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

Ministry of Housing, Spatial Planning and the Environment

CONTENTS

1 EXECUTIVE SUMMARY

Introduction

This report presents the Fifth National Communication from the Netherlands, as required under the Climate Change Convention as well as under the Kyoto Protocol. It describes the information required by the guidelines, including the supplementary information under Article 7.2 of the Kyoto Protocol. The report gives an overview of all required elements, but focuses in more detail on the developments since the Fourth National Communication.

National Circumstances

The Netherlands is a constitutional monarchy. The legislative process is realised in a combined effort by the government and Parliament. 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 Ministries are responsible for integrating environmental policy targets and endorsing the environmental policies within their respective fields.

The Netherlands is a densely populated country. In 2008 the population amounted to 16.4 million people, with approximately 486 persons per km^2. A further important demographic factor influencing the pressure on the environment is a decrease in the number of persons per household.

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 highest point is 321 metres above sea level, at the border with Belgium and Germany, and the lowest point is 7 metres below sea level. The surface area of the land, plus inland and coastal waters, amounts to 41,543 km^2. The land surface covers 33,729 km^2. In 2006 the land surface consisted of 68% agricultural land, 10% forest, 4% natural land and 15% for urban uses and infrastructure.

The Netherlands is located in the so-called 'temperate zone'. 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. An increase of around one degree has been measured in the Netherlands over the last 100 years, with the warmest summers concentrated over the past 10-12 years.

The Gross Domestic Product (GDP) of the Netherlands, in 2008, was € 487 billion (using 2000 prices). The Netherlands ranks relatively high on the list of agricultural exporters. The transportation sector has traditionally been an important activity due to the country's favourable location for transporting goods from the harbours to the EU inland destinations. Rotterdam's ports are among the largest in the world. The ports function as a 'mainport' (hub) for transporting all kind of goods to many countries throughout Europe.

Agriculture in the Netherlands focuses on cattle breeding, crop production and horticulture; of which greenhouse horticulture is the most important subsector. The amount of horticulture in total agricultural production is increasing over time. The amount of fuel consumed by the greenhouse horticultural sector is comparable to fuel consumption in the commercial and public service sector (taking cogeneration into account).

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 percentage of natural gas in the total end-use for energy was nearly 50% in 2002, which is extremely high.

Greenhouse gas inventory information

In 2007, total direct greenhouse gas emissions (excluding emissions from Land Use, Land-Use Change and Forestry, LULUCF) in the Netherlands are estimated at 207.5 Tg CO_2 eq., which is 2.7% lower than the 213.3 Tg CO_2 eq. reported in the base year (1990; 1995 is the base year for fluorinated gases). Figure 1.1 shows the trends and relative contributions of the different gases to the aggregated national greenhouse gas emissions

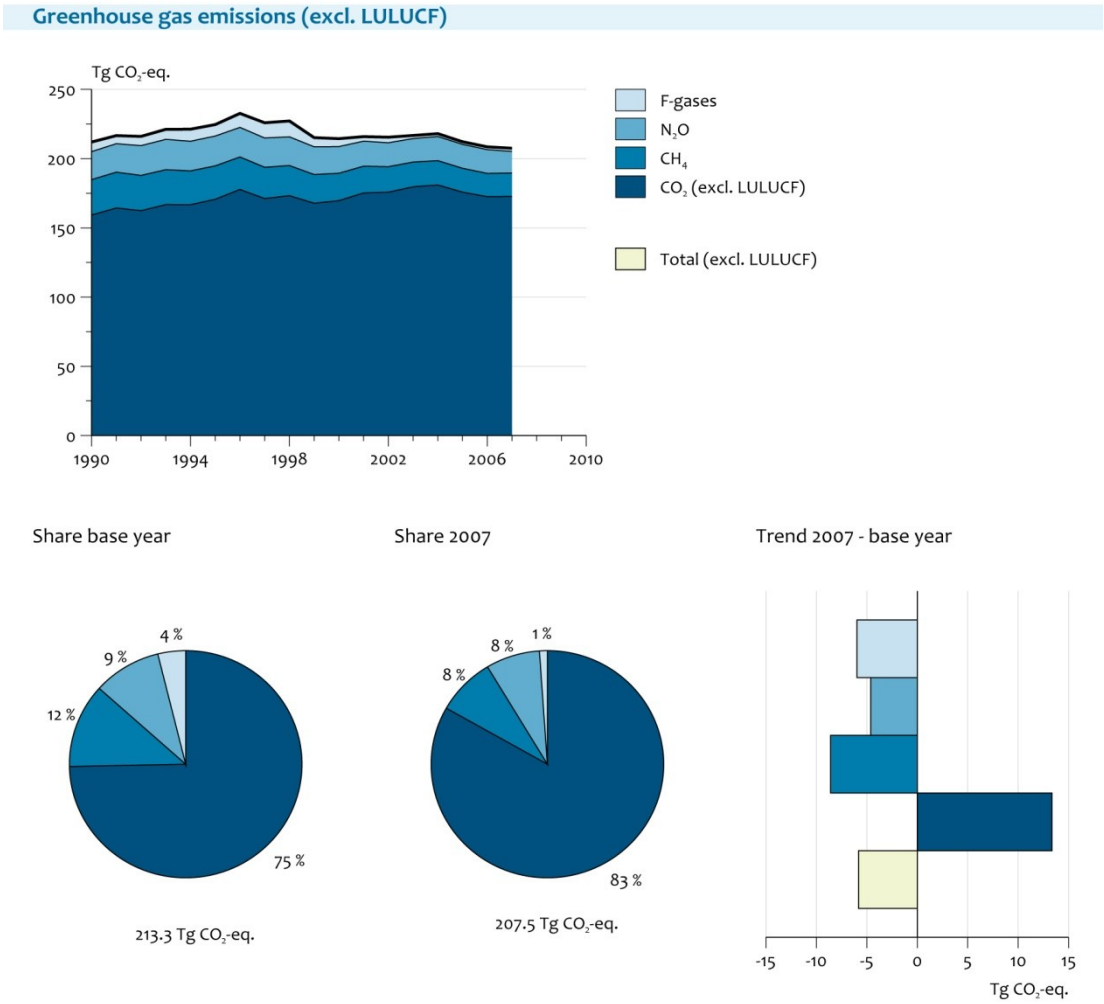


Figure 1.1 Greenhouse gases: trends, emission levels and share of gases, 1990–2007.

The Netherlands uses a national system for estimating anthropogenic emissions by sources and removals by sinks as meant under Article 5.1 of the Kyoto Protocol, with SenterNovem operating as the 'single national entity' (or NIE, national inventory entity). The Netherlands established its National System in 2005. During the initial review it was found to comply with the aforementioned requirements. Since then, the system as such has remained unchanged, with some small changes planned as from January 1st 2010.

The Netherlands maintains its National Registry as a separate system. The Registry has been developed and improved in cooperation with other European Parties (Sweden, Netherlands, Norway, Ireland, Italy, United Kingdom, Slovenia, Bulgaria, Romania and Iceland) under leadership of the UK Department of Energy and Climate Change (DECC). This cooperation is called Greta. The Registry is maintained by the NEa, the Netherlands Emission Authority.

Policies and measures

The Netherlands ratified the Kyoto Protocol on May 31st 2002. For the Netherlands this meant an emission-reduction target of 6% below the emissions level in the base year, for the period 2008-2012. Under the Kyoto Protocol this implies emissions should not exceed about 1,000 Mton over the entire Kyoto-period. Of this, 437 Mton are reserved for emissions by Dutch companies participating in the EU Emissions Trading Scheme (ETS) and the remaining 563 Mton of CO_2 equivalent are available for the sectors that do not participate in the ETS (such as consumers, agriculture, transport and services). Important policies and measures in those sectors include tightening of energy efficiency requirements for new buildings and policy instruments set up between 2005 and 2009 in order to encourage the retrofitting of existing buildings. for CO2 reduction and a special programme on reduction of non-CO2 greenhouse gases (ROB) e.g. with nitric acid industry, agriculture, waste and cooling sectors. The tables in chapter 4 give an extensive overview of the policies measures

Due to the recession, domestic emissions by the sectors that participate in the ETS will decline until 2010. If the economy grows by 2.7% per year in 2011 and 2012, the non-ETS sectors will emit 555 to 615 Mton of CO_2 equivalents during the entire Kyoto period, which means that the government will probably have to use foreign emissions credits in order to remain within its national allocation. With enough of foreign emissions credits available – via the Clean Development Mechanism (CDM) and Joint Implementation (JI) projects – the target will be achieved.

The Netherlands has signed CDM, JI and AAU contracts with a number of countries, companies and international organisations. The Netherlands' Ministry of Housing, Spatial Planning and the Environment (VROM) has been assigned as the Designated National Authority (DNA) of the Netherlands. The Dutch Ministry of Economic Affairs mandated the implementation of its role as Designated Focal Pont for JI, and appointed SenterNovem to act as the DFP-JI on its behalf. For the Kyoto period the National Administration has chosen to make financial reservations in the national budget of roughly € 606 million.

In 2007, the new government coalition agreement stipulated firm targets for reducing greenhouse gas emissions, while increasing both energy efficiency and renewable energy sources in the ambitious working programme, entitled: 'New Energy for Climate Policy: The Clean and Efficient Programme (Nieuwe energie voor het klimaat: Werkprogramma Schoon en Zuinig). This programme is aimed at setting a trend change. The policy target for GHG is reducing emissions of greenhouse gases, especially CO_2, by 30% in 2020, compared to the 1990 level. In March 2009 the Dutch government coalition negotiated an additional policy agreement for energy and climate measures. An important element is a long-term policy agenda for sustainability and energy.

The central coordination of the climate policy progress is the responsibility of the interdepartmental Programme Board 'Clean and Efficient', which reports directly to the Minister of Housing, Spatial Planning and the Environment (VROM).

The approximately 360,000 hectares of forest in the Netherlands, which cover 10% of the total surface of the country, are managed according to the principles of Sustainable Forest Management (SFM), which also apply to newly planted forests.

Sustainable development is one of the priority themes for the Dutch government. Non-sustainable trends must be countered by supporting leaders in sustainability, national and international cooperation, with a strong emphasis on innovation. The government has designed an approach with a core element to bring about fundamental social changes ('transitions'), which will take 20-25 years to complete.

During the climate conference in Bali in 2007, it was agreed that not only mitigation, but also adaptation should be part of a new climate convention. The Dutch government, through the Development Minister, has adopted the guiding principle in financing adaptation in developing countries that those who emit high levels of CO_2 pay for the adaptation to climate change of others whose emissions are low but who suffer the consequences.

Projections and the total effects of policies and measures

The projections in this National Communication are an update of those from the Global Economy (GE) scenario presented in the previous National Communication. This scenario is used as a reference. The update could not provide a full inclusion of the effects of the economic crisis; however it considers the effects of lower economic growth as part of the uncertainty analysis. It includes two energy price variants. Apart from the energy prices the main changes include the higher CO_2 price assumed in the emission trading system, the inclusion of plans for new power plants, the recent surge in the new horticultural use of combined heat and power, the new policies for renewable energy electricity and the inclusion of new transport projections.

The projections presented are the 'with measures' projections based on the above scenario. These projections only include policies that have already been decided on in their definitive form, hence the results only include a small part of the present Clean and Efficient (Schoon & Zuinig) programme. The assumptions for future economic growth and demography still originate from the Global Economy scenario.

The 'with existing measures' variant (WEM) includes all existing policy instruments which have been decided on in their definitive form. The effects of the planned policies and policies that are still under development within the framework of the Clean and Efficient programme have not been included. These were subject of a separate study (Dril 2009). The results are used to present a range of possible projections in the 'with additional measures' variant. Furthermore, the calculated effect of the WEM-measures are used to construct the 'Without measures' variant. To complete the picture, figure 1.2 shows also a variant including the expected effect of emission trading.

