch programmes also aim to stimulate the private sector both from Annex I countries and Non-Annex I countries to increase their environmentally sound technology investments in developing countries and countries with economies in transition.

This chapter[7] provides an overview of the financial resources provided, including new and additional resources, plus information on the assistance that the Netherlands provides to developing countries that are vulnerable to climate change, as well as on activities related to the transfer of technology.

7.2 Provision of financial resources

7.2.1 Financial resources

As in the previous reporting period (1997-2000), the Dutch Government maintained its Official Development Assistance (ODA) budget at 0.8% of its Gross National Product (GNP) for the period 2001-2004. With annual budgets ranging from 0.84% to 0.88%, the Dutch Government has complied with this policy. In doing so, the Netherlands is one of the few countries that meets the UN target of 0.7%. These budgets include expenditures for assistance in the field of environment following the principles of Agenda 21. Since 1997, at least 0.1% of the aforementioned 0.8% has been earmarked for additional expenditures in this field (see table 7.2).

Table 7.1 Financial contributions to the Global Environment Facility (GEF)

	Contribution (million €)			
Global Environment Facility	2001	2002	2003	2004
	13.423	14.421	27.025	19.021

7.2.2 Multilateral assistance programmes

The Netherlands contributes to a variety of multilateral and intergovernmental institutions that assist developing countries. These institutes include organisations with global coverage such as the World Bank, UNDP and UNEP, as well as regionally engaged institutions such as the Asian Development Bank and the African Development Bank. The Global Environment Facility (GEF), as operating entity of the financial mechanism of the Framework Convention on Climate Change, received from the Netherlands a financial contribution of around € 73.89 million for the period 2001-2004, on average € 10 million more per annum than in the preceding period 1997-2000. (See table 7.1 and 7.2)

7.2.3 Bilateral cooperation

Apart from providing multilateral assistance, the Netherlands also has a bilateral cooperation programme. Until 2003, the Netherlands had two types of development cooperation strategies, namely 'full cooperation' and 'thematic cooperation'. Developing countries with full cooperation programmes (of which 'environment' can be a part) include: Bangladesh, Burkina Faso, Bolivia, Egypt, Eritrea, Ethiopia, Ghana, India, Indonesia, Macedonia, Mali, Mozambique, Nicaragua, Palestinian Authority, Sri Lanka, South Africa, Surinam, Tanzania, Uganda, Viet Nam, Yemen and Zambia. Countries such as Brazil, Cape Verde, China, Colombia, Ecuador, Guatemala, Mongolia, Nepal, Pakistan, Peru, the Philippines and Senegal had thematic cooperation with the Netherlands on environment.
In 2003, it was decided to merge the two types of strategies into long-term partnerships. As a result of this new policy, the number of countries receiving bilateral assistance was reduced

7 The structure of this chapter includes the sections, required by the guidelines, while providing relevant supporting informating in seperate sections. The appropriate sections also include the supplementary information under Art. 7.2 of the Kyoto Protocol, related to information under Art. 10 and financial resources under Art. 11.

Table 7.2 Breakdown of environment-related expenditures within Official Development Assistance (€ million)[1]

	Expenditures (million €)[2]			
	2001	2002	2003	2004
Multilateral institutions				
GEF	13.423	14.421	27.025	19.021
UNEP	4.374	7.392	4.632	12.532
Desertification Treaty	0.178	0.225	0.241	0.244
IFAD (10%)	1.498	1.074	1.049	0.673
World Bank partnership (30%)	21.099	23.220	9.000	9.000
UNDP (20%)	14.975	14.975	16.000	16.000
European Development Fund (5%)	2.170	4.078	5.742	6.368
International Development Association (10%) and Regional development banks and funds (5%)	15.814	11.268	16.967	16.967
FAO Partnership			4.816	4.281
UNICEF			2.805	2.805
Environmental programmes				
bilateral programmes	190.594	207.869	177.774	211.737
Miliev programme /private sector	28.756	14.058	14.952	14.952
MFO and SNV including PSO (7.5%)	45.078	49.159	54.922	55.299
Education and research	14.800	14.249	14.516	14.516
Other (5-15%)	44.223	32.886	54.133	49.298
Environment total	**396.982**	**394.874**	**404.574**	**433.693**
ODA total	**3772.174**	**3828.301**	**3816.160**	**3904.747**
GNP (x 1000)	**431.080**	**436.990**	**442.050**	**464.990**
Environment as % of GNP	**0.092**	**0.090**	**0.092**	**0.093**

1 Percentage in brackets indicate the estimated proportion of environment-related expenditures within the total contributions.
2 Dollar-euro rates used for this table are 0.9 (2001), 0.94 (2002), 1.13 (2003) and 1.21 (2004) respectively, and are applicable throughout this chapter.

Table 7.3 Financial contributions to multilateral institutions and programmes

Institute or programme	Contribution (million E)			
	2001	2002	2003	2004
World Bank partnership (30%)	21.099	23.220	9.000	9.000
International Development Association (10%) and Regional development banks and funds (5%)	15.814	11.268	16.967	16.967
European Development Fund (5%)	2.170	4.078	5.742	6.368
UNDP (20%)	14.975	14.975	16.000	16.000
UNEP	4.374	7.392	4.632	12.532
Desertification Treaty	0.178	0.225	0.241	0.244
IFAD (10%)	1.498	1.074	1.049	0.673
FAO Partnership			4.816	4.281
UNICEF			2.805	2.805

to 36 partner countries. Within this policy, which still focuses strongly on sustainable poverty alleviation, ensuring environment sustainability, as one of the Millennium Development Goals, plays a prominent role. Table 7.4 provides an overview of the new partner countries, some of which are also eligible for support through the Netherlands' private sector targeted programmes such as the Programme for Cooperation with Emerging Markets (PSOM), Programme of Eastern European Cooperation (PSO) and Development-related Export Transactions Programme (ORET), which includes MILIEV - the Environment and Economic Self-sufficiency Programme, (ORET/MILIEV). These three latter programmes will be discussed in the following subsections.

8 This paper was jointly prepared by the African Development Bank, Asian Development Bank, Department for International Development, United Kingdom, Directorate-General for Development, European Commission, Federal Ministry for Economic Cooperation and Development, Germany, Minister for Development Cooperation, The Netherlands, Organization for Economic Cooperation and Development, United Nations Development Programme, United Nations Environment Programme, and The World Bank in 2002.

9 This group consists of the 2001 EU countries plus Canada, Iceland, New Zealand, Norway and Switzerland.

The least-developed countries (LDCs) that are particularly vulnerable are presented in the table in italics.

7.3 Netherlands Cooperation Programmes on Climate

7.3.1 Climate policy

The general climate policy implemented by the Netherlands Minister for Development Cooperation aims to support developing countries that are planning to formulate and implement their own climate change policy. The main areas of support are:

- adapting to the adverse effects of climate change;
- building capacity and developing institutes required for climate policy as well as for the Clean Development Mechanism;
- transferring CO_2 reducing technologies;
- contributing towards providing access by the poor to energy services, where possible through low-carbon development.

The aforementioned climate change policy is anchored in the UN Convention on Climate Change and the Kyoto Protocol as well as the Netherlands' development cooperation policy (as

Table 7.4 Partner countries eligible for public and private finance and support by the Netherlands (2003-2004)*

Afghanistan	Colombia	Macedonia	*Senegal*
Albania	Egypt		South Africa
Armenia[2, 3]	*Eritrea*	*Mali*	Sri Lanka[1, 2]
		Moldova[2, 3]	
Bangladesh	*Ethiopia[1]*		Surinam
Benin		Mongolia	*Tanzania[1]*
Bolivia[1]	Georgia[2, 3]	*Mozambique[1]*	
			Uganda[1]
Bosnia-Herzegovina[2, 3]	Ghana[1, 2]	Nicaragua[2]	
			Vietnam[1, 2]
Burkina Faso	Guatemala[2]	Pakistan	*Yemen*
Cape Verde		Palestinian Authority[2]	Zambia
	Indonesia[1, 2]		
		Rwanda	
	Kenya		

* In addition to the partner countries the following non-partner countries are eligible for support through the PSOM, ORET/MILIEV: Albania[3], Azerbeidzjan[3], Bulgaria[3], China[1,2], Colombia[1,2], Croatia[1], Cuba[1,2], Ecuador[2], Egypt[1,2], El Salvador[2], Ivory Coast[2], Jordan[2], Kazachstan[3], Macedonia[2,3], Montenegro[3], Peru[1,2], Philippines[1,2], Russian Federation[3], Serbia[3], South Africa[1,2], Thailand[1,2], Ukraïn[3]

1 PSOM
2 ORET/MILIEV
3 PSO

presented in the 2003 Minister for Development Cooperation's (DGIS) policy paper entitled 'Mutual interests, mutual responsibilities') that is strongly aimed at poverty alleviation. The Netherlands Minister for Development Cooperation also contributed both financially and substantially to the joint paper on 'Poverty and Climate Change: Reducing the Vulnerability of the Poor through Adaptation'[8]. This illustrates the increased interest of the Dutch Government in the climate change adaptation issues in developing countries. Although this is not expressed explicitly in its budget, it is apparent in its policy-making regarding this topic.

7.3.2 New and additional resources for climate change

Table 7.5 shows expenditures of the Netherlands Minister for Development Cooperation's climate programme. These expenditures are funded from the additional 0.1% of the GNP that has been earmarked for Agenda 21 assistance in the field of environment as indicated in Section 7.2.1.

At the Conference of the Parties in July 2001 in Bonn, the EU+5[9] reaffirmed its strong political commitment, that they will reach in 2005 an annual funding level for climate change activities in developing nations, which is US$ 410 million extra compared with the year 2001. This amount is to be revised in 2008 (Bonn Political Declaration). Agreeing with a target level of €17 million more than the level of 2001, the Netherlands as member of this group intensified its Climate Change funding for programmes and projects accordingly to reach in 2005 this annual funding level. Present figures as shown in Table 7.5 indicate that the Netherlands is on track.

For the current reporting period, the Netherlands has already started to pledge part of the new climate change funds. The Netherlands has contributed to the Least-Developing Countries Fund. In 2005, the Special Climate Change Fund received its first donation from the Netherlands, and it is anticipated that, when the adaptation fund is operational, the Netherlands will pledge the fund through the share of proceeds.

Noting the need to comply with the reporting requirements of the UNFCCC, the Netherlands (together with OECD and OECD partners) started to develop a set of 'Rio' markers that will allow them to distinguish between climate-related funding and other environment-related funding. In 2001, the Netherlands

Table 7.5 Amounts and categories of funding for the years 2001 to 2004 by the Dutch Minister for Development Co-operation (in mln E)

		2001	2002	2003	2004
Bilateral					
	Mitigation[1]	45.58	35.98	52.92	54.46
	Adaptation[1]	4.50	10.78	9.38	6.58
Multilateral					
	UNDP	0.16	0.53	0.84	1.31
	UNEP		0.60	3.53	2.10
	AsDB	0.94	1.69	1.48	0.69
	AfDB			1.66	1.30
	WB[2]	n.a.	n.a.	n.a.	n.a.
GEF		5.34	5.74	10.75	7.57
New funds					
	LDC				0.10
	SCCF				
	Adaptation Fund				
Total		**56.52**	**55.31**	**80.56**	**74.10**

1 Including 'Principal' and 'Significant' projects. A weight factor of 0.4 is applied for the financial contribution of 'Significant' projects following OECD-DAC guidelines.
2 The Netherlands and the World Bank have signed a partnership agreement. Figures on the direct contribution to climate change projects are not available.

Table 7.6 Expenditure of climate change related activities (€ million) applying OECD reporting guidelines[11]

	2001	2002	2003	2004
Mitigation				
Principal	15.30	5.90	11.20	9.50
Significant	30.28	30.08	41.72	44.96
Adaptation				
Principal	3.30	7.90	7.10	4.70
Significant	1.2	2.88	2.28	1.88
Mitigation Total	**45.58**	**35.98**	**52.92**	**54.46**
Adaptation Total	**4.50**	**10.78**	**9.38**	**6.58**

introduced a marker to distinguish the climate change part of the ODA and, as of 2003, additional markers have been introduced to distinguish the support for both adaptation and mitigation[10]. This approach has been applied to budgets dating back to 2001. Table 7.6 shows the breakdown of the expenditures for mitigation and adaptation (2001-2004).

By applying the guidelines suggested by the OECD-DAC even a sector-specific budget allocation was possible, as presented in Table 7.7.

Tables 7.7 and 7.8 together aim to provide the information from Table 5 from the guidelines. The Netherlands, in close cooperation with OECD and partner countries, will continue to improve its internal reporting system. It is expected that it will be able to report on these expenditures on host country level in its next National Communication.

The following subsections briefly describe both mitigation and adaptation activities implemented and/or financed by the Netherlands. Also examples of capacity-building activities are given for both themes at the end of each subsection.

7.3.3 Mitigation

The Netherlands programmes and projects that deal with mitigation mainly support developing countries and countries with economies in transition; helping them to implement activities that use environmentally sound technologies and know-how. The main sectors in both types of countries are energy, transport, industry, agriculture and forest management. A brief description of typical programmes and projects is given in the following sections and Annex 7.1.

Developing Countries

Acknowledging the important role that energy plays in greenhouse gas emissions, the Dutch Government incorporated this aspect into its development cooperation policy. The main goals of this energy policy are:

- poverty alleviation and improvement of energy-related living conditions, which in almost all cases implies the promotion of low-carbon development;
- reduction of natural resource depletion and degradation of local environment.

One of the successful approaches that the Netherlands applied in the past (from 1989 onwards), and still applies in order to help combat climate change through emissions reduction in developing countries, is to 'green' the energy sector portfolio of Multilateral Development Banks. This policy was conceptualised together with UNDP, the World Bank, and US DOE (US Department of Energy) in a programme to develop green energy for small-scale urban and rural users in Asia and Africa, which was called Financing Energy Services for Small-Scale End-Users (FINESSE)[12].

10 OECD-DAC definitions for Bio-diversity, Climate Change and Desertification related aid were applied (DCD/DAC/STAT(2002)7), including the sector classification and non-sector-specific activities.
11 The projects aim to achieve one of the criteria of the DAC guidelines directly and explicitly (Principal) or indirectly (Significant). A weight factor of 0.4 was used to calculate the financial contributions of 'Significant' projects to the climate change expenditures.
12 The Netherlands has a large partnership programme with the World Bank, which covers inter alia the theme of environment (see also Table 7.1). This implies that the partnership fund is used for greenhouse gas abatement activities.

Table 7.7 **Expenditures in € million for mitigation and adaptation activities in the Netherlands Cooperation Programme (OECD guidelines and preferred sectors)**

	Mitigation				Adaptation			
	2001	2002	2003	2004	2001	2002	2003	2004
General environment								
Principal	3.00	4.20	9.20	7.20	2.00	3.70	4.40	2.70
Significant	9.20	13.92	17.92	18.64	0.40	1.76	0.88	0.48
Agriculture								
Principal	0.00	0.00	0.00	0.00	0.40	0.70	0.00	0.00
Significant	0.16	0.00	2.40	2.32	0.00	0.00	0.12	0.00
Water supply and sanitation								
Principal	5.00	0.20	0.10	0.10	0.90	3.50	2.70	2.00
Significant	3.20	0.92	0.92	0.76	0.40	0.80	1.04	1.08
Forestry								
Principal	0.30	0.00	0.20	0.30	0.00	0.00	0.00	0.00
Significant	12.80	12.32	9.80	11.16	0.00	0.00	0.00	0.00
Energy generation and supply								
Principal	7.00	1.50	1.70	1.90	0.00	0.00	0.00	0.00
Significant	4.40	2.16	5.64	7.68	0.20	0.24	0.20	0.32
Rural development								
Principal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Significant	0.40	0.76	4.80	4.32	0.20	0.08	0.04	0.00
Transport and storage								
Principal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Significant	0.12	0.00	0.24	0.08	0.00	0.00	0.00	0.00
Total								
Principal	15.30	5.90	11.20	9.50	3.30	7.90	7.10	4.70
Significant	30.28	30.08	41.72	44.96	1.20	2.88	2.28	1.88
Grand total	**45.58**	**35.98**	**52.92**	**54.46**	**4.50**	**10.78**	**9.38**	**6.58**

As result of FINESSE activities in Asia, the World Bank and its partners established the Asia Alternative Energy programme (ASTAE) at the Bank in 1992. ASTEA is currently supporting several pipeline projects with an estimated total alternative energy cost of US$ 2 billion and an estimated Bank/GEF support of US$ 450-900 million. The Netherlands contributed significantly to this initiative through the World Bank Partnership (€ 62 million for the present reporting period of 2001-2004).

At present, another FINESSE-like programme is being implemented at the Asian Development Bank, where a four-year programme called Promotion of Renewable energy, Energy efficiency and Greenhouse gas Abatement (PREGA) was established in 2001. This programme received a € 4.6 million contribution from the Netherlands, which is the prime donor. Moreover, the Development Bank of the Philippines received technical assistance to strengthen its capacity to evaluate and manage alternative energy projects.

This 'greening' approach was also applied in the African SADC region and resulted in market studies and business plans for sustainable energy projects. Building on this experience, the Dutch Government and the African Development Bank recently entered into a four-year agreement where the Netherlands will provide a grant funding of around € 4.5 million to support FINESSE-Africa (Financing Energy Services for Small-Scale End-Users) activities.

Two examples of mitigation projects in developing countries supported by the Netherlands include the Support project for the Biogas programme for Animal Husbandry Sector (Viet Nam) and the Tejona Wind Farm (Costa Rica).

- In 2000, ICE (Costa Rica's state electricity company) and Essent (one of the Netherlands electricity companies) signed a five-year partnership to implement a 20 MW wind farm in Tejona. The project aims to reduce greenhouse gas emissions and gain knowledge of project-based mechanisms. The total cost of the project amounted about US$ 26.3 million; a grant of € 4.3 million was provided by the Netherlands Minister for Development Cooperation;
- Early in 2003, the governments of Viet Nam and the Netherlands signed a Memorandum of Understanding concerning the implementation and financing of a Biogas programme, which aims to further develop commercial and structural deployment of biogas while simultaneously avoiding the use of fossil fuels and biomass resource depletion. The Netherlands Minister for Development Cooperation provides financial support of € 2.23 million for this three-year project currently being implemented in six provinces across Viet Nam.

Central and Eastern Europe

The aim of the cooperation between the Netherlands and the Central and Eastern European countries is to broaden support for the climate change issue in these countries and, at the same time, to reduce greenhouse gas emissions. The main programmes implemented by the Netherlands in this region are:

- Programme of Eastern European Cooperation (PSO);
- Social transformation Eastern European Programme (MATRA);
- Supporting the Cooperation of Rational Energy Use (SCORE).

The Programme of Eastern European Cooperation (PSO)[13] supports transfer of knowledge and know-how from the Dutch private sector to Central and Eastern European countries, thus contributing to their transition to market-oriented and sustainable economies. Countries that receive support in the fields of energy and environment are Bulgaria, Georgia, Kazakhstan, Romania, and Russia.

The SCORE programme, which is partly financed through MATRA (this programme is managed by SenterNovem, a Dutch governmental agency)[14], provided integrated support for end-use energy efficiency improvement in Hungary, Poland and Latvia. This programme finished in 2001. In two countries, Bulgaria and Romania, the initial phase of SCORE was implemented in 2000. In addition, the two latter countries received financial support for a joint implementation capacity-building programme (implemented from 1999 to 2002) to establish and operate local centres to assist the identification, development and implementation of JI projects.

13 The Dutch agency Senter managed the PSO programme on behalf of the Netherlands Ministry of Economic Affairs until 2004.

14 In May 2004, the agencies Senter and Novem, both previously involved in the programme, joined forces and merged into the organisation now known as SenterNovem.

Capacity building for mitigation
Capacity building is an integral part of the Netherlands development cooperation programme. This is also the case for the Netherlands Climate Change programme. However, there are also programmes and projects that have typical capacity-building elements. Examples of mitigation capacity-building programmes include the *SouthSouth*North (SSN) programme, the Capacity Development for the Clean Development Mechanism (CD4CDM), the Cooperation Programme on Water and Climate, as well as Kyoto, Think Global, Act Local and, to a lesser extent, the aforementioned PREGA programme. Some of these projects are described in more detail in the following paragraphs.

Although not directly earmarked as such, many of these activities are aimed to build the capacity of the developing countries in order to meet the obligations under Article 10 of the Kyoto Protocol.

Promoting sustainable development is a fundamental pillar of the CDM. The programme by *SouthSouth*North, an NGO in South Africa, contributes to poverty alleviation through capacity building among private and public stakeholders. Its objective is to contribute to a specific and significant CDM project portfolio that will generate benefits for the poor. The SSN programme is implemented in four developing countries. To implement this programme (2002-2004) the SSN initiative received a grant from the Netherlands Minister for Development Cooperation amounting to € 2.2 million.

Another programme with more emphasis on the institutional development of host countries to participate in a Carbon Market is known as CD4CDM, which is implemented by UNEP through the UNEP Risø Centre. It is a three-year programme (2003-2005) involving 12 countries worldwide and is funded by the Netherlands Development Cooperation with a grant of € 7.6 million.

A third example is the programme Kyoto, Think Global, Act Local. This is a five-year research and capacity-building programme that started in 2003; it is implemented by the Technology and Development Group at Twenty University, in collaboration with four partner institutes in the Netherlands, Senegal, Tanzania and Nepal. It is financially supported until 2005 with € 0.83 million through the Netherlands Development Cooperation. The programme aims to increase the empowerment of poor, marginalised rural communities over nearby forests. The programme should contribute to the negotiations on a future regime by enabling access to FCCC/Kyoto Protocol-related funds for community-based forest management (CFM). Many of the CFM activities (though not all) are designed to result in a sustainable supply of wood fuels, while others have biodiversity, environmental protection, or economic benefits as their main aim. Although CFM activities do not qualify directly under the Clean Development Mechanism, they might meet the requirements of other funding options including the BioCarbon Fund (BCF), the Community Development Carbon Fund (CDCB) and the private sector for the post-Kyoto period.

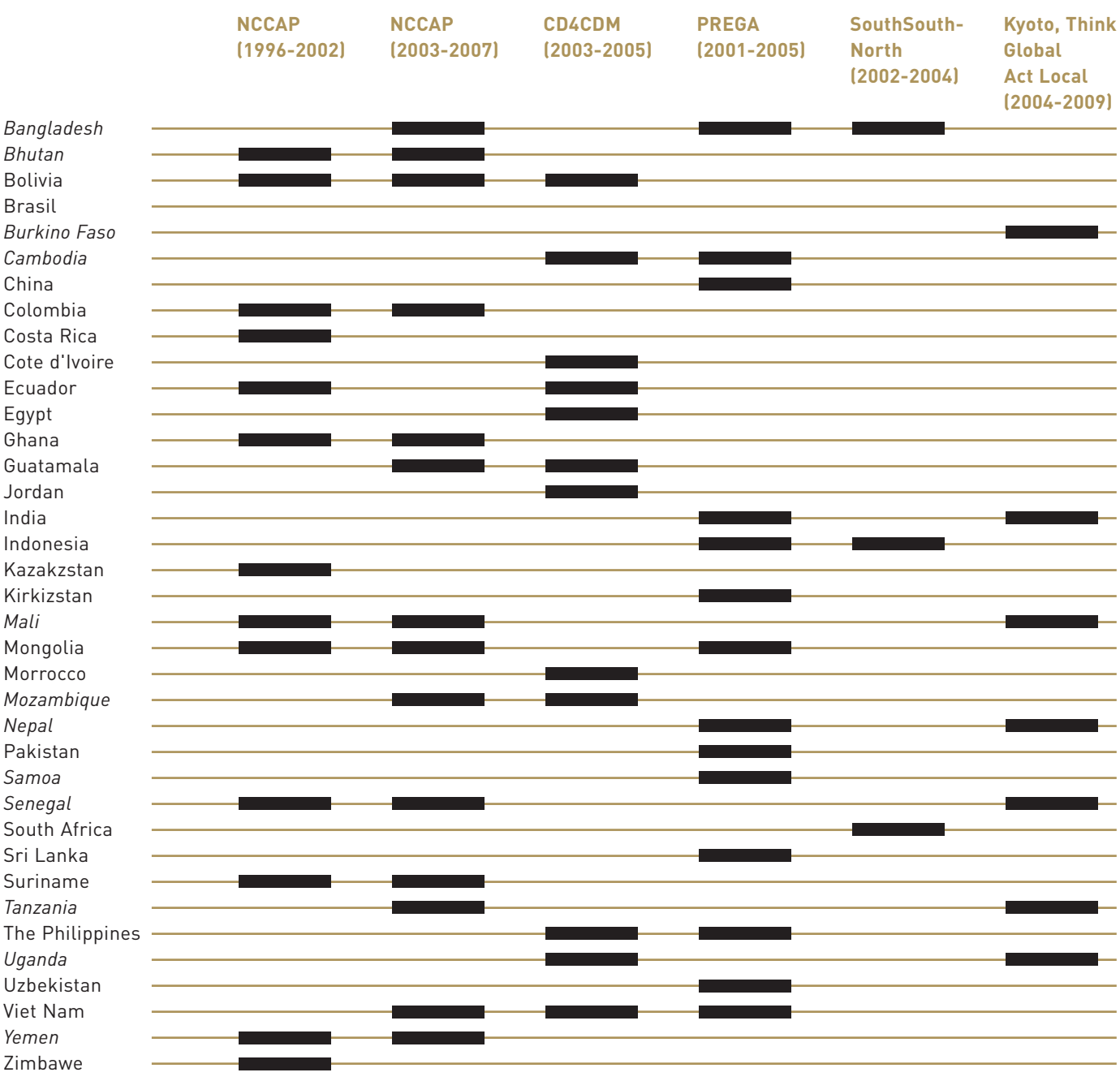
7.3.4 Adaptation

For a long time now the Netherlands has actively supported countries in addressing the adverse effects of climate change through the support of multilateral agencies such as the GEF and other types of organisations, and through bilateral assistance programmes. It provides both financial recourses and capacity to committees and working groups of the UNFCCC on adaptation and the least-developed counties, such as the Least-Developed Country Expert Group (LEG) and the Consultative Group of Experts on National Communications from Parties not Included in Annex I to the Convention (CGE). Moreover, in 2004 the Ministry of Foreign Affairs and Development Cooperation started consultative discussions with relevant stakeholders in order to strengthen its policy on adaptation.

Developing countries
Typical examples of adaptation programmes and projects supported by the Netherlands Government include:
- Netherlands Climate Change Studies Assistance Programme (NCCSAP)/ Netherlands Climate Assistance Programme (NCAP);
- The Red Cross Preparedness for Disasters related to Climate Change;
- Cooperative Programme on Water and Climate (WPWC).

The Netherlands Climate Change Studies Assistance Programme (NCCSAP), developed by DGIS and developing

Table 7.8 Countries supported through main climate programmes*



* Least-developed countries are shown in italics

countries (and implemented by ETC Consultants) was launched during the mid-1990s. After a successful first phase aimed at assisting developing countries to prepare their National Communications, and at undertaking capacity building, education and training activities, a second phase was launched in 2003. This programme, presently called the Netherlands Climate Assistance Programme (NCAP), is scheduled to be finalised in 2007. While the first phase mainly focused on basic climate change studies, the present phase is geared towards policy making in relation to climate change through a multi-stakeholder process and is being implemented in 14 developing countries. Project activities will be embedded into the governmental organisational structure of participating countries. The total support by the Netherlands Development Cooperation will be approximately € 6.3 million.

The main elements of the Red Cross (RC) programme on Preparedness for Disasters related to Climate Change are awareness raising, action and advocacy. Managed by the RC office in the Netherlands, it is primarily implemented in Viet Nam and Nicaragua. The programme receives a total support from the Netherlands of around € 0.63 million for the years 2003-2006. Its goals are strengthening the capacity of local RC branches and local communities to reduce risks, implementing vulnerability assessments, and implementing small-scale adaptation projects.

The Cooperative Programme on Water and Climate (WPWC, 2004-2008) was established to encourage more coordinated actions between the climate science, water resources and disaster relief communities and to build bridges between the two disciplines of water and climate change. UNESCO-IHE in the Netherlands acts as secretariat for this international network. The CPWC activities include raising awareness among the public and professionals, plus information exchange to increase access to up-to-date approaches, techniques and tools for water and climate professionals. CPWC also provides technical assistance, supportive research, training and skills development. The countries and regions that are covered by the CPWC encompass both Annex I countries and Non-Annex I countries. This programme receives € 0.5 million support from the Netherlands.

Central and Eastern Europe

Adaptation activities in Central Europe that are supported by the Netherlands are limited compared to those in developing countries. However, indirectly such adaptation issues are tackled through a variety of environmentally sound projects carried out under the PSO and PSOM programmes, as well as through projects under the EU's TACIS (technical dissemination) programme[15].

Capacity building for adaptation

Although most of the adaptation programmes under the Netherlands Climate Policy target elements of capacity building, some programmes such as START can be considered as full awareness and capacity building programmes. START (SysTem for Analysis Research and Training, an NGO based in the US) is responsible for research-driven capacity building in developing regions dealing with issues of global environmental change and sustainable development. It promotes regional research networks in the target regions. Through these networks, it facilitates inter alia the development of human and institutional capacity in global change science, fosters collaborative research on regional aspects of global change, assesses the impacts of adaptations to climate and global change, and provides scientific information to policy makers and decision makers in the region. The Netherlands supports various initiatives and grants that are coordinated and implemented by START through a financial contribution of € 1.1 million.

7.3.5 Assistance to developing countries that are particularly vulnerable to climate change

The Netherlands provides ample assistance to many of the least-developed countries, as described in the aforementioned subsections. These are the countries that are, generally speaking, most vulnerable to climate change. The assistance from the Netherlands takes place indirectly through the multilateral assistance by organisations such as the UNDP and the World Bank (see 7.3.2) as well as through partnerships that include the Netherlands (7.3.3). Direct assistance is also

15 Launched by the EC in 1991, the Tacis Programme provides grant-financed technical assistance to 12 countries of Eastern Europe and Central Asia (Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan, Ukraine and Uzbekistan), and mainly aims at enhancing the transition process in these countries.

provided though the climate change programmes (see overview of target countries in Table 7.8). Moreover, the Netherlands provides financial support as well as human capacity to the LDC Expert Group (LEG).