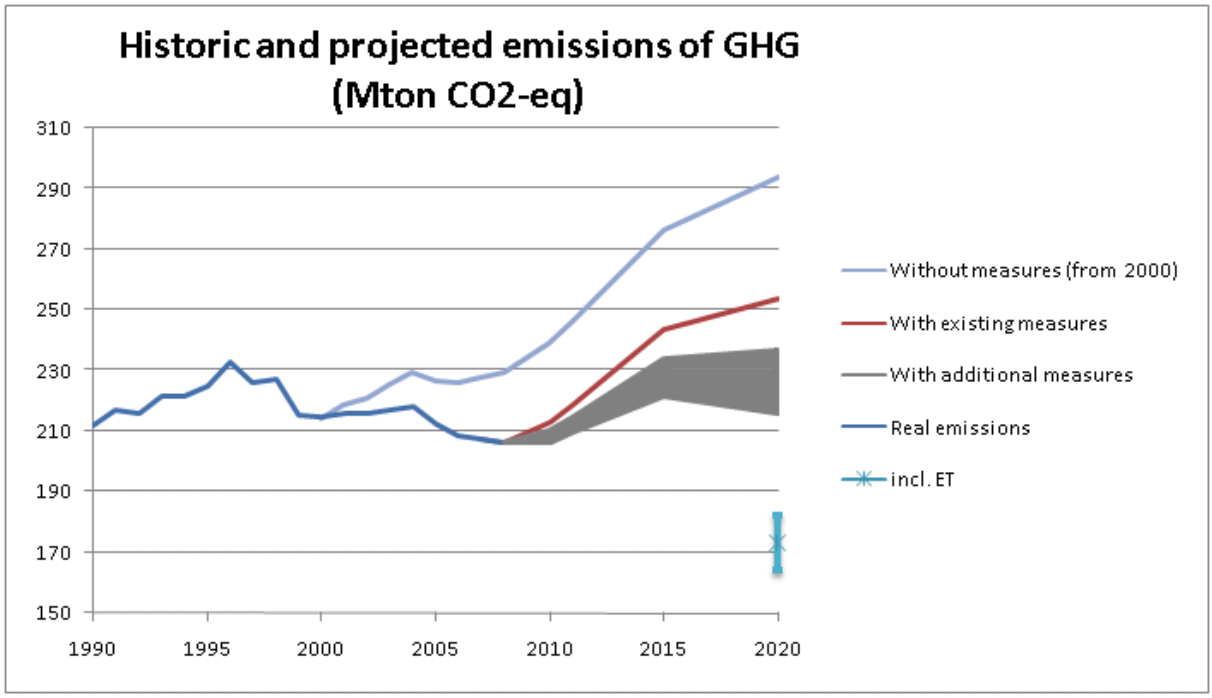


Figure 1.2 Historic and projected emissions of Greenhouse gasses

The ratio between domestic actions and use of the project-based mechanisms in 2008 depends on which domestic actions are included in the comparison. Avoided emissions due to total domestic efforts leads to a ratio of 139/13, while policy related efforts results in a ratio of 62/13 (where 13 Mton is the maximum project based mechanism).

Vulnerability assessment, climate change impact and adaptation measures

The climate in the Netherlands is expected to undergo significant changes over the coming decades. The most pressing consequences include warmer and wetter winters, drier and hotter 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 situated in a low-lying delta-area, with four large rivers and with a high population density – will more frequently result in climate change impacts that need to be counteracted.

Over the last four years adaptation to climate change impacts has gained significant importance on the Dutch political agenda. Following a resolution by parliament, in a combined effort the Departments of Housing, Spatial Planning and the Environment (VROM), Transport, Public Works and Water Management (V&W), Agriculture, Nature and Food Quality (LNV) and Economic Affairs (EZ), in cooperation with the Associations of Provincial Authorities (IPO), Netherlands Municipalities (VNG) and Water Boards (UvW), initiated the National Programme for Spatial Adaptation to Climate Change (ARK) in 2006. This programme is based on the shared belief that spatial adaptation to the effects of climate change is essential and a top administrative priority. The first product of this programme is the National Adaptation Strategy, which was approved in November 2007.

The effects of climate change are particularly felt in the risk of flooding or breaching of water-retaining structures (social disruption). Hence adaptation in the Netherlands has been and, in the near future will be, strongly focused on the water sector. For this reason the Cabinet appointed a 'new' Delta Committee in 2007. This Sustainable Coastal Development Committee (Delta Committee) has formulated a vision and policy advice on the long-term protection of the Dutch coast and its hinterland.

Financial resources and transfer of technology

The Dutch government has worked to achieve the Millennium Development Goals (MDGs) ever since they were first agreed. Globalisation necessitates a repositioning and rethinking of development cooperation. This was presented in the policy letter 'Our Common Concern: investing in development in a changing world' (October 2007) A stronger policy focus on four areas was presented:

- security and development;
- growth and equity;
- more rights and opportunities for women and girls;
- sustainability, climate and energy.

The Netherlands emphasises international cooperation by increasing policy coherence between aid, trade, the environment and human security.

In July 2001 in Bonn, the EU+51 reaffirmed their political commitment to increase their annual funding for climate change activities in developing countries during 2005-2008. For the Netherlands it implies that expenditure on climate change activities in developing countries should exceed the 2001 expenditures by €17 million annually. Compared to the 2001 level of funding New and additional funding under the Bonn declaration totalled €19 million in 2008. It should be noted that The Netherlands meets its ODA commitment of 0,7% of GDP. Climate change policy, together with other ODA for support to environmental activities in developing countries is funded on top of this commitment raising the Dutch ODA level to 0,8% of GDP. For the period 2008-2012 another € 375 million will be added on top of the 0,8% GDP in support of renewable energy in developing countries.

[1] The European Union member states plus Canada, Iceland, New Zealand, Norway and Switzerland.

The Netherlands actively contributes to the Nairobi Work Programme (NWP) under the UNFCCC to support countries, particularly developing countries, in adapting to climate change and mitigating negative effects.

The Over the period 2005-2008, € 10.2 million was provided to the GEF's Least Developed Countries (LDC) Fund. Besides multilateral assistance, the Netherlands also provides (bilateral) support to developing countries, as they suffer disproportionately from the effects of climate change. Many have large semi-arid regions that are becoming even larger and drier, while others will suffer recurrent flooding. The figures below give an impression of the funding for mitigation and adaptation respectively

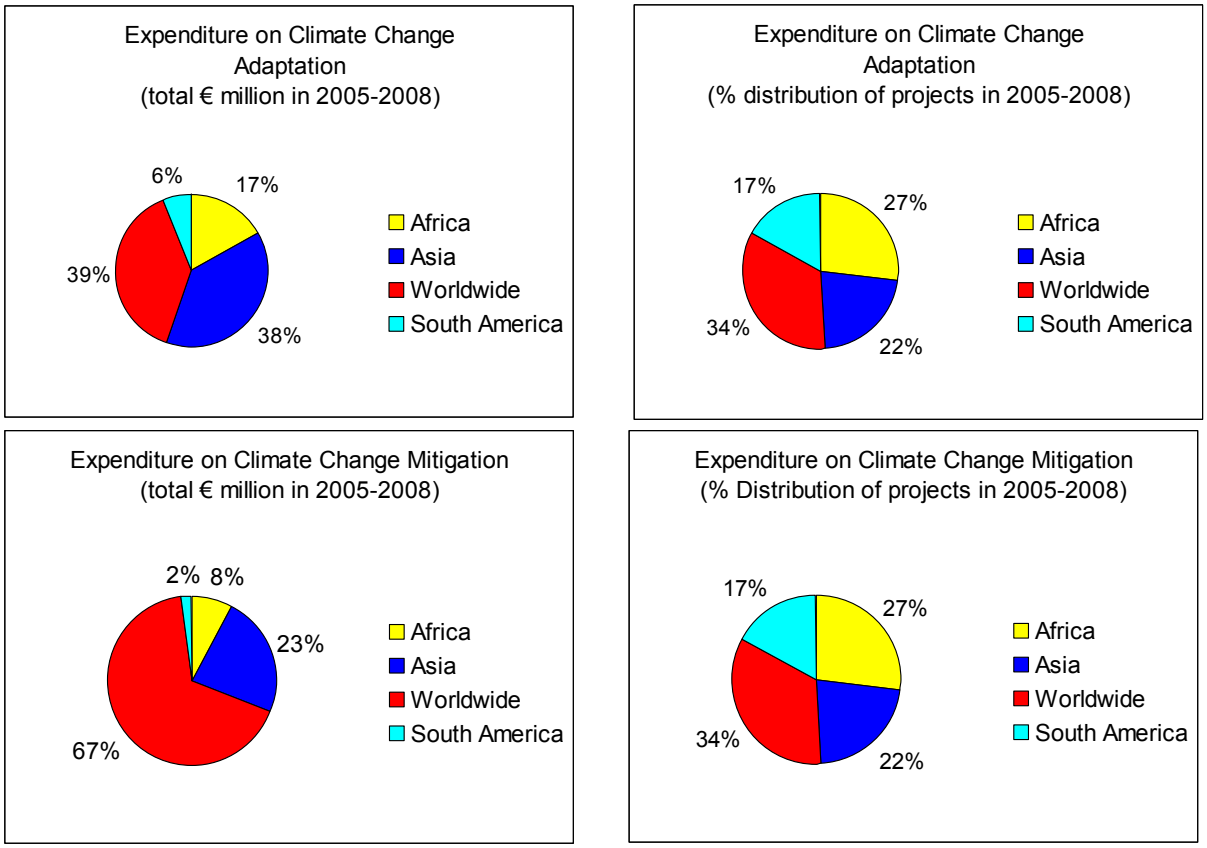


Figure 1.3 expenditures on Climate change adaptation and mitigation

Since 2002, The Netherlands supports the Capacity Development for the Clean Development Mechanism. The contribution between 2005-2008 was €3.3 million. In relation to strengthening national institutions on climate change adaptation the Netherlands provides some specific support through the Netherlands Climate Assistance Programme (NCAP), with a budget €6.6 million between 2003-2009.

The Netherlands promotes the transfer of technology through various channels, e.g. through:

- EU programmes and mechanisms;
- participation in IEA programmes;
- bilateral or multilateral programmes and schemes.

These include regional cooperation, cooperation with developing countries and promotion of private sector involvement.

Actions to involve private parties' involvement include the ETS, linked to CDM/JI markets, and the provision of export subsidies to the private sector to encourage technology transfer. An example of

this is the ORIO programme[2] for non-commercial environmental and sustainable investments in developing countries.

The Dutch support in relation to the transfer of technology is mostly in the form of support programmes relating to the private sector (encompassing hard and soft technologies). Until 2008, a major support programme was called PSOM (Programme for Cooperation with Emerging Markets). As of 2009, the programme is called PSI (Private Sector Investment Programme), supporting innovative investment projects in emerging markets in Africa, Asia, Central and Eastern Europe and Latin America. A PSI project is an investment project, implemented by a Dutch (or foreign) company together with a local company, in one of the eligible developing countries. If this investment meets the criteria, it can be eligible for a PSI grant, which consists of a financial contribution to the costs of the investment.

The information on activities, actions and programmes undertaken to meet commitments under Article 10 is described in various parts of this National Communication (see also section 7.5 for an overview).

Research and systematic observation

Research activities in the Netherlands cover a range of climate system, impact and policy support, and implementation studies. These activities are characterised by:
- intensive participation in international and European programmes;
- clustering into a few larger national research programmes.

The Netherlands' research on climate change is well embedded in, acknowledged by, and co-steered in large international scientific programmes from the UN. Many of the leading Dutch institutions also have research projects under the EU's 6th and 7th Framework Programmes (FP). National research programmes add to, and support, international research programmes.

The national research activities include:
- National Research Programmes under the Earth and Life Sciences (ALW) theme of NWO (Netherlands organisation for scientific research) and the Global Change theme of KNAW (Netherlands science academy);
- National Research Programme on climate issues, such as 'Knowledge for Climate' (KvK) and its predecessor 'Climate Changes Spatial Planning' (KvR);
- Energy innovation agenda, an interdepartmental programme (also referred to as the 'energy transition approach'), which aims at a sustainable energy economy;
- More specific R&D programmes of the various ministries, in areas closely related to climate change and variability (e.g. water), or mitigation (also on non-CO_2 greenhouse gases).

Cooperation is not only assured through clustering nationally and internationally, but also the national research programmes actively seek private-sector participation and facilitate the dialogue between stakeholders from scientific, policy 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 often be obtained free of charge or at low cost.

With regard to systematic observation, the Netherlands actively participates in the various fields of climate-related monitoring, both nationally and within European and global programmes. An integrated national programme for implementing the Netherlands' contribution to GCOS has not yet been established. However, steps are being taken to develop and implement such a strategy.

[2] until January 2009 this programme was called ORET/MILIEV

Monitoring activities on systematic observation and GCOS (Global Climate Observation System) in the Netherlands are firmly embedded in international programmes such as Framework programmes (on a European level) and GEOSS (Global Earth Observation System of Systems), on a global level. We also see international cooperation at project level.

Education, training and public awareness

The approach encompasses general elements related to climate change and activities responding to more specific needs of target groups of policies and measures. The latter in general are specifically designed as integrated part of the related policy measures. The former is part of the interdepartmental Dutch climate change programme 'Clean and Efficient' . The programme's general communication approach includes various steps (also in line with the New Delhi work programme):

- to inform and raise awareness among the relevant target groups
- offer specific options for action, relevant and suitable for the target groups
- provide inspiring examples;
- demonstrate the exemplary function of the government.

Within the Netherlands for VROM (or others) rather frequently, surveys are being carried out into the awareness, knowledge, attitude and behaviour (practice) of the general public. Most of these surveys show a significant awareness of climate change. These types of surveys do form a basis for (learning and adapting) better understanding the specific information needs and for the national communication approach on climate change issues under the programme 'Clean & Efficient". VROM and the other ministries involved in climate policy regularly organise public information campaigns on climate change. The aim is to increase energy efficiency and the use of renewable energy through low-cost and 'easy to implement' actions. These include general campaigns (e.g. 'The Dutch climb for a better climate' and campaigns as part of specific policies and measures (e.g. ecodriving)

Public access to environmental information that is available from the government, including data on greenhouse gas emissions and energy use, has been further strengthened as a result of the Treaty of Aarhus being implemented into Dutch law.

Education and training are aspects of the work carried out by the intermediary organisations SenterNovem and MilieuCentraal. For example, the MilieuCentraal website includes a subsection for pupils of primary and secondary school education. Also the Dutch Programme 'Learning for Sustainable Development' enhances learning processes on sustainability in many issues. Various training programmes are also directed towards professionals and students from developing countries.

The ministries involved in climate policy also commission intermediary organisations to implement certain resource and information centre type tasks. To improve efficiency and prevent overlap, in 2005 several of these organisations merged into two new organisations: SenterNovem, focusing on professional parties, such as industry, local governments and companies, and MilieuCentraal, concentrating on consumers. They both operate extensive resources websites.

NGOs play also an important role in education, training and public awareness. VROM stimulates this also through a subsidy programme entitled Social Organisations and the Environment (SMOM), enabling environmental projects these organisations to take the initiative, while also providing VROM with better 'insight' into, and information on relevant developments in society. In a large campaign, 'Hier' (Dutch for Here), 40 organisations (mostly NGOs such as WWF/ WNF, Red Cross, Oxfam Novib) work together to counter the negative effects of climate change through activities such as coordinated consumer campaigns, raising awareness, joint communication efforts, and political lobbying.

With the activities and efforts in the field of education, training and public awareness the Netherlands also implement the (amended) New Delhi work programme. The activities include also special

activities for youth, as well as regional cooperation actions and activities aimed at international education, training and capacity building.

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 441municipalities (CBS, 2009a). 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 regional governments, for example, are responsible for granting environmental licences and permits.

The Environmental Protection Act (EPA) of March 1st 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 submits the NEPP to Parliament. If Parliament approves the Plan, it becomes permanent. Not every commitment (e.g. emission target) in the Plan needs to be legislated. In 2006 the Future Environment Agenda (*Toekomst Agenda Milieu)* was implemented as an extension of the policies and vision of the 4th NEPP (Parliamentary Report, 2009).

The Ministry for Housing, Spatial Planning and the Environment (known as the Ministry of VROM) is responsible for environmental legislation and policy development. Other ministries are responsible for integrating environmental policy targets and endorsing the environmental policies 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.

2.2. Population profile

The period 1980-2008 saw a population increase in the Netherlands from 14.1 million to around 16.4 million inhabitants (Figure 2.1). Annual growth fell from 0.8% in 1980 to around 0.5% in 1996. Between 1998 and 2002 annual growth increased somewhat, but since 2002 it has fallen again to 0.014% in 2007. For the coming years an increase in growth is expected, due to a decrease in mortality rate and an increase in immigration.

The Netherlands is a densely populated country. The population density increased from 415 to 486 persons per km^2 (CBS, 2009b). A further 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 2.2 in 2008). The number of households increased from 5 million in 1980 to 7.2 million in 2008, while the percentage of single-person households increased from 22% to almost 36% (CBS, 2009b). A consequence of this development is the need for more housing, and an increasing claim on land for new dwellings and infrastructure.

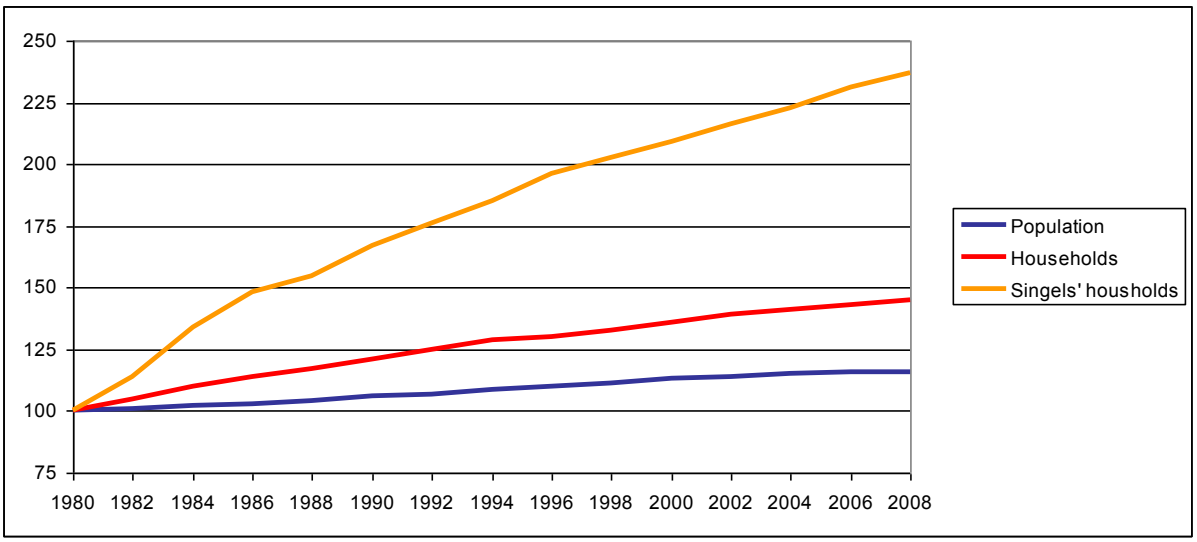


Figure 2.1 Development of the total population, number of households and the number of singles' households in the Netherlands for the period 1980-2008 (index; 1980 =100). Source: CBS, 2009b

2.3. Geographic 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 being below sea level. The soils consist of fluvial and tidal deposits, partially covered by peat. After the ice age, this Holocene peat was formed behind the coastal dunes in the western part of the Netherlands, where polders have been created with controlled water levels. 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 metres above sea level, at the border with Belgium and Germany, and the lowest point is 7 metres below sea level. The surface area of the land, plus inland and coastal waters, amounts to 41,543 km^2. The land surface covers 33,729 km^2.

In 2006 the land surface consisted of 68% agricultural land, 10% forest, 4% natural land and 15% for urban uses and infrastructure [3]. 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).

[3] Urban uses and infrastructure: consists of infrastructure, built area and semi-built areas (graveyards, landfils scrapheaps etc).

Figure 2.2 Key elements of the Netherlands' geographic profile

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.

	De Kooy (coastal station)	Twente Airbase (inland)
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

Table 2.1 Some climatological characteristics for De Kooy (coastal station) and Twente Air Base (around 150 km from the coast), based on observations for the period 1971-2000. Source: KNMI

Throughout the country, mean winter temperatures are about 3°C and mean summer temperatures are around 17°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 (KNMI, 2005), while warming also continued over the last few years (KNMI, 2008). With an average temperature of 10.6°C, 2004 was the twelfth year in a row with an average temperature above 10°C: the 30-year average being 9.8°C. The years 2006 and 2007 were the warmest in at least 300 years, with an average of 11.2°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).

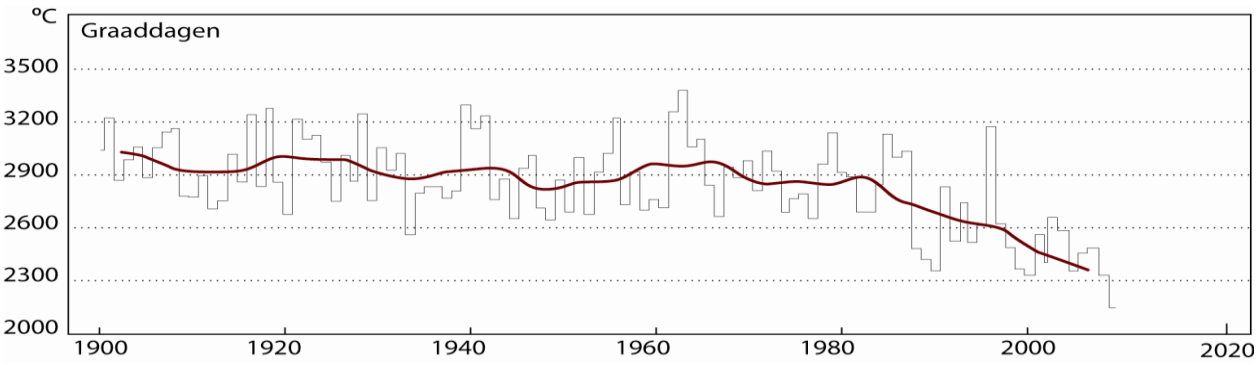


Figure 2.3 Development of the average surface temperature and the number of heating degree days (HDD) in the Netherlands during the period 1906-2003. Source: KNMI, 2008

2.5. Economic profile

The Gross Domestic Product (GDP) of the Netherlands was € 306 billion in 1990 and € 487 billion (using 2000 prices) in 2008: an increase of 88% (CBS, 2009d). The Netherlands ranks relatively high on the list of agricultural exporters. The principal exports are machinery and transport equipment (38% of the total value of exports in 2008), chemicals (13%) and food and other livestock products (13%) (CBS, 2009e). Exports increased by around 189% between 1990 and 2008 (volume index, prices for 2000). Principal imports to the Netherlands in 2008 included machinery and transport equipment (43% of the total value), food and other livestock products (8%) as well as chemical products (10%)(CBS, 2009f).