7.4 Actions related to the transfer of technology

Transfer and development of technology activities can range from hardware issues (equipment) to software issues (know-how), with the latter expressed particularly in adaptation-related issues. The Dutch programmes and projects directly aimed at transfer of technology comply with national obligations under the Convention (UNFCCC) as well as the Kyoto Protocol.

The programme that contributes most to the transfer of technology in a direct way is the aforementioned PSOM. One of the main project criteria of this programme is that the projects should result in the transfer of know-how and technology from the Dutch company to the company in the host developing country. Through this programme, the Netherlands contributes considerably to the development and transfer of technology to developing countries and to Central and Eastern European Countries.

Examples of projects that have received support from the PSOM include the Biomass Gasification Unit for Sustainable Energy in Bolivia and the Joint Venture Rural Energy Services in South Africa. The latter aimed to improve the access to energy for rural communities in Northern KwaZulu Natal. Local energy shops were created to supply energy through solar home systems and other energy sources. The project received an 80% contribution totalling €1 million and was successfully implemented in 2001-2003. The former project envisages the generation of electric energy by using locally available biomass (nutshells resulting from crushing processes). The technology applied is based on biomass gasification, followed by gas cleansing and combustion in a gas motor that is linked to a power generator. This € 1.5 million project received a 50% contribution from PSOM. Late in 2004, the Netherlands Development Cooperation (DGIS) increased the budget for PSOM projects and expanded the list of eligible countries from 16 to 41.

Apart from complete programmes, individual projects are also tackling the issue of technology transfer. For example, in early 2003, China and the Netherlands signed a cooperation agreement to promote the comprehensive development and utilisation of renewable energy in Western China's countryside through the project Promotion of Rural Renewable Energy in Western China. The project, sponsored by the China Association of Rural Energy Industry (CAREI), received investment of € 5.3 million from the Dutch Government and Yuan 5.4 million (€ 0.52 million) of subsidiary funds from the Chinese Ministry of Agriculture. The project is aimed at comprehensively developing and utilising the area's renewable energy sources, including solar energy, wind power, hydroelectricity and terrestrial heat, expanding the utilisation scale, raising management standards and improving consumer energy structures to establish a sustainable development. It also aims to promote the realisation of the western region development strategy objectives. This will be achieved through capacity building, demonstration projects, technology transfer and dissemination of project results.

7.5 Role of the private sector

It is acknowledged that the private sectors' contribution to sustainable development, and thus implicitly to combating climate change in developing countries and countries with economies in transition, is becoming increasingly important. Most of the environmentally sound technologies (including climate-friendly technologies) are owned by the private sector. Stimulating the private sector to actively participate in these types of projects is one of the basic concepts of the Netherlands development cooperation programmes aimed at central and eastern European countries and developing countries. The main examples of such programmes and initiatives include:

- Development-related Export Transactions Program (ORET);
- Programme for Cooperation with Emerging Markets (PSOM);
- Solar Investment Fund.

The main aim of the Development-related Export Transactions Program (ORET), which includes MILIEV - the Environment and Economic Self-sufficiency Programme, is to stimulate commercial activity and enhance job opportunities in developing countries and, at the same time, to increase Dutch exports to the beneficiary country. ORET is administered by FMO, the

Netherlands Development Finance Company, which primarily provides soft loans to business projects in developing countries. It also participates in equity investments in commercial undertakings, in cooperation with other foreign development banks. In addition to ORET, FMO also administers special assistance programmes for developing countries, e.g. the IPTA, Investment Promotion and Technical Assistance. This programme provides short-term support to investment promotion activities such as feasibility studies, job-related training and temporary management.

The Netherlands also supports several other national and international initiatives that encourage the private sector to invest in environmentally sound technology projects to be implemented in developing countries and Central and Eastern Europe. One of the well-known programmes is the Solar Investment Fund, which was established by the Triodos Bank Group and is financially supported by the Ministry of Development Cooperation. The bank, together with partners such as the World Bank, has established the Solar Development Group. The objective of the Solar Development Group (SDG) is to increase the delivery of solar home systems (SHS) and thus bring environmentally clean electricity to rural households in developing countries. Specifically, it aims to overcome the key barriers to accelerated growth of PV (photovoltaics) in the off-grid segment, including lack of medium-term funding to enable customers to repay the relatively high initial cost of PV systems over time, lack of understanding of PV by conventional financial intermediaries (FIs), and weak capitalisation of many indigenous PV companies. The SDG will address these constraints by providing both financing and business development services. The SDG consists of two companion entities with a target capitalisation of US$ 50 million, an approximately US$ 30 million private equity fund (Solar Development Capital (SDC)) that will provide investment capital through debt and equity instruments; and an approximately US$ 20 million foundation (Solar Development Foundation, or SDF) that will provide grants for business development services. The SDF started to operate in February 2000 and the SDC in March 2001. At present, the Netherlands has contributed (up to 2005) around € 2.2 million to the Solar Development Fund.

In order to comply with their emissions-reduction target as laid down in the Kyoto Protocol, Annex I countries are allowed to use several mechanisms encompassing, for example, the two project-based mechanisms (PBM) joint implementation (JI) and the clean development mechanism (CDM). Since PBM projects are additional to ongoing support and activities (for CDM this is a strict requirement and many JI host countries will make sure that, for first-track projects, this is also the case), additional private sector finance is sought to fund these projects. Along with many other Annex I countries, the Netherlands will use these mechanisms (see 4.5), thus indirectly encouraging private sector involvement. However, the Netherlands not only encourages the private sector to invest in climate-friendly projects by purchasing emission-reduction units, but also through various CDM and JI-oriented capacity building programmes (see aforementioned examples).

8. Research and systematic observation

8.1 General policy on research and systematic observation

Research activities in the Netherlands cover a range of climate system, impact and policy support studies. These activities are characterised by:

- intensive participation in international and European programmes;
- clustering into a few larger national research programmes.

The following sections provide a brief overview of important research activities.

A further clustering of national research was facilitated (from 2004) by a government programme on Subsidies for the Knowledge Infrastructure (BSIK). The BSIK guidelines resolve intellectual property rights and the open access to programme results. The national research programmes actively seek private sector participation and to facilitate the dialogue between stakeholders from the scientific, policies and private sectors. To overcome barriers to exchanging data and information the national research programmes closely coordinate their communication and research activities. Results from the international, European and national research programmes are made available to the international community through reports, publications and the Internet. These results can typically be obtained free of charge or at low cost.

8.2 Research

8.2.1 Cooperation in international research

The Netherlands' research on climate change is well embedded in, acknowledged by and co-steered in the three large international scientific programmes in the field of global change research: the International Geosphere Biosphere Programme (IGBP), the World Climate Research Programme (WCRP) and the International Human Dimensions Project (IHDP). National research programmes further try to support this position. The Netherlands Organisation for Scientific Research (NWO) and the Royal Netherlands Academy of Arts and Sciences (KNAW) both coordinate Dutch contributions to the international research arena (see 3rd National Communication).

Extensive support is also given to the work of the Intergovernmental Panel on Climate Change (IPCC). Ten Dutch scientists contributed as (lead) authors to the fourth IPCC assessment report on three of its prioritised areas: climate scenarios, mitigation and adaptation. RIVM provides office facilities and support for one of the co-chairs and for the Technical Support Unit of IPCC Working Group III. Netherlands experts also contribute to the development of the IPCC Guidelines for National Greenhouse Gas Inventories. The Netherlands further hosts a number of international programmes that specifically aim at technology transfer and international cooperation (see also Chapter 7).

8.2.2 Cooperation in European research

Many of the leading Dutch institutions have research projects under the EU's 5th and 6th Framework Programmes (FP) and are actively involved in preparing new projects to be submitted under the 6th FP. These projects are thematically closely connected to all main themes of national research programmes. The synergy and cooperation between European projects and the national research programmes reinforces the crucial international dimension to Dutch research activities. The most relevant research projects and networks financed by the EU 5th and 6th Framework Programmes are listed below.

→ Dutch cooperation in research projects and networks financed by the EU's 5th and 6th Framework Programmes (FP) and other European Funds

Climate and monitoring

- CLOUDNET/CLIWANET. Climate monitoring and processes
- PRUDENCE. Regional climate scenarios
- DAEDALUS, EOROTRAC. Aerosol-based and trans-boundary air pollution transport
- MERSEA (FP6). High resolution modelling
- EMEP. Programme for monitoring and evaluation of long-term transmission of air pollution in Europe
- ACCENT. European network of excellence on atmospheric composition change
- Earlinet. European aerosol research Lidar network to establish an aerosol climatology
- ELDAS. European land data assimilation system
- INTROP (ESF programme). Interdisciplinary Tropospheric Research
- ENSEMBLES (FP5). Ensemble-based predictions of climate changes and their impacts

- EU Cliwoc. Climatological database for the world's oceans 1750-1850
- EU METNET. A network grouping 20 European national meteorological services
- EUROCORES/EUROMARGINS/EUROCLIMATE (ESF programme). Processes in the European passive continental margins/climate variability and (past, present and future) carbon cycle
- AquaTerra (FP6). Improved river basin management through a better under-standing of the river-sediment-soil-groundwater system
- Wege des Wassers (Interreg III). Operational water management in the EU region Meuse-Rhine
- European forum on Integrated environmental assessment (EFIEA)
- GMES. Operational satellite information for environmental and climate studies

Carbon Cycle and Land Use
- FLUXNET, Integrating worldwide CO_2 flux measurements
- CARBOEUROPE cluster. Quantification and understanding of the European terrestrial carbon balance
- CASFOR II. Modelling carbon sequestration in forested landscapes
- ACCENT. Carbon monoxide observations system
- CHIOTTO (FP5). Verification of greenhouse gas emissions in Europe
- CAMELS (FP5). Carbon assimilation and modelling of the European land surfaces
- EU-RURALIS. Scenario study of future land use, its drivers and consequences

Biodiversity
- PEER. Biodiversity, landscape planning, aquatic ecosystems, pollution and its remediation
- ATEAM (FP5). Advanced terrestrial ecosystem analysis and modelling (see further on)
- Greenveins: Impacts on biodiversity, land use and landscape patterns in rural areas
- BRANCH. Biodiversity adaptation in northwest Europe to climate change
- TLINKS. Trophic linkages between above- and below-ground organisms as a key to successful restoration of biodiversity on ex-arable land across Europe
- CONSIDER (Thematic network), Conservation of soil biodiversity

Economic Sectors
- STELLA (FP6). Sustainable Transport
- ESPON (Interreg III). European Spatial Planning Observation Network
- cCASHh (FP5). Climate Change and Adaptation Strategies for Human health

Integration and Policy
- ADAM (FP6). Adaptation and Mitigation Strategies
- enVISage. Sustainability and integrated earth system approaches
- NeWater (FP6). New approaches to adaptive water management under uncertainty
- Aquastress (FP6). Mitigation of water stress through new approaches to integrating management, technical, economic and institutional instruments
- ATLANTIS (FP5). Atlantic sea level rise: Adaptation to imaginable worst case climate change
- ESPACE (INTERREG III). European spatial planning adapting to climate events
- European Climate Forum (ECF) dialogues between science, policy and private sector on sustainable solutions to climate change; founded by the European Commission
- European Climate Change Programme (ECCP) dialogues between science, policy and private sector on cost-effective European emission reduction policies

→ A-TEAM - Vulnerability of human sectors relying on ecosystem services with respect to global change

ATEAM's primary objective was to assess the vulnerability of human sectors relying on ecosystem services with respect to global change. ATEAM considered vulnerability to be a function of potential impacts and adaptive capacity to global change. Multiple, internally consistent scenarios of potential impacts and vulnerabilities of the sectors agriculture, forestry, carbon storage, water, nature conservation and mountain tourism in the 21st century were mapped for Europe using a regional scale for four time periods (1990, 2020, 2050, 2080).

ATEAM contributed to the understanding of Europe's vulnerability to global change. Specifically, ATEAM assesses the rate and extent of climate and land-use change, potential changes in ecosystem service supply and the vulnerability of key human sectors. Existing understanding of the dynamics of European ecosystems (managed and unmanaged) in the form of data and models, were assembled in a coherent framework. The ATEAM results facilitate sustainable environmental management and help evaluate the effectiveness of implementation measures such as the European Biodiversity Strategy. Project findings on Europe's carbon storage potential provide input to the debate around the Kyoto Protocol and support the design of climate protection strategies. The project actively promoted the dialogue between stakeholders and scientists to increase mutual understanding and the usefulness of scientific results. This dialogue process has impacted all project conclusions.

The full range of environmental impact scenarios provided spatially explicit projections of ecosystem services over time, including (for the first time) the variation over multiple plausible scenarios. The set of multiple plausible global change scenarios showed severe changes in European climate and land use in the next century. Though some of the expected impacts may be considered positive (e.g. increases in forest area and productivity), and others hold potential opportunities for the future (e.g. 'surplus land' for extending agriculture), most of the anticipated changes have negative impacts on ecosystem service supply, and therefore on human society (e.g. declining soil fertility, increased fire risk, biodiversity losses). The main trends in anticipated environmental impacts of global change seem clear enough to trigger both immediate action and further inquiry.

ATEAM produced two main products: (1) A CD-ROM with the interactive ATEAM mapping tool displaying the full range of charts and maps of results with exhaustive documentation and summarised conclusions. (2) A peer-reviewed journal (special issue), summarising scientific papers. In addition to this special issue, numerous papers have been, and will be, published as a result of the ATEAM project.

More information: *www.pik-potsdam.de/ateam/*

8.2.3 National Research Programmes

National research activities are clustered into following main groups:

- National Research Programme on Global Air Pollution and Climate Change (NRP-CC);
- National Research Programme 'Climate Changes Spatial Planning' (BSIK-KvR Programme);
- Other research programmes such as
  - R&D programmes of the various government ministries;
  - National research programmes in areas closely related to climate change and variability (e.g. water).

The first two programmes specifically focus on climate change. Communication and coordination between these two programmes is implemented by combining programme offices, coordinating research questions, developing one communication strategy and maintaining one website for outreach (*www.klimaatportaal.nl)*.

National Research Programme on Global Air Pollution and Climate Change (NRP-CC)

As a follow-up to NRP-2 (2001, see 3rd National Communication), the Ministry (VROM), the Netherlands Organisation for Scientific Research (NWO) and seven key Dutch institutes entered into an agreement to cooperate in the 'National Research Programme on Climate Change' (NRP-CC). RIVM was appointed to host the management of this programme from 2002-2006. It consists of four work packages:

- fundamental research (implemented by NWO, see further on);
- scientific assessments and policy analyses (managed by NRP-CC, see further on);
- policy advice and communication;
- short-term policy support.

Activities are carried out in cooperation with six other Dutch institutes: the Netherlands Energy Research Centre (ECN), Wageningen University and Research Centre / Centre for Climate Change and Biosphere Research (WUR/CCB), the Royal Dutch Meteorological Institute (KNMI), Utrecht University (UU), Maastricht University/ International Centre for Integrative Studies (ICIS) and the Climate Centre of the Vrije Universiteit Amsterdam (CCVUA). The NRP-2 programme initiated activities such as NRP Impact, a major integrated assessment, focusing on the impacts of, and adaptation to, climate change in the

Netherlands (see also chapter 6). Until recently the NRP-CC research programme was the largest programme in which a broad range of Dutch research institutes conducted research together on climate change issues.

The communication activities are carried out by the Platform for Communication on Climate Change (PCCC), a cooperation between RIVM, KNMI, WUR/CCB, CCVUA and NWO.

→ NWO Programmes

'Vulnerability, Adaptation and Mitigation' (VAM)
The Earth and Life Sciences (ALW) and Social Sciences (MaGW) of the Netherlands Organisation for Scientific Research (NWO) have launched the programme 'Vulnerability, Adaptation and Mitigation' (VAM), which runs from 2004-2008. It will include a (single) subsidy round in which € 2.5 million are invested in high-quality research. The VAM research programme is carried out under the responsibility of the NWO Social Sciences board. A VAM programme committee operates under this Social Sciences board and consists of scientific experts in VAM research areas.

VAM focuses on research into the social and behavioural aspects of climate change, particularly within and in cooperation between public administration, geography, environmental economics, sociocultural sciences, environmental law, psychology and other disciplines. The programme is not intended for biological and ecological research. The VAM themes include:
- Vulnerability: can be seen as the extent to which health, economy and nature and biodiversity will be affected as a result of a certain climatic change;
- Adaptation: means adapting to a changed or changing climate, and covers local, national and global aspects. Adaptation is intended to reduce the vulnerability of systems;
- Mitigation: this term can be explained in various ways. Sometimes it is seen as the avoidance of climate change, whatever strategy may be followed. This may include a reduction in greenhouse gas emissions. Another choice would be to clearly separate mitigation from reduction. Mitigation is then limited to the neutralisation of greenhouse emissions that have already been produced, such as storing CO_2 underground or absorbing it by planting forests.
- Adaptation-plus-mitigation: adaptation and mitigation are not alternatives for each other. They form two complementary, parallel tracks in climate policy. Mitigation is the only fundamental solution for the climate problem, but adaptation is necessary in order to withstand the inevitable consequences of climate change.

NWO global change programme
The NWO participates both in funding and coordinating the national research programme NRP-CC. In addition, the NWO Research Councils, the Foundation for the Advancement of Tropical Research (WOTRO), NWO's oceanographic institute (NIOZ) and Space Research Foundation (SRON), fund a variety of special research programmes on global change issues, which are being implemented by universities and scientific institutes. More information: *www.nwo.nl*

→ The Scientific Assessment and Policy Analysis Programme

The Scientific Assessment and Policy Analysis is a sub-programme under the NRP-CC to:
- collect and evaluate relevant scientific information for policy development and decision making in the field of climate change;
- analyse resolutions and decisions within the framework of international climate negotiations and their implications.

The Programme realises analyses and assessments intended to provide a balanced evaluation of the state of the art to underpin policy choices. These analyses and assessment activities are carried out in short periods (several months up to around a year), depending on the complexity and urgency of the policy issue. Assessment teams organised to handle the various topics consist of the best Dutch experts in their fields. Teams work on incidental and additionally financed activities, as opposed to the regular, structurally financed activities of the climate research consortium. The work should reflect the current state of science on the relevant topic. The main commissioning bodies are the National Environmental Policy Plan departments, with the Ministry (VROM) assuming a coordinating role. Work is also commissioned by organisations in society that play an important role in the decision-making process concerned with the implementation of the climate policy. RIVM, as main contracting body, assumes final responsibility.

National Research Programme 'Climate Changes Spatial Planning' (BSIK-KvR)
The main goal of the 'Climate Changes Spatial Planning' research programme is to embed the climate change factor into spatial planning: at all scales and across all sectors of society. The programme seeks to enhance sustainable use of our space and exploits innovative implementations of multifunctional land use. A multi-sectoral dialogue ensures that awareness will be raised and measures will be developed that both decrease greenhouse gas emissions and better prepare the Netherlands for adapting to climate change. The programme is supported by a € 40 million grant from the Subsidies for Knowledge Infrastructure scheme (BSIK). Programme partners match the subsidy with a similar amount. The programme runs from January 2005 to December 2009 and is implemented by a foundation that brings together almost 100 national and international scientific institutes, governmental institutions, non-governmental institutions (NGOs) and private enterprises.

In order to ensure, embed and further enhance the status of the Netherlands as knowledge country, the programme supports a 'Network on climate and spatial planning' operated by stakeholders from government, private enterprises and scientific institutes. Partners in the network conduct a series of interlinked projects, which are clustered around four main themes: Climate Scenarios, Mitigation, Adaptation and Integration. The programme budget is equally divided between the themes. In addition to these main themes, 10% of the overall budget is reserved for new projects to bring research results of the programme into action or to respond to new developments.

Other programmes
In addition to the aforementioned climate research programmes, 'sectoral' ministries also operate more specific climate-related R&D programmes. These programmes include:

- Ministry of Agriculture (LNV): climate research programmes, focusing on aspects such as sinks in forestry and agriculture, adaptation of nature and agriculture[16];
- Ministries of Environment (VROM) and LNV (together): Reduction Programme for Non-CO_2 Greenhouse Gases (ROB), including R&D on reduction of non-CO_2 greenhouse gases in agriculture, industry and other sectors (implemented by SenterNovem);
- Ministry of Transport (V&W): systematic observation of climate variables (see section 8.3)
- Ministry of Transport (V&W): various subsidy programmes enhancing R&D and innovation in transport. These include themes related to transition management for achieving 'sustainable mobility' e.g. research into alternative fuels. For research into vulnerability assessment and adaptation (including spatial planning) see Chapter 6;
- Ministry of Economic Affairs (EZ) has extensive programmes, including the energy transition approach, which was started after the publication of the Fourth National Environmental Plan (NMP4) in 2001. Following an intensive dialogue between numerous stakeholders, in 2004 the Dutch Ministry of Economic Affairs published a white paper on innovation in energy policy. It distinguishes a number of preferable transition paths clustered into five main roadmaps: green resources, alternative motor fuels, chain efficiency, efficient and green gas, and renewable electricity.

The energy transition is directly supported by € 30 million and by € 170 million in energy innovation research. A total of some 100 coalitions are currently working on transition experiments. The energy transition approach has refocused the funding of research and development into technologies for energy efficiency and clean and/or renewable energies.

The national climate research programmes seek close cooperation with research programmes in areas that are impacted by climate change or that may strengthen the adaptive capacity. Such cooperation aims to avoid overlap and gain mutual benefits from synergy. It is implemented, among other things, through shared projects. Such research areas include water (e.g. 'Living with Water / Leven met Water' and the 'Delft's Cluster' projects) and spatial planning (e.g. Habiforum and 'Innovative use of space/Vernieuwend Ruimtegebruik' projects.

8.2.4 Main research themes: an overview
Most of the research themes described in the 3rd National Communication are still important. The following brief summary includes the main research themes, highlights,

16 www.onderzoekinformatie.nl/en/oi/nod/onderzoek/OND1284625/

innovations and significant efforts. The structure of this table follows the themes of the National Research Programme 'Climate Changes Spatial Planning' (BSIK-KvR). Most of the research projects listed are shared between different organisations and research programmes. Please note that some major activities, mentioned under 'other programmes' in the previous sector are not included in the table below; most of the themes in these 'other' programmes relate to 'mitigation'.

8.3 Systematic observation

Within the Netherlands various institutions actively participate in national and international programmes on climate-related monitoring. An integrated national programme, combining the activities of atmospheric, oceanographic and terrestrial-oriented institutes, is under development, for which the GCOS Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC is seen as providing guidance. The development of this programme is being coordinated by the Royal Netherlands Meteorological Institute (KNMI), building on an earlier national study and recommendations.

In 1998 an authoritative national study (NIMM) was undertaken to evaluate the Netherlands' contribution to international monitoring systems (an English-language summary is available from the nlGCOS site from KNMI. This report deals with five areas of monitoring activities (oceans, coast and delta, land, weather and climate, and atmospheric composition). The findings from this study include the strong recommendation to strive for integrated approaches at a national level, in accordance with IGOS. To that effect it was proposed that national focal points be designated for GCOS, GOOS and GTOS. From 2000 onwards the Royal Netherlands Meteorological Institute (KNMI) has acted as focal point for GCOS in the Netherlands. The NIMM study recommends substantial strengthening of climate-related monitoring, requiring further investments and organisational structuring.

The GCOS requirements are being met by the Netherlands. The GCOS monitoring principles and best practices are known at the professional level and are taken into account. Free data exchange is encouraged, within the limits of international regulations (e.g. the ECOMET rules). At present there is no explicit national policy for capacity building, related to GCOS, although activities do take place frequently, on a project level.

Monitoring activities in the Netherlands are firmly embedded in international programmes such as Framework programmes on European level and GEOSS on global level. Also on project level we see international cooperation. With regard to Earth Observation, contributions are made to e.g. ESA, EUMETSAT and NASA missions and data retrieval methods. Data are exchanged internationally, and submitted to numerous databases around the world. Overall guidance is provided by e.g. GCOS and WCRP, while contributions are regularly made to help optimise these programmes.

More detailed information on the Netherlands systematic observation activities is described in Annex 8.

	(a) Climate process and climate system studies, including paleoclimatic studies	(b) Modelling and prediction, including general circulation models	(c) Research on the impacts of climate change	(d) Socioeconomic analysis, including analysis of the impacts of climate change and response options	(e) Research and development on mitigation and adaptation technologies
Theme 1 'Climate Scenarios'					
Main goal: to develop a national database on regional climate data and climate scenarios. In order to respond adequately to climate change and variability, society needs access to up-to-date climate data and scenarios. The production of tailor-made climate information is central to this research theme that builds on the wealth of existing climate scenario information. Specific research projects include:					
North Atlantic Ocean monitoring and modelling.	■	■			
Monitoring and profiling with the Cabauw Experimental Site for Atmospheric Research (CESAR).	■	■			
Representation of soil moisture and root water uptake in climate models		■	■		
The regional climate impact of aerosols	■	■	■		
Remote influences on European climate		■	■		
Climate scenarios of wind and precipitation for the Netherlands with a high-resolution regional climate model		■	■		
Tailoring climate information for impact assessment			■		
Precipitation time series information for the validation of climate scenarios		■			
Modelling and reconstructing precipitation and flood frequency in the Meuse catchment during the late Holocene	■	■			

	(a) Climate process and climate system studies, including paleoclimatic studies	(b) Modelling and prediction, including general circulation models	(c) Research on the impacts of climate change	(d) Socioeconomic analysis, including analysis of the impacts of climate change and response options	(e) Research and development on mitigation and adaptation technologies
Theme 2 'Mitigation'					
Main goal: Methods of quantifying and decreasing land-use-bound greenhouse gas emissions, advance low GHG-emitting energy systems, and encourage climate-neutral entrepreneurs and emission trading. Special research attention goes to knowledge required for managing land-bound sources and sinks. In addition low or zero GHG-emitting energy systems are explored characterised by an increasing share of either renewable energy sources or carbon-neutral fossil fuel use. These research results may be shared with third countries through the flexible instruments. Companies start to show an interest in proactively anticipating possible climate risks and opportunities in their management strategy. Methodologies to become a climate-neutral entrepreneur are being developed. They include emission-reduction options, company carbon footprinting, benchmarking and investment in projects to offset or compensate for remaining emissions, many of which have a distinct spatial component. Specific research projects include:					
Integrated observations and modelling of greenhouse gas budgets at the ecosystem level in the Netherlands		■			■
Integrated observations and modelling of greenhouse gas budgets at the national level in the Netherlands		■			■
Soil carbon dynamics and variability at the landscape scale: its relation to aspects of spatial distribution in national emission databases					■
The effect of the spatial arrangement of wetlands on water quality improvement and carbon sequestration in a multifunctional land-use setting				■	■
Participatory assessment of long-term strategies for the management of Dutch fen meadows using spatial decision-support tools (PAL)			■	■	■
Renewable energy: offshore wind energy (definition phase)				■	■
Renewable energy: biomass (definition phase)				■	■

	(a) Climate process and climate system studies, including paleoclimatic studies	(b) Modelling and prediction, including general circulation models	(c) Research on the impacts of climate change	(d) Socioeconomic analysis, including analysis of the impacts of climate change and response options	(e) Research and development on mitigation and adaptation technologies
Theme 3: 'Adaptation'					
Main goal: To design new adaptation strategies to alleviate the negative effects of climate change and climate variability and, at the same time, support sustainable development. The Dutch Government needs new approaches with respect to safety and risks. Opportunities for different sectors are found by implementing new adaptation strategies and tools in the planning process, including financial risk arrangements supported by banks and insurers, and the implementation of new adaptation measures by engineering companies. Emphasis is on the dialogue with stakeholders to co-produce adaptation options. Specific research projects include:					
Biodiversity in a changing environment: predicting spatiotemporal dynamics of vegetation			■		■
Strategies for optimising the nature conservation potential of the Dutch Ecological Network and the surrounding multifunctional farm landscape under predicted climate change scenarios			■		■
ACER: Developing Adaptive Capacity to Extreme events in the Rhine basin				■	■
Climate change impacts on inland transport systems, an evaluation of adaptation strategies			■	■	■
Financial arrangements for disaster losses under climate change				■	■
Climate-related shifts in the coastal ecosystem (definition phase)					
Climate change and agriculture (definition phase)			■	■	■

	(a) Climate process and climate system studies, including paleoclimatic studies	(b) Modelling and prediction, including general circulation models	(c) Research on the impacts of climate change	(d) Socioeconomic analysis, including analysis of the impacts of climate change and response options	(e) Research and development on mitigation and adaptation technologies
Theme 4: 'Integration & Communication' Main goal: Integration through dialogue, risk analysis and knowledge transfer. The projects under 'Integration' are meant to support and integrate activities within themes 1, 2 and 3. Integration will be achieved through a dialogue that is supported by integrated assessment, cost-benefit analyses, knowledge transfer approaches and linkages to international programmes. The dialogue aims to enhance learning with and among those involved. Learning is primarily understood as reaching a shared understanding of complexity, especially the facts and values relevant for different participants. The dialogue on climate change does not seek for consensus. The identification of diverging views and conflicting lines of argument is of equal value, or is even more important, for the long term. Specific research projects include:					
Communication strategy and outreach (see Chapter 10)					▬
Integrated analysis of emission reduction over regions, sectors, sources and greenhouse gases				▬	▬
LANDS: Land use and climate change				▬	▬
Cost-benefit analysis of adaptation and mitigation options for climate change: methods and applications				▬	▬
PRObing, a method to Facilitate the Interactive Linking of Expert knowledge to Stakeholder assessment (PROFILES)				▬	
Adaptation-Mitigation Strategies (definition phase)				▬	▬
Risk and uncertainty management (definition phase)				▬	▬
Climate change and the business community (definition phase)				▬	

9. Education, training and public awareness

9.1 Introduction

This chapter describes the state of affairs and governmental activities in the Netherlands regarding education, training and public awareness on climate change. Section 9.2 addresses general issues such as the trend in public awareness on climate change. Section 9.3 deals with governmental activities in education, training, and raising public awareness, e.g. websites, public information campaigns, information centres and involvement of the general public. Special attention is given to the campaign 'The Netherlands lives with water'. Section 9.4 describes several activities by non-governmental organisations, while Section 9.5 describes activities in education and training. Finally, Section 9.6 indicates what the Netherlands has done to implement the New Delhi work programme on Article 6 of the UNFCCC.