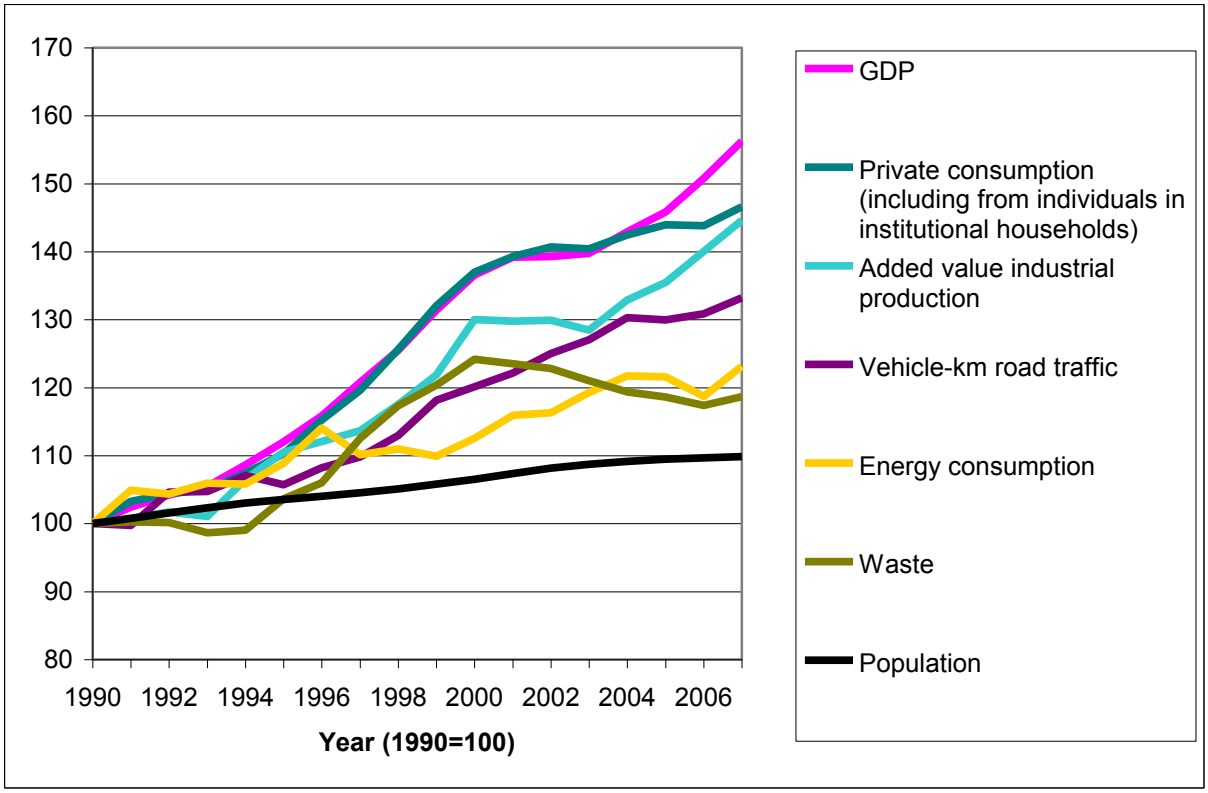


Figure 2.4 Trends in volume development in the Netherlands during the period 1990-2007
Source: CBS 2009g and CBS/PBL/WUR 2009a

The transportation sector has traditionally been an important activity due to the country's favourable location for transporting goods from the coastal harbours to the EU inland destinations. The geographic situation also favours oil refineries in Rotterdam, from which large amounts of oil products are exported. Rotterdam ports are among the largest in the world. The port functions as a mainport (hub) for transporting all kind of goods to many countries throughout Europe. Schiphol Airport near Amsterdam is important as an air transit point for the rest of Europe. These mainport functions explain the relatively high use of bunker fuels.

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. For livestock numbers, a downward trend started around 1990, due to the milk quota system and various animal diseases. This downward trend was curbed in 2003 and livestock numbers have increased since then. See Figure 2.5 (including animals kept for fur) (CBS, 2009h).

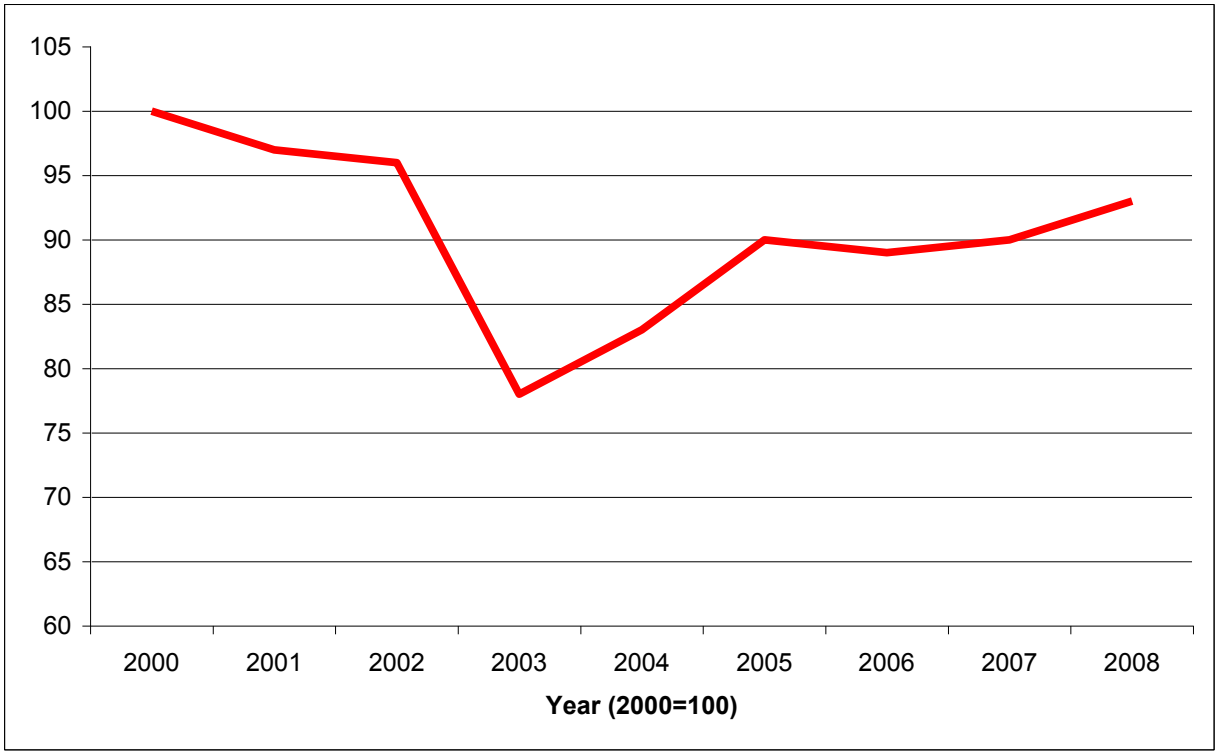


Figure 2.5 Developments in livestock 2000-2008 (2000=100). Source: CBS 2009i

Private consumption increased by 40% over the period 1990-2006 (CBS, 2009j). 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.

2.6. Energy profile

Energy consumption
During the period 1985-1995 energy consumption in the Netherlands increased by 1.6% annually. The following period (1995-2005) showed a lower increase in annual energy consumption (1.2%). The increase during this period was largely caused by the rapid increase in non-energy use of energy products, such as feedstocks in the chemical industry for the production of chemical products (such as plastics), by more than 6% per year. Energetic use of energy products increased by only 0.6% per year. Final energy consumption in households even decreased by 0.7% per year during this period.

In the recent years (2005-2008) total energy consumption remained at about the same level, with little differences in individual sectors (energy sector decrease of 0.3% per year, industry decrease of 0.5% per year, transport increase of 1.2% per year, households decrease of 1.1% per year).

During the period 1985-2008 the total consumption of electricity increased by more than 80% (see table 2.3). The purchase levels of electrical appliances formed an important cause. The first part of the period showed the highest increase in electricity consumption, by more than 4% per year. During the course of this period the increase gradually reduced. Throughout the most recent years the consumption of electricity only grew by about 1.5% per year.

Energy consumption per sector 1985-2008							
		1985	**1990**	**1995**	**2000**	**2005**	**2008**
	PJ						
Total of energy companies[1]		**337**	**364**	**403**	**408**	**464**	**447**
electricity and heat producers		298	302	322	297	344	328
other energy companies[1]		39	62	81	111	120	119
Total of energy consumers[2]		**2221**	**2360**	**2562**	**2657**	**2847**	**2882**
Industry[2]		1026	1153	1200	1267	1412	1389
transport		326	375	421	462	486	504
households	.	.		455	432	425	411
other energy consumers	.	.		486	495	523	579
Total domestic energy consumption		**2558**	**2723**	**2964**	**3065**	**3311**	**3330**
	mld Euro						
Gross Domestic Product (GDP)		**259,6**	**306,0**	**342,8**	**418,0**	**446,3**	**487,6**
(price level 2000)							
	MJ per Euro GDP						
Energy intensity		**9,85**	**8,90**	**8,65**	**7,33**	**7,42**	**6,83**
[1)] excluding refineries and coke plants							
[2)] including refineries and coke plants							

Table 2.2.. Energy consumption per sector 1985 -2008. Source CBS, 2009k

Despite the increase in energy consumption, energy intensity (energy use per € GDP, at 2000 price levels) fell during the period 1985-2008 by more than 30%, or about 1.3% average annually. This decline was partly due to energy-saving activities (which amounted to 0.9% annually during the period 1995-2007 (ECN, 2009). The economic structure in the Netherlands has also changed over the years, showing a gradual shift from energy-intensive (industrial) activities to more energy-extensive activities (service sectors).

Electricity production, consumption, import, export 1985-2008							
		1985	**1990**	**1995**	**2000**	**2005**	**2008**
Production electricity total	**PJ**	**226,7**	**258,8**	**291,8**	**321,9**	**361,5**	**387,6**
generated from renewable sources	PJ		2,6	4,4	9,6	25,3	32,4
	%		1,0	1,5	3,0	7,0	8,4
Total consumption electricity	**PJ**	**245,2**	**292**	**332,8**	**390**	**427,4**	**444,4**
Import	PJ	18,9	34,8	43,1	82,6	85,3	89,9
export	PJ	0,5	1,7	2,1	14,5	19,4	32,8
net import	PJ	18,4	33,1	41	68,1	65,9	57,1
net import as % of total consumption	%	7,5	11,3	12,3	17,5	15,4	12,8

Table 2.3.Electricity production, consumption, import and export 1985-2008. CBS, 2009l

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 percentage of the basic materials processing industry. The fuel mix in the Netherlands also differs substantially from that in other countries (Figure 2.6). The percentage of natural gas in the total end-use for energy was nearly 50% in 2002, which is extremely high.

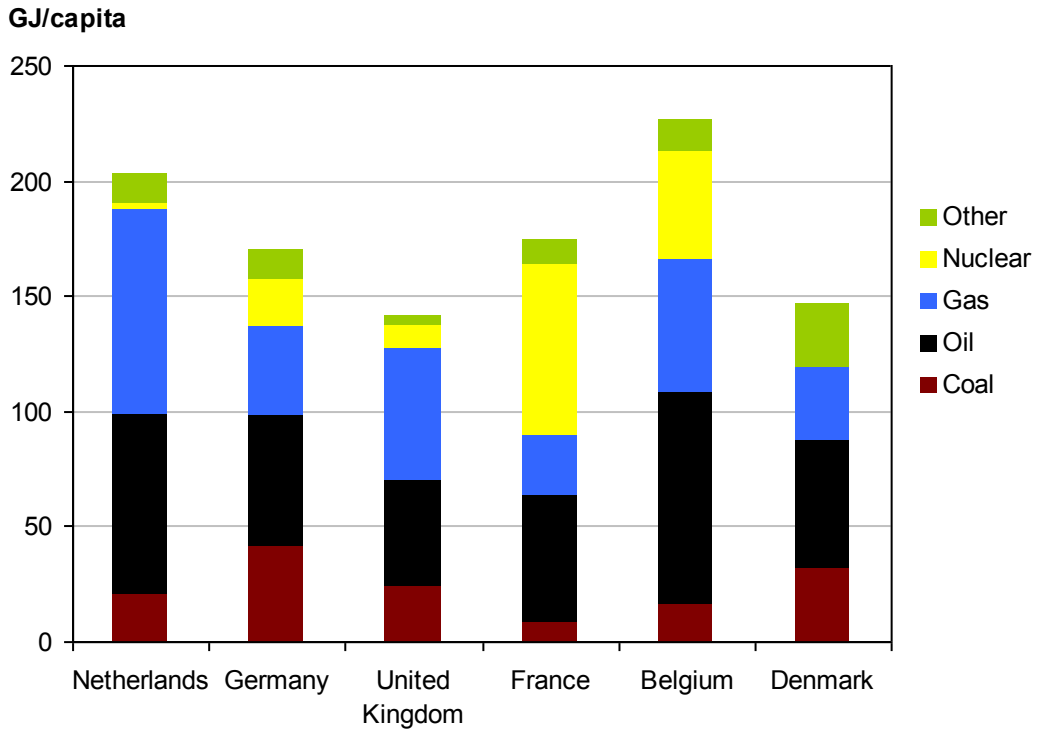


Figure 2.6 Energy use per inhabitant by fuel type in the Netherlands, compared with other countries in 2008. Source: ECN, 2009a

Gas production

Since 1980 natural gas production in the Netherlands has totalled approximately 70-80,000 million Nm^3 per year (CBS 2009u). 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.

Electricity production

The increase in electricity consumption during the period 1985-2008 (80%) was mainly 'countered' by increased cogeneration and 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 power generation compared to separated generation of electricity and heat.