9.2 General trends

9.2.1 Public awareness of climate change

Within the Netherlands the majority of the general public are concerned about climate change. This is confirmed by various surveys, e.g. the national VROM survey, which was conducted in 2004 on behalf of the Ministry of Environment (VROM). Some 8000 citizens participated in this survey, which showed that, as far as issues of national interest are concerned, climate change is one of the population's major concerns. This significant awareness level is also illustrated by the increased attention that the media is paying to climate change. Two recent examples:

- in February 2005 a national private television company broadcast the 'National Climate Survey', a three-hour prime-time television show, which drew an audience of 1.6 million viewers. The objective was to inform the general public about climate change and its possible consequences, as well as to test the knowledge of the general public and its willingness to act. VROM cooperated with the show and supported it financially;
- for one week in May 2005 a national TV news programme 'Twee Vandaag' dedicated its daily programme to climate change. The week was concluded by a debate on prime-time TV (Saturday night) with politicians, scientists, plus representatives from environmental lobby groups and industry. It also held a public survey on its website, in which 18,000 people participated. This showed that 68% were considerably worried about climate change.

9.2.2 Public access to environmental information

Public access to environmental information that is available from the government, including data on greenhouse gas emissions and energy use, has recently been improved as a result of the Treaty of Arhus being implemented into Dutch law. To this end, the Freedom of Information Act and the Environmental Management Act were both adjusted on February 14, 2005. The definition of environmental information has now been extended and the grounds for rejecting a request for environmental information have been limited. The government must actively make emission figures available to the general public. Much other information is passively available.

9.2.3 Increased attention for (adaptation to) the consequences of climate change

A trend in public awareness that has been seen since 2001, concerns increased attention for the possible consequences of climate change and adaptation in the Netherlands. This is illustrated e.g. by the campaign 'The Netherlands lives with water' and the programme 'Climate changes spatial planning' (see hereafter). Also non-governmental organisations pay attention to this issue. This is e.g. illustrated by the publication 'The Netherlands warmed up' (2004), presenting current knowledge on the consequences of climate change for nature, water and agriculture in an easily accessible way.

9.3 Activities by the Dutch government

Within the Netherlands the Ministry of VROM is responsible for coordinating national climate policy, as well as for residential energy savings, reduction of non-CO_2 greenhouse gases and the Clean Development Mechanism. The Ministry of Economic Affairs is responsible for industrial energy savings, renewable energy and Joint Implementation. The Ministry of Agriculture, Nature and Food Quality is responsible for energy savings in agriculture and LULUCF, while the Ministry of Transport, Public Works and Water Management is responsible for energy savings in transport and for adapting the Dutch water management to climate change. All these ministries implement activities in education, training and public awareness in their respective

fields of responsibility. The most relevant activities are described below.

9.3.1 VROM website on climate change

The VROM website *(www.vrom.nl)* contains a dossier on climate change, which explains the causes and nature of climate change and the consequences for the Netherlands. It also describes international and national climate policy, provides links to other relevant websites and publishes press releases. Visitors may address questions to the ministry. During the Netherlands' presidency of the EU (second half of 2004) press releases on CoP 10 etc. were regularly published on the website. In general, the dossiers on VROM's website are consulted around 600 times a week. Issues such as energy, energy savings and climate change are among those most frequently consulted. VROM also hosts an English-language website *(www.vrom.nl/international/)*. From May to July 2005 VROM's online international magazine on this website was dedicated to climate change.

9.3.2 Public information campaigns on climate change

VROM and the other ministries involved in climate policy regularly organise public information campaigns on climate change, comparable to those described in the 3rd National Communication. The aim is to increase energy efficiency and the use of renewable energy through low-cost and 'easy to implement' actions. Examples since the 3rd National Communication include:

- 2002: national campaigns to promote a tax-rebate for buyers of new energy-efficient passenger cars and to promote subsidies for insulation measures in residences;
- 2003: a campaign to promote the Energy Performance Advice, an advisory scheme on insulation measures in residences, partially subsidised by VROM. Furthermore, a general campaign encouraged energy savings and the use of green electricity;
- 2004: under the initiative of the Netherlands' presidency of the EU, the EU presented its climate policy at an exhibition stand during the CoP 10 in Buenos Aires;
- the campaign 'The new driving force programme' (previously described in the 3rd National Communication), has continued since 2001. This is a cooperative scheme between the Ministry of VROM, the Ministry of Transport, Public Works and Water Management, SenterNovem and relevant sector organisations. The programme teaches drivers, both private and professional, to drive in a safer and more energy-efficient manner, by adapting their driving behaviour. The programme runs from 1999 to 2006. A public information campaign was started in 2004, promoted in the national media and on the website *www.hetnieuwerijden.nl;*
- in 2003, the campaign 'The Netherlands lives with water' was initiated by the Ministry of Transport, Public Works and Water Management. It includes a public information campaign. 'The Netherlands lives with water' is described further in Section 9.3.5.

9.3.3 Transfer of knowledge by resource and information centres

As part of their task in education, training and raising public awareness, the ministries involved in climate policy commission intermediary organisations to implement certain tasks. To improve efficiency and prevent overlap, in 2005 several of these organisations merged into two new organisations, i.e. SenterNovem and MilieuCentraal. SenterNovem focuses on professional parties, such as industry, local governments and companies providing service in energy and the environment. MilieuCentraal concentrates on consumers. Both organisations are described below. Communication activities are also implemented under the framework of 'Climate changes spatial planning' through the Platform Communication on Climate Change. These activities are also described below.

SenterNovem

SenterNovem is an agency of the Dutch Ministry of Economic Affairs: it implements programmes for various ministries on innovation, energy and climate, and environment and spatial planning. Clustering knowledge, SenterNovem aims to strengthen the economy through sustainable development and innovation. Examples of the many programmes that SenterNovem carries out include: the CO_2 reduction plan, Energy Performance Advice, the national renewable energy programme, Long-Term Agreements with industry to increase energy efficiency and the reduction programme for non-CO_2 greenhouse gases. Education, training and raising public awareness form an integrated part of its activities. Also a website *www.greenhousegases.nl* is hosted by SenterNovem, under assignment from VROM. Its main aim is to provide information on the National System for monitoring, on the

(trends in) greenhouse gas emissions in the Netherlands and on climate policy, as reported in the National Inventory Reports and National Communications respectively.

MilieuCentraal
MilieuCentraal *(www.milieucentraal.nl)* is an independent organisation that provides consumers with practical and reliable information on the environment. The quality of this information is assured via a review process, whereby information from various sources is gathered and various experts are consulted. MilieuCentraal hosts a website and a call centre. It initiates communication campaigns, usually in cooperation with other organisations, which are aimed directly at consumers. The organisation also conducts public surveys on environmental issues. In March 2005 MilieuCentraal launched the website *www.consument-en-energie.nl* (consumer and energy), following an initiative by the Ministry of Economic Affairs. This website aims to provide consumers with independent and reliable information on renewable energy, energy savings, and selecting an energy supplier. In parallel, the campaign 'Knowing by measuring' has started, which aims to improve public knowledge of energy savings.

Communication activities of 'Climate changes spatial planning'
Increased attention to the possible consequences of climate change is illustrated by the combined communication activities of the research programmes NRP-CC (Netherlands Research Programme Climate Change) and 'Climate changes spatial planning' (see Chapter 8). The Ministry of VROM funds these programmes. The Dutch Platform Communication on Climate Change (PCCC) was initiated at the end of 2003; this is a cooperation of Dutch institutes involved in climate change research. The communication activities aim to increase the knowledge of climate research, including the consequences of climate change and possible adaptation measures, for politicians, policy makers, industry, non-governmental organisations, the media and the general public. The four main activities are:

- organising dialogue workshops between politicians, government officials, industry, etc.;
- establishing a communications network between Dutch institutes involved in climate change research;
- stimulating the transfer of knowledge by bringing together parties that may offer or need knowledge on climate change;
- providing information on climate change research to the general public.

Activities include publishing fact sheets, brochures and summaries of scientific reports. After its foundation in 2003, the PCCC's first activity was to organise a meeting on climate change for Members of Parliament. In 2004 it organised a thematic day on climate. By now PCCC is considered the primary outlet for information on climate change research in the Netherlands. The information can be accessed on the website: *www.klimaatportaal.nl.*

9.3.4 Involving the general public

VROM's general aim is to encourage society to develop in a sustainable way. To do this, major national and international changes (or 'transitions') are necessary, e.g. the transition to renewable energy. Such transitions can only be achieved with support from society in general, including the general public. VROM tries to increase the involvement of the general public in its policy making and to stand closer to what motivates the general public, e.g. through the programme 'Policy with citizens', which started in 2002. This consists of various projects in which citizens are invited to join debates, propose solutions, participate in projects or carry out research.

9.3.5 'The Netherlands lives with water'

Increased attention to the possible consequences of climate change, specifically for the Netherlands, is also illustrated by the campaign 'The Netherlands lives with water', which was started in 2003 by the Ministry of Transport, Public Works and Water Management, together with provinces, water boards and municipalities. The campaign was initiated on the occasion of the new Dutch 'Water Policy in the 21st Century'. The implementation of this policy is elaborated in the National Administrative Agreement on Water between the Ministry of Transport, Public Works and Water Management and provinces, water boards and municipalities. The core message of the policy is that more space should be given to water. The policy is further described in Chapter 6. The aim of the campaign is to increase the awareness among the general public that the climate is changing and that the government is working to take measures to adapt to this, so that the Netherlands will remain a safe and comfortable place to live. The campaign consists of the following three main parts: a national mass-media

campaign aimed at the general public, a campaign aimed at relevant local authorities and a campaign aimed at those people that will be directly affected by the new water policy. These three parts are described below.

- The national mass-media campaign runs from 2003-2006. The objective is to increase the general public's understanding of, and support for, the new policy to give more space to water. In the initial years the main message was that the climate is changing and that this has consequences for the water management in the Netherlands. Later on the campaign showed examples of actual measures that will be taken and measures that have already been realised. The main elements of the campaign are the website *www.nederlandleeftmetwater.nl,* infomercials broadcast on national television and radio, plus static posters on billboards. Several other activities have also been undertaken, e.g. educational activities and an exhibition in cooperation with the Dutch Water Museum. Surveys show that the campaign is considered informative and credible. The awareness that the government is working on this issue has increased considerably. At the end of 2003, around 82% of the population acknowledged that measures should be taken to protect the Netherlands from inconvenience due to water.
- The second part of the campaign concerns activities in cooperation with and facilitating/ advising the provinces, municipalities and water boards, in order to help them implement the government's policy on a local level and fulfil their role in local communication. An enclosed website and campaign material are available.
- Finally, the campaign communicates with people who will be directly affected by the new water policy, for example those living close to rivers. This communication is mostly done by the local authorities.

9.4 Involvement and supporting of non-governmental organisations

VROM also contributes to education, training, and raising public awareness through the subsidy programme entitled Social Organisations and the Environment (SMOM), already described in the 3rd National Communication. The scheme focuses on environmental projects and programmes by non-profit organisations, enabling these organisations to take the initiative, while also providing VROM with a better 'feeling' of, and information on, relevant developments in society. All environmental issues are eligible for subsidy, and VROM strives to achieve an even distribution across all environmental issues and organisations. Several projects on climate change are approved each year. Below some examples since 2001 are listed.

Examples of projects in the SMOM programme:
2001:
- Friends of the Earth Netherlands makes the general public aware of the relationship between the use of energy and climate change, e.g. by paying attention to the energy use of appliances in standby mode;
- the National Consultation for a Car-free Sunday organises the European car-free day in the Netherlands.

2002:
- the National Association of Cyclists runs a campaign on sustainable mobility;
- MilieuCentraal informs consumers about the possibility of compensating for greenhouse gas emissions by buying forest certificates ('Trees for Travel').

2003:
- the Worldwide Fund Netherlands develops the International Climate Symbol 'Save Our Climate' and presents it at CoP 9 in Milan;
- Friends of the Earth Netherlands organises a manifestation and conference entitled 'Europe Past Kyoto'.

2004:
- the Red Cross Climate Centre runs a campaign to inform the general public on possible consequences of climate change for the Netherlands;
- the association Save Our Climate is preparing a campaign for 2006 and 2007 in cooperation with the national lottery.

9.5 Education and training

9.5.1 Learning for Sustainable Development

The Dutch National Programme Learning for Sustainable Development 2004-2007 is a general programme that focuses on education and training. It is the successor of 'Learning for Sustainability', described in the 3rd National Communication. The Dutch Government is committed to implementing sustainable development. A National Strategy for Sustainable

Development was prepared for the Johannesburg summit of 2002, which was subsequently transformed into a National Action programme on Sustainable Development (ADO). To anchor itself into society, sustainable development depends on changes in lifestyles and patterns of consumption and production. In line with the goals of the UNECE strategy on Education for Sustainable Development, the national programme creates effective learning processes in order to enable judgements and choices in favour of sustainable development. Learners at all levels are encouraged to use systematic, critical and creative thinking and reflection in both local and global contexts. Programme focus areas have been appointed. One of these is 'the learning individual', which focuses on formal education. Activities are aimed at vision-development and agenda-setting of sustainable development in the entire (formal) educational system, e.g. primary and secondary school education, vocational training and university education.

9.5.2 Resource and information centres

As described in Section 9.3.3, education and training are aspects of the work carried out by the intermediary organisations SenterNovem and MilieuCentraal. For example, within the framework of the Long-Term Agreements to increase energy efficiency, informational material and training to companies are provided. The MilieuCentraal website includes a subsection for pupils of primary and secondary school education.

9.5.3 SMOM projects

Part of the SMOM projects concern educational projects. These may be aimed at all school levels, from primary schools through universities. Examples include:

- 2001: The Dutch Students Platform for Sustainable Development started a project to make Dutch institutions for higher education switch to green electricity;
- 2002: COS in the province of Noord-Holland implemented a climate programme for secondary education in this province;
- 2002: SME Environmental Consultancy developed 'The calendar of nature'. This is a programme on climate change that can be used both in primary and secondary education. By taking measurements outdoors, pupils actually observe the consequences of climate change;
- 2003: Friends of the Earth Netherlands organised 'The Bet 2004'. Secondary school pupils make a bet with local governors, waging that they will be able to reduce their CO_2 emissions by 8%.

9.6 New Delhi work programme on Article 6 of the UNFCCC

In the previous paragraphs the Netherlands' activities for article 6 of the UNFCCC have been described. These are largely in line with the guidance given by the New Delhi work programme. The activities are country-driven and adjusted to the specific circumstances in the Netherlands. These are that in the Netherlands a tradition exists in informing the public on environmental issues, among which climate change, wherefore the public awareness of climate change is high and also organisations other than the government pay attention to climate change. The information provided is therefore elaborate and offers the possibility to gain more in-depth knowledge. Another specific circumstance in the Netherlands is its vulnerability to climate change, being a low-lying country bordering the sea. Therefore a start has been made with informing the public on adaptation. In general, the activities aim at all stakeholders and major groups. For example, the public information campaigns of the ministries aim at the general public, SenterNovem aims at professional parties and MilieuCentraal aims at consumers. The public is participating in policy making through the programme 'Policy with citizens'.

Through the activities described in the previous paragraphs, the Netherlands implemented several of the activities listed under part D of the New Delhi work programme. The needs for article 6 activities are assessed and capacities are developed on a regular basis by the institutions involved, for example following the outcome of surveys. The function of national focal point is performed in cooperation between the ministries and information centres. Activities are geared to one another and responsibilities and tasks are divided clearly. The information provided is mostly broad and interdisciplinary. Much information is easily accessible through the internet and some main material is available in English as well.

International cooperation for article 6 activities are described in chapter 7. The Netherlands contributes in the first place through its contribution to multilateral assistance programmes, like the Global Environment Facility (GEF). Furthermore the

Netherlands contributes in the context of bilateral support for capacity building, for example through the Netherlands Climate Assistance Programme.

Chemical compounds, units

Chemical compounds

C_2F_6	Perfluoroethane (hexafluoroethane)
CF_4	Perfluoromethane (tetrafluoromethane)
CFCs	Chlorofluorocarbons
CH_4	Methane
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_2-eq.	Carbon dioxide equivalent (in this report using a GWP-100)
CTC	Carbon tetrachloride (tetrachloromethane)
FICs	Fluoroiodocarbons
HFCs	Hydrofluorocarbons
HCFCs	Hydrochlorofluorocarbons
MCF	Methyl Chloroform (1,1,1-Trichloroethane)
NMVOC	Non-Methane Volatile Organic Compounds
N_2O	Nitrous oxide
NOx	Nitrogen oxide (NO and NO_2), expressed as NO_2
PFCs	Perfluorocarbons
SF_6	Sulphur hexafluoride
SO_2	Sulphur dioxide
VOC	Volatile Organic Compounds (may include or exclude methane)

Units

bbl	Oil barrel US (= 0.159 m^3)
Gg	Giga gramme (109 gramme)
GJ	Giga Joule (109 Joule)
ha	hectare
kton	kilo ton (= 1,000 metric ton = 1 Gg)
kW	kilo Watt (1000 Watt)
mld	1,000 million
mln	million
Mton	Mega ton (= 1,000,000 metric ton = 1 Tg)
MWe	Mega Watt electricity (10^6 Watt)
Nm^3	Normal cubic metre (volume of gas at 10^5 Pa and 20°C)
Pg	Peta gramme (10^{15} gramme)
PJ	Peta Joule (10^{15} Joule)
TJ	Tera Joule (10^{12} Joule)
Tg	Tera gramme (10^{12} gramme)
US$	US Dollar
€	Euro

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Glossary

A

AAO	Afval Overleg Orgaan (Waste Coordination Platform)
ACEA	Refers to agreements with European, Japanese and Korean car manufactures
ACSEX	Agulhas Current Source Experiment
Argo	Array for Real-time Geostrophic Oceanography
AIJ	Activities Implemented Jointly
AfDN	African Development Bank
AsDB	Asian Development Bank
ASAP	Automated Shipboard Aero logical Programme

B

BLOW	Intergovernmental Netherlands wind energy agreement
BEES(/A)	Order, governing combustion plants emssion requirements
BREF	Best Reference document
BSET	Besluit Subsidies Energiebesparingstechnieken (subsidy scheme for energy conservarion technologies)
BSIK	Besluit Subsidies Investeringen Kennisinfrastructuur (Subsidy scheme for the knowledge infrastructure)

C

CAMP	Clivarnet Atlantic Monitoring Programme
CBS	Netherlands Statistics (Centraal Bureau voor de Statistiek)
CCB	Centre for Climate Change and Biosphere Research
CCOP	Committee for Coastal and Off-shore Geoscience Programmes
CCPM	Common and Coordinated Policies and Measures (of EU)
CDM	Clean Development Mechanism
CER	Certified Emission Reductions Unit
CERUPT	Certified Emission Reduction Unit Procurement Tender
CESAR	Cabauw Experimental Site for Atmospheric Research
CHP	Combined Heat and Power (Cogeneration)
CKO	Centrum voor Klimaat Onderzoek (Netherlands Centre for Climate Research)
CLIMAT	Climate messages encoded for the WMO network
CONCAWE	Oil companies' European Organisation for Environment, Health and Safety
CoP	Conference of the Parties (to the Climate Change Convention)
CPB	Central Planning Bureau
CRF	Common Reporting Format
CZMC	Coastal Zone Management Centre

D

DIVERSITAS	Biodiversity Programme of the Rio Conference 1992
DGIS	Directoraat-Generaal Internationale Samenwerking (Development Cooperation)
DOC	Degradable Organic Carbon

E

EBIT	Energie Besparing In Transport (Energy savings in transport)
EC	European Commision/European Community
EC-LNV	Expert Centrum van het Ministerie voor Landbouw Natuurbeheer en Visserij (National Reference Centre for Agriculture (formerly IKC-L)
ECA	European Climate Programme
ECN	Energie Centrum Nederland (Netherlands Energy Research Centre)
EDGAR	Emission Database for Global Atmospheric Research
EEA	European Environment Agency
EIA	Energie Investerings Aftrek (Energy investment tax deduction)
EINP	Energy Investeringsaftrek Non-Profit Organisaties (Energy investment tax deduction for non-profit sectors)
ENSO	El Niño - Southern Oscillation
EOS-AURA	Earth Observing System - AURA
EPA	Energie Prestatie Advies (Energy performance advice)
EPA	Environmental Protection Act
EPC	Energy performance coefficient

EPICA	European Project for Ice Coring in Antarctica
EPN	Energie Prestatie Norm (Energy performance norm)
EPS	Energie Prestatie Standaard (Energy performance standard)
EPR	Energie Premie Regeling (Energy premium rebate)
ER	Emissions Registration
ER	European Renaissance scenario
ERU	Emission Reduction Unit
ESA	European Space Agency
ESF	European Science Foundation
EU	European Union
EUMETNET	European Organisation for the Exploitation of Meteorological Network
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
EZ	Ministerie van Economische Zaken (Ministry of Economic Affairs)

F

F-gases	Fluorinated greenhouse gases (HFC's, PFC's, SF_6)
FAO	Food and Agriculture Organisation of the United Nations
FCCC	Framework Convention on Climate Change
FINESSE	Financing Energy Services for Small Scale Energy Users
FLUXNET	Global Terrestrial Network - Carbon
FTP	File Transfer Protocol

G

GAVE	Subsidieregeling milieugerichte technologie GAsvormige en Vloeibare Energiedragers (transl. Subsidy program environmental technology Gaseous and Liquid Energy Carriers)
GAW	Global Atmosphere Watch of WMO
GC	Global Competition
GCOS	Global Climate Observing System
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GEIA	Global Emissions Inventory Activity
GHG	GreenHouse Gas
GHSN	Global Historical Station Network
Glami	Greenhouse Horticulture Covenant
GNP	Gross National Product
GOA	Geografische Onderzoek Associatie (Foundation for Earth Sciences)
GOME	Global Ozone Monitoring Experiment
GOOS	Global Ocean Observing System
GPCC	Global Precipitation Climatology Centre
GPS	Global Positioning System
GSN	GCOS Surface Network
GTN-G	Global Terrestrial Network - Glaciers
GTN-P	Global Terrestrial Network - Permafrost
GTOS	Global Terrestrial Observing System
GUAN	GCOS Upper Air Network
GWP	Global Warming Potential

H

HDD	Heat Degree Day
HYDE	Hundred Year Database of the Environment

I

ICSU	Internation Council for Science
IEA	International Energy Agency
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation
IGBP	International Geosphere-Biosphere Programme
IGOS	Integrated Global Observing Strategy
IHDP	International Human Dimensions Programme (of Global Environmental Change)
IMAGE	Integrated Model to Assess the Greenhouse Effect
IMAU	Institute for Marine and Atmospheric Research
IOC	Intergovernmental Oceanographic Commission of UNESCO
IPCC	Intergovernmental Panel on Climate Change
ITL	Independent Transaction Log

J

JI	Joint Implementation
JIN	Foundation for the Joint Implementation Network

K

KNAW	Koninklijke Nederlandse Akademie van Wetenschappen (Royal Netherlands Academy of Arts and Sciences)
KNMI	Koninklijk Nederlands Meteorologisch Instituut (Royal Netherlands Meteorological Institute)
KZRZ	Koop Zuinig! Rij Zuinig! (Buy Fuel Efficient! Drive Fuel Efficient)

L

LDC	Least Developed Countries
LDV	Light Duty Vehicle
LEI	Agricultural Economics Institute (Landbouw Economisch Instituut)
LML	Landelijke Monitoring Luchtkwaliteit (National air quality monitoring network)
LNV	Ministry of Agriculture,Nature and Food Quality (Landbouw, Natuurbeheer en Voedselkwaliteit)
LOICZ	Land-Ocean Interaction in the Coastal Zone
LPG	Liquefied Petroleum Gas
LTA	Long-Term Agreement
LULUCF	Land-use, Land-Use Change and Forestry

M

MAP	Milieu Actie Plan (Environmental Action Plan)
MARE	Mixing of Agulhas Rings Experiment
MATRA	Social Transformation Eastern Europe Programme
MEP	Milieuvriendelijke Electriciteits Productie (Environmentally friendly electricity production)
METOP	METeorological Operational satellite
MER	Milieu Effect Rapportage (Environmental Impact Assessment Report)
MFO	Medefinancierinsorganisaties (NGO's that co-finance development projects)
MIA	Milieu Investerings Aftrek (Environment Investment Tax Reduction)
MILIEV	Milieu en Economische Verzelfstandiging (ORET/MILIEV is a development and environment related export transactions programme)
MJV	Milieujaarverslag (Annual Environmental Report)
NP	Environmental Assesment Agency
MPI	Milieu Plan voor de Industrie (Environmental Plan for Industry)
MSG	Meteosat Second Generation

N

NASA	National Aeronautics and Space Administration
NC	National Communication
NCCSAP	Netherlands Climate Change Studies Assistance Program
NCPIP	National Climate Policy Implementation Plan
NDSC	Network of Detection of Stratospheric Change
NDVI	Normalised Difference Vegetation Index
NeA	Netherlandse Emissie Autoriteit (Dutch Emissions Authority)
NEO	National Environmental Outlook
NEPP	National Environmental Policy Plan
NEWS	Subsidy scheme for energy innovations in combination with combined heat and power generation
NGO	Non-Governmental Organisation
NIE	National Inventory Entity (under Kyoto Protocol)
NIOO-CEMO	Nederlands Instituut voor Oceanografisch Onderzoek - Centrum voor Estuarium en Maritiem Onderzoek (transl. Netherlands Institute for Oceanographic Research - Centre for Estuarine and Marine Research)
NIOZ	Netherlands Institute for Sea Research
NIR	National Inventory Report
NMVOC	Non-Methane Volatile Organic Compounds
NOVEM	See: SenterNovem
NRP	National Research Programme
NRP-MLK	National Research Programme on Global Air Pollution and Climate Change
NWO	Nederlandse Organisatie voor Wetenschappelijk Onderzoek (Netherlands Organisation for Scientific Research)
NWP	Numerical Weather Prediction
NWP	Netherlands Water Partnership

O

OCW	Ministry of Education, Arts and Science
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
OMI	Ozone Monitoring Instrument
O3MSAF	SAF on Ozone Monitoring

P

PER	Pollutant Emission Register
PIN	International Nature Policy Project
PSO	Programme of Eastern European cooperation
PSOM	Programme for Stimulation of Upcoming Markets
PV	Photovoltaic

Q

QA	Quality Assurance
QC	Quality Control
QUELRC	Quantified Emission Limitation and Reduction Commitment

R

REV	Rationaal Energiegebruik in Vervoer (Rational energy use in traffic and transport)
RIVM	Rijksinstituut voor Volksgezondheid en Milieu (trans. National Institute of Public Health and the Environment)
ROB	Reductieprogramma Overige Broeikasgassen (trans. Reduction Programme for non-CO_2 greenhouse gases)
R&D	Research & Development
R,D&D	Research, Development & Demonstration
RUU	State University of Utrecht
RWS	Directorate General of Public Works and Water Management

S

SADC	Southern African Development Community
SAF	Satellite Application Facilities
SARCS	Southeast Asia Research Committee on START
SCAR	Scientific Committee on Antarctic Research
SCCF	Special Climate Change Fund
SCIAMACHY	Scanning Imaging Absorption Spectrometer for Atmospheric Cartography
SCORE	Supporting the Cooperational Organisation of Rational Energy use
SenterNovem	Governmental agency for Energy, Innovation and Environment
SFC	Surface Drifters
SNV	Netherlands Development Organisation
SMEC	Second Memorandum on Energy Conservation
SOOP	Ship of Opportunity Programme
SRON	Space Research Organisation Netherlands
SST	Sea-Surface Temperature
SSZ	Stiller, Schoner en Zuiniger verkeer (Quieter, cleaner and more economical traffic)
START	Global Change System for Analysis, Research and Training
STEG	Steam Turbine and Gas Turbine combination
Sub-SFC	Sub-surface

T

TenneT	Manager of the Dutch transmission grid
TEWI	Total Equivalent Warming Impact
TNO	Netherlands Organisation for Applied Scientific Research

U

UN	United Nations
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCCC	United Nations Framework Convention on Climate Change
UNFSTD	United Nations Fund for Science and Technology Development
USDOE	United States Department of Energy

V

V&W	Verkeer & Waterstaat (Ministry of Transport, Public Works and Water management)
VAMIL	Variable Depreciation of Energy Investments

VBE	Verficatie Bureau Benchmarking (Bureau for verification Benchmarking)
VOS	Volunteer Observing Ship
VROM	Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer (Ministry of Housing, Spatial Planning and the Environment)

W

WEB	Werkgroep Emissie monitoring Broeikasgassen (Working group Emission monitoring Greenhouse gases)
WCRP	World Climate Research Programme
WHYCOS	World Hydrological Cycle Observing System
WMO	World Meteorological Organisation
WOTRO	NOW Foundation for the Advancement of Tropical Research
WOUDC	World Ozone and UV Data Centre
WUR	Wageningen University and Research centre
WWF	World Wildlife Fund
WWW	World Weather Watch of WMO

Annexen

Annexes

Annex 1.1 Overview of supplementary information under Art. 7.2 of the Kyoto Protocol

This 4th National Communication also contains the required supplementary information under Article 7.2 of the Kyoto Protocol. The various issues are dealt with under the most appropriate thematic sections in this report. To further assist the reader, the table below gives an overview of the sections, where the core of the information can be found.

Supplementary information under Art.7.2	Described in section*
National System	Section 3.2 and Annex 3.1
National Registry	Section 4.8.4 and Annex 4.2
Supplementarity relating to the mechanisms pursuant to Articles 6, 12 and 17	Section 4.6
Policies and measures in accordance with Art. 2	
- sustainable development	Section 4.7.1
- aviation and marine bunker fuels	Section 4.7.2
- minimizing adverse effects	Section 4.7.3
Domestic and regional programmes and/or legislative arrangements and enforcement and administrative procedures	Section 4.8
Information under Art.10	
- improvement of inventories, etc. (10.a)	Sections 3.2. and Annex 3.1
- measures etc. (10.b)	Chapter 4 and (for adaptation) Chapter 6
- cooperation in scientific and technical research etc. (10.c)	Chapter 8 and Annex 8.1
- provision of financial resources, cooperation in education and training programmes and cooperation in the transfer of climate change technologies (Art.10 c,d,e and Art.11)	Chapter 7 and Annex 7.1

* Given the many relations that various of the mentioned issues have with different chapters, themes and sections, this overview cannot be fully exhaustive. Thus, also other sections may contain related information.

Annex 3.1 Description of the national system[1]

1 Scope and objectives of the national system

1.1 Introduction

As Party to the United Nations Framework Convention on Climate Change (UNFCCC), the Netherlands has to report an inventory of greenhouse gas emissions and sinks each year, in accordance with a defined set of guidelines. Under the Kyoto Protocol, further obligations have been defined, among which the obligation (under Article 5.1) to have in place, no later than one year prior to the start of the first commitment period, a national system for the estimation of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol. Under Council Decision 280/2004/EC of the EU, the Netherlands is required to establish such a system as early as possible and by the end of 2005 at the latest. Over the past years, the Netherlands has made every effort to establish a National System that meets the requirements in time. This report details the system as it operates by 31 December 2005, describing how the required functions are performed in the Netherlands, following the outline from the reporting guidelines (see below).

Institutional and organisational aspects (section 2), including:
- the name and contact information for the national entity and its designated representative with overall responsibility for the national inventory of the Party;
- the roles and responsibilities of various agencies and entities in relation to the inventory development process, as well as the institutional, legal and procedural arrangements made to prepare the inventory.

Methodological and process aspects (section 3), including:
- a description of the process for collecting activity data, for selecting emission factors and methods, and for the development of emission estimates;
- a description of the process and the results of key source identification and, where relevant, archiving of test data;
- a description of the process for the recalculation of previously submitted inventory data.

Quality management aspects (section 4), including:
- a description of the quality assurance and quality control plan, its implementation and the quality objectives established, and information on internal and external evaluation and review processes and their results in accordance with the guidelines for national systems;
- a description of the procedures for the official consideration and approval of the inventory.

1.2 Objectives of the National System

Objectives of the National System

Under the Kyoto Protocol, a National System[2] includes all institutional, legal and procedural arrangements made within a Party included in Annex I for estimating anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, and for reporting and archiving inventory information. The objectives of the Netherlands' national system in accordance with the guidelines are as follows:
- to enable estimation and reporting of anthropogenic GHG emissions by sources and removals by sinks[3];
- to facilitate meeting the commitments under Articles 3 and 7;
- to facilitate the review of the information submitted;
- to ensure and improve the quality of the inventory.

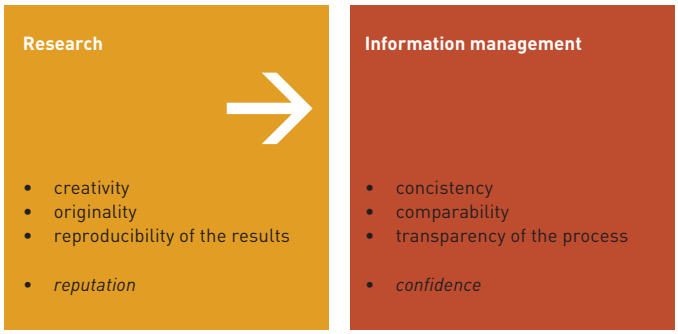
Implications for the Netherlands inventory process

Since 1974, the Netherlands has a pollutant emissions inventory process in place, the Emissions Registration (ER)[4], which is aimed at producing annual emission inventories for some 170 policy-relevant compounds and compound groups present in the air, water and soil. Ministries and institutes use the data for various purposes, such as policy analyses, annual environmental balances and international reporting. The system is the basis for monitoring of greenhouse gas emissions and removals.

The Kyoto Protocol requires a changing role and character of the inventory process, reflected in the requirements of a National System to assure the quality of inventories, one factor being their suitability to demonstrate compliance with relevant requirements. They should not only produce good and reliable figures, but also demonstrate to intended users (UNFCCC) that

1 This annex is taken from reference (SenterNovem, 2005)
2 Definitions used in this report are those used in UNFCCC guidelines
3 As required by Article 5, and to report these emissions by sources and removals by sinks in accordance with Article 7, paragraph 1, and relevant decisions of the Conference of the Parties (COP) and/or the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (COP/MOP)
4 Since 2004, the Ministry (VROM) outsources co-ordination of the ER to the Netherlands Environmental Assessment Agency (MNP)

Figure 1 **Required transition of the inventory system under the Kyoto Protocol (source: DHV, 2002)**



these are of high quality and suitable as a basis for accounting. The system should ensure:

- transparency, to enable review and control and demonstrate compliance;
- consistency, completeness and comparability, to be of use for accounting;
- accuracy, demonstrating these are the best estimates, reasonably and practicably possible.

1.3 Development of the National System

In recent years, an improvement programme has been implemented to achieve the required transition of the inventory process in terms of both role and culture. The government agency SenterNovem was contracted by the Ministry of Housing, Spatial Planning and the Environment (VROM) to coordinate the programme and to assume the overall co-ordination of QA/QC. The involvement of both ER and SenterNovem should ensure that normal inventory work continues and at the same time sufficient attention is paid to process improvement and ('independent') quality assurance.

The programme focused on:

- assessing, selecting, improving and describing methods and processes in transparent monitoring protocols and process descriptions. This process was instrumental in systematically assessing potential areas for improvement;
- elaborating and implementing a QA/QC programme;
- ensuring implementation and 'maintenance' of agreed methods and tasks, through a mix of covenants, contracts and (other) legal arrangements, including a legal basis for the monitoring of greenhouse gases.

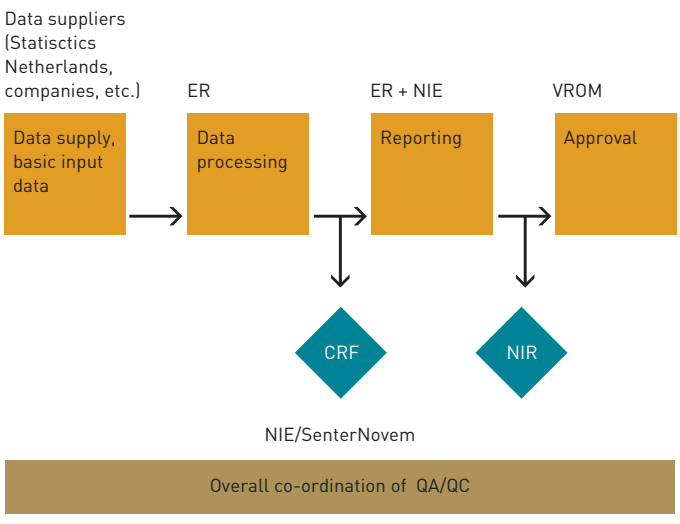
2 Institutional, legal and organisational aspects

2.1 General description of the inventory process

Schematic representation

The primary process in preparing the greenhouse gas inventory in the Netherlands is outlined in Figure 2. It provides the CRF and the NIR. Because of the role of the National System in accounting and compliance, 'formal approval' and 'QA/QC' are essential steps in this system.

Figure 2 **Schematic overview of the main steps in the primary process. In practice, there are various feedback loops**



General responsibilities
With the adoption in 2004 of target values for CO_2 emissions from four major sectors and for non-CO_2 greenhouse gases, responsibilities for meeting the Kyoto targets became more delineated and defined for each of the ministries involved, viz. Economic Affairs (EZ), Agriculture, Nature and Food Quality (LNV), Transport, Public Works and Water Management (V&W) and Housing, Spatial Planning and the Environment (VROM). As co-ordinating Ministry, VROM has overall responsibility for establishing and maintaining a National System for monitoring. The responsibility for integrating the monitoring of LULUCF emissions and removals into the system has been delegated to the Ministry of Agriculture, Nature and Food Quality.

The Ministry of VROM assigned SenterNovem the role of National Inventory Entity[5] until April 2006 (at least). This ensures continuity during the period in which the national system is being established and its first period of full operation. These arrangements may change in the course of 2006.

2.2 Arrangements for data collection

The basic data used for the inventory are collected from various data suppliers. A distinction is made between following data sources:

Statistical data
- Most general statistical data are provided by Statistics Netherlands (CBS) as part of their legal tasks (see next highlighted paragraph) or the priorities set by the Central Commission for Statistics.
- Many statistical data on agriculture, land use change and forestry are provided by agricultural institutes (i.e. Alterra, LEI) under a broad assignment for legally required research tasks (WOT). The actual tasks are assigned by a Commission each year on a project-to-project basis.
- Waste data are collected by AOO (Waste Coordination Platform, recently merged with SenterNovem) under a longer term assignment from the Ministry (VROM).

5 Also referred to in Art. 5.1 of the Kyoto Protocol as single national entity. Contact information: SenterNovem, PO Box 8242, 3503 RE Utrecht, the Netherlands. Telephone: +31 (0)30 2393429. Co-ordination: D. Both. Email: d.both@senternovem.nl
Co-ordination by Dutch government: Ministry of Housing, Spatial Planning and the Environment, PO Box 20951, 2500 EZ, The Hague, the Netherlands. Co-ordination: A. Agterberg, telephone: +31 (0)70 339 26 39, e-mail: agnes.agterberg@minvrom.nl

Statistics Netherlands (CBS) [Source: CBS, www.cbs.nl, version June 2005]

Statistics Netherlands is responsible for collecting, processing and publishing statistics to be used in practice by policymakers and for scientific research. In addition to its responsibility for (official) national statistics, Statistics Netherlands also has the task of producing European (community) statistics. The legal basis for Statistics Netherlands and its work is the Act of 20 November 2003 governing the central bureau of statistics.

Statistics Netherlands' statistical programmes (the long-term statistical programme and the annual work programme) are set by the Central Commission for Statistics. This is an independent commission that watches over the independence, impartiality, relevance, quality and continuity of the statistical programme. The Director-General decides autonomously which methods to use to make these statistics, and whether or not to publish results.

It uses existing administrative registrations of government and government-funded organisations. The information from these files is supplied to Statistics Netherlands free of charge. Only if they do not contain sufficient information, Statistics Netherlands is allowed to conduct supplementary surveys among companies and private persons. Companies are usually obliged by law to supply information to Statistics Netherlands and can be forced to co-operate under certain circumstances; Statistics Netherlands may use sanctions such as administrative fines. On 3 January 2004, Statistics Netherlands became an autonomous agency with legal personality. There is no longer a hierarchical relationship between the Minister of Economic Affairs and the organisation. However, the minister is responsible for setting up and maintaining a system for the provision of government statistical information; in other words the minister is politically responsible for legislation and budget, for the creation of conditions for an independent and public production of high quality and reliable statistics. The costs of tasks and activities undertaken to put this legislation into practice are accountable to the government's budget.

The provision of the statistical data is not part of greenhouse gas-related contracts. To assure that data and supporting activities for greenhouse gas inventories will be supplied by

these organisations, covenants or agreements have been established between ER and the mentioned organisations.

Data from individual companies
A large number of companies are legally required to submit an annual environmental report (MJV). These are validated under responsibility of the competent authorities (provincial, sometimes municipal) that issue the permits. In addition, a number of companies with large combustion plants are required to report information under the BEES/A regulations or within the framework of environmental covenants.

The inventory uses calculations of industrial process emissions of non-CO_2 greenhouse gases that are based mainly on environmental reports (e.g. for N_2O, HFC-23 and PFCs released as by-products). CO_2 emission data from environmental reports from industry, energy, refineries and waste handling are mainly used for verification of calculated emissions. When the reports from major industries contain plant-specific information on activity data and emission factors of sufficient high quality and transparency, these data will be used in national emission estimates.

Additional greenhouse gas-related data
Where sectors are not sufficiently covered in the above-mentioned data sources, other institutes and consultants are specifically contracted, either by the ER or SenterNovem, to provide additional information. For greenhouse gases and sinks, these include:
- ER contracts with TNO on preparation of the CRF;
- SenterNovem contracts with consultants to annually provide F-gas emission estimates from cooling and product use.

2.3 Arrangements for data processing (and storage)

Actual calculation of greenhouse gas emissions and sinks for the various CRF categories is the responsibility of the ER. The objective of the ER is to reach a uniform, well-founded, broadly accepted and accessible set of emission data.

The ER is carried out as a project on behalf of the Ministries of the Environment (VROM), Transport (V & W) and Agriculture (LNV). Since 1 April 2004, co-ordination of the ER has been assigned to the MNP for a period of 4 years. The institutes involved in the ER are responsible for the collection, processing, management and reporting of emission data. Data are collected and processed by five task groups (TG) according to predetermined methods described in the Monitoring Protocols (see below).

Emission Registration (ER)

Tasks and responsibilities
Major decisions on tasks and priorities are taken by the Steering Committee ER (SCER) through approval of the Annual Work Plan. This committee consists of the directors from the commissioning ministries, a representative of regional governments and the director of MNP.

Various organisations are involved in the ER: the Directorate General for Environmental Protection (DGM/VROM), the Directorate General for Public Works and Water Management (RWS), the Institute for Inland Water Management and Waste Water Treatment (RIZA), the Ministry of Agriculture, Nature and Food Quality (LNV), the Agricultural Economics Research Institute (LEI), the Alterra institute from Wageningen University of Agriculture (WUR), Statistics Netherlands (CBS), TNO, the Waste Coordination Platform (AOO; recently merged with SenterNovem), the Facilitary Organisation Industry (FO-I) and MNP. Each of the institutes involved has its own role and responsibilities with respect to the inventory, as described in the annual work plan. The ER project leader at MNP acts as co-ordinator and is responsible for the ER process; the outcomes of that process are the responsibility of the institutes involved. The contribution of the various institutes is ensured by contracts, covenants or other agreements.

Approach
Five Task Groups are responsible for data collection and processing:
- task group Energy, Industry and Waste Disposal (ENINA), covering air emissions from the mentioned sectors. Paricipating institutes: MNP, TNO, CBS, RIZA, AOO and FO-I;
- task group Traffic and Transport, covering the emissions to air, water and soil generated by traffic and transportation. Participating institutes: MNP,TNO-MEP, CBS, RIZA;
- task group Agriculture, covering emissions (and removals) to

air, water and soil generated by agriculture and LULUCF sectors. Participating institutes: MNP, LEI, Alterra, TNO, CBS, RIZA, LNV;
- task group Methods Development Water Emissions (MEWAT), covering emissions to water generated by all sources not covered by other task groups. Participating institutes: MNP, TNO, CBS, RIZA;
- task group Other Sources (WESP), covering emissions generated by consumers. They also provide information about emission sources of Trade, Service and Government (TSG). Participating institutes: MNP, TNO, CBS.

The data are stored in a Central Database system. At present, this system consists of three partial databases. The database system is being renewed, a project to be completed by 2006. MNP is responsible for maintaining the database. The CRF is completed using these emissions and removals data, a task MNP has assigned to TNO.

2.4 Arrangements for reporting, QA/QC co-ordination and review

The National Inventory Report is prepared by the ER in close co-operation with CBS, TNO and SenterNovem. ER is responsible for contents, consistency with the CRF and timely delivery. SenterNovem (NIE) is responsible for quality assurance and providing input on the National System, QA/QC and the improvement actions. As co-ordinating Ministry, VROM is responsible for formal approval of CRF and NIR before submission to UNFCCC (see 5.4).

SenterNovem has also been assigned QA/QC co-ordination of the inventory and the national system, facilitation of UNFCCC reviews and co-ordination of requests for clarification.

2.5 Legal arrangements for the National System

An Act on Monitoring of Greenhouse Gases is expected to become effective by the end of 2005. This Act will determine the establishment of a National System for monitoring of greenhouse gases and will empower the Minister of Housing, Spatial Planning and the Environment (VROM) to appoint an authority responsible for the National System and the National Inventory.

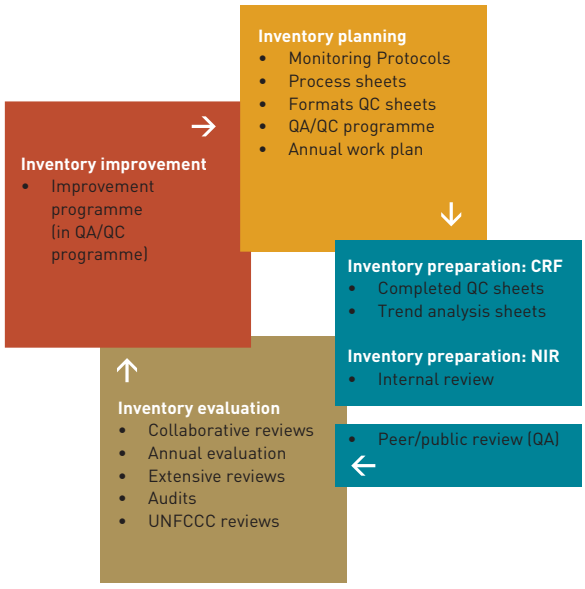
The Act will also determine that the National Inventory be based on methodologies and processes as laid down in the monitoring protocols. Adjustments to the protocols will require official publication of the new protocols and announcement of publication in the official Government Gazette (the 'Staatscourant').

3 Methodological and process aspects

3.1 Introduction

To ensure high quality and continuous improvement, the annual inventory process is implemented as a cyclical project. This annual cycle (see Figure 3) is a key quality management tool (based on the Deming cycle of plan-do-check-act) and encompasses:
- inventory planning;
- inventory preparation;
- inventory evaluation;
- inventory improvement;
- inventory management.

Figure 3 Inventory process management cycle in the Netherlands



The following sections describe how the required specific functions are performed for each of these steps. The figure illustrates the steps and the QA/QC tools used in each step.

3.2 Inventory planning

Quality
High quality requires that the intended use of the inventories be properly understood. This use is reflected in objectives and characteristics of the National System and detailed further in the applicable guidelines and good practice guidance. These user requirements were the starting point for development of the Netherlands National System. During operation of the system, the outcomes of UN reviews are key in measuring the actual quality as perceived by the user.

Inventory planning during development of the National System
The basic structure and elements for the National System were defined and designed during the past few years. This encompasses the following functions and elements:

- agreements on the basic institutional, legal and organisational structure, including the designation of the single national entity and the co-operation between the organisations involved. These agreements have been laid down in contracts, legal arrangements and covenants. The previous chapter provides more details;
- definition and allocation of the specific roles, responsibilities and tasks in the process, as described in the previous chapter. These have been worked out in more detail in:
  - the set of Monitoring Protocols. These describe the choice of method, the activity data and emission factors, as well as specific tasks, responsibilities, working processes and time schedules. Table 2 presents a list of the protocols;
  - a set of Procedures for other relevant processes, e.g.s the preparation of CRF and NIR, documentation & archiving, key source and uncertainty analyses (see table 1);
- a QA/QC programme, including quality objectives and a plan and time schedule for QA and QC activities. This programme includes an improvement plan.

Table 1 List of procedures in the National System

Procedures	
Primary processes	**Management and supporting processes**
Preparing the CRF	Annual evaluation and improvement process
Preparing key source analysis	Facilitating UN reviews/ responding to questions for clarification
Preparing uncertainty analysis	Treatment of confidential information
Preparing NIR	Implementing NIE review process (peer, public reviews)
Documenting and archiving	Implementing audits

Inventory planning during operation of the National System
Each year, the above-mentioned agreements, protocols, procedures and QA/QC programme are reviewed, updated (if necessary) and approved for use in the next cycle. Changes in the Monitoring Protocols require the approval of the Ministry of VROM and the Steering Committee ER. SenterNovem is responsible for updating the QA/QC programme, including the improvement programme. Formal approval needs to be given by VROM, after consultation of the Consultative Committee NIE[6]. For LULUCF issues, VROM will consult the Ministry of Agriculture (LNV).

The annual planning is further detailed in the Annual Work Plans, specifying staffing, time budgets and scheduling of the next inventory cycle. These plans also describe the tasks in performing the general QC (Tier 1), including the sample calculations, and further describe which work instructions, databases, documentation sheets and other tools should be used. The work plan is approved by the respective organisations[7], after mutual consultation.

6 Consisting of representatives of the Ministries (VROM, LNV) and institutes (CBS, ER/MNP) involved.
7 For the ER, approval is given by the Steering Committee ER.

Table 2 List of monitoring protocols

IPCC-code	Description	Gas(es)
All	Reference approach	CO_2
1A1 1A2 1A4	Stationary combustion (fossil)	CO_2 N_2O CH_4
1A1b 1B1b 1B2aiv 2A4i 2B1 2B4i 2B5i 2B5vii 2B5viii 2C1vi 2D2 2Giv	Process emissions (fossil)	CO_2 N_2O CH_4
1A2f 1A4c	Mobile equipment	CO_2 N_2O CH_4
1A4c	Fisheries	CO_2 N_2O CH_4
1A3a	Inland aviation	CO_2 N_2O CH_4
1A3b	Road transport	CO_2
1A3b	Road transport	N_2O
1A3b	Road transport	CH_4
1A3c	Rail transport	CO_2 N_2O CH_4
1A3d	Inland navigation	CO_2 N_2O CH_4
1A5	Defence	CO_2 N_2O CH_4
1B2	Oil & gas production	CO_2 CH_4
1B2	Oil & gas distribution/transport	CO_2 CH_4
2A1 2A2 2A3 2A4ii 2A7i 2B5ix 2C1i 2C1vii 2C3 2Gi 2Gii 2Giii 2Gv 3A 3B 3C 3D	Process emissions (non-fossil)	CO_2 N_2O CH_4
2B2	Nitric acid	N_2O
2B5	Caprolactam	N_2O
2C3	Aluminium production	PFC
2E1	HCFK-22 production	HFC
2E3	HFC by-product emissions	HFC
2F1	Stationary refrigeration	HFC
2F1	Mobile refrigeration	HFC
2F2	Hard foams	HFC
2F4	Aerosols	HFC
2F8	Double glazing	SF_6
2F8	Semi-conductors	SF_6 PFC
2F8	Electrical equipment	SF_6
4A1	Enteric fermentation, cattle	CH_4
4A2-13	Enteric fermentation, other	CH_4
4B	Manure management	N_2O
4B1	Manure management, cattle	CH_4
4B8	Manure management,swine	CH_4
4B2-7,9-13	Manure management, other	CH_4
4D	Agricultural soils, indirect	N_2O
4D	Agricultural soils, direct	N_2O
5A	Forest	CO_2
5D	Soil	CO_2
6A1	Waste disposal	CH_4
6B	Waste water treatment	CH_4 N_2O
6D	Large-scale composting	CH_4 N_2O
Memo item in reports	Biomass	CH_4 CO_2
Memo item in reports	International bunker emissions	CO_2 N_2O CH_4

3.3 Inventory preparation

The inventory preparation encompasses the following functions and activities:

- data collection, data processing and emission estimation in accordance with the Monitoring Protocols and the planning in the Annual Work Plan. The actual process will be documented in documentation sheets that include information on data used, any necessary deviations from the agreed methods (including their approval) and any other relevant information needed for a 'paper trail' of the estimates;
- performing the general QC procedures (Tier 1), as detailed in the Annual Work Plans, results and corrections (and approval) are documented in documentation sheets;
- performing the key source and the uncertainty analyses as described in the respective Procedures. The key source analysis will be performed after the emissions have been calculated. Any changes in key sources, as well as the results from the uncertainty analyses, will be taken into account in the improvement programme and planning for the next cycle;
- performing and documenting recalculations, if any, in accordance with the related procedure. Methods can only be changed after formal approval of the revised methods and Protocols by SCER and VROM;
- elaborating the CRF and NIR in accordance with the related procedures.

3.4 Inventory evaluation

The annual inventory evaluation consists of various elements:

- annual 'internal' review of the draft NIR before submission to the UNFCCC. This review is coordinated by the NIE and comprises an internal quality assurance, a basic peer review and a public review. The latter is performed using the national system website, together with notification of potentially interested experts and organisations.
- implementing an annual internal evaluation and improvement cycle, implemented jointly by NIE and ER, comprising two major steps:
  - in May: evaluating the previous cycle and updating the QA/QC programme. NIE and ER will together prepare an internal evaluation report;
  - in September: updating the planning for the next cycle and, if necessary, the protocols.

3.5 Inventory improvement

The improvement programme, an integral part of the QA/QC programme, will be updated as part of the this annual cycle. If results, notably those from UN reviews, give rise to urgent improvement actions, additional actions may be decided on. Improvements that influence methods or may induce recalculations require formal approval according to the respective procedure. The QA/QC programme also includes non-annual review and audit activities, which contribute towards evaluation and continuous improvement of the national system.

3.6 Inventory management

Management of the inventory in the Netherlands encompasses:

- documenting the relevant information and archiving this in annual project files for each cycle, using an annual catalogue of relevant documents. Key documents of a non-confidential nature are made accessible through the national system website *www.greenhousegases.nl.* Other non-confidential (internal) documents and memos will be archived and held available centrally for UN reviews. Confidential information will not be centrally archived, but only maintained and archived by the 'owner'. It will be available for UN review only as far as legal and procedural arrangements allow;
- facilitating UN reviews and responding to any related requests for clarification under the EU monitoring mechanism and the UNFCCC.

The NIE is responsible for co-ordination of the website, the list of documents, central archiving[8] and access to non-confidential information.

8 Actual responsibilities for each key document are listed in the List of key documents

4 Quality management aspects

4.1 Introduction

The National System itself is a key tool in improving the quality and process management of the inventory process, as described in the previous chapter. The various tools and QA/QC activities are further elaborated in the QA/QC programme, described in section 4.2. Over the last few years, various improvement actions have been implemented. Main inputs were the results of internal and external evaluation and review processes. These are described in section 4.3, including their consequences. Section 4.4 describes the process of official consideration and approval of the inventory.

4.2 QA/QC programme

General aspects
The QA/QC programme describes the quality objectives of inventory and national system and the QA/QC plan. This includes a time schedule, tasks and responsibilities. An improvement programme forms an integral part of this QA/QC programme. The QA/QC programme is basically an internal document that will be held available for UN review. SenterNovem is responsible for co-ordination and implementation of the programme. The current programme covers the upcoming period up to 1 July 2006. It will be updated, if needed, once a year in May, as part of the annual evaluation and improvement cycle.

The overall objectives of the QA/QC programme for 2005/2006 are:
- to annually finalise, by 15 March, inventories that are of sufficient[9] quality to meet the requirements under UN and EU;
- to sufficiently measure and control the quality of annual inventories by appropriate quality control procedures;
- to ensure that quality objectives are met and regularly evaluated by implementing appropriate quality assurance and evaluation procedures by staff that is not directly involved;
- to establish the national system by the end of 2005.

These objectives are further elaborated in the programme into more specific quality objectives, related to improving transparency, consistency, comparability, completeness and accuracy (the 'inventory principles').
QA/QC plan
The QA/QC plan consists of four groups of activities:
- quality control;
- quality assurance;
- documentation and archiving;
- evaluation and improvement.

For each group, the main actions are briefly described below.

Quality control
The main activities include:
- providing a transparent system through protocols, procudures and QA/QC programme. This step is essential for the planning phase. It defines requirements and outputs;
- reviewing and updating the information on QA/QC of external agencies;
- applying General QC (Tier 1) procedures, as part of the regular working processes, in accordance with IPCC good practice guidance and, where applicable, source-specific QC procedures for selected sources. The main responsibilities for implementation lie with the ER. SenterNovem (NIE) regularly checks whether activities and outputs (still) conform with the guidelines.

Quality assurance
This is primarily done by staff not directly involved in the inventory process, coordinated or implemented by SenterNovem. The main activities:
- peer review process:
  - annual basic peer reviews before submission of NIR/CRF to the UNFCCC;
  - extensive review process: co-ordinating a 5-year cycle of extensive reviews of relevant sectors. This includes possible intra-EU collaborative reviews;
  - performing - in 2005 - a pilot review of selected sources together with Belgium;
- assessing practical options for further verification and source-specific QA;
- assessing options and needs for audits.

The extensive review process intends to (peer) review all key sources and sources with significant changes. As part of the

9 'Sufficient' implies that no significant problems are identified by UNFCCC review teams.

elaboration of the monitoring protocols over the last few years, all relevant sources have been submitted to extensive scrutiny.

Documentation and archiving
The main activities are related to the cycle as a whole:
- providing documentation and archiving. This is part of the normal inventory process. Most documentation on the annual results and outputs is the responsibility of the ER. Planning documents come from ER and NIE, while review reports come mainly from NIE;
- facilitating reviews and responses for clarification. This is a joint responsibility of ER and NIE, the latter being charged with co-ordination.

Evaluation and improvement
The main activities include:
- implementation of the annual evaluation and improvement cycle, mentioned above;
- implementing the improvement programme. This includes an upgrade of the Tier 2 uncertainty analysis.

A special procedure is being developed to deal with improvement actions that may lead to changes in historical emission data. This aims to strengthen consistency. Improvement actions that do not lead to changes in the reference year will be considered, based on priorities, practicality and cost effectiveness. The Consultative Committee NIE (see section 3.2) may be asked to advise NIE on this matter. The Ministries (VROM, and LNV for LULUCF) ultimately decide.

4. 3 Results from internal and external evaluations and reviews

To prepare for the Kyoto Protocol and bring the national system into line with requirements, the Netherlands has implemented a monitoring improvement programme over the last few years[10]. The actions taken are/were based on the following major inputs:

- expert workshops made a preliminary assessment (around 1999/2000) of the inventory process, any weak spots and of potential areas for improvement. A longlist of actions was identified. An interdepartmental committee (WEB) prepared a shortlist of prioritised actions, to be included in an improvement programme. In 2001, SenterNovem was asked to assume the practical co-ordination of this programme;
- extensive sectoral reviews ans studies, implemented to support the elaboration of monitoring protocols;
- review of cross-cutting issues such as QA/QC and uncertainty analyses, identifying any weak spots and potential improvements for these issues;
- UNFCCC reviews. These provided a crucial input for improvement actions, being the main indicator of 'customer' satisfaction.

The inputs led to shifts and updates in the improvement programme, and often supported each other. The UNFCCC review process, for example, often identified similar areas for improvement as national assessments. This provided for a clear set of priorities.