In 1985 net imported electricity contributed around 8% of total electricity consumption (Table 2.3). Since about 1999, the liberalisation of the European electricity market has resulted in a higher net import of electricity, increasing to 15-17% over the last 10 years.

During the period 1990-2008 the production of renewable electricity has increased by a factor of 8, which resulted in a share of 8.3% in total electricity consumption in 2008. Around 51% of this stems from biomass combustion, and 47% from wind energy. The installed capacity of wind power amounted to approximately 2120 MWe by the end of 2008. The growth rate has been particularly high in recent years (doubled in four years time). This is clearly a result of the Dutch government's stimulation programme, which subsidises the extra production costs of renewable electricity (where these are higher than the costs of conventional electricity production).

Refineries

The Netherlands has six large refineries, with four of them located in Rotterdam. These refineries have a total capacity of 61 million tons of crude oil. The degree of utilisation is high; in some years 100%; in 2007 this was 98% (ECN, 2009b). 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%.

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 2.7. 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).

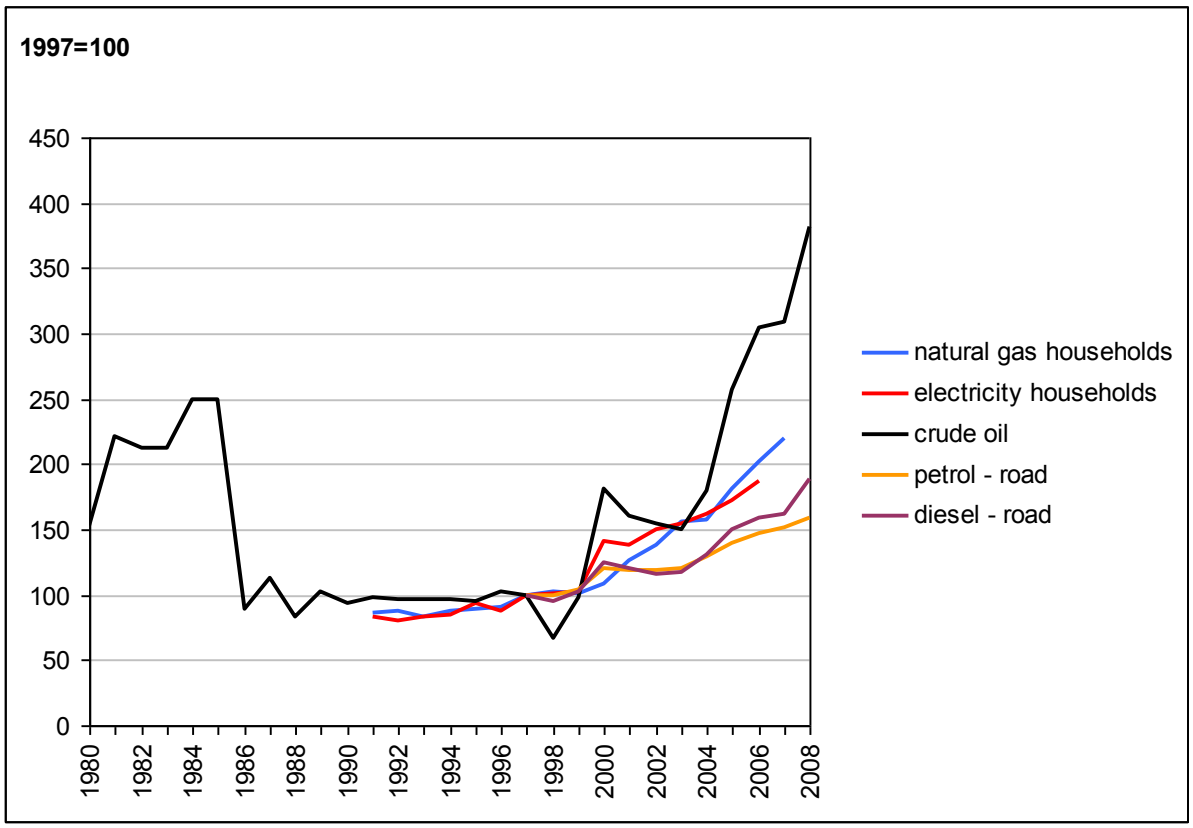


Figure 2.7. Development of energy prices in the Netherlands (1997=100). Data for the period 1980-2008 (crude oil); 1991-2007 (electricity and natural gas for households) and 1997-2008 (petrol and diesel) .Source: ECN, 2009a

2.7. Transportation

The volume of transportation is influenced by demographic, economic, spatial and infrastructural factors. Air and international shipping are highly concentrated: in 2008 Schiphol Airport handled 94% (CBS, 2009m) of all air passengers and 97% of all air freight (CBS, 2009n), with the port of Rotterdam handling 75% of the total freight in tonnage (CBS, 2009o).

Between 1990 and 2003 the number of car-km driven by passenger cars increased by 28%, which was less than the increase in GDP (CBS, 2009p). On the other hand, the increase in ton-kilometre road transport during the period 1990-2000 was 44%, which is higher than the trend in GDP (Eurostat, 2005). By far the main part of the emissions stem from road transport, the remainder coming from inland air transport, inland shipping, fisheries, rail transport, military transport and mobile equipment. CO2 emissions have risen mainly due to road transport. In 2007 the effects of biofuel use resulted in a decrease with about 1 Mton (CBS/PBL/WUR, 2009b).

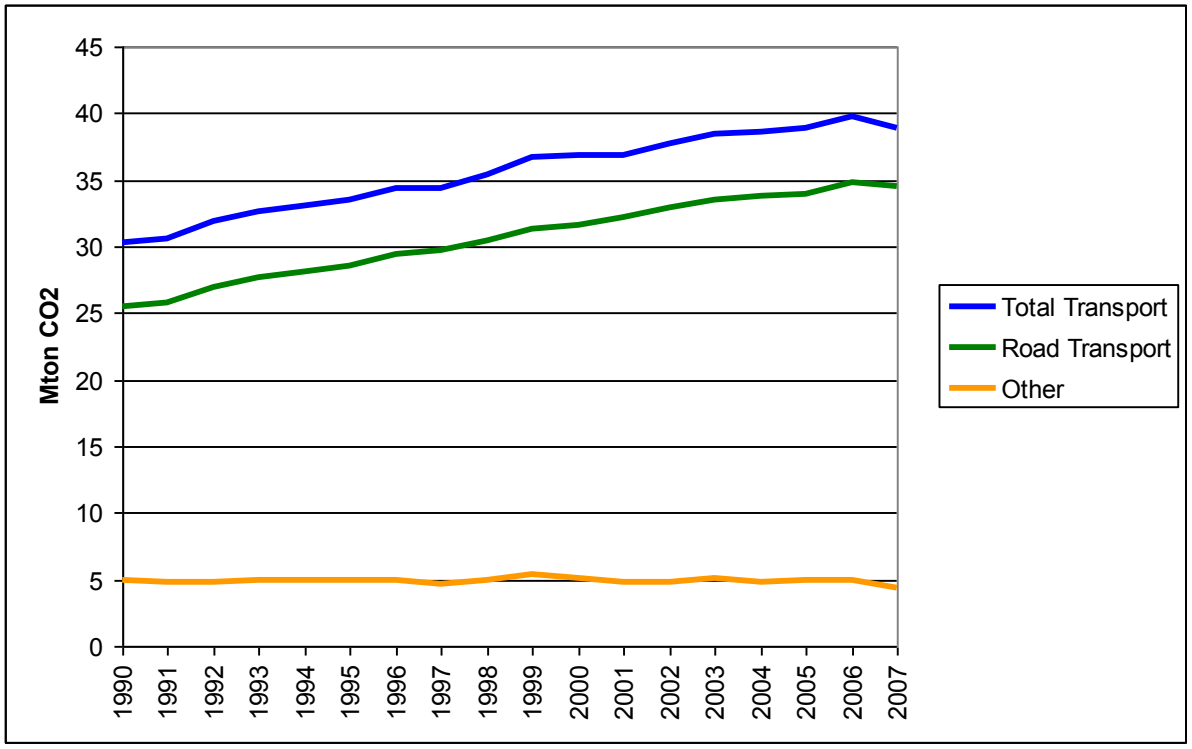


Figure 2.8 CO_2-emissions transport. Source: Hanschke et al., 2009

2.8. Industry

Table 2.4 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 19% of GDP. The other sectors each accounted for less than 10% of GDP. After 1990 the total industrial production (in constant prices) grew only marginally. As a result, the industrial sector's share fell from 17% to 14%. Over the same period, gross value-added of commercial and public services grew more, to achieve a 67% share in 2008. 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, the UK or Denmark.

	1990	1995	2000	2005	2007*	2008*
GDP (x million Euro)	**243 652**	**305 261**	**417 960**	**513 407**	**568 664**	**595 883**
Total gross value added (current (2009) prices in %						
Agriculture, forestry and fishery	**4**	**3**	**2**	**2**	**2**	**2**
Mineral Production	**3**	**3**	**2**	**2**	**3**	**3**
Industry	**19**	**18**	**16**	**14**	**14**	**14**
Of which:						
Food and tobacco industry	3	3	3	3	3	3
Chemical, rubber and synthetics industry	3	3	3	3	2	2
Metals industry	5	5	4	4	4	3
Other	7	7	6	6	5	5
Energy and water suppliers	**2**	**2**	**2**	**2**	**2**	**2**
Construction and installation firms	**5**	**5**	**5**	**5**	**5**	**5**
Commercial and public services	**60**	**62**	**65**	**66**	**65**	**67**
Of which:						
Trade, hotels, catering and repair shops	13	14	14	14	13	14
Transport, storage and communication	6	6	6	6	6	6
Financial and business services	19	21	25	25	25	26
Government	12	11	10	10	10	10
Healthcare and other services	10	10	10	11	11	11
Unspecified	**8**	**7**	**8**	**8**	**8**	**9**

Table 2.4 Development of GDP (in 2009 prices) and the breakdown per economic sector (1990-2008) * = preliminary figures
Source: CBS, 2009q

2.9. Waste

The total amount of waste produced in 2007 (excluding polluted soil, dredging sludge and animal manure) amounted to 60 million tons. Figure 2.9 shows the main sources of waste in the Netherlands in 2007 (CBS/PBL/WUR, 2009c).

Between 1990 and 2007 the rate for reusing waste (i.e. recycling and the use of waste for energy production) increased from 60% to almost 84%% of the total amount (Figure 2.10)(CBS/PBL/WUR, 2009c). This included 46% of residential and office waste, 83% of industrial waste and 94% of demolition waste. Waste products from agriculture and coal-fired power plants were almost fully recycled. Approximately 9.8 million tons are not reused or recycled, of which residential waste has the largest share (44%), followed by office waste (23%) and industrial waste(14%). As Figure 2.10 shows, the amount of non-reused or recycled waste is still decreasing. Since 2004 the total amount of waste produced has stabilised at about 60 million tons, while the GDP has increased. Governmental policies aimed at decoupling GDP growth and waste production are thus successful. In 2007 just over 2 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 disposed on a landfill is incinerated (7.3 million tons, over half of which (53%) comes from the residential sector) or discharged into water (CBS/PBL/WUR, 2009c). Only clean water that remains from the treatment of watery waste is discharged.

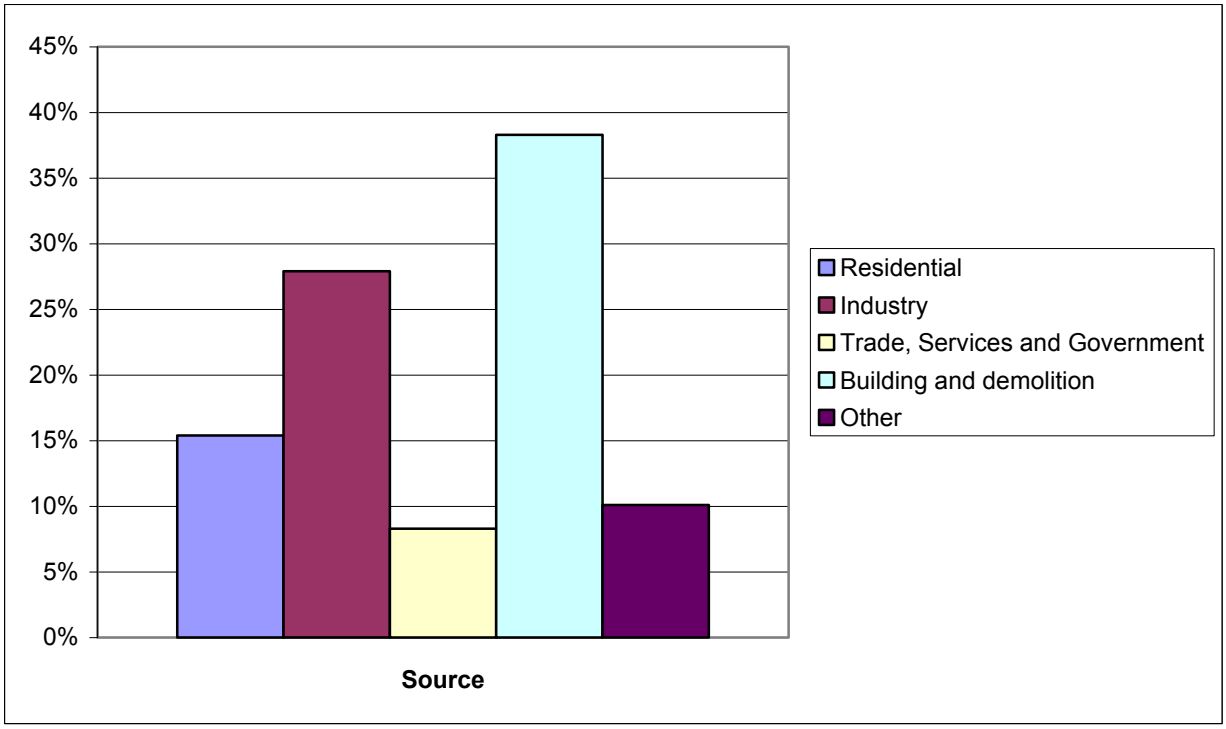


Figure 2.9 Waste generation in 2007 by source category: gross generation excluding polluted soil, dredging sludge and animal manure. Source: CBS/PBL/WUR, 2009d

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, as well as garden and food wastes (compost). As a result, the maximum target for the 2012 policy goal of 2 million tons of landfill waste was almost met in 2007 (CBS/PBL/WUR, 2009d).

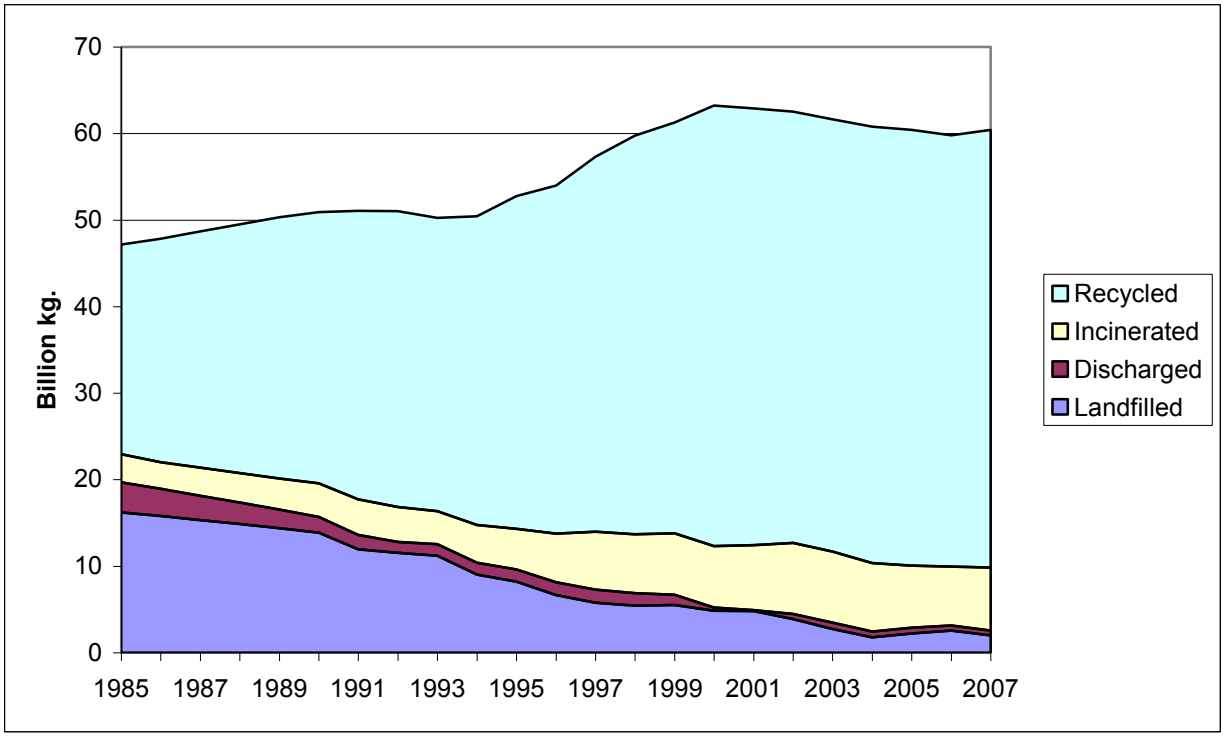


Figure 2.10 Waste generation and methods of disposal 1985-2002. Source: CBS/PBL/WUR, 2009c

2.10. Building stock and urban structure

In 2009 the number of residential homes totalled 7.1 million (CBS, 2009r). Since 1990 an average of 80,000 new homes has been built annually. However, as of 1998 this construction rate has decreased somewhat but, since 2007, the number is back at around 80,000 (CBS, 2009s). In the year 2003 the total area used for residences in the Netherlands amounted to 2,239 km^2, an increase of 4.7% compared to 1996 (CBS, 2009t). The area used for industry and trade increased by 22% over the same period, to 820 km^2.

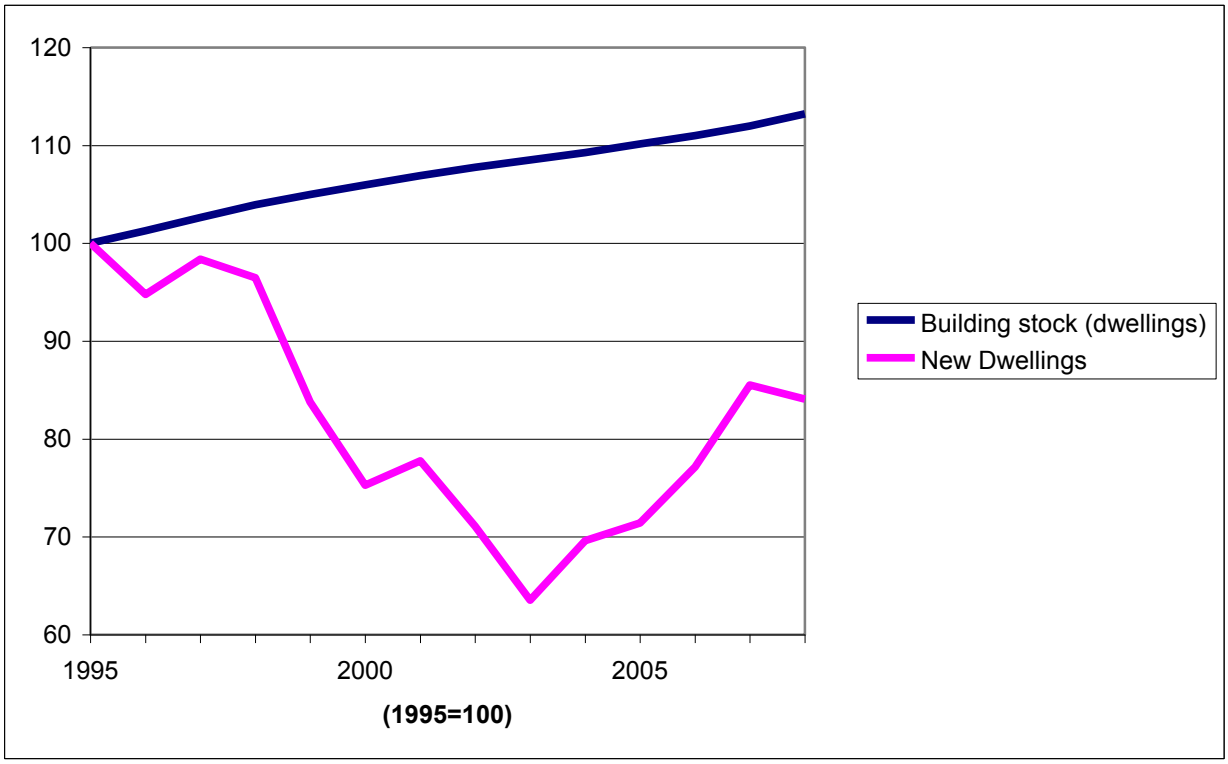


Figure 2.11 Trends in total number of residences and annual production of new homes. Source: CBS 2009r, 2009s

2.11. Agriculture

Agriculture in the Netherlands focuses on cattle breeding, crop production and horticulture; of which greenhouse horticulture is the most important sub sector. The amount of horticulture in total agricultural production is increasing over time. The amount of fuel consumed by the greenhouse horticultural 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 the occurrence of animal diseases (such as BSE), the number of cattle being raised has steadily decreased until 2006, but has since increased somewhat.

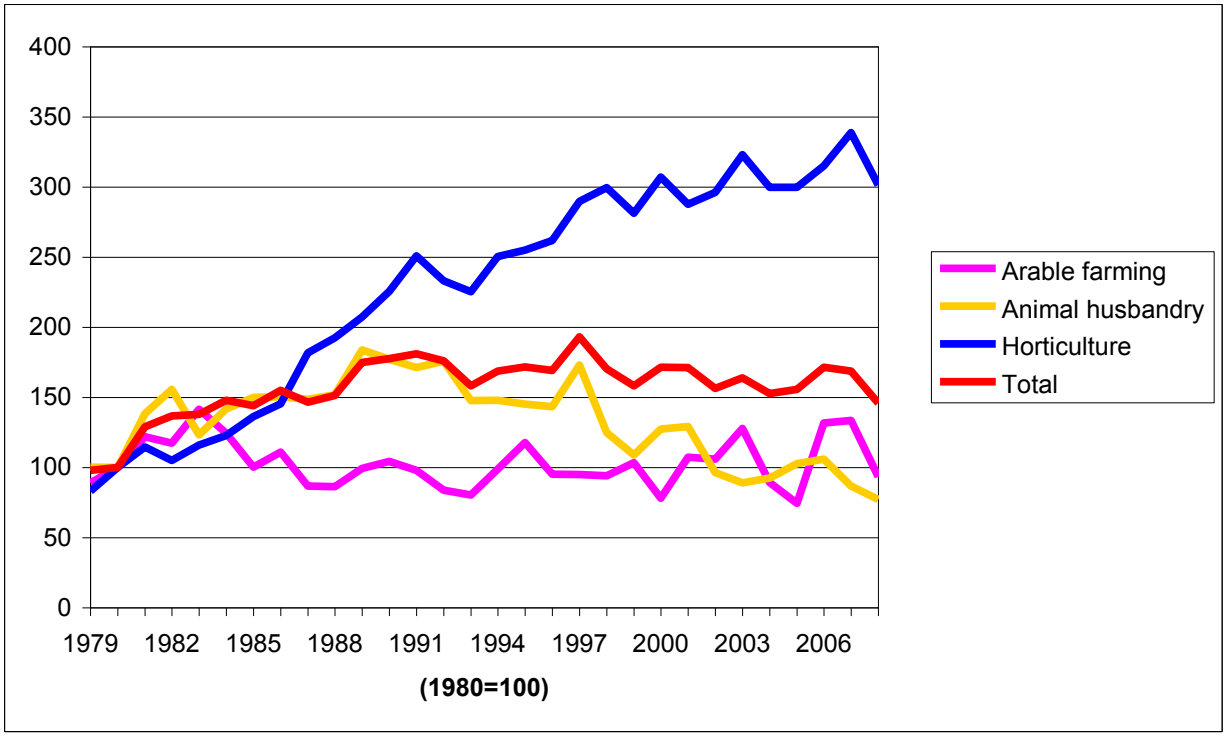


Figure 2.12 Trends in agricultural gross added value by sub sector over the period 1979-2008 (1980 = 100) Source: CBS/LEI, 2009

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. Also, as a consequence of the increasingly stricter manure /nutrient policies (both Dutch and EU), the number of farms that produce more manure (minerals) than they are allowed to use on their own land is increasing. This has led to a sharp increase in the export of manure (Figure 2.13) (CBS/PBL/WUR, 2009e). Furthermore, more farmers are looking for ways to process manure (e.g. separation of liquid and solid fractions) or to use manure as an input for energy production (fermentation, biogas).