Some major results and improvement actions are illustrated in the text hereafter.

Main results from review processes and (subsequent) improvement actions

Cross-cutting:
- QA/QC: the elaboration of monitoring protocols proved instrumental in improving the transparency of the national system, identifying the weak spots in background information and systematically reviewing relevant sectors. It led to various more detailed assessments of country-specific emission factors and to upgraded and better substantiated methods;
- uncertainties: in 2001/2002, a first attempt was made to apply a Tier 2 uncertainty analysis. This showed that Tier 2 added clear insight into improvement options in the expert process and related background information, although it did not lead to significantly different overall uncertainty estimates as with Tier 1. It was decided to improve the process and the background information and to implement Tier 2 updates only after the planned methodological

10 This is in line with Art.10 a) of the Kyoto Protocol. In addition to the national improvement actions, the Netherlands actively participates in EU (expert) workshops and in collaborative mutual review activitities, in order to exchange experiences and further improve the inventory. Further cooperation e.g. includes a mission of Dutch experts, funded by UNDP, to cooperate with China in improving inventories.

improvements and recalculations had taken place i.e. not sooner than late 2005.

Sectoral improvement projects (examples, not exhaustive):
- agriculture: the monitoring protocols and supporting studies led to better substantiation and upgrading of various emission factors and methods in the agricultural sector;
- energy: the emission factors of various fuels were studied and better substantiated and updated. Furthermore, the variations in quality and transparency of company level data on combustion and process emissions led to adaptation of the methods in the energy sector, in order to improve quality and transparency;
- transport: to comply with IPCC requirements, further studies were conducted into a better distinction between domestic and international emissions from aviation and shipping. This resulted in improved methods for including emissions from fisheries into domestic emissions;
- LULUCF: the methods in this sector were upgraded for forests and complemented for soils, to reflect the recently adopted GPG for LULUCF.

4.4 Official consideration and approval

An official inventory approval process is implemented to further support its quality (see Table 1). The following steps are of importance for formal consideration and approval:
- the data set that is being used for the CRF is officially approved in writing to the Project leader ER by the institutes involved in the ER. For LULUCF, approval is given by the Ministry of Agriculture (LNV);
- the draft NIR is checked by the NIE. The Ministry of VROM gives formal written approval to ER and NIE for the NIR/CRF to be submitted to the UNFCCC, after consulting the findings of the checks by the NIE and after consulting the Ministry for Agriculture on LULUCF issues.

Annex 3.2 Summary tables national inventory report

This annex detailes the emission trend tables, as these were provided by the Netherlands as part of the submission of the CRF and NIR 2005 (Klein Goldewijk et al, 2005).

Following sheets are presented:
- CO_2
- CH_4
- N_2O
- F-gases
- Summary with all gases

Emission trends (CO_2)

Greenhouse gas source and sink categories	base year[1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	(Gg)														
1. Energy	**149.639**	**149.639**	**154.727**	**153.459**	**158.139**	**157.416**	**161.268**	**169.233**	**161.752**	**164.264**	**159.028**	**161.179**	**167.328**	**166.987**	**170.018**
A. Fuel Combustion (Sectoral Approach)	*148.398*	*148.398*	*153.486*	*152.302*	*157.130*	*156.300*	*160.298*	*168.104*	*160.977*	*163.481*	*158.178*	*160.353*	*166.506*	*166.148*	*169.148*
1. Energy Industries	51.626	51.626	52.319	52.377	54.708	57.462	61.134	62.218	62.978	65.347	61.480	63.187	67.313	66.623	67.347
2. Manufacturing Industries and Construction	32.768	32.768	32.246	32.826	32.054	30.476	27.891	28.570	27.103	27.348	27.070	26.603	25.944	26.662	27.056
3. Transport	26.008	26.008	26.281	27.544	28.155	28.623	29.146	29.908	30.304	31.043	32.005	32.365	32.878	33.580	34.157
4. Other Sectors	37.431	37.431	42.102	39.002	41.675	39.254	41.615	46.900	40.107	39.224	36.974	37.616	39.897	38.783	40.151
5. Other	566	566	539	553	538	486	512	508	485	520	650	583	474	499	437
B. Fugitive Emissions from Fuels	*1.241*	*1.241*	*1.241*	*1.157*	*1.009*	*1.116*	*969*	*1.130*	*775*	*783*	*850*	*826*	*822*	*839*	*870*
1. Solid Fuels	403	403	430	431	446	559	517	651	505	492	446	422	412	430	464
2. Oil and Natural Gas	839	839	811	726	563	557	453	479	270	291	404	404	410	409	405
2. Industrial Processes	**8.043**	**8.043**	**7.959**	**7.425**	**7.197**	**7.918**	**8.154**	**7.889**	**8.257**	**7.711**	**7.709**	**7.522**	**6.867**	**6.781**	**6.683**
A. Mineral Products	1.216	1.216	1.254	1.228	1.258	1.496	1.426	1.332	1.275	1.324	1.396	1.354	1.461	1.398	1.349
B. Chemical Industry	3.538	3.538	3.858	3.915	3.787	3.976	4.047	3.899	4.029	3.801	3.749	3.784	3.217	3.126	2.935
C. Metal Production	2.909	2.909	2.548	1.953	1.888	2.189	2.184	2.135	2.444	2.110	1.995	1.765	1.737	1.821	1.968
D. Other Production	73	73	49	54	50	29	22	49	48	41	51	49	43	32	46
E. Production of Halocarbons and SF_6															
F. Consumption of Halocarbons and SF_6															
G. Other	307	307	249	275	213	228	474	475	462	435	517	571	408	404	385
3. Solvent and Other Product Use	**316**	**316**	**239**	**215**	**208**	**214**	**242**	**194**	**174**	**189**	**197**	**169**	**158**	**160**	**160**
4. Agriculture	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
A. Enteric Fermentation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B. Manure Management	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C. Rice Cultivation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D. Agricultural Soils	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E. Prescribed Burning of Savannas	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
F. Field Burning of Agricultural Residues	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G. Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5. Land-Use Change and Forestry	**2.894**	**2.894**	**2.796**	**2.673**	**2.620**	**2.623**	**2.651**	**2.671**	**2.844**	**2.736**	**2.730**	**2.814**	**2.775**	**2.759**	**2.761**
A. Changes in Forest and Other Woody Biomass Stocks	-2.505	-2.505	-2.546	-2.642	-2.653	-2.605	-2.558	-2.529	-2.335	-2.415	-2.381	-2.289	-2.289	-2.289	-2.289
B. Forest and Grassland Conversion	866	866	866	866	866	866	866	866	866	866	866	866	866	866	866
C. Abandonment of Managed Lands	-21	-21	-42	-63	-84	-105	-126	-148	-169	-190	-211	-232	-253	-274	-274
D. CO_2 Emissions and Removals from Soil	4.555	4.555	4.519	4.513	4.491	4.468	4.470	4.482	4.482	4.476	4.456	4.469	4.452	4.456	4.458
E. Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6. Waste	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
A. Solid Waste Disposal on Land	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B. Waste-water Handling	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C. Waste Incineration	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
D. Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7. Other	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total Emissions/Removals with LUCF	**160.893**	**160.893**	**165.720**	**163.773**	**168.163**	**168.171**	**172.315**	**179.988**	**173.028**	**174.901**	**169.664**	**171.684**	**177.128**	**176.686**	**179.621**
Total Emissions without LUCF	**157.998**	**157.998**	**162.924**	**161.100**	**165.544**	**165.548**	**169.664**	**177.317**	**170.183**	**172.164**	**166.934**	**168.870**	**174.352**	**173.928**	**176.861**
Memo Items:															
International Bunkers	**38.775**	**38.775**	**40.180**	**41.267**	**43.137**	**41.528**	**43.012**	**44.263**	**47.160**	**48.414**	**50.031**	**52.474**	**56.562**	**56.446**	**53.262**
Aviation	4.540	4.540	4.845	5.649	6.214	6.535	7.584	8.080	8.740	9.560	9.832	9.749	9.539	9.982	9.817
Marine	34.235	34.235	35.335	35.618	36.923	34.994	35.428	36.183	38.420	38.854	40.199	42.725	47.023	46.464	43.445
Multilateral Operations	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
CO_2 Emissions from Biomass	**5.598**	**5.598**	**6.448**	**6.343**	**6.647**	**6.226**	**5.474**	**5.988**	**6.681**	**6.896**	**6.949**	**7.828**	**8.152**	**8.319**	**8.247**

1 Base year CO_2 = 1990

Emission trends (CH_4)

Greenhouse gas source and sink categories	base year[1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	(Gg)														
Total Emissions	**1.220,46**	**1.220,46**	**1.232,84**	**1.210,99**	**1.188,54**	**1.154,62**	**1.134,73**	**1.106,22**	**1.051,90**	**1.013,31**	**962,98**	**929,43**	**905,01**	**867,65**	**831,19**
1. Energy	**130,50**	**130,50**	**131,20**	**128,83**	**128,83**	**126,66**	**126,41**	**123,68**	**94,66**	**90,97**	**83,57**	**80,92**	**81,32**	**80,21**	**79,86**
A. Fuel Combustion (Sectoral Approach)	*31,69*	*31,69*	*32,50*	*31,06*	*31,89*	*30,79*	*31,22*	*34,01*	*30,91*	*29,85*	*29,17*	*29,41*	*30,06*	*29,28*	*29,28*
1. Energy Industries	2,76	2,76	3,07	3,15	3,49	3,43	3,53	3,94	4,28	4,37	4,44	4,51	4,72	4,96	4,97
2. Manufacturing Industries and Construction	2,68	2,68	2,60	2,61	2,52	2,47	2,31	2,37	2,28	2,32	2,27	2,34	2,20	2,22	2,19
3. Transport	7,51	7,51	6,58	6,41	6,09	5,80	5,63	5,25	4,96	4,74	4,53	4,10	3,88	3,72	3,50
4. Other Sectors	18,69	18,69	20,20	18,84	19,74	19,05	19,70	22,40	19,34	18,38	17,87	18,41	19,21	18,34	18,57
5. Other	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,05	0,04	0,05	0,07	0,06	0,05	0,05	0,04
B. Fugitive Emissions from Fuels	*98,81*	*98,81*	*98,70*	*97,77*	*96,94*	*95,86*	*95,19*	*89,67*	*63,75*	*61,11*	*54,40*	*51,51*	*51,26*	*50,92*	*50,58*
1. Solid Fuels	1,44	1,44	1,44	1,44	1,44	1,45	1,45	1,46	1,45	1,42	1,16	1,06	1,11	1,06	1,08
2. Oil and Natural Gas	97,37	97,37	97,26	96,33	95,50	94,41	93,74	88,21	62,30	59,69	53,23	50,45	50,15	49,86	49,50
2. Industrial Processes	**14,13**	**14,13**	**14,14**	**14,12**	**14,07**	**14,11**	**14,14**	**14,09**	**14,09**	**14,07**	**14,20**	**14,32**	**14,24**	**14,69**	**14,81**
A. Mineral Products	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
B. Chemical Industry	12,13	12,13	12,13	12,13	12,13	12,13	12,13	12,13	12,13	12,15	12,25	12,42	12,39	12,89	12,97
C. Metal Production	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
D. Other Production	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
E. Production of Halocarbons and SF_6															
F. Consumption of Halocarbons and SF_6															
G. Other	2,01	2,01	2,02	2,00	1,94	1,98	2,01	1,96	1,96	1,93	1,95	1,90	1,85	1,81	1,85
3. Solvent and Other Product Use	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
4. Agriculture	**490,05**	**490,05**	**496,02**	**487,77**	**480,88**	**470,75**	**479,21**	**470,40**	**460,75**	**445,99**	**440,87**	**434,30**	**432,97**	**413,28**	**404,05**
A. Enteric Fermentation	348,67	348,67	353,69	346,97	340,33	335,94	334,38	327,60	318,36	314,03	311,33	306,99	307,45	292,86	288,69
B. Manure Management	141,38	141,38	142,33	140,80	140,55	134,81	144,83	142,80	142,39	131,96	129,54	127,31	125,52	120,42	115,36
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5. Land-Use Change and Forestry	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
A. Changes in Forest and Other Woody Biomass Stocks	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
B. Forest and Grassland Conversion	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
C. Abandonment of Managed Lands	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
D. CO_2 Emissions and Removals from Soil	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
E. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	**585,78**	**585,78**	**591,48**	**580,28**	**564,77**	**543,10**	**514,98**	**498,06**	**482,40**	**462,28**	**424,35**	**399,89**	**376,48**	**359,48**	**332,47**
A. Solid Waste Disposal on Land	571,93	571,93	572,31	560,46	544,52	526,80	500,07	483,26	467,80	447,78	409,65	385,72	362,67	345,38	322,61
B. Waste-water Handling	13,79	13,79	18,39	18,33	18,30	13,40	11,48	11,31	11,03	10,97	11,23	10,50	10,47	10,67	9,86
C. Waste Incineration	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
D. Other	0,06	0,06	0,77	1,48	1,95	2,90	3,43	3,49	3,57	3,53	3,47	3,67	3,34	3,42	0,00
7. Other	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
Memo Items:															
International Bunkers	**0,84**	**0,84**	**NE**	**NE**	**NE**	**NE**	**0,88**	**0,89**	**0,92**	**0,94**	**0,96**	**1,02**	**1,12**	**1,10**	**NE**
Aviation	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Marine	0,84	0,84	0,87	0,88	0,88	0,84	0,88	0,89	0,92	0,94	0,96	1,02	1,12	1,10	NE
Multilateral Operations	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
CO_2 Emissions from Biomass															

1 Base year CH_4 = 1990

Emission trends (N_2O)

Greenhouse gas source and sink categories	base year[1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	(Gg)														
Total Emissions	**68,75**	**68,75**	**70,03**	**72,25**	**74,60**	**71,86**	**72,33**	**71,57**	**70,83**	**69,98**	**67,57**	**64,18**	**60,90**	**57,97**	**55,87**
1. Energy	**1,67**	**1,67**	**1,79**	**1,95**	**2,12**	**2,23**	**2,34**	**2,43**	**2,45**	**2,49**	**2,42**	**2,44**	**2,46**	**2,48**	**2,45**
A. Fuel Combustion (Sectoral Approach)	*1,67*	*1,67*	*1,79*	*1,95*	*2,12*	*2,23*	*2,34*	*2,43*	*2,45*	*2,49*	*2,42*	*2,44*	*2,46*	*2,48*	*2,45*
1. Energy Industries	0,51	0,51	0,48	0,48	0,51	0,54	0,54	0,60	0,62	0,64	0,56	0,63	0,66	0,69	0,70
2. Manufacturing Industries and Construction	0,10	0,10	0,10	0,10	0,10	0,09	0,07	0,07	0,07	0,07	0,07	0,08	0,07	0,07	0,07
3. Transport	0,88	0,88	1,02	1,19	1,33	1,43	1,54	1,57	1,60	1,60	1,61	1,56	1,55	1,56	1,52
4. Other Sectors	0,15	0,15	0,15	0,14	0,15	0,14	0,15	0,15	0,14	0,14	0,13	0,14	0,16	0,14	0,14
5. Other	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,04	0,03	0,03	0,03	0,03
B. Fugitive Emissions from Fuels	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*	*0,00*
1. Solid Fuels	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2. Oil and Natural Gas	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
2. Industrial Processes	**27,44**	**27,44**	**27,69**	**27,86**	**29,54**	**28,23**	**26,91**	**26,79**	**26,65**	**26,51**	**25,65**	**25,36**	**23,51**	**22,49**	**21,66**
A. Mineral Products	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
B. Chemical Industry	24,42	24,42	24,70	24,90	26,70	25,50	24,25	24,20	24,20	24,10	23,23	23,03	21,23	20,23	19,40
C. Metal Production	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
D. Other Production	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
E. Production of Halocarbons and SF_6															
F. Consumption of Halocarbons and SF_6															
G. Other	3,03	3,03	2,99	2,96	2,84	2,73	2,66	2,59	2,45	2,41	2,42	2,34	2,29	2,26	2,26
3. Solvent and Other Product Use	**0,73**	**0,73**	**0,73**	**0,73**	**0,70**	**0,66**	**0,64**	**0,62**	**0,55**	**0,52**	**0,50**	**0,44**	**0,36**	**0,29**	**0,29**
4. Agriculture	**37,25**	**37,25**	**38,10**	**40,00**	**40,55**	**39,01**	**40,81**	**40,12**	**39,60**	**38,85**	**37,45**	**34,40**	**33,04**	**31,21**	**30,19**
A. Enteric Fermentation	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
B. Manure Management	2,16	2,16	2,24	2,38	2,43	2,29	2,39	2,34	2,32	2,51	2,53	2,39	2,38	2,38	1,93
C. Rice Cultivation	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
D. Agricultural Soils	35,09	35,09	35,86	37,62	38,12	36,72	38,42	37,78	37,28	36,34	34,92	32,01	30,66	28,83	28,26
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5. Land-Use Change and Forestry	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
A. Changes in Forest and Other Woody Biomass Stocks	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
B. Forest and Grassland Conversion	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
C. Abandonment of Managed Lands	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
D. CO_2 Emissions and Removals from Soil	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
E. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	**1,66**	**1,66**	**1,72**	**1,71**	**1,69**	**1,73**	**1,63**	**1,60**	**1,59**	**1,62**	**1,56**	**1,53**	**1,53**	**1,51**	**1,28**
A. Solid Waste Disposal on Land	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
B. Waste-water Handling	1,66	1,66	1,69	1,65	1,61	1,61	1,49	1,46	1,44	1,48	1,42	1,38	1,39	1,37	1,28
C. Waste Incineration	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
D. Other	0,00	0,00	0,03	0,06	0,08	0,12	0,14	0,14	0,14	0,14	0,14	0,15	0,13	0,14	0,00
7. Other	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**	**0,00**
Memo Items:															
International Bunkers	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Aviation	0,04	0,04	NE	NE	NE	NE	0,06	0,07	0,07	0,08	0,08	0,08	0,08	0,08	0,08
Marine	0,27	0,27	0,28	0,28	0,29	0,27	0,28	0,28	0,30	0,30	0,31	0,33	0,37	0,36	0,34
Multilateral Operations	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
CO_2 Emissions from Biomass															

1 Base year N_2O = 1990

Emission trends (HFCs, PFCs and SF_6) - Emissions of individual compounds in ton

Greenhouse gas source and sink categories	base year[1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Emissions of HFCs - CO_2 equivalent (Gg)	**6.010,90**	**4.431,82**	**3.451,56**	**4.447,33**	**4.998,04**	**6.517,86**	**6.010,90**	**7.664,34**	**8.294,85**	**9.347,56**	**4.868,38**	**3.839,06**	**1.492,11**	**1.566,46**	**1.449,91**
HFC-23	492,21	378,79	295,01	377,99	422,80	536,57	492,21	588,62	573,39	665,86	294,02	206,91	38,44	58,51	39,36
HFC-32	2,40	0,00	0,00	0,00	0,00	0,00	2,40	0,00	3,00	1,00	0,00	0,60	12,43	0,24	6,34
HFC-41	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
HFC-43-10mee	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
HFC-125	3,83	0,00	0,00	0,00	0,00	0,00	3,83	8,98	15,52	36,32	45,60	61,52	78,38	64,86	75,20
HFC-134	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
HFC-134a	175,78	0,00	0,00	18,01	12,16	116,97	175,78	425,86	678,28	700,25	723,73	602,06	428,81	326,05	328,30
HFC-152a	17,86	0,00	0,00	9,93	28,79	24,00	17,86	25,00	0,00	0,00	0,00	21,93	6,51	2,04	3,93
HFC-143	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
HFC-143a	1,70	0,00	0,00	0,00	2,64	6,28	1,70	34,72	12,64	35,80	36,50	77,89	45,42	51,53	72,84
HFC-227ea	0,00														
HFC-236fa	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
HFC-245ca	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
HFC Unspecified	0,75	0,00	0,00	0,00	7,14	20,26	0,75	21,12	203,67	136,08	73,69	54,64	27,97	26,71	23,54
Emissions of PFCs - CO_2 equivalent (Gg)	**1.805,90**	**2.115,33**	**2.094,88**	**1.905,49**	**1.926,38**	**1.853,44**	**1.805,90**	**2.001,64**	**2.176,69**	**1.729,65**	**1.465,90**	**1.520,98**	**1.416,98**	**1.416,15**	**1.396,06**
CF_4	236,86	280,93	277,76	251,94	254,17	243,85	236,86	261,19	277,98	217,28	153,53	179,94	171,97	168,21	162,15
C_2F_6	24,96	29,46	29,18	26,49	26,80	25,71	24,96	27,66	29,49	22,40	35,38	18,04	17,24	16,90	16,27
C_3F_8															
C_4F_{10}															
c-C_4F_8															
C_5F_{12}															
C_6F_{14}															
PFC unspecified	4,37	2,17	2,50	2,88	3,31	3,80	4,37	5,89	11,73	13,24	16,96	22,07	16,74	19,92	22,91
Emissions of SF_6 - CO_2 equivalent (Gg)	**301,26**	**217,32**	**133,91**	**143,09**	**149,90**	**191,20**	**301,26**	**312,40**	**344,85**	**328,84**	**317,03**	**335,15**	**356,95**	**358,81**	**334,48**
SF_6	12,61	9,09	5,60	5,99	6,27	8,00	12,61	13,07	14,43	13,76	13,27	14,02	14,94	15,01	14,00

1 Base year F-gases = 1995

Emission trends (Summary)

Greenhouse gas emissions	base year[1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	CO_2 equivalent (Gg)														
Net CO_2 emissions/removals	160.892,55	160.892,55	165.720,34	163.772,54	168.163,36	168.170,96	172.315,44	179.988,02	173.027,56	174.900,60	169.663,56	171.684,26	177.127,69	176.686,44	179.621,28
CO_2 emissions (without LUCF)	157.998,36	157.998,36	162.924,12	161.099,72	165.543,52	165.548,28	169.663,94	177.316,79	170.183,50	172.164,31	166.933,81	168.870,36	174.352,47	173.927,69	176.860,74
CH_4	25.629,73	25.629,73	25.889,58	25.430,82	24.959,39	24.246,93	23.829,39	23.230,65	22.090,00	21.279,59	20.222,61	19.518,11	19.005,18	18.220,74	17.455,01
N_2O	21.312,14	21.312,14	21.707,85	22.397,12	23.125,64	22.275,64	22.421,18	22.185,89	21.957,94	21.694,48	20.947,93	19.894,30	18.878,30	17.971,26	17.320,58
HFCs	6.010,90	4.431,82	3.451,56	4.447,33	4.998,04	6.517,86	6.010,90	7.664,34	8.294,85	9.347,56	4.868,38	3.839,06	1.492,11	1.566,46	1.449,91
PFCs	1.805,90	2.115,33	2.094,88	1.905,49	1.926,38	1.853,44	1.805,90	2.001,64	2.176,69	1.729,65	1.465,90	1.520,98	1.416,98	1.416,15	1.396,06
SF_6	301,26	217,32	133,91	143,09	149,90	191,20	301,26	312,40	344,85	328,84	317,03	335,15	356,95	358,81	334,48
Total (with net CO_2 emissions/removals)	**215.952,47**	**214.598,89**	**218.998,13**	**218.096,39**	**223.322,71**	**223.256,04**	**226.684,06**	**235.382,93**	**227.891,89**	**229.280,73**	**217.485,41**	**216.791,86**	**218.277,20**	**216.219,86**	**217.577,32**
Total (without CO_2 from LUCF)	**213.058,28**	**211.704,70**	**216.201,91**	**215.423,57**	**220.702,88**	**220.633,36**	**224.032,57**	**232.711,70**	**225.047,83**	**226.544,44**	**214.755,67**	**213.977,96**	**215.501,99**	**213.461,10**	**214.816,78**

Greenhouse gas source and sink categories	base year[1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	CO_2 equivalent (Gg)														
1. Energy	152.897,77	152.897,77	158.037,41	156.769,57	161.501,25	160.768,41	164.646,69	172.584,05	164.498,71	166.945,25	161.532,67	163.635,08	169.797,89	169.439,87	172.454,79
2. Industrial Processes	24.965,39	23.611,81	22.518,64	22.852,91	23.723,92	25.527,28	24.911,84	26.469,34	27.629,86	27.629,53	22.611,27	21.380,96	17.720,76	17.402,83	16.889,02
3. Solvent and Other Product Use	541,18	541,18	464,65	442,64	424,10	418,80	439,85	387,10	345,15	350,45	350,48	306,89	268,54	248,57	250,16
4. Agriculture	21.838,55	21.838,55	22.227,42	22.643,17	22.668,98	21.978,85	22.714,51	22.315,60	21.951,75	21.409,29	20.867,77	19.784,30	19.334,77	18.353,98	17.843,95
5. Land-Use Change and Forestry	2.894,19	2.894,19	2.796,22	2.672,82	2.619,83	2.622,68	2.651,50	2.671,23	2.844,06	2.736,29	2.729,75	2.813,90	2.775,22	2.758,75	2.760,54
6. Waste	12.815,39	12.815,39	12.953,78	12.715,28	12.384,63	11.940,02	11.319,67	10.955,61	10.622,36	10.209,92	9.393,48	8.870,74	8.380,02	8.015,85	7.378,86
7. Other	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

1 Base year CO2, CH4 and N2O is 1990.
Base year F-gases is 1995

Annex 4.1
Information on CDM/JI projects and project criteria

Netherlands CDM and JI projects

Name	Country	Type of project	Emission reduction until the end of 2012, in tonnes
CDM Projects with Netherlands participation registered by the CDM Executive Board as of October 2005			
Huitengxile (Inner Mongolia)	China	Wind	578,000
Rio Azul (SARET)	Costa Rica	Landfill	663,000
Villa Dominico	Argentina	Landfill	5,888,890
Biomass in Rajastan	India	Biomass	754,000
Nova Gerar	Brazil	Waste	2,500,000
JI Projects contracted by the Netherlands as of January 2005			
BioHeat International	Czech Republic	Biomass	522,320
Hidroelectrica s.a.	Romania	Hydro	1,673,844
Holcim s.a.	Romania	Energy efficiency	800,000
BKB Waste Management	Slovakia	Landfill gas recovery	551,023
AES Borsod	Hungary	Biomass	713,488
Meridian	New Zealand	Wind	530,000
Bakony Power Plant	Hungary	Biomass	453,000
Hidroelectrica s.a.	Romania	Hydro	267,000
Oü Paldiski Tuulepark	Estonia	Wind	730,593
Overgas Inc. AD	Bulgaria	Fuel switch	350,000
S.C.NUON Energy Romania	Romania	District heating	349,306
Arcadis Ekokonrem	Poland	Landfill gas reduction	253,000
Biovet	Bulgaria	Energy efficiency	307,000
BKB Waste Management	Romania	Landfill gas reduction	475,644
Stadtwerke Herne	Germany	Mine gas (CH_4) reduction	250,000
Plovdiv EAD	Bulgaria	District heating	533,176
Overgas Inc	Bulgaria	Fuel switch	500,000
Füsföi	Hungary	Biomass heat and power	350,000

CDM Project Criteria

Consistency with UNFCCC, the Kyoto Protocol, the Marrakech Accords and the guidance provided by the CDM Executive Board.
- Projects should comply with all current decisions on modalities and procedures adopted by Parties to the UNFCCC and/or the Kyoto Protocol, as well as all future decisions on modalities and procedures, when adopted.

Consistency with Relevant National Criteria.
- Project designs should be compatible with and supportive of the national environmental and sustainable development priorities of the Host Country.

Consistency with General Guidance Provided by VROM.
- The contracted intermediaries shall seek to ensure that projects comply with the general guidance provided by VROM at the regular meetings between VROM and the intermediary (which usually concerns new decisions by the CDM Executive Board or new guidance based on other policies of the Dutch government).

Location of Projects.
- Projects shall be located in countries not listed in Annex I to the UNFCCC which have (i) signed and ratified, accepted, approved or acceded the Kyoto Protocol, or (ii) signed the Kyoto Protocol and have demonstrated a clear interest in becoming a Party thereto in due time.

Nuclear energy.
- Nuclear energy projects are not eligible.

LULUCF.
- The Netherlands may implement 1% of its assigned amount by means of projects involving land-use or land-use change (afforestation, reforestation). This equals 11 Mtonnes of CO_2 equivalents up to the end of the Kyoto Protocol's first commitment period (2012).

Hydropower projects.
- Hydropower projects have to provide substantiated information on how they have taken into account the recommendations of the World Commission on Dams.

Environmental and Social Impact.
- Projects that are expected to have large-scale adverse social or environmental effects are not eligible.

Cost Effectiveness and Sustainability.
- Cost Effectiveness and Sustainability will play a major role in the selection and approval of Projects.

Equity.
- VROM intends to create a portfolio in which a broad range of technologies and project types spread over all relevant UNFCCC regions are represented.

Risk management related to technology transfer.
- Projects should be structured to mitigate various types of risks. Projects should generally entail manageable technological risk. The technology to be used in a project should be commercially available, have been demonstrated in a commercial context, and be subject to customary commercial performance guarantees. The technical competence in the Host Country to manage this technology should be established during project appraisal. Projected Emission Reductions over the life of the project should be predictable and should involve an acceptable level of uncertainty.

Criteria for successful JI projects

- The feasibility study of the project has been completed and a solid business plan has been developed. The project shows progress in the development stage and a clear project design is available. SenterNovem prefers projects that can be realised within six months after contracting.
- The Host Country approves the project as a JI project by issuing a Letter of Approval. Contact with the focal point of the Host Country should be established at an early stage.
- Financing of the project is solid and near to closure and the supplier (or its guarantor) has sufficient financial and economic standing.
- The project team is experienced in developing and operating similar projects and has experience in the carbon business as well. Companies that are not experienced in methodologies to calculate and monitor emission reductions can hire a consultant who has done the job before. Selling Emission Reductions is an entirely new commodity to most companies and companies should therefore definitely gain a (thorough) understanding of what it is they are selling;
- A solid Project Design Document (PDD) is drawn up by the supplier (or his consultant) and validated by a validator. This step is required under the Marrakech Accords and proves that the calculations of the emission reductions are executed according to the available guidelines or methodologies.