The Dutch government cooperates with the agricultural sector to reduce the environmental impacts of agriculture. To achieve this, the covenant 'Clean and Efficient Agriculture' was implemented. Apart from increasing energy efficiency and energy production of renewable energy production, the covenant aims to reduce non-CO_2 greenhouse gases by 25-30% in 2020 (compared to 1990 levels).

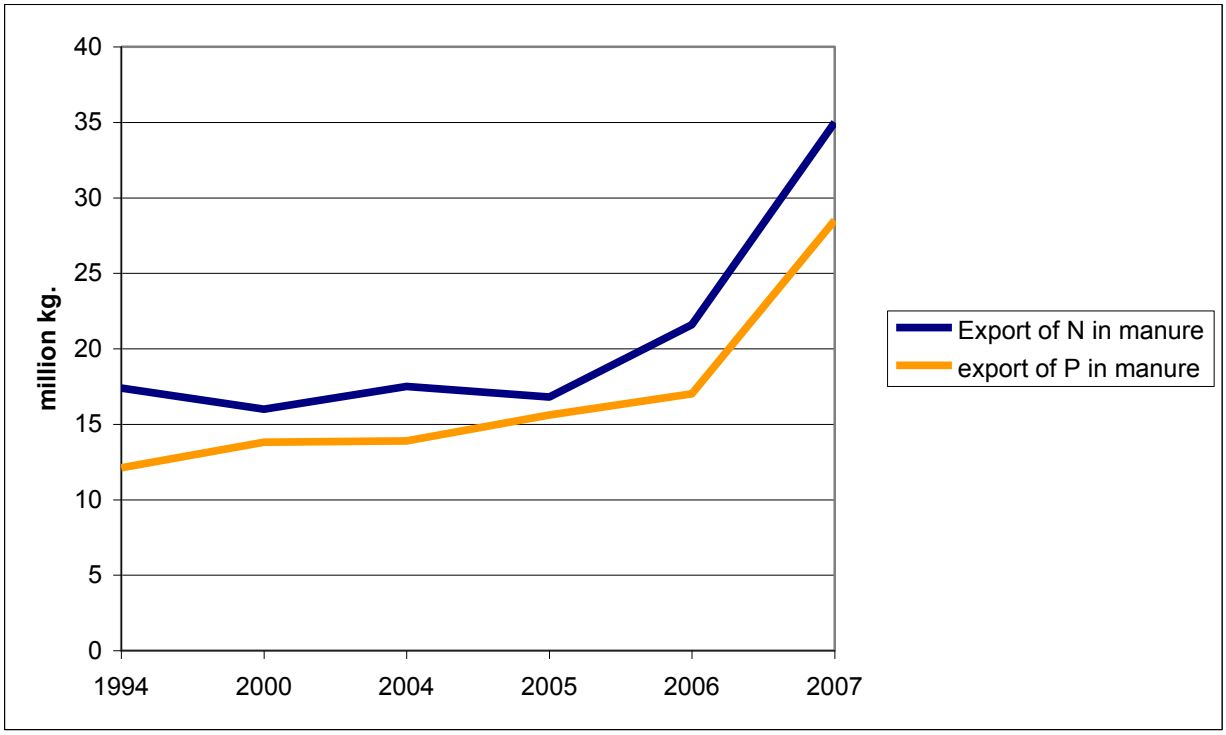


Figure 2.13 Exports of nutrients from over-production of manure in the Netherlands. Source: CBS/PBL/WUR, 2009f

2.12. Forests

According to the Forest Resources Assessment 2005, the forest area in the Netherlands 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 areas in the Netherlands are 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 in 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 broad-leaf 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 areas in the Netherlands can be considered 'semi-natural'.

Type of forest	Share
Unmixed coniferous	32%
Mixed coniferous	7%
Mixed coniferous/broadleaf	21%
Unmixed broadleaf	21%
Mixed broadleaf	15%
Open/young forest	4%
Clear-cut area	0%
Total	**100%**

Table 2.6 Composition of forests in the Netherlands in 2005. Source: LNV (Ministry of Agriculture, Nature and Food Quality), 2007

3 GREENHOUSE GAS INVENTORY INFORMATION

[INCLUDING INFORMATION ON NATIONAL SYSTEMS AND NATIONAL REGISTRIES]

3.1. (A) Summary tables

The Netherlands submitted its most recent greenhouse gas inventory (period 1990-2007) to the UNFCCC in April 2009. No update inventory has been supplied between that submission and the end of 2009. The summary tables, including CO_2 equivalent emission trend tables are shown in Annex 3.1 of this National Communication. The main trends are explained in Section 3.B. below.

3.2. (B) Descriptive summary

This section summarises the trends in greenhouse gas emissions during the period 1990–2007, by greenhouse gas and by sector, as described in the National Inventory Report 2009. More detailed explanations are provided in the NIR 2009.

Emission trends for aggregated greenhouse gas emissions

In 2007 total direct greenhouse gas emissions (excluding emissions from Land Use, Land-Use Change and Forestry, LULUCF) in the Netherlands are estimated at 207.5 Tg CO_2 eq, which is 2.7% lower than the 213.3 Tg CO_2 eq reported in the base year (1990; 1995 is the base year for fluorinated gases). Figure 3.1 shows the trends and relative contributions of the different gases to the aggregated national greenhouse gas emissions. In the period 1990–2007 emissions of carbon dioxide (CO_2) increased by 8% (excluding LULUCF), while emissions of non-CO_2 greenhouse gases decreased by 36% compared with the base year emissions. Of the non-CO_2 greenhouse gases, methane (CH_4), nitrous oxide (N_2O) and fluorinated gases (the F-gases) individually decreased by 34%, 23% and 72% respectively.

Emissions of LULUCF-related sources decreased by 2.3%, from 2.6 Tg in 1990 to 2.5 Tg CO_2 eq in 2007. In 2007, total greenhouse gas emissions (excluding LULUCF) remained almost stable compared to 2006 (208.5 Tg CO_2 eq in 2006 and 207.5 Tg CO_2 eq in 2007).

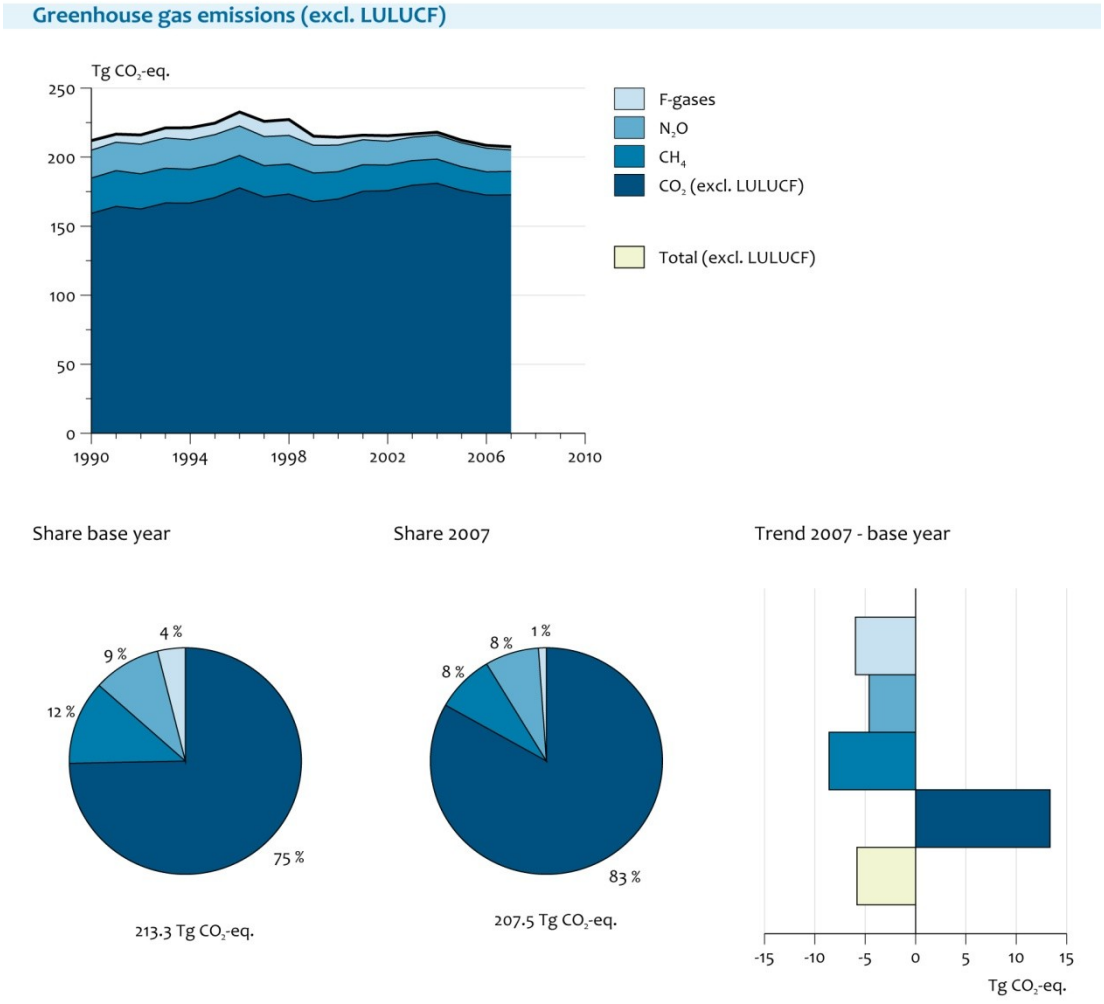


Figure 3.1 Greenhouse gases: trends, emission levels and share of gases, 1990–2007

Emission trends by gas

Carbon dioxide

Figure 3.2 presents the contribution of the most important sectors, as defined by the Intergovernmental Panel on Climate Change (IPCC), to the trend in total national CO_2 emissions (excluding LULUCF). In the period 1990–2007 the national CO_2 emissions increased by 8% (from 159.3 to 172.7 Tg). The energy sector is by far the largest contributor to CO_2 emissions in the Netherlands (96%), with the categories 1A1 'Energy industries' (38%) and 1A4 'Other sectors' (20%) as largest contributors in 2007.

The relatively high level of CO_2 emissions in 1996 is mainly explained by a very cold winter, which caused increased energy use for space heating in the residential sector. The resulting emissions are included in the category 1A4 'Other sectors'. The relatively low level of CO_2 emissions in the category 1A1 'Energy industries' in 1999 is explained by the marked increase in imported electricity and a shift from the use of coal to residual chemical gas and natural gas in 1999; the percentage of imported electricity almost doubled. However, this increased import of electricity led to only a temporary decrease in CO_2 emissions. During the period 2000-2004, the pre-1999 annual increase in CO_2 emissions from this category – about 1-2% – was observed again. In 2007 the import of electricity decreased. During 2007, CO_2 emissions remained stable compared to 2006.