Further requirements

- The Host Country should have ratified the Kyoto Protocol. If the Host Country has not ratified the Kyoto Protocol, SenterNovem will assess whether it is likely that the Host Country will ratify it in the near future. If not, the project will be rejected in the contract awarding phase.
- Projects that started construction before 1 January 2000 are not eligible.
- Projects in the field of nuclear energy are not eligible
- Forest management projects are not eligible. Other Land-use, Land-use Change and Forestry projects remain eligible.
- Projects that are participating in another Dutch JI programme are not eligible. This includes multilateral programs in which the Netherlands participates.
- Projects expected to have large-scale adverse effects on society or biodiversity (e.g. large-scale hydropower dams) and/or projects which might sooner or later result in social or political agitation are not eligible.

If SenterNovem has doubts about the results of the Environmental Analysis and/or the Environmental Impact Assessment (EIA) carried out, it may require an EIA in accordance with European quality standards.

Annex 4.2
National registry

This annex describes the National Registry of the Netherlands. It follows the outline for presenting information from the guidelines on reporting of information under Article 7.2. of the Kyoto Protocol. Since the ITL is still under development, this annex focuses on the experiences so far, notably those for the EU emission trading scheme.

(a) The name and contact information of the registry administrator designated by the Party to maintain the national registry

Registry administrator

Name	Harm van de Wetering
Address	Prinses Beatrixlaan 2
	PO Box 91503
City	The Hague
Postcode	2509 EC
Country	The Netherlands
Telephone number	+31-(0)70-3394747
Fax number	+31-(0)70-3391394
Email	harm.vandewetering@minvrom.nl

(b) The names of the other Parties with which the Party co-operates by maintaining their national registries in a consolidated system.

The Netherlands maintains its national registry as an independent system. The registry is developed and improved in co-operation with the GRETA licensees (United Kingdom, Denmark, Sweden, Norway, Finland, Ireland, Italy, Hungary, Slovenia and Lithuania)

(c) A description of the database structure and capacity of the national registry

1. The GRETA registry system is implemented using a Microsoft SQL Server relational database management system with a dedicated data model for supporting registry operations.
2. The absolute maximum size of an SQL Server 2000 database is: 1,048,516 Terabytes or 50 Terabytes per single file entry. A Terabyte is equivalent to 10 to the power 12 (1012) bytes.
3. The SQL Server database model is scalable up to 32 processors with 64 gigabytes of memory.
4. The GRETA team has made an estimate of annual database growth based on the current size of the UK database. The total current size of the Dutch database is smaller, so it will fit into the estimate made by GRETA.

From experience drawn from the present UK Registry system for the EU Emissions Trading Scheme, which has been live for nearly 2 months, it contains:

a. 800 organisations
b. with 1,600 users
c. with 800 holding accounts
d. and 3,000 address objects
e. 600 transactions performed involving 600 unit blocks.
f. 5,430 messages communicated between the registry and CITL.
g. total size of the database: approximately 100 megabytes.

Applying a predicted growth of 10% in organisations, users and accounts, with an envisaged 10 transactions per year per Operator Holding Accounts and 100 transactions per year for Person Holding Accounts, with each transaction assumed to involve an average of 5 unit blocks, it is predicted that this would result in an annual growth in database storage of approximately 50 megabytes per year. Based on this information, it is envisaged that it should be well within the capability of the database system.
Furthermore, where a particular performance issue is identified, a dedicated development team is available to perform any necessary fine-tuning.

(d) A description of how the national registry conforms to the technical standards for data exchange between registry systems for the purpose of ensuring the accurate, transparent and efficient exchange of data between national registries, the clean development mechanism registry and the transaction log (decision 19/CP.7, paragraph 1)*

1. The GRETA registry system has been developed for the EU Emissions Trading Scheme. This scheme requires its Member States' registries to be compliant with the UN Data Exchange Standards specified for the Kyoto Protocol. Currently, the development adheres to the standards

1 See decision 24/CP.8.

specified in Draft #7 of the UN DES document. Many of the members have had their Registry systems tested successfully by the EU Commission and their Registries have since gone live.

2. As part of the EU Registry development, the team has developed the functionality to perform issuance, conversion, external transfer, (voluntary) cancellation, retirement and reconciliation processes using XML messages and web services as specified in draft #7 of the UN Data Exchange Standards document.
3. In addition, we have implemented 24-Hour Clean-up, Transaction Status enquiry, Time Synchronisation, Data Logging requirements (including Transaction Log, Reconciliation Log, Internal Audit Log and Message Archive) and the different identifier formats as specified in the UN DES document. GRETA can therefore perform extensive tests on these functionalities with the ITL test system once it becomes available.
4. With regard to performing tests with the CDM Registry (external transfer, for example) this can also be performed once the ITL test system becomes available.
5. It has been identified that the following additional Kyoto functionality would be needed to be developed for our Registry and tested against the ITL test system:
   a. Replacement of tCER or lCER.
   b. Carry-Over.
   c. Expiry Date Change (for tCER and lCER), and
   d. The entire area of functionality for ITL Notices (and the Notification Log).

We intend to schedule the development of these functionalities in our future releases in order to comply with the timetable required for Kyoto.

(e) A description of the procedures employed in the national registry to minimise discrepancies in the issuance, transfer, acquisition, cancellation and retirement of ERUs, CERs, tCERs, lCERs, AAUs and/or RMUs, and replacement of tCERS and lCERs, and of the steps taken to terminate transactions where a discrepancy is notified and to correct problems in the event of a failure to terminate the transactions

1. In order to minimise discrepancies between the Registry and the Transaction Log, the following approach has been adopted for the Registry system to be developed for the EU Emissions Trading Scheme. The same approach will be adopted for the development of the remaining Kyoto functionality for our Registry software:
   a. Communication between the National Registry and the ITL will be via web services using XML messages - as specified in the UN DES document. These web services, XML message formats and the processing sequence will be as specified in the UN DES document.
   b. As far as possible, the Registry shall validate data entries against the list of checks performed by the ITL - as documented in Annex E of the UN DES Annexes document - before forwarding the request to the ITL for processing. This will help to minimise sending incorrect information to the ITL for approval.
   c. All units that are involved in a transaction shall be earmarked internally within the Registry, thereby preventing the units from being involved in another transaction until a response has been received from the ITL and the current transaction has been completed.
   d. The web service that sends the message to the ITL for processing will ensure that a message-received acknowledgement is received from the ITL before completing submission of the message. Where no acknowledgement message has been received following a number of retries, the web service will terminate the submission and roll back any changes made to the unit blocks involved.
   e. Where a 24-hour clean-up message is received from the ITL, the existing web service will roll back any pending transactions and the units that were involved, thereby preventing any discrepancies in the unit blocks between the Registry and the ITL.
   f. Finally, if an unforeseen failure were to occur, the data discrepancies between our Registry and the ITL can be corrected via a manual intervention function within our registry. Following this, reconciliation will be performed to validate that the data are in sync between the Registry and the ITL.

(f) An overview of security measures employed in the national registry to prevent unauthorised manipulations and to prevent operator errors and of how these measures are kept up to date

1. The following security measures have been taken for our Registry:
   a. By default, access to the Registry is via Username and Password - although a different authentication module can be added locally if required. The Netherlands is conducting a study on how to enhance the security and the level of authentication. The results of this study will be used to select the most suitable method.
   b. The actions that a user can perform are controlled by a permission systempreventing unauthorised access to restricted actions.
   c. All actions performed are recorded by audit.
   d. Database manipulations are only carried out by protected, internally stored procedures that are not directly accessible from the user interface and can only be invoked by our internal web services.
   e. A dedicated development team is available to make any further security enhancements as and when required.
2. In order to prevent operator errors, our Registry software incorporates the following design:
   a. Validation on all user inputs to ensure that only valid details are submitted for processing.
   b. Confirmation of user input to help the user spot any errors that have been made.
   c. Implementation of an internal approval process for secondary approval of relevant operations before submitting the details to the ITL for processing.

(g) A list of the information publicly accessible by means of the user interface to the national registry

1. The user interface to the national registry itself has no publicly accessible information. Users always need to log on to their account first, before they have access to their specifically authorised information.
2. The homepage of our website is linked to the CITL, where all information required by the European Regulation on Registries (2216/2004) is displayed.
3. The user terms and conditions can be downloaded from our website.

(h) The Internet address of the interface to its national registry

www.nederlandse-emissieautoriteit.nl

(i) A description of measures taken to safeguard, maintain and recover data in order to ensure the integrity of data storage and the recovery of registry services in the event of a disaster

The necessary procedures have been identified according to the method required by the Dutch government for governmental information systems (A&K analysis). This document is available in Dutch.

1. Physical security
   a. The physical security of the building and computer rooms is carried out by the Security department of PinkRoccade Infrastructure Services b.v. (PRInS), 24 hours a day, 7 days a week. The department uses technical and procedural means. Visitors are only allowed after invitation by one of the PRInS employees. Access to the computer rooms is severely restricted and only possible after showing proof of identity. All security rules can be found in the book: 'Beveiligingsregels PinkRoccade Infrastructure Services' (in Dutch).
   b. The back-up and production environments are (geographically) separated. The distance between Apeldoorn and Amsterdam Zuidoost is approximately 100 km.
   c. In case of calamities, a backup server is available at the location of PinkRoccade Infrastructure Services BV in Amsterdam Zuidoost. According to the Service Level Agreement (SLA - available in Dutch), this back-up server should be operational within 48 hours after it is decided to use this server.
   d. In case of loss of the production environment, the back-up tape of the day before the 'disaster' will be transferred from the (secret) external location to Amsterdam Zuidoost. The relevant data will be retrieved and installed on the back-up servers. Action will also have to be undertaken to transfer URLs and certificates to this machine.

2. Technical details regarding back-up scenario:
   a. Electronic medium: dds-4 data cartridge, 40GB.
   b. Full back-ups (meaning databases as well as applications) will be made on a daily basis (7 days a week).
   c. Every week, a back-up will be transferred to an external location (secret location somewhere in in the province of

Gelderland, the Netherlands).
   d. The back-up will be kept for 2 weeks.
   e. Restore time during business hours is no more than 4 hours.
   f. Physically guarded computer area.

3. System security
   a. Standard (continuous) monitoring of the servers making use of the following security components: Intrusion Detection System and Firewalls.
   b. Both the web server and the database server are dedicated servers for GRETA. A dedicated firewall is also in place. This site is only accessible from the two GRETA websites and CITL. Continuous monitoring by Intrusion Detection Services should prevent unauthorised access to the machines.
   c. Log files are checked each month with regard to security issues and further analysis in case of peculiarities.
   d. Annual analysis of security systems. A report will be drawn up giving an overview of the current situation and suggestions for possible improvement.
   e. Controlled patching of the operating system and system applications concerning security issues.

4. In the event of a disaster, the following recovery procedures have been incorporated in the design of the Registry system:
   a. Local information in the database is held over a raid-array structure with automatic error detection and recovery. Therefore, any single database failure would be reported and the Registry would automatically switch over to use information from the remaining 'correct' databases.
   b. Data are also archived every hour to an off-site disaster recovery site that can be used to take over as the live registry in case the main site has become inoperable. This will then be followed by reconciliation (with the ITL) and manual intervention processes in order to check and restore data inconsistency that may exist in the Registry.

(j) The results of any test procedures that might be available or developed with the aim of testing the performance, procedures and security measures of the national registry undertaken pursuant to the provisions of decision 19/CP.7 relating to the technical standards for data exchange between registry systems.

   a. Currently, our registry system for the EU Emissions Trading Scheme uses the security mechanism as specified within the EU Regulation (Annex XV); that is, it uses basic authentication and SSL.
   b. For Kyoto, digital cert and VPN will be used when the ITL becomes available. This will be included in a future project phase.
   c. No existing performance data or test procedure are available.

Annex 5.1
Parameters on projections pursuant to Annex IV, Implementing Provisions (European Commission decision 2005/166/EC)

General Economic Parameters

parameter	value in 2000	annual growth in %/yr 2002-2010		annual growth in %/yr 2011-2020	
		SE	GE	SE	GE
GDP, in million euro's	402 291	1.8	2.9	1.8	2.9
		value in 2010		value in 2020	
Population, in millions	15.9	16.8	16.8	17.6	17.9
international coal price, in €/GJ	1.50	1.70	1.70	1.70	1.70
international oil price, in €/GJ	5.36	4.41	4.41	4.72	4.72
international gas price, in €/GJ	3.06	2.89	2.89	3.39	3.39

Prices are in real euro's at 2000 level

Assumptions regarding weather parameters

	2000	2005	2010	2015	2020
heating degree days	2695	2846	2773	2700	2628
cooling degree days	56	98	112	127	144

Assumptions for energy intensive industries

industrial subsector	Parameter	Value in 2000	annual growth in %/yr 2000-2010		annual growth in %/yr 2011-2020	
			SE	GE	SE	GE
dairy	tonnes milk	10.89	-0.7	-0.7	-0.7	-0.7
paper manufacturing	mln tonnes paper	3.29	1.6	1.7	1.3	1.1
inorganic basic chemicals	mln tonnes C12	0.80	0.9	1.1	2.0	2.2
fertilizer	mln tonnes NH_3	2.26	0.9	0.9	1.3	1.5
bricks	mln WF bricks	1559	0.6	0.8	1.3	1.7
cement	mln tonnes cement production	3.42	-0.3	-0.1	0.7	0.9
cement	mln tonnes clinker production	0.64	-100.0	-100.0	-	-
ferro	mln tonnes primary steel production	*	3.4	3.4	1.0	1.0
ferro	mln tonnes secondary steel production	0.16	2.8	-2.8	1.0	1.0
primary aluminium	tonnes Al	0.30	0.2	0.2	0.5	0.5
secundary aluminium	tonnes Al	0.086	1.7	1.7	2.0	2.0
petrochemicals and aromatics	Tonnes	unknown	3.5	3.6	2.1	2.3

** confidential, range = 5-6*

Assumptions for manufacturing industries and other sectors

(sub)sector	value of production in 2000 in mln euro's	annual growth in %/yr 2000-2010		annual growth in %/yr 2011-2020	
		SE	GE	SE	GE
agriculture and fisheries	21 863	0.7	0.2	0.8	1.3
foodstuffs and luxury items	43 821	1.3	1.7	2.3	3.6
chemicals, rubber and plastics	40 365	2.2	3.3	3.9	3.4
Metal	68 674	-0.3	1.6	0.0	1.7
Petroleum	17 530	1.0	1.4	2.9	4.1
minerals production	12 292	-1.5	-4.8	-2.0	-4.1
public utilities	18 249	1.9	0.7	3.5	0.5
construction and installation	60 244	1.3	0.7	2.9	2.6
real estate rental and trade	37 716	1.3	1.3	1.3	1.6
trade and repair	82 537	2.0	2.4	3.3	3.8
transport and storage	37 768	2.1	2.7	4.1	4.6
banking and insurance	39 751	1.6	2.0	2.6	2.9
remainder tertiary	109 465	1.6	1.9	2.4	2.6

Assumptions for transport sector: macroeconomic models

parameter	1996-2000	2001-2005		2006-2010		2011-2015		2016-2020	
		SE	GE	SE	GE	SE	GE	SE	GE
growth of transport relative to GDP	4.0%	2.6%	1.5%	5.6%	2.7%	4.6%	2.7%	4.6%	2.7%

Assumptions for transport sector: other models

parameter	2005		2010		2015		2020	
	SE	GE	SE	GE	SE	GE	SE	GE
Car kilometers	99 966	99 966	110 832	110 832	118 492	118 492	126 152	126 152
truck kilometers	8118	8118	9412	9412	11 681	11 681	13 950	13 950

Assumptions for buildings

parameter	value in 2000	annual growth in %/yr 2002-2010		annual growth in %/yr 2011-2020	
		SE	GE	SE	GE
floor space tertiary buildings, in mln m^2	186.6	0	1.0	1.0	1.0
floor space residences, in mln m^2	416.2	1.0	1.0	2.0	2.0
number of dwellings, in thousands	6589.6	1.0	1.0	1.0	1.0
number of employees in tertiary sector, MFTE	4.7	1.0	1.0	1.0	1.0

Assumptions for energy sector

Parameter	2000	2010		2020	
		SE	GE	SE	GE
total gross inland consumption in PJ	**3 147**	**3 844**	**5 114**	**3 463**	**3 692**
Oil	1 042	1 257	1270	1 456	1 524
Coal	321	390	389	322	477
Gas	1 548	1 465	1 532	1 546	1 542
renewable	69	556	56	27	12
Nuclear	39	39	39	0	39
other*	131	137	137	112	98
total electricity production in MWh	**87 139**	**106 722**	**114 166**	**131 028**	**153 723**
Oil	3 944	3 778	3694	1 000	2 806
Coal	23 167	26 583	26472	18 361	35 972
Gas	52 250	59 944	66 278	87 444	72 528
Renewables	1 806	9 639	10 944	21 167	35 639
Nuclear	3 722	3 722	3722	0	3 722
other*	2 250	3 056	3056	3 056	3 056
energy demand energy industries in PJ	**542**	**632**	**646**	**638**	**754**
Oil	133	139	143	137	177
Coal	245	285	283	204	358
Gas	288	327	350	471	330
Electricity	-189	-241	-255	-308	-359
other*	65	122	125	134	248
energy demand industry in PJ	**1 125**	**1 286**	**1 297**	**1 398**	**1 462**
Oil	393	557	563	648	666
Coal	75	106	106	118	118
Gas	560	526	531	534	582
Electricity	70	63	62	65	62
other*	27	34	35	33	34
energy demand tertiary sector in PJ	**525**	**509**	**547**	**491**	**576**
Oil	54	58	62	63	72
Coal	0	0	0	0	0
Gas	350	301	328	257	315
Electricity	104	131	137	151	169
other*	17	19	20	20	20
energy demand households in PJ	**445**	**427**	**448**	**416**	**470**
Oil	4	4	4	4	4
Coal	0	0	0	0	0
Gas	349	311	324	283	315
Electricity	78	98	105	114	134
other*	14	14	15	15	17
energy demand transport sector in PJ	**465**	**505**	**505**	**611**	**611**
Oil	459	499	499	605	605
Coal	0	0	0	0	0
Gas	0	0	0	0	0
Electricity	6	6	6	6	6
other*	0	0	0	0	0

** The category 'other' includes heat and biomass.*

Assumptions for agriculture sector: macroeconomic models

parameter	unit	1996-2000		2001-2005		2006-2010		2011-2015		2015-2020	
share of agriculture	mutations vis-a-vis preceding year in %/yr	SE	GE	SE	GE	SE	GE	SE	GE	SE	GE
in GDP	added value	1.0	1.0	0.2	0.0	1.3	1.6	0.2	1.2	0.3	1.3
in relative growth	production value	1.2	1.2	0.0	-0.2	1.0	1.2	-0.2	0.9	-0.1	1.0

Assumptions for agriculture sector: other models

parameter	value in 2000	annual growth in %/yr 2002-2010		annual growth in %/yr 2011-2020	
		SE	GE	SE	GE
number of beef cattle	448 000*	-4.05	-3.7	-0.6	-16.5
number of dairy cows	1 504 000	-0.7	-0.7	0.5	2.1
number of sheep	1 408 000	0.4	0.4	1.7	1.7
number of pigs	13 118 000	-1.6	-1.6	-3.8	0.1
number of poultry	104 015 000	-1.5	-0.3	-2.4	0.6
hectare crop area	943 640	-1.3	-0.8	-0.3	-2.5
hectare grassland	1 011 887	0.1	-0.4	-0.1	0.6
emission factors	**value in 2000**	**value in 2010**		**value in 2020**	
		SE	GE	SE	GE
enteric fermentation, in kg CH_4 per average animal					
beef cattle	54	53	53	54	55
dairy cows	109	119	119	120	123
sheep	8	8	8	8	8
manure management, fertilizer use in kg N_2O per kg N use	0.039	0.04	0.04	0.04	0.04

**excl. 783 000 veal calves*

Assumptions for waste sector*

Parameter	Value in 2000	value in 2010		value in 2020	
		SE	GE	SE	GE
tonnes municipal solid waste[1]	9.8 mln	n.a.	n.a.	n.a.	n.a.
organic fraction municipal solid waste, in %[2]	35	n.a.	n.a.	n.a.	n.a.
share municipal solid waste disposed to landfills, in %	15	n.a.	n.a.	n.a.	n.a.
share of municipal solid waste incinerated, in %	37	n.a.	n.a.	n.a.	n.a.
share of municipal solid waste composted, in %	20	n.a.	n.a.	n.a.	n.a.

** not used in modelling approach in the Netherlands*

1 municipal solid waste defined as waste collected by or by order of the municipality (household waste plus sanitation department waste)
2 organic fraction defined as fruit, vegetable and garden waste (whether or not separately collected) from households plus green fraction of sanitation department waste

Assumptions for forestry sector

parameter	amount in 2000	amount in 2010	amount in 2020
hectare managed forest	342 000	347 700	353 400
hectare of unmanaged forest	26 000	26 500	27 000
total	368 000	374 200	380 400

Forest definition

Forest land is land with woody vegetation and with tree crown cover of more than 20% and area of more than 0.5 hectare. The trees should be able to reach a minimum height of 5 meters at maturity in situ. Forest land may consist of either closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground or of open forest formations with a continuous vegetation cover in which tree crown cover exceeds 20%. Young natural stands and all plantations established for forestry purposes which have yet to reach a crown density of 20% or tree height of five meters are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention or natural causes but which are expected to revert to forest.

Forest land also includes:

- Forest nurseries and seed orchards that constitute an integral part of the forest.
- Forest road, cleared tracts, firebreaks and other small open areas, all smaller than 6 meter within the forest.
- Forest in national parks, nature reserves and other protected areas such as those of special environmental, scientific, historic, cultural or spiritual interest, with an area of more than 0.5 hectare and a width of more than 30 meters.
- Windbreaks and shelterbelts of trees with an area of more than 0.5 hectare and a width of more than 30 meters.
- This excludes tree stand in agricultural production systems for example in fruit plantations and agro forestry systems.

Annex 5.2 Policies and measures in the three policy variants

Policy Instrument	'Without measures' variant	'With measures' variant	'With additional measures' variant
CO_2 emissions trading	No CO_2 emissions trading	CO_2 price € 2/tonne in 2005; € 7/tonne in 2010; € 11/tonne in 2020.	Same as with measures.
Energy tax	Energy tax (old regulatory tax and old fuel tax) repealed for all sectors after 2000	Tax rates for non-trading sectors assumed to be at least equal to rates for trading sectors plus CO_2 price	Same as with measures.
EPR, EPA existing buildings	EPR and EPA are not introduced; there are no subsidy programs.	EPA replaced by EU Directive Energy Performance Buildings as of 2006; EPR discontinued.	CO_2 Tender Scheme for Buildings as possible replacement for EPR.
EPN, EPC for new buildings	All building regulations pertaining to energy conservation are repealed after 2000.	Standard for non-residential buildings at current level; standard for residential buildings tightened to 0,8 in 2007.	Same as 'with measures'.
EPR, Energy labelling of appliances	Labelling and EPR both repealed.	Continuation of labelling scheme. EPR repealed.	Same as 'with measures'.
EIA/Vamil other than for CHP and renewables	Tax breaks repealed after 2000.	Tax break continues at current level, about 19% of (additional) investment cost; budget cut by €100 mln; technology criteria equivalent to € 14-70/tonne CO_2.	Same as 'with measures'.
EINP	Repealed after 2000	Repealed as of 2003.	Same as 'with measures'.
CO_2 Reduction Program/ General and Clean Fossil Fuels Program	Programs discontinued after 2000.	Temporary support for selected technologies; criteria equivalent to € 14- 70/tonne CO_2-eq., budget limited	Same as 'with measures'.
Benchmark Covenant and LTA-2	Benchmark Covenant and LTA-2 repealed after 2000	Replaced by emissions trading with continued use of benchmarks as basis for allocation of emission credits	Same as 'with measures'.

Policy Instrument	'Without measures' variant	'With measures' variant	'With additional measures' variant
Environmental Permit and LTA	No energy requirements in environmental permits after 2000.	Remains at current level (all energy measures with IRT>15% must be taken), applies to non-trading companies only.	Same as 'with measures'.
Glami and Orders in Council Greenhouse Horticulture	Glami and Orders in Council repealed after 2000	Orders in Council expire in 2010, thereafter same treatment as environmental permit (all energy measures with IRT>15% must be taken).	Same as 'with measures'.
MEP – renewables and other economic incentive policies (Green Funds, EIA/Vamil)	MEP not introduced. Other economic incentives for renewables repealed as of 20000.	Continuation of current scheme: subsidy for non-economic top of currently defined technologies such that subsidy declines with decreasing costs for renewables; no budget limits. Art. 36i per 1 January 2005 repealed; MEP grows accordingly.	Same as 'with measures'.
MEP – CHP	All incentives for CHP repealed after 2000.	Current scheme continued based on 50% of average non-economic top to extent needed	Same as 'with measures'.
Coal Covenant	No coal covenant signed.	In force until 2012.	Same as 'with measures'.
EU Agreement with car manufacturers	No agreement.	Continuation of current agreements with same target: 140 grams CO_2/km from new cars in 2008/2009.	Same as 'with mesures'.
Energy labelling of cars	Not introduced.	Continuation of current scheme.	Same as 'with measures'.
Tax exemption for hybrid cars	Not included.	Not included.	Hybrid cars exempted from purchase tax.

Policy Instrument	'Without measures' variant	'With measures' variant	'With additional measures' variant
CO_2 differentiation in purchase tax on new cars	Not included.	Not included.	Purchase tax differentiated according to CO_2 emissions as of 1 January 2006.
Kilometer charge	Not included.	No kilometer charge (not implemented or adopted as of 1 December 2004).	Impacts of two price variants estimated.
Other fiscal measures affecting transport sector	Raises in excises since 2000 assumed not to occur.	Continuation of current tax regimes and excise duties	Same as 'with measures'.
Biofuels Directive	Not included.	Not included (not implemented or adopted as of 1 December 2004)	2% biofuels in 2010.
Enhanced enforcement of speed limit	No enhanced enforcement.	As announced.	Same as 'with measures'.
The New Driving Force	Program repealed after 2000.	Exisiting program continued.	Same as 'with measures'.
CO_2 Reduction Program/ Freight Transport	Program not included.	Exisiting projects continued.	Same as 'with measures'.
CO_2 Reduction Progam/ passenger transport	Projects not included.	Existing projects continued.	Same as 'with measures'.
Quieter, Cleaner, More Fuel-Efficient Program	Program repealed after 2000.	Program in place.	Same as 'with measures'.
afterburner HCFC production	Afterburner in place, but improvements after 2000 void.	No further improvements to afterburner assumed.	Same as 'with measures'.
CH_4 gas sector	Covenant repealed after 2000.	Covenant with oil and gas producers continues.	Same as 'with measures'.
CH_4 waste sector	Agreements void after 2000.	Agreement as to amounts and composition of waste to be landfilled in 2010 and 2020 based on National Waste Plan.	Same as 'with measures'.

Policy Instrument	'Without measures' variant	'With measures' variant	'With additional measures' variant
CH_4, N_2O agricultural sector	All measures repealed after 2000.	Ammonia policies, manure policies and Common Agricultural Policy	Same as 'with measures'.
Process adjustments aluminium production	No measures at aluminium plants after 2000.	PFC reduction by means of pointfeeder prebake as of 2005.	Same as 'with measures'.
Catalytic reduction nitric acid production	Not included.	Not included.	Catalytic reduction at nitric acid production plants.
Emission ceiling semi-conductor industry	Measure repealed after 2000	Ceiling continued at current level.	Same as 'with measures'.
EU F-gas regulations	Not included.	Not included. Autonomous improvement in leak control from car airco assumed in scenario's.	Additional impact after 2015.

Annex 5.3 Emissions Projections by scenario, policy variant and year

Historical emissions

The tables below show actual emissions by gas and sector in 1990, 1995 and 2003. The figures are taken from the National Inventory Report 2005. When comparing these figures with the tables containing projections on the following pages, it needs to be borne in mind that the projections were based on the provisional recalculation of historic emission figures as submitted to the European Commission on 15 January 2005. Between January and March, when the recalculations were completed, further improvements were made. Therefore minor differences exist between the figures on 15 January 2005 and the final National Inventory Report 2005.

1995

	Emissions (in Mt CO_2-equivalents)						
Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	62,3	2,1	0,2	-	-	-	64,6
Transport	33,5	0,1	0,5	-	-	-	34,1
Industry	34,8	0,3	8,3	6	1,8	0,3	51,5
Agriculture	8,3	10,1	12,6	-	-	-	31
LUCF	2,7	-	-	-	-	-	2,7
Waste	-	10,8	0,5	-	-	-	11,3
Buildings	30,8	0,4	-	-	-	-	31,2
Other	-	-	0,2	-	-	-	0,2
Total incl. LUCF	172,3	23,8	22,4	6	1,8	0,3	226,7
Total excl. LUCF	**169,7**	**23,8**	**22,4**	**6**	**1,8**	**0,3**	**224**

1990

	Emissions (in Mt CO_2-equivalents)						
Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	53	2,1	0,2	-	-	-	55,3
Transport	30,5	0,1	0,3	-	-	-	30,9
Industry	39,2	0,4	8,5	4,4	2,1	0,2	54,8
Agriculture	8,3	10,3	11,6	-	-	-	30,2
LUCF	2,9	-	-	-	-	-	2,9
Waste	-	12,3	0,5	-	-	-	12,8
Buildings	26,9	0,4	-	-	-	-	27,3
Other	-	-	0,2	-	-	-	0,2
Total incl. LUCF	160,9	25,6	21,3	4,4	2,1	0,2	214,6
Total excl. LUCF	**158**	**25,6**	**21,3**	**4,4**	**2,1**	**0,2**	**211,7**

2003

	Emissions (in Mt CO_2-equivalents)						
Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	68,5	1,2	0,2	-	-	-	69,9
Transport	38,4	0,1	0,5	-	-	-	39
Industry	32,1	0,3	6,7	1,4	1,4	0,3	42,2
Agriculture	7	8,5	9,4	-	-	-	24,9
LUCF	2,8	-	-	-	-	-	2,8
Waste	-	7	0,4	-	-	-	7,4
Buildings	30,8	0,3	-	-	-	-	31,1
Other	-	-	0,1	-	-	-	0,1
Total incl. LUCF	179,6	17,5	17,3	1,4	1,4	0,3	217,6
Total excl. LUCF	**176,9**	**17,5**	**17,3**	**1,4**	**1,4**	**0,3**	**214,8**

Strong Europe, with measures (in Mt CO_2-eq.)

2005

Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	69,3	0,8	0,3				70,4
Transport	38,3		0,5				38,8
Industry	34,3		7	1,9	1	0,3	44,5
Agriculture	7,3	8,5	9,5				25,3
LULUCF	0,5						0,5
Waste	0	6,4	0,3				6,7
Buildings	29		0,1				29,1
Total incl. LULUCF	178,7						215,3
Total excl. LULUCF	**178,2**	**15,7**	**17,7**	**1,9**	**1**	**0,3**	**214,8**

2010

Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	73	0,3	0,3				73,6
Transport	39,7		0,5				40,2
Industry	35,1		7,1	2,5	0,6	0,3	45,6
Agriculture	6,8	8,3	8,9				24
LULUCF	0,4						0,4
Waste	0	4,4	0,3				4,7
Buildings	27,5		0,1				27,6
Total incl. LULUCF	182,5						216,1
Total excl. LULUCF	**182,1**	**13**	**17,2**	**2,5**	**0,6**	**0,3**	**215,7**

2015

Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	78,7	0,3	0,3				79,3
Transport	43,6		0,6				44,2
Industry	35,2		7,2	2,7	0,6	0,2	45,9
Agriculture	6	8,2	8,6				22,8
LULUCF	0,3						0,3
Waste	0	3,3	0,3				3,6
Buildings	26,1		0,1				26,2
Total incl. LULUCF	186,9						222,3
Total excl. LULUCF	**189,6**	**11,8**	**17,1**	**2,7**	**0,6**	**0,2**	**222**

2020

Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	77,3	0,3	0,3				77,9
Transport	47,4		0,7				48,1
Industry	35,4		7,3	2,9	0,7	0,2	46,5
Agriculture	5,6	8	8,2				21,8
LULUCF							0
Waste	0	2,2	0,3				2,5
Buildings	24,8		0,1				24,9
Total incl. LULUCF	n.a.						n.a.
Total excl. LULUCF	**190,5**	**10,5**	**16,9**	**2,9**	**0,7**	**0,2**	**221,7**

Strong Europe, without measures (in Mt CO_2-eq.)

2005

Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	71,6	1,1	0,3				73
Transport	39		0,5				39,5
Industry	35,1		7	4,3	2,1	0,3	48,8
Agriculture	7,4	8,6	9,9				25,9
LULUCF							0
Waste	0	9,4	0,3				9,7
Buildings	29,8		0,1				29,9
Total incl. LULUCF	n.a.						n.a.
Total excl. LULUCF	**182,9**	**19,1**	**18,1**	**4,3**	**2,1**	**0,3**	**226,8**

2010

Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	80,2	0,6	0,3				81,1
Transport	41,1		0,5				41,6
Industry	36,2		7,1	5,4	1,7	0,3	50,7
Agriculture	7,1	8,6	9,5				25,2
LULUCF							0
Waste	0	8,4	0,3				8,7
Buildings	29,3		0,1				29,4
Total incl. LULUCF	n.a.						n.a.
Total excl. LULUCF	**193,9**	**17,6**	**17,8**	**5,4**	**1,7**	**0,3**	**236,7**

2015

Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	94,2	0,6	0,3				95,1
Transport	45		0,6				45,6
Industry	36,3		7,2	5,6	1,7	0,2	51
Agriculture	6,6	8,3	8,9				23,8
LULUCF							0
Waste	0	8,3	0,3				8,6
Buildings	29,1		0,1				29,2
Total incl. LULUCF	n.a.						n.a.
Total excl. LULUCF	**211,2**	**17,2**	**17,4**	**5,6**	**1,7**	**0,2**	**253,3**

2020

Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	97,3	0,6	0,3				98,2
Transport	48,8		0,7				49,5
Industry	37,3		7,3				44,6
Agriculture	6,2	8	8,2	5,8	1,8	0,2	30,2
LULUCF							0
Waste	0	8,2	0,3				8,5
Buildings	29,4						29,4
Total incl. LULUCF	n.a.						n.a.
Total excl. LULUCF	**219**	**16,8**	**16,8**	**5,8**	**1,8**	**0,2**	**260,4**

Strong Europe, with additional measures (in Mt CO_2-eq.)

2005

Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	69,3	0,8	0,3				70,4
Transport	38,3		0,5				38,8
Industry	34,3		3	1,9	1	0,3	40,5
Agriculture	7,3	8,5	9,5				25,3
LULUCF							0
Waste	0	6,4	0,3				6,7
Buildings	28,7		0,1				28,8
Total incl. LULUCF	n.a.						n.a.
Total excl. LULUCF	**177,9**	**15,7**	**13,7**	**1,9**	**1**	**0,3**	**210,5**

2010

Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	73	0,3	0,3				73,6
Transport	38,6		0,5				39,1
Industry	35,1		3,1	2,5	0,6	0,3	41,6
Agriculture	6,8	8,3	8,9				24
LULUCF							0
Waste	0	4,4	0,3				4,7
Buildings	27,2		0,1				27,3
Total incl. LULUCF	n.a.						n.a.
Total excl. LULUCF	**180,7**	**13**	**13,2**	**2,5**	**0,6**	**0,3**	**210,3**

2015

Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	78,7	0,3	0,3				79,3
Transport	42,5		0,6				43,1
Industry	35,2		3,2	2,7	0,6	0,2	41,9
Agriculture	6	8,2	8,6				22,8
LULUCF							0
Waste	0	3,3	0,3				3,6
Buildings	25,8		0,1				25,9
Total incl. LULUCF	n.a.						n.a.
Total excl. LULUCF	**188,2**	**11,8**	**13,1**	**2,7**	**0,6**	**0,2**	**216,6**

2020

Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	77,3	0,3	0,3				77,9
Transport	46,3		0,7				47
Industry	35,4		3,3	2,9	0,7	0,2	42,5
Agriculture	5,6	8	8,2				21,8
LULUCF							0
Waste	0	2,2	0,3				2,5
Buildings	24,5		0,1				24,6
Total incl. LULUCF	n.a.						n.a.
Total excl. LULUCF	**189,1**	**10,5**	**12,9**	**2,9**	**0,7**	**0,2**	**216,3**

NB: as indicated in table 5.4 the effect of additional measures ranges between a maximum and minimum effect. In the tables above the average effect is taken into account.

Global economy, with measures (in Mt CO_2-eq.)

2005

Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	70,1	0,8	0,3				71,2
Transport	38,3		0,5				38,8
Industry	34,4		7,1	1,9	1	0,3	44,7
Agriculture	7,6	8,6	9,5				25,7
LULUCF	0,5						0,5
Waste		6,4	0,3				6,7
Buildings	29,3		0,1				29,4
Total incl. LULUCF	180,2						217
Total excl. LULUCF	**179,7**	**15,8**	**17,8**	**1,9**	**1**	**0,3**	**216,5**

2010

Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	75,5	0,3	0,3				76,1
Transport	39,7		0,5				40,2
Industry	34,6		7,3	2,5	0,6	0,3	45,3
Agriculture	7,7	8,3	9,2				25,2
LULUCF	0,4						0,4
Waste	0	4,4	0,3				4,7
Buildings	28,7						28,7
Total incl. LULUCF	186,6						220,6
Total excl. LULUCF	**186,2**	**13**	**17,6**	**2,5**	**0,6**	**0,3**	**220,2**

2015

Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	79,5	0,2	0,3				80
Transport	43,6		0,6				44,2
Industry	37,3		7,5	2,7	0,7	0,2	48,4
Agriculture	7,5	8,8	9,5				25,8
LULUCF	0,3						0,3
Waste		3,3	0,3				3,6
Buildings	28,1		0,1				28,2
Total incl. LULUCF	196,3						230,5
Total excl. LULUCF	**196**	**12,3**	**18,3**	**2,7**	**0,7**	**0,2**	**230,2**

2020

Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	87,8	0,2	0,3				88,3
Transport	47,4		0,7				48,1
Industry	37,9		7,6	2,9	0,7	0,2	49,3
Agriculture	7,5	9,4	9,8				26,7
LULUCF							0
Waste	0	2,2	0,3				2,5
Buildings	27,7		0,1				27,8
Total incl. LULUCF	n.a.						n.a.
Total excl. LULUCF	**208,3**	**11,8**	**18,8**	**2,9**	**0,7**	**0,2**	**242,7**

Global economy, without measures (in Mt CO_2-eq.)

2005

Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	72,1	1,1	0,3				73,5
Transport	39		0,5				39,5
Industry	35,5		7,1	4,3	2,1	0,3	49,3
Agriculture	7,8	8,7	9,9				26,4
LULUCF							0
Waste	0	9,4	0,3				9,7
Buildings	29,9		0,1				30
Total incl. LULUCF	n.a.						n.a.
Total excl. LULUCF	**184,3**	**19,2**	**18,2**	**4,3**	**2,1**	**0,3**	**228,4**

2010

Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	82,8	0,6	0,3				83,7
Transport	41,1		0,5				41,6
Industry	36,7		7,3	5,4	1,7	0,3	51,4
Agriculture	8,1	8,6	9,8				26,5
LULUCF							
Waste	0	8,4	0,3				8,7
Buildings	30,6		0,1				30,7
Total incl. LULUCF	n.a.						n.a.
Total excl. LULUCF	**199,3**	**17,6**	**18,3**	**5,4**	**1,7**	**0,3**	**242,6**

2015

Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	97,5	0,5	0,3				98,3
Transport	45		0,6				45,6
Industry	38,8		7,5	5,6	1,8	0,2	53,9
Agriculture	8,2	9	9,8				27
LULUCF							0
Waste	0	8,3	0,3				8,6
Buildings	31,5		0,1				31,6
Total incl. LULUCF	n.a.						n.a.
Total excl. LULUCF	**221**	**17,8**	**18,6**	**5,6**	**1,8**	**0,2**	**265**

2020

Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	113,4	0,5	0,3				114,2
Transport	48,8		0,7				49,5
Industry	39,9		7,6	5,8	1,8	0,2	55,3
Agriculture	8,2	9,4	9,8				27,4
LULUCF							0
Waste	0	8,2	0,3				8,5
Buildings	33,1		0,1				33,2
Total incl. LULUCF	n.a.						n.a.
Total excl. LULUCF	**243,4**	**18,1**	**18,8**	**5,8**	**1,8**	**0,2**	**288,1**

Global economy, with additional measures (in Mt CO_2-eq.)

2005

Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	70,1	0,8	0,3				71,2
Transport	38,3		0,5				38,8
Industry	34,4		3,1	1,9	1	0,3	40,7
Agriculture	7,6	8,6	9,5				25,7
LULUCF	0						0
Waste	0	6,4	0,3				6,7
Buildings	29		0,1				29,1
Total incl. LULUCF	n.a.						n.a.
Total excl. LULUCF	**179,4**	**15,8**	**13,8**	**1,9**	**1**	**0,3**	**212,2**

2015

Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	79,5	0,2	0,3				80
Transport	42,5		0,6				43,1
Industry	36,3		3,5	2,7	0,7	0,2	43,4
Agriculture	7,5	8,8	9,5				25,8
LULUCF							0
Waste	0	3,3	0,3				3,6
Buildings	27,8		0,1				27,9
Total incl. LULUCF	n.a.						n.a.
Total excl. LULUCF	**193,6**	**12,4**	**14,2**	**2,7**	**0,7**	**0,2**	**223,8**

2005

Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	75,5	0,3	0,3				76,1
Transport	38,6		0,5				39,1
Industry	34,6		3,3	2,5	0,6	0,3	41,3
Agriculture	7,7	8,3	9,2				25,2
LULUCF							0
Waste	0	4,4	0,3				4,7
Buildings	28,4		0,1				28,5
Total incl. LULUCF	n.a.						n.a.
Total excl. LULUCF	**184,8**	**13**	**13,7**	**2,5**	**0,6**	**0,3**	**214,9**

2020

Sector	CO_2	CH_4	N_2O	HFC	PFC	SF_6	Total
Energy	87,8	0,2	0,3				88,3
Transport	46,3		0,7				47
Industry	37,9		3,6	2,9	0,7	0,2	45,3
Agriculture	7,5	9,4	9,8				26,7
LULUCF							0
Waste	0	2,2	0,3				2,5
Buildings	27,4		0,1				27,5
Total incl. LULUCF	n.a.						n.a.
Total excl. LULUCF	**206,9**	**11,8**	**14,8**	**2,9**	**0,7**	**0,2**	**237,3**

NB: as indicated in table 5.4 the effect of additional measures ranges between a maximum and minimum effect. In the tables above the average effect is taken into account.

Annex 5.4 Emissions projections for international bunkers

Projections of quantities of bunker fuels, in SE scenario, in PJ

Fuel type	2005	2010	2015	2020
Lubricants	6.8	7.2	7.8	8.4
Kerosene	157.9	179.4	190.3	201.2
Marine diesel	77.7	79.4	80.4	81.3
Bunker oil	500.2	527.3	545.2	563.1

Projection of quantitities of bunker fuels, in GE scenario, in PJ

Fuel type	2005	2010	2015	2020
Lubricants	7.1	7.9	8.9	9.9
Kerosene	157.9	179.4	190.3	201.2
Marine diesel	77.7	79.4	80.4	81.3
Bunker oil	524.7	576.2	624.2	672.2

Projections of CO_2 emissions from bunker fuels, SE scenario, in Mtonnes

Fuel type	2005	2010	2015	2020
Lubricants	0.5	0.5	0.6	0.6
Kerosene	11.2	12.8	13.6	14.4
Marine diesel	5.8	5.9	6.0	6.0
Bunker oil	38.7	40.8	42.2	43.6

Projections of CO_2 emissions from bunker fuels, GE scenario, in Mtonnes

Fuel type	2005	2010	2015	2020
Lubricants	0.6	0.6	0.7	0.7
Kerosene	11.2	12.8	13.6	14.4
Marine diesel	5.8	5.9	6.0	6.0
Bunker oil	40.6	44.6	48.3	52.0

Annex 7.1
Description of selected projects and programmes

that promote(d) practicable steps to facilitate and/or finance the transfer of, or access to, environmentally-sound technologies.

a)

Project / programme title

Co-operative Programme on Water and Climate: Bridging Water & Climate for Development.

Purpose

The CPWC seeks to encourage more co-ordinated action between the climate science, water resources and disaster relief communities.

Recipient country Global

Sector Water management

Total funding € 0.5 million

Year in operation 2004-2008

Description

The CPWC includes a major capacity development component, providing technical assistance, supportive research and appropriate training/skills development. The activities also cover awareness raising, and the exchange of knowledge, experience and best practices. The sub-programmes Dialogue on Water and Climate in Small Valleys in Central America aim 'to identify a priority list for technical assistance and technology transfer activities for local stockholders'.

Indicate factors which led to project's success

Programme is still on-going.

Technology transferred

To be identified.

Impact on greenhouse gas emission/sinks (optional)

-

b)

Project / programme title

BIGUSE (Biomass Gasification Unit for Sustainable Energy).

Purpose

Fuel switching from diesel to biomass by using locally available nutshells.

Recipient country Bolivia

Sector Energy

Total funding € 1.5 Million

Year in operation 2004-2006

Description

Tahuamanu, a Bolivian company, operates a Brazil-nut crushing plant in the city of Cobija (Pando province) close to the Brazilian border in the north of Bolivia. Presently, the plant runs on electricity supplied by ENDE, one of the national energy companies. Due to the low population density and large distances between villages, the Bolivian electricity grid is not interconnected. Therefore, power for the plant is generated locally with diesel engines. Trucks transport the necessary fuel over 1,100 km at a very high cost. The national government has subsidised the diesel price (up to 60 percent) for years, limiting the effect of the high cost for the consumers. However, this subsidy will gradually be reduced to zero in 2008.

The project envisages the generation of electrical energy by using locally available biomass (nutshells resulting from the crushing process). The technology applied is based on biomass gasification, followed by gas cleansing and combustion in a gas motor, which is linked to a power generator. The envisaged electrical capacity is 800 kW, based on two modules of 400 kW.

The nutshell waste, which is available in large quantities, is an excellent fuel with a high heating value. In the end, as generating capacity is increased, other sources of biomass available in the region will be utilised.

A joint venture between Tahuamanu and HABO, a Dutch company specialised in the gasification of biomass and energy generation, implemented the project.

Indicate factors which led to project's success

-

Technology transferred

Biomass gasification and combustion technologies.

Impact on greenhouse gas emission/sinks (optional)

-

c)

Project / programme title

Introduction of energy-efficient mobile cascade boiler systems for heating purposes.

Purpose

Installation of mobile cascade boiler systems.

Recipient country Russian Federation

Sector Industry

Total funding € 611,000

Year in operation 2003-2004

Description

The project aims at transferring new energy-efficient heating technology to ZAO SEZ Energo, allowing the company to start the installation, assembly and licensed production of the

mobile cascade boiler systems. This project enables Russian organisations to consume decentralised, variable, tailor-made quantities of heating and hot water by using the mobile cascade boiler system developed by Gasunie Research. The mobile cascade boiler system is a complete mobile boiler house built in one or more containers and providing simple measures for meeting space heating and hot water needs. The project foresees the installation of two demonstration cascade mobile boiler units. Essent Van Loenen Energy will build the components for the cascade systems that can be assembled by ZAO SEZ Energo. Gasunie Research will play an important role in the technical implementation of the project and in transferring its knowledge on the actual application of the cascade systems and the software for design, calculation and control strategy. Together with a Russian partner, Lighthouse will establish a company that provides sales of the cascade boiler systems produced.

Indicate factors which led to project's success

-

Technology transferred

Mobile cascade boiler systems.

Impact on greenhouse gas emission/sinks (optional)

-

d)

Project / programme title

Efficient production of charcoal in Russia for industrial and domestic applications.

Purpose

Introduction of efficient charcoal production technologies.

Recipient country Russian Federation

Sector Environment

Total funding € 780,000

Year in operation 2003-2004

Description

The project aims at using wood residue from the Russian forestry industry for the production of charcoal for industrial and domestic applications. Charcoal production is a viable option for efficient use of forestry residues - Dutch conversion technologies are considered to be among the most efficient currently available. At present, charcoal is mainly used for domestic applications (barbecue). If the quantity of supply is sufficient, Dutch power companies are very much interested in replacing hard coal by charcoal, in order to meet emission reduction targets. For local industries, charcoal could be an alternative for hard coal in metallurgical industries and as an input for activated carbon production. Lescom LTD is a forestry company with several branches in the north-western region of the Russian Federation. The charcoal plant will be realised near an existing wood terminal in the port of Ustluga.

There are substantial environmental benefits involved because applying this technology provides for a reduction of wood waste, a prevention of detrimental emissions to the air compared to the current burning of woodchips or wood waste, and a highly energy-efficient and clean way of producing charcoal. When used as an alternative for charcoal there is also a reduction of emissions to the air and use of non-renewable sources of energy. Various studies over the last decades have acknowledged that these environmental benefits easily surpass the detrimental effects of transportation.

Indicate factors which led to project's success

-

Technology transferred

Conversion technologies for charcoal production.

Impact on greenhouse gas emission/sinks (optional)

-

e)

Project / programme title

Ghana: implementation of 'PV Connection' Programme.

Purpose

To provide training and capacity building for construction and use of PV systems to furnish local energy markets.

Recipient country Ghana

Sector Residential/small-scale industry

Total funding € 730,000

Year in operation 2001-2005

Description

This project seeks to contribute to the availability of alternative, sustainable energy sources on a commercial basis in support of the energy supply infrastructure in the rural regions in Ghana. The project provides for the establishment of a Ghanaian company, which is to furnish the local solar energy market with sustainable energy technology as well as ensuring training and transfer of knowledge of the construction and use of solar panels. The project aims to

provide electricity to the rural Greater Accra region. The project activities comprise the incorporation of a joint venture between the Dutch and Ghanaian partners and the establishment of a distribution, sales, after sales and maintenance network, plus the introduction of an attractive financial system for solar energy users. Assembly and components are to be sourced locally.

Indicate factors which led to project's success

-

Technology transferred

Knowledge of construction and use of solar panels.

Impact on greenhouse gas emission/sinks (optional)

-

f)

Project / programme title

Umema Jua Solar PV.

Purpose

To improve the distribution network and services for the PV market in Dar es Salaam.

Recipient country Tanzania

Sector Residential/ Small-scale industry

Total funding € 621,000

Year in operation 2001-2004

Description

The joint venture company Umema Jua will be established as part of the project. The activities of the joint venture will consist of assembling solar energy systems in Dar es Salaam from imported and locally produced equipment. Furthermore, a dealers' selling and service network will be started up to promote and repair solar systems. The dealers, local sellers and those responsible for providing repair and support service will be trained and supported in starting up their business. The project will facilitate the start-up of local credit facilities in the field of solar energy. The activities within the project scope will be focused on five regions in Tanzania. The joint venture will create employment for six people, the dealer and service network for twenty people.

This project has been completed successfully.

Indicate factors which led to project's success

-

Technology transferred

Solar home technology.

Impact on greenhouse gas emission/sinks (optional)

-

g)

Project / programme title

Production of low-cost biomass-fuelled boiler systems for application in public buildings and block heating in Bulgaria.

Purpose

To develop and introduce a small biomass-fuelled boiler system in Bulgaria for the heating of public buildings and block heating.

Recipient country Bulgaria

Sector Built environment

Total funding € 347,000

Year in operation 2003-2005

Description

The objective of the project is to develop and introduce a small (100-500 kWth), low-cost, widely applicable biomass-fuelled boiler system in Bulgaria for the heating of public buildings (hospitals, schools, etc.) and block heating (apartment blocks, hotels, etc.). These boilers will replace existing inefficient, polluting and outdated fossil-fuelled boilers at these locations.

The boiler systems (based on Dutch technology) will be produced in Bulgaria by a Dutch-Bulgarian production joint venture. The joint venture partners are Dutch boiler manufacturer KARA and Bulgarian heating system manufacturer ERATO. The two companies will establish a boiler production facility in Bulgaria. KARA will supply the product and production technology while ERATO will supply personnel and organisational support. In addition, KARA will provide technical assistance and training for the joint venture production personnel.

A pilot project will be implemented at the 'Ivan Skenderov' hospital in Gotse Delchev, in south-western Bulgaria. The hospital currently uses oil for space and water heating, which will partly be replaced by biomass. The required biomass will be supplied by sawmills and forestry companies in the vicinity of Gotse Delchev.

Indicate factors which led to project's success

-

Technology transferred

Low-cost, widely applicable biomass-fuelled boiler system.

Impact on greenhouse gas emission/sinks (optional)

-

h)

Project / programme title

Promotion of Rural Renewable Energy in Western China (RRE).

Purpose

To promote the comprehensive development and utilisation of renewable energy in western China's countryside.

Recipient country China

Sector Agricultural

Total funding € 5.3 million

Year in operation 2003-2007

Description

The project, sponsored by the China Association of Rural Energy Industry (CAREI), received an investment of EUR 5.3 million from the Dutch government and 5.4 million yuan (EUR .52 million) of subsidiary funds from the Chinese Ministry of Agriculture. The project is to comprehensively develop and utilise the area's renewable energy sources, including solar energy, wind power, hydroelectricity and terrestrial heat; to expand the utilisation scale; to raise management standards; to improve consumer energy structures; to establish a sustainable development and utilisation system of consumer energy suitable for rural people living in different areas; and to promote the realisation of the goals of the western region development strategy. This will be achieved through capacity building, demonstration projects, technology transfer and dissemination of project results in nearby provinces.

Indicate factors which led to project's success

Project is still ongoing.

Technology transferred

Renewable energy technologies (wind, solar, biomass).

Impact on greenhouse gas emission/sinks (optional)

-

Annex 8.1 Global climate observation system

A. General approach to systematic observation[1]

In the Netherlands, various institutions actively participate in national and international programmes on climate-related monitoring. An integrated national programme combining the activities of atmospheric, oceanographic and terrestrial oriented institutes is under development, for which the GCOS Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC is seen as guidance. The development of this programme is co-ordinated by the Royal Netherlands Meteorological Institute (KNMI), building on an earlier national study and recommendations.

In 1998, an authoritative national study (NIMM) was undertaken, evaluating the Netherlands' contribution to international monitoring systems (An English summary is available at the KNMI's *nlgcos* website). This report deals with five areas for monitoring activities (oceans, coast & delta, land, weather & climate and atmospheric composition). Amongst the findings of the study is the strong recommendation to strive for integrated approaches at a national level, in accordance with IGOS. To that effect, it was proposed to designate national focal points for GCOS, GOOS and GTOS. As from the year 2000, the KNMI acts as focal point for GCOS in the Netherlands. The NIMM study recommends substantial strengthening of climate-related monitoring, requiring investments and organisational structuring.

The GCOS requirements are being met by the Netherlands. The GCOS monitoring principles and best practices are known at the professional level and are taken into account. Free data exchange is encouraged, within the limits of international regulations (such as the ECOMET rules).

Monitoring activities in the Netherlands are embedded in international programmes such as framework programmes on European level and GEOSS on global level. Also on project level we see international cooperation. With regard to Earth Observation, contributions are made to e.g. ESA, EUMETSAT and NASA missions and data retrieval methods. Data are exchanged internationally, and submitted to numerous databases around the world. Overall guidance is provided by e.g. GCOS and WCRP, while contributions are regularly made to help optimise these programmes. Capacity building activities, related to GCOS, do take place frequently, on a project level

The Netherlands actively participates in GMES and GEOSS.

B. Meteorological and atmospheric observation

Network atmospheric observing systems (table S1)
Presently the KNMI operates a network of 36 ground observational stations (Area Netherlands) of which the hourly values of almost all listed elements of Appendix S1 (Land surface) are archived. Having long observational periods (> 30yrs), a subset of 15 stations in this network is considered suitable for climate monitoring. One station is a GCOS-GSN station (De Bilt: 06260), five stations are Climate Reporting stations (De Bilt: 06260 >= 1906, De Kooy: 06235 >= 1972, Eelde: 06280 >= 1947, Vlissingen: 06310 >= 1907 and Beek: 06380 >= 1947)[2]. The monthly time series of these 5 stations are reported to GHSN (Global Historical Station Network).

In addition to this network, the KNMI operates some 325 climatological precipitation stations giving daily records of the sum of the precipitation (rain 08.00 - 08.00 UT). Some 220 of these stations have long observational periods (> 30 years) and are suitable for climate monitoring. The monthly sums from 100 of these stations are reported periodically to GPCC (Global Precipitation Climatology Centre, DWD).

Cabauw Observatory
Observational programmes have been carried out at Cabauw Observatory since 1973. In-situ measurements of profiles of basic atmospheric parameters along a 213 m high tower and on the field around the tower were complemented with remote-sensing measurements in later years. In many periods, measurements of surface fluxes were also carried out. A continuous data set since 1973 is not available due to interruptions caused by renovations, and because special research was carried out at certain times. Quality-controlled data sets are available for several periods, the first one being1977/78. A long-term profile and surface flux measurement programme was run from 1986-1997, of which a

1 For questions concerning this report or national GCOS matters in general contact nlgcos@knmi.nl
2 (Note >= yyyy = indicates the first year digitised hourly data are available).

detailed homogeneous data set was prepared. These data found their way in the literature and were also used by the operational weather service of the KNMI. During 1998 and 1999, test measurements were performed at the 80m level of the meteorological tower to judge performance of the new operational instruments in the tower necessary for a complete renovation of the instruments.

The presently implemented observational programme includes the measurement of profiles of wind speed, wind direction, temperature and dew point temperature at the 200m, 140m, 80m, 40m, 20m, 10m and 1.5m levels. At the 1.5 m level only temperature and dew point temperatures are observed. Also measured are amount of precipitation, surface pressure, in- and outgoing short-wave radiation and in- and outgoing long-wave radiation. Wind profiler RASS measurements of wind speed and direction and virtual temperature in the atmospheric boundary layer (depending on atmospheric conditions) are continuously available. Cloud base height measurements are routinely measured by a lidar ceilometer.

Cabauw is currently being developed as a national site for atmospheric research. In May 2002, seven national institutes and universities joined in this venture, named CESAR (Cabauw Experimental Site for Atmospheric Research). The main goal is 'to set-up and operate at the Cabauw site an observational facility with a comprehensive set of remote sensing and in situ equipment for the long-term characterisation of the state of the atmosphere, its radiative properties and interaction with the land surface, for the study of physical processes, climate monitoring and validation studies'. Since 2001, there is a continuous cloud dataset deriving from cloud radar / cloud lidar with occasional long periods of cloud liquid water from microwave radiometry. The construction of a Baseline Surface Radiation Network site is now complete and Cabauw has been registered a candidate BSRN site, pending approval as a fully operational BSRN-site in the second half of 2005. In 2005, substantial funding was acquired from the Dutch 'Climate Changes Environment' programme for improvement of the CESAR infrastructure with state-of-the-art monitoring facilities, with emphasis on strengthening the atmospheric profiling capabilities. A Raman lidar is being constructed, and from 2006 onwards a microwave profiler will allow for the continuous observations of temperature, humidity and liquid water profiles above Cabauw with a resolution of less than a minute. Aerosol optical thickness observations have now started using two different instruments. Cabauw is part of Aerosol Robotic Network (AERONET) and European Aerosol Research Lidar Network (EARLINET). Plans are underway embedding Cabauw in the national network of PM-10 measurements, which is run by RIVM. CESAR will be one of the anchor stations for climate monitoring and satellite validation in Europe *(http://www.cesar-observatory.nl).*

Available homogeneous data sets (table S2)
All hourly climatic data (and its aggregations - daily, monthly) are available for the community. (For terms and specifications see the KNMI catalogue at *(http://www.knmi.nl/product/catalogus/)*. The majority of the data archived have been thoroughly quality controlled. The level of homogeneity of derived time series has not always been assessed. Assessments of quality and other meta-data of the observational series of precipitation, sunshine and radiation and wind are given in a series Klimaat van Nederland' (Climate in the Netherlands), Vol. 1, 2, 3 edited by the KNMI (Dutch Language).

The KNMI HYDRA wind data set contains the homogenised hourly time series of potential wind speed and wind direction of 45 Dutch stations for the 1949-2003 period. For freely accessible and downloadable from the Internet, see: *http://www.knmi.nl/samenw/hydra*

Within the framework of the EUMETNET ECSN programme, the ECA&D project (European Climate Assessment and Dataset, the KNMI as responsible member) operates a website, database and tools for statistical analyses and quality control. The website serves as a communication platform for the ECSN members, as well as providing access to data and analyses of about 3,000 long-term (40 years) daily time series of temperature, surface air pressure and precipitation amount covering Europe (area VI) and the Mediterranean. See *http://eca.knmi.nl/.*

The KNMI Climate Explorer *(http://climexp.knmi.nl/)* gives access to a global data set of monthly time series of temperature, precipitation and air pressure.

The following historical data[3] sets are available on special request in digitised format:

- daily instrument readings of temperature, air pressure, wind speed, wind direction and state of the sky from 11 observational locations in the Netherlands, timespan 1706-1860;
- LCT, the Low Countries temperature series: seasonal and annual temperatures for Central Holland, period 800 AD-present.

RIVM has acquired a time series of automatically lidar-inferred boundary layer heights and cloud base statistics from 1993 to 2001 in Bilthoven, the Netherlands. In 2001, the lidar system was relocated to Cabauw , resuming the boundary layer height measurement scheme in 2002.

Satellite Application Facility on Climate Monitoring

In order to optimise the use of Meteosat Second Generation (MSG), the new series of European geostationary meteorological satellites, EUMETSAT has funded 6 Satellite Application Facilities (SAF) for the development of applications. The Climate Monitoring SAF is a co-operation of eight institutes that work on retrieving parameters from MSG that are relevant to the climate research community. The main topics are radiation components, cloud properties, humidity fields and sea state. The KNMI contributes with its expertise in quantitative cloud analysis, which is used to improve and validate retrievals of physical cloud parameters from MSG and the polar orbiting meteorological satellites AVHRR and METOP. The following physical cloud properties are retrieved: presence, temperature, height, optical thickness, liquid water path and thermodynamic phase. Reference data for validation are obtained from intensive measurement campaigns such as CLARA96, CLIWANET and the Baltex Bridge Campaign (BBC and BBC2).

The CM-SAF focuses exclusively on parameters that are relevant to the hydrological cycle. It has been recognised that many of the other SAFs also produce parameters highly relevant for climate monitoring purposes. These parameters include ozone, methane concentration, long-term observations of other chemical constituents, aerosols, humidity and surface characteristics. It is expected, therefore, that these parameters from SAFs other than the CM-SAF will soon be embedded in climate monitoring data streams. The KNMI participates in SAFs other than the CM-SAF so that its involvement in securing data streams for climate monitoring purposes exceeds those confined to the CM-SAF.

New Passive Imager Design

The KNMI is involved in the design of a new passive imager. ESA is planning new generations of satellite platforms for meteorological and research use. Each platform has a passive visual and infrared imager. Images obtained by this instrument are currently used during the weather forecast to illustrate current and past weather. The new generation of passive imagers is to provide more *quantitative* information on the state of the atmosphere and underlying surface. Quantitative analysis enables new applications in land use, agriculture, oceanography, etc. The KNMI was asked to contribute to the design of this new generation of passive imagers in order to optimise it for use in climate research and meteorology. The KNMI focuses on quantitative cloud analysis and aerosols.

Atmospheric constituents observing systems for climate

The reader is referred to table S5 for more information.

Ground-based measurements of ozone

The KNMI operates two ozone stations: De Bilt in the Netherlands and Paramaribo in Surinam. Paramaribo is an excellently situated station for gaining more knowledge on the role of the tropics in chemistry-climate coupling and for validation of satellite data. Both stations have a Brewer instrument that continuously measures the ozone columns and the UV spectrum. Ozone soundings are performed once per week. All data are submitted to the WOUDC (World Ozone and UV Data Centre, part of WMO) and contained in the GAW programme. The ozone sondes of both stations are part of the NDSC (Network of Detection of Stratospheric Change).

- Measurements Brewer De Bilt since 1-1-1994
- Measurements ozone sondes De Bilt since end 1992
- Measurements Brewer Paramaribo since 1-4-1999
- Measurements ozone sondes Paramaribo since 1-9-1999

3 Apply to: KNMI, Climatological Services, PO Box 201, 3730 AE De Bilt (the Netherlands).
More information concerning historical data sets can be found on:
http://www.knmi.nl/onderzk/hisklim/intro-en.html

All these measurements have adequate (standard) procedures for quality control.

Satellite measurements of ozone and other gases
The satellite measurements of ozone and other gases in which the KNMI and SRON and RIVM are involved are mostly not national property. The KNMI is involved in the following fields, related to climate and air-quality monitoring:

- principle Investigator of the Dutch-Finnish satellite instrument OMI. OMI was launched on NASA's EOS-AURA mission in July 2004. OMI measures ozone and several other trace gases important for climate and air quality. The KNMI is responsible for a number of tasks concerning OMI, including algorithm development, processing, instrument monitoring and validation;
- partner in the Satellite Application Facility on Ozone Monitoring (O3MSAF). This SAF is responsible for the development, processing and validation of atmospheric constituent measurements of instruments on the EUMETSAT METOP missions, in particular the GOME-2 instrument. The KNMI is responsible for the ozone profile and aerosol products and data assimilation analyses;
- the KNMI co-ordinates the international effort of the validation of SCIAMACHY products. SCIAMACHY is a Dutch-German-Belgian instrument on board ENVISAT (launched in March 2002) aimed at trace gas measurements in the stratosphere and troposphere, including greenhouse gases and ozone;
- definition of user and mission requirements for a new (GMES) mission on climate and environmental monitoring: CAPACITY study for ESA;
- the TRAQ satellite mission proposal for the ESA "Call for new missions in 2005". TRAQ aims primarily at air pollution, but is relevant for climate as well;
- the GMES Service Element (GSE) (PROMOTE). PROMOTE develops services on ozone, air quality, UV and greenhouse gases aiding public authorities in their tasks concerning policies on environmental protection and providing information to citizens in Europe. The KNMI leads the current consolidation phase (2005) in which more than 35 European partners co-operate, including more than ten national environmental agencies. The forerunner ESA project called TEMIS is more limited in scope but remains an important source of daily information on ozone and air quality as observed from satellite;
- the EU FP6 Integrated Project GEMS, led by ECMWF, is developing a new European operational system for operational global monitoring of atmospheric chemistry and dynamics and an operational system to produce improved medium-range and short-range air-chemistry forecasts, through much improved exploitation of satellite data. The KNMI develops data assimilation systems for GEMS and leads the validation task;
- integration of air quality measurement from satellite and ground in co-operation with RIVM. The objective is to produce more complete and more accurate descriptions of the distribution of health-related air pollutants in the Netherlands and neighbouring countries, both on a daily basis (air quality forecasts) and to construct historical records. Optimal use of air quality models and measurements from space and the ground is sought.

A cross-cutting aim of the activities listed above is the construction of long-term homogeneous data sets on atmospheric gases relevant for climate and air quality using data from multiple satellite instruments and data assimilation methods. Validation using ground-based measurement is a vital component in this context to ensure the appropriate quality.

Ground-based measurements, other air pollution components
The Laboratory for Environmental Monitoring of the National Institute of Public Health and the Environment (RIVM - the Netherlands) operates the Dutch National Air Quality Monitoring Network (LML) to monitor ambient air quality and to supervise implementation of air quality standards. The LML programme includes the following components (between brackets the number of monitoring locations):

- gaseous components: carbon monoxide (23), ozone (38), nitrogen oxides (46), sulphur dioxide (37), ammonia (8), Volatile Organic Components C6 - C16 (9), Fluorides (5);
- particulate matter: fine dust PM10 (19), Black Smoke (15), acidifying aerosols (ammonium, chloride, nitrate, sulphate) (7), aerosol bound heavy metals (arsenic, cadmium, lead, zinc) (4);
- chemical composition of wet precipitation (acidifying components, heavy metals) (15).

The results are available from *www.lml.rivm.nl* and other sources.
Moreover, within the framework of the UN-ECE EMEP programme and OSPARCOM, the following area is also monitored (at 1 location):

- Very Volatile Organic Components C2 - C6;
- the chemical composition of wet precipitation (mercury, lindane, daily values of acidifying components).

Ground-based measurements, greenhouse gases
Within the framework of the Dutch National Air Quality Monitoring Network (LML), the (greenhouse) gases carbon monoxide, carbon dioxide and methane are continuously followed at one location. The results are reported as part of the GAW programme.

ECN has monitored greenhouse gas concentrations on the Cabauw tower since 1992. The first continuous record is from 1992-1997. During this period, concentrations of CO_2 were measured at several levels of the tower (continuous, NDIR). CH_4 concentrations were observed at 200 m AGL (continuous, GC). In the second period from 2000-2004, ECN measured CO_2, CH_4 and N_2O concentrations at 4 levels (continuous, NDIR, GC). Measurements were stopped in May 2004 and were continued using new equipment in November 2004 and will continue at least until 2009, measuring CO_2, CH_4, N_2O, CO (continuous, GC) at 4 levels according to the WMO-GAW precision targets. Starting late 2005, 222 Rn (Ansto), and HFCs and HCFCs (continuous, GC/MS) will also be monitored at 200 m AGL.

Measurements were and are embedded in national and international research projects such as NRP, FP4, FP5, CarboEurope IP, CESAR and BSIK KvR ME-2. Calibration is performed against NOAA standards.

Remote Sensing measurements of Ozone
The Laboratory for Environmental Monitoring of the National Institute of Public Health and the Environment (RIVM - the Netherlands) operates a differential absorption lidar (DIAL) system for the vertical profiling of ozone up to the stratosphere (50 km). The DIAL system is located in New Zealand as part of the NDSC (Network of Detection of Stratospheric Change). Bilthoven operates a lidar system for profiling tropospheric ozone (1 - 15 km) within the framework of Eurotrac-TOR. (At present, no regular measurements are performed due to a lack of funding).

Climate-relevant aerosol
In 2002, from 21 June to 20 August, ECN monitored the composition of the aerosols in the climate-relevant submicron size-ranges at 200 m AGL at Cabauw.

Remote Sensing measurements of Aerosols
Recently, RIVM started the development of CAELI, a water vapour, aerosol and cloud Raman lidar system (1 - 10 km) to explore the relevance for climatic change. This system is due to be operational by the end of 2006 and will have its home-base at CESAR.
The KNMI, TNO and ECN are a few of the parties involved.

Table 1. Participation in the global atmospheric observing systems

	GSN	GUAN	GAW	GHSN
How many stations are the responsibility of the Party?	1		2	5
How many of those are operating now?	1			
How many of those are operating to GCOS standards now?	1			
How many are expected to be operating in 2005?	5			
How many are providing data to international data centres now?	1		2	

Table S1. Atmospheric observing systems for climate at the land surface (meteorological land surface observations)

Systems	Climate Parameters* (e.g. Temp, Precip, other)	Total # Stations	Appropriate for Characterising National Climate? (tick one box) Fully	Partly	No	Time Series # stations/platforms (# Data Digitized) 30-50y	50-100y	>100y	Adequate Quality Control Procedures? (tick one box) Fully	Partly	No	Metadata available Total # Stations (% Digitised)	Continuity # expected operational in 2005
Stations Useful for National Climate Monitoring Purposes (Specify parameters observed*)	All params given in appendix 3	36		X		10(10)	5(5)			X		15 (10%) which means that approx. 10% of the available metadata is digitised	14
	Daily 08-08 hr. UT precipitation sum	325		X		180(180)	40(40)			X		325 (10%) see above	325
Stations Reporting Internationally	100 08-08 precipitation stations and 5 climate reporting stations)	105				105 (105)				X			105
CLIMAT Reporting Stations		5					5(5)			X			5
Reference Climate Stations													

* Refer to Appendix S1 for a list of possible climate parameters

Table S2. Available homogeneous data sets for meteorological land surface observations

Data Set Name	Climate Parameters	# Stations or Grid Resolution and Region covered	Time Period	References
KIS	All elements from Appendix S1	15, the Netherlands	1900-present	*http://www.knmi.nl/product/catalogus/* KNMI-Climatological Services, PO Box 201, 3730 AE De Bilt, the Netherlands
HYDRA	Hourly wind speed and wind direction	45, the Netherlands	1949-2003	*http://www.knmi.nl/samenw/hydra* KNMI-Climatological Services, PO Box 201, 3730 AE De Bilt, the Netherlands
Climate Explorer	Monthly temperature, precipitation and air pressure	Global	1900-present	*http://climexp.knmi.nl/*
ECAD	Daily temperature and precipitation indices	150, RAVI	1900-present	http://eca.knmi.nl
LCT	Seasonal and annual temperatures Central Holland	1	AD 800-present	KNMI-Climatological Services, PO Box 201, 3730 AE De Bilt, the Netherlands
HWW	Daily clock readings of temperature, air pressure, wind speed, wind direction, state of the sky	11	1706-1854	KNMI-Climatological Services, PO Box 201, 3730 AE De Bilt, the Netherlands

Table S3. Atmospheric observing systems for climate above the surface (meteorological upper air observations)

Systems Useful for National Climate Monitoring Purposes	Total # Stations or platforms	Appropriate for Characterising National Climate? (tick one box)			Time Series # stations/platforms (# Data Digitised)				Adequate Quality Control Procedures? (tick one box)			Metadata available	Continuity
		Fully	Partly	No	5-10y	10-30y	30-50y	>50y	Fully	Partly	No	Total # Stations (% Digitised)	# expected operational in 2005
Radiosonde stations	1		X			1 (1)				X		1(10%)	0
Wind-only stations	7		X										
Stations reporting Internationally													105
CLIMAT TEMP reporting stations	1					1(1)				x			0
ASAP stations													
Profilers*	1					1			X			1 (100%)	1
Aircraft (land locations)*													
GPS*	5				5				X			5 (100%)	5
Others (e.g. satellite-based)*													
Meteorological tower	1	X				1 (1)			X			1(20%)	1
Total Upper Air Network													

* Specify parameters monitored

Table S4. Available homogeneous data sets for meteorological upper air observations

Data Set Name	Climate Parameter	# Stations or Grid Resolution and Region covered	Time Period	References
See comments S1 and S2				
Radiosonde	wind, temp., hum.	De Bilt 06260	from 1961	
Cabauw Observatory	see text	Cabauw 06348	start 1973	

Table S5. Atmospheric constituent observing systems for climate

Constituent	Total # Stations or platforms	Appropriate for Characterising National Climate? (tick one box)			Time Series # stations/platforms (# Data Digitised)				Adequate Quality Control Procedures? (tick one box)			Metadata available Total # Stations (% Digitised)	Continuity # expected operational in 2005
		Fully	Partly	No	10-20y	20-30y	30-50y	>50y	Fully	Partly	No		
Carbon dioxide	1		X		< 10 y				X			yes	yes
Ozone (surface)	38	X				X			X			yes	yes
Ozone (column)	1	X			< 10 y				X			yes	yes
Ozone (profile)	2		X		approx. 10 y				X			yes	yes
Atmospheric Water Vapour	Under development								X			yes	yes
Other Greenhouse Gases	CH4 : 1 CO : 1		X X		< 10 y < 10 y				X X			yes yes	yes yes
Aerosols	3		X		< 10 y				X			yes	yes
Other	NOx : 45 CO : 23	X X				X X			X X			yes yes	yes yes

Table S6. Available homogeneous data sets for atmospheric constituents

Name	Constituent	# Stations or Grid Resolution and Region covered	Time Period	References
see comments S5	Carbon dioxide			
	Ozone			
	Water Vapour			
	Other Greenhouse Gases			

C. Oceanographic observations

NIOZ contributions to GOOS

The Royal Netherlands Institute for Sea Research (NIOZ) is actively involved in a number of research programmes that contribute to the GOOS objectives.

Monitoring of ocean currents and properties is performed in the framework of the Dutch contribution to CLIVAR. These activities are funded partly by the Netherlands Organisation for Scientific Research (NOW) and are carried out in close collaboration with IMAU (Utrecht University) and the KNMI. Present activities include:

- the Clivarnet Atlantic Monitoring Programme (CAMP) in which a former WOCE hydrographical section (AR7E, Ireland - Greenland) is monitored bi-annually (2004, 2006, 2008) by NIOZ. Observations include various 'standard' properties like salinity, temperature, nutrients, oxygen, CO_2;
- the Long-Term Ocean Climate Observations programme (LOCO) with profiling moorings (currents, temperature, salinity) in the North Atlantic ocean (Irminger Sea) and an array of current meter moorings (and temperature, salinity sensors) in the Mozambique Channel in the Indian Ocean. The LOCO programme runs from 2003 until 2008.

Apart from these ocean-going observational programmes, NIOZ performs long-term observations in the Dutch coastal zone and the Wadden Sea which contribute to the GOOS objectives. These long-term time series include:

- temperature and salinity observations in Marsdiep tidal inlet, since 1860;
- currents in Marsdiep tidal inlet, ferry observations since 1998;
- macrofauna on tidal flats in the Wadden Sea, yearly since 1970;
- phytoplankton in Marsdiep tidal inlet, weekly since 1970.

Rijkswaterstaat RIKZ contributions to GOOS

The Rijkswaterstaat - National Institute for Coastal and Marine Management (RWS-RIKZ) is actively involved in a number of National, EuroGOOS and other activities that contribute to the GOOS objectives.

Table 2. Participation in the global oceanographic observing systems

	VOS	SOOP	TIDE GAUGES	SFC DRIFTERS	SUB-SFC FLOATS	MOORED BUOYS	ASAP
For how many platforms is the Party responsible?	200		19		3 (KNMI)	10	
How many are providing data to international data centres?	200		5			10	
How many are expected to be operating in 2005?	200		19			10	

Note: See appendix 1 for explanation of acronyms
Note 1: Estuaries (Wadden Sea, Scheldt River, etc.) not included
Note 2: The international data centre is the Permanent Service for Mean Sea Level

National:
There is a National Monitoring Programme for physical, biological and chemical parameters. As part of that programme a real-time monitoring network of quality controlled tide gauges, wave buoys and a sea temperature station along the coast and on open sea is maintained. Some information has been delivered for years to international services as PSML and ESEAS and is also reported to ICES and OSPAR. None of these points are part of the GLOSS network at this moment. All the Rijkswaterstaat marine monitoring and project data are stored in a historical national database, called WADI (formerly DONAR)

As partner of the National Oceanographic Data Commission (NODC) RIKZ plays a role in realising a national (virtual) infrastructure (national portal) for marine data in the Dutch part of the North Sea. The NODC is a formal member of the IODE working group of IOC.

On national level there is a national board for issues that are related to GMES and INSPIRE. In close cooperation with the KNMI, RIKZ contributes to the national IPCC activities and is involved in the development of scenarios for accelerated sea level rise and storm surge changes patters due to climate change

International:
As member of EuroGOOS, RIKZ has been very active in providing operational oceanographic products and services and promoting cooperation and co-production in this field. Within EuroGOOS, RIKZ has played a partner role within the FP6 EDIOS project (European Directory of Initial Observing Systems); they were responsible for the Future Update of EDIOS.

As partner of the NOOS (North West European Shelf Operational Oceanographic System) task-team RIKZ is involved in a lot of transnational activities as:
- real-time data exchange of monitoring networks data for common transnational products;
- exchange of model forecast-results for the purpose of getting better storm-surge forecast services for the regions;
- co-ordinate, improve and harmonise marine observation and information systems in general

- close co-operation with OSPARCOM, ICES and other relevant bodies with the aim to avoid duplication of work and to maximise mutual assistance;
- identify new customers for operational oceanographic products;
- further develop the market for operational oceanographic products.

The national NODC is also partner of the SEASEARCH network within Europe. This network of 33 institutes/centres from 30 different European coastal states are highly skilled in management and added-value services on a wide range of oceanographic and marine data and information. Each of these centres is operating in their country as national data centre or focal point for oceanographic and marine data & information. They are representative nodes in their countries with links to other organisations, active in marine research and marine environmental management, thus monitoring and overseeing national marine research activities and marine data flows.

The FP-6 SEADATANET project, initiated by the seasearch partners, will start at the end of 2005 and will realise in 5 years time a Pan-European infrastructure for Ocean and Marine Data Management, a system for on line integrated data access to distributed heterogeneous systems.

Table S7. Oceanographic observing systems for climate

System Component	Total # Stations	Appropriate for Characterising National/Regional Climate? (tick one box) Fully	Partly	No	Time Series # stations/platforms (# Data Digitised) 30-50y	50-100y	>100y	Adequate Quality Control Procedures? (tick one box) Fully	Partly	No	Metadata available Total # Stations (%Digitised)	Continuity # expected operational in 2005
Sea Level, e.g. Tide gauges	19	x			2		5	x			19 (100%)	No changes
SST (e.g. Moored Buoys)	11	x			2		1	x			11(100%)	No changes
Meteorological Obs (e.g. Temp, Precip, Pressure)	200 VOS ships		X						X		200 (10%)	200
Sub-Surface Profiles												
Ocean Circulation	10		X				10		X		10	10
Carbon Fluxes												
Energy Fluxes												

Note 1: Estuaries (Wadden Sea, Scheldt River, etc.) not included
Note 2: Sea Level: i.e. Time Series of times and heights of all high and low waters. Hourly water level data are available only for the last 30 years.

Table S8. Available homogeneous data sets for oceanographic observations

Integrated Data Sets Name and Brief Description	Climate Parameter	Platforms and/or Grid Resolution and Region covered	Time Period	References
Two time series, SST and air temperature	SST T	2 locations (light-vessel) along Dutch coast	1859 (1898)-1990	Korevaar, C.G., "North Sea Climate", 1990, Kluwer

Table 3. Participation in the global terrestrial observing systems

	GTN-P	GTN-G	FLUXNET	Other
How many sites are the responsibility of the Party?			11	
How many of those are operating now?			11	
How many are providing data to international data centres now?			11	
How many are expected to be operating in 2005?			11	

D. Terrestrial observations

A wealth of climate-related data is being collected in the terrestrial biosphere of the Netherlands. These comprise national forest inventory data, agricultural productivity data, soil databases and collection systems, land use and land use change maps, ecological studies, non-CO_2 GHG flux studies and CO_2 flux measurements, etc. As these are often related to land use aspects, they provide a good basis for relating fluxes to their causes. These provide directly applicable data that offer insight in the functioning of the biosphere.

Many of the data are gathered or collected and analysed at Wageningen University and Research, some under the research programmes of the Ministry of Agriculture, Nature Management and Food Quality, others under BSIK, KvR, FP6, etc.

Table S9. Terrestrial observing systems for climate

Systems useful for national climate monitoring	Total # stations	Appropriate for Characterising National Climate? (tick one box)			Time Series # stations/platforms (# Data Digitised)			Adequate Quality Control procedures? (tick one box)			Metadata available Total # Stations (%Digitised	Continuity # expected operational in 2005
		Fully	Partly	No	30-50y	50-100y	>100y	Fully	Partly	No		
River Discharge (streamflow gauges)	23	x						x			23	23
Ground Water Storage (e.g., boreholes)	hundreds		x		x				x		100	hundreds
Snow*												
Glaciers*												
Permafrost*												
Ice*												
FluxNet	11	x			x			x			100	11
Radiation*												
Soil* SOM	hundreds once only		x		x				x		30	0
Other												

* Specify those parameters necessary for climate monitoring (e.g. snow variables to consider include Coverage, Depth, and Water Equivalence)

Table S10. Ecological observing systems for climate

Systems useful for national climate monitoring	Total # stations	Appropriate for Characterising National Climate? (tick one box)			Time Series # stations/platforms (# Data Digitised)				Adequate Quality Control Procedures? (tick one box)			Metadata available Total # Stations (% Digitised)	Continuity # expected operational in 2005
		Fully	Partly	No	30-50y	50-100y	100-300 y	>300y	Fully	Partly	No		
Phenological*	1 (5000 volunteers)	x				x				x		- (in progress)	good
Biomass Change*	National forest inventory (3,000 plots)		x		x				x			100	600
Vegetation Type*	ICP forest health monitoring		X		X				X			100	40
	Forest Reserves programme		X		X				x			100% = 60 stations	60
	Much ad hoc research-related monitoring			X	X						x	Often sparse	
	Agricultural stats									X			
			X		X							100	
Land Cover*	LGN & HGN maps		x			x				x		100	New land cover maps expected 2006-2008
Fire Distribution*	Statistics Netherlands		x		x				x			x	
Land Use Change*	Statistics Netherlands		x		x				x			x	New land cover maps expected 2006-2008
PaleoClimate #													
Pollen monitoring	2		x		2				x			2	2

* Specify those parameters necessary for climate monitoring – refer to Appendix S1 for suggestions.
# Paleoclimate is not limited to terrestrial, please consider atmospheric and oceanographic elements when filling this out.

Table S11. Available homogeneous data sets for terrestrial and ecological observations

Data Set Name	Climate Parameter	# Stations or Grid Resolution and Region covered	Time Period	References
National forest inventory	Forest biomass	3,000	1992-2005	
Agricultural stats	NPP, sum	Parcel registration	2002-2005	

E. Space-based observing programmes[4]

Satellite Application Facilities (SAF)
Since 1991, the KNMI has produced continuous series of sea surface winds and stresses in the context of the SAF on Climate Monitoring and the Ocean and Sea Ice SAF *(www.osi-saf.org).* The products are based on the ESA ERS and NASA SeaWinds scatterometer, and from 2006 onwards they will also be based on the EUMETSAT ASCAT scatterometer. The production is in real time and off-line, and extended data series are available on request through the Ocean and Sea Ice SAF.

Atmospheric wind profiles from space
Together with ESA and other partners, the KNMI is involved in the realisation of a space-borne Doppler Wind Lidar by 2008, which will provide improved atmospheric wind fields, which will in turn provide better knowledge of atmospheric transport and circulation processes. The main improvements of the mission, called ADM-Aeolus, are expected in data-sparce yet key climate regions, such as the tropics *(www.esa.int/esaLP/LPadmaeolus.html)*. The main involvement of the KNMI is in the processing algorithms, particularly in the treatment of cloudy regions, and in the Doppler Wind Lidar profile data assimilation.

The Netherlands particpates in ESA and EUMETSAT Space Programmes for Earth Observation. It also includes data retrieval, production and distribution to scientific and public sector users and the general public through internet pages.

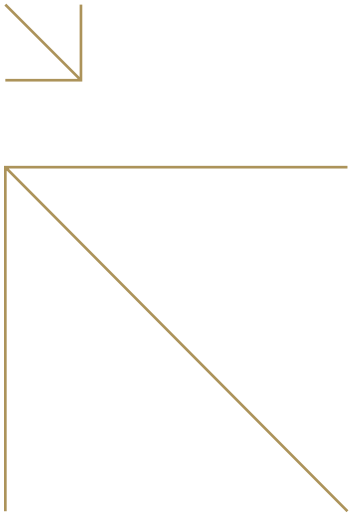
4 Refer to GCOS-15 (WMO/TD No 685). The GCOS Plan for Space-based Observations, Version 1.0, June 1995 (GCOS-15) is available at *http://www.wmo.ch/web/gcos/publist2.html#plan*, while GCOS space-based observations requirements can be found by specifying GCOS as the user in *http://sat.wmo.ch/stations/_asp_htx_idc/Requirementsearch.asp.*

Specific activities for atmospheric research and monitoring:
- NASA/EOS-AURA. OMI (2004 -): near-real-time products on ozone and nitrogen dioxide; off-line products on ozone profile, sulphur dioxide, aerosol optical depth, surface UV derived from ozone and cloud information supporting trace gas retrieval. OMI provides measurements on small ground pixels, covering the entire globe in 24 hours;
- ESA/ERS-2 .GOME instrument (1995 -): Near-Real-Time products (Total Ozone Columns, Assimilated Ozone Columns, Clear-sky UV Index and Cloud Information) [ref. *http://www.knmi.nl/gome_fd*] *http://www.temis.nl* and *http://www.gse-promote.org;*
- ESA/ENVISAT (2002 -). SCIAMACHY instrument: Calibration/Validation, Near-Real-Time Ozone Clear-sky UV Index, Nitrogen dioxide, sulphur dioxide and formaldehyde tropospheric columns;
- EUMETSAT/METOP. GOME-2 instrument (2006 -): Within the SAF on Ozone monitoring, the KNMI produces ozone profiles and aerosol optical depth (in co-operation with SRON).

Specific scientific activities for sea and land surface research:
NOAA-AVHRR
An operational system has been set up at the KNMI to process, fully automatically and in real time, locally received raw AVHRR data towards Sea Surface Temperature (SST) images of all European waters and a large part of the North Atlantic Ocean. Also, Normalised Difference Vegetation Index (NDVI) images of Europe are produced routinely. The persistent cloud cover above Europe urges the need for the use of compositing techniques in order to obtain more complete SST and NDVI maps. Therefore, the KNMI produces weekly SST and NDVI composite maps using all images of a period from Monday to Monday. All weekly SST

and NDVI maps are archived in digital form at the KNMI. Detailed information can be found on *http://www.knmi.nl/organis/wm/rdw/en/AVHRR_products.html.*

The KNMI has played a leading role in the definition of the EarthCare mission, which was recently approved by ESA for a Phase-B study. This will eventually lead to the construction of a space-borne instrument integrating passive and active observations of clouds, aerosols and radiation. The primary aim of the station is to obtain globally vertical profiles of radiation throughout the atmosphere with precise attribution to atmospheric variations in clouds, aerosols and moisture.



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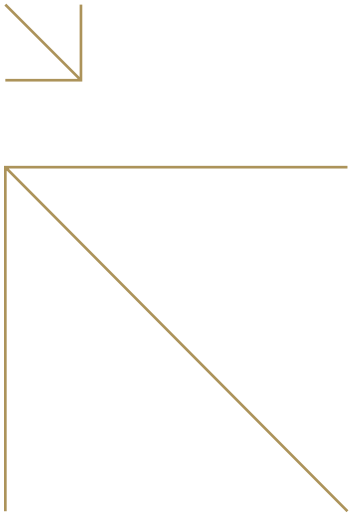

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