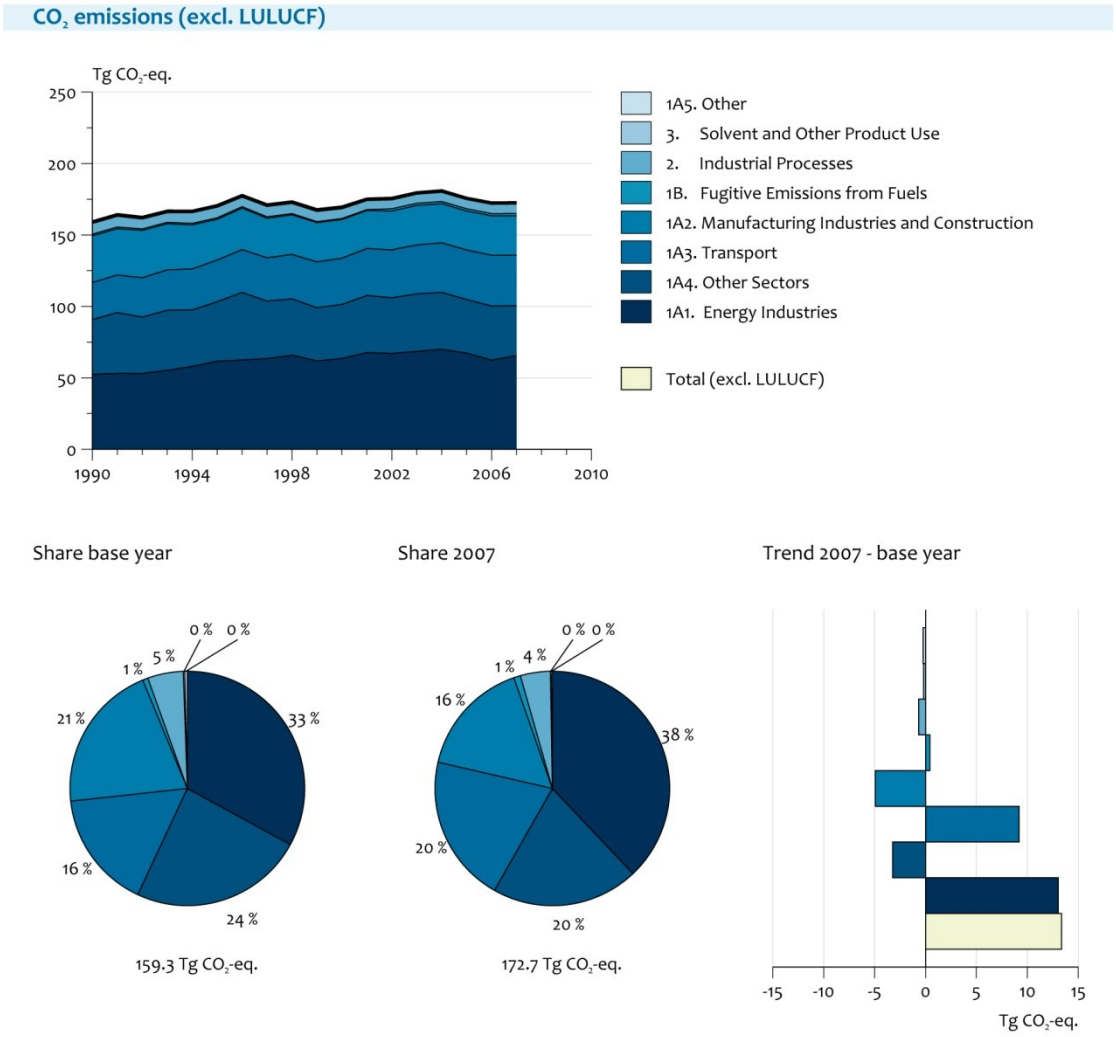


Figure 3.2 CO_2: trend, emission levels and share of sectors, 1990–2007

Methane

Figure 3.3 presents the contribution of the most important IPCC sectors to the trend in total CH_4 emissions. The national CH_4 emissions decreased by 34%, from 1.21 Gg in 1990 to 0.80 Gg in 2007 (25.5 to 17.0 Tg CO_2 eq). The Agriculture and Waste sectors (53% and 33%) were the largest contributors in 2007. Compared to 2006, national CH_4 emissions increased by 1% in 2007 (0.1 Tg CO_2 eq), due to the increase in CH_4 emissions, mainly in category 1A: 'Emissions from stationary combustion of non-CO_2'.

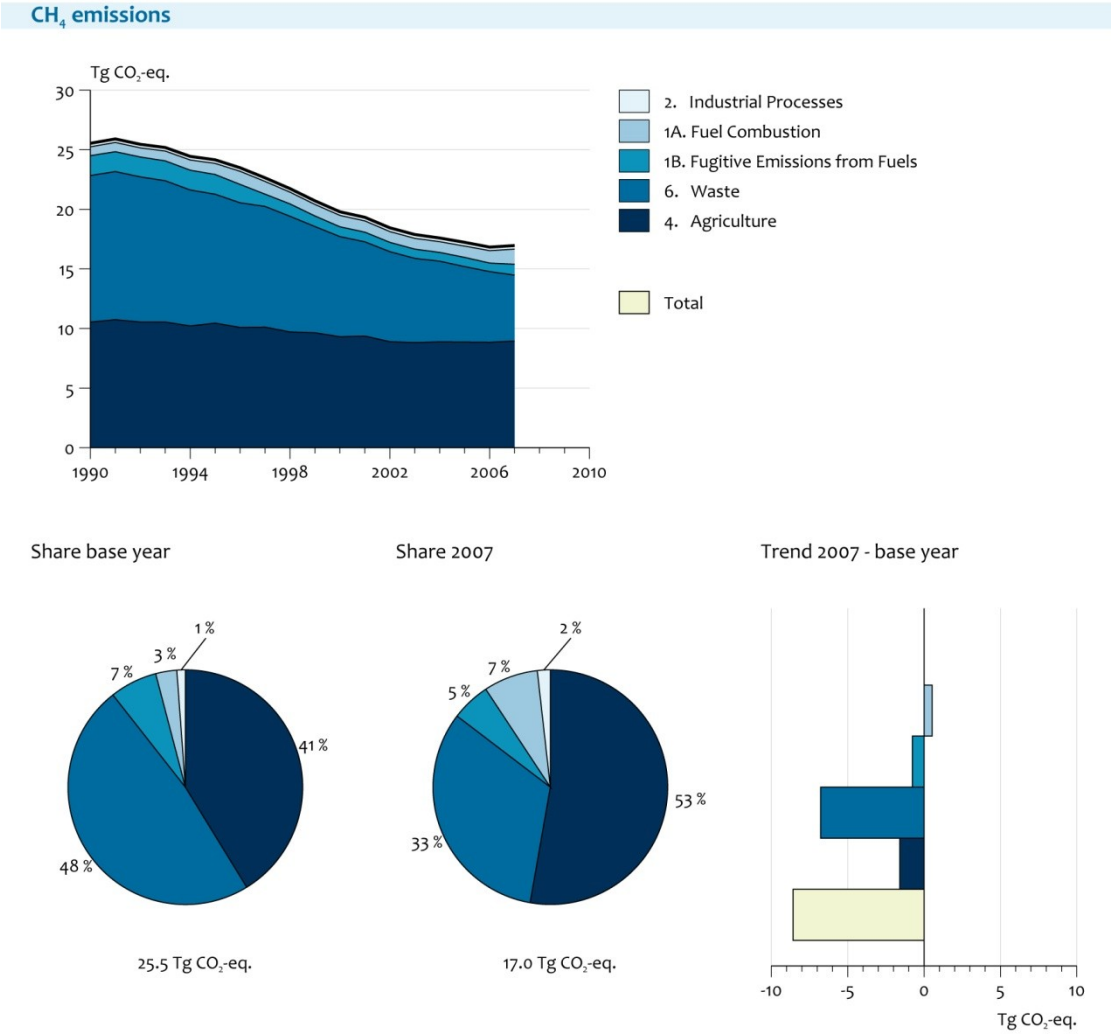


Figure 3.3 CH_4: trend, emission levels and sector percentages, 1990-2007

Nitrous oxide

Figure 3.4 presents the contribution of the most important IPCC sectors to the trend in national total N_2O emissions. The total national inventory of N_2O emissions decreased by about 23%, from 65.2 Gg in 1990 to 50.3 Gg in 2007 (from 20.2 to 15.6 Tg CO_2 eq). The sector contributing the most to this decrease in N_2O emissions is 'Industrial Processes' (–32%). During the same period N_2O emissions from fossil fuel combustion actually increased. This latter trend can be largely clarified by increased emissions from the Transport sector. Compared to 2006, the total N_2O emissions decreased by 9% in 2007 (-1.5 Tg CO_2 eq).

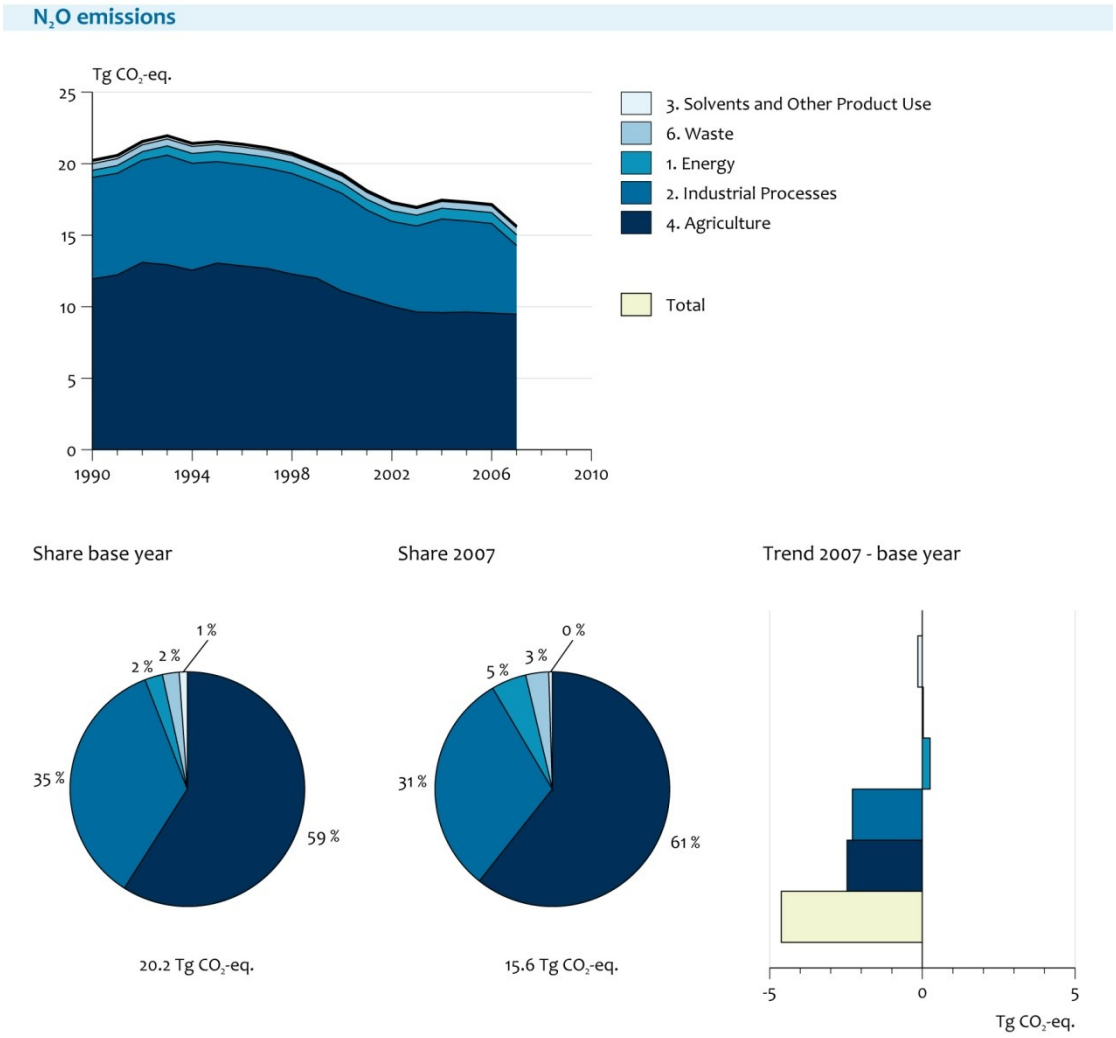


Figure 3.4 N_2O: trend, emission levels and sector percentages, 1990–2007

Fluorinated gases

Figure 3.5 shows the trend in F-gas emissions included in the national greenhouse gas inventory. The emission level of the total F-gases decreased by 72% between 1995 and 2007, from 8.3 Tg CO_2 eq in 1995 (base year for F-gases) to 2.3 Tg CO_2 eq in 2007. Emissions of hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) decreased by approximately 71% and 83% respectively during this same period, while sulphur hexafluoride (SF_6) emissions decreased by 29%. The aggregated emissions of F-gases increased by 13% from 2006 to 2007. PFC and HFC emissions showed an increase of 27% and 11% respectively, while SF_6 emissions increased by 6%.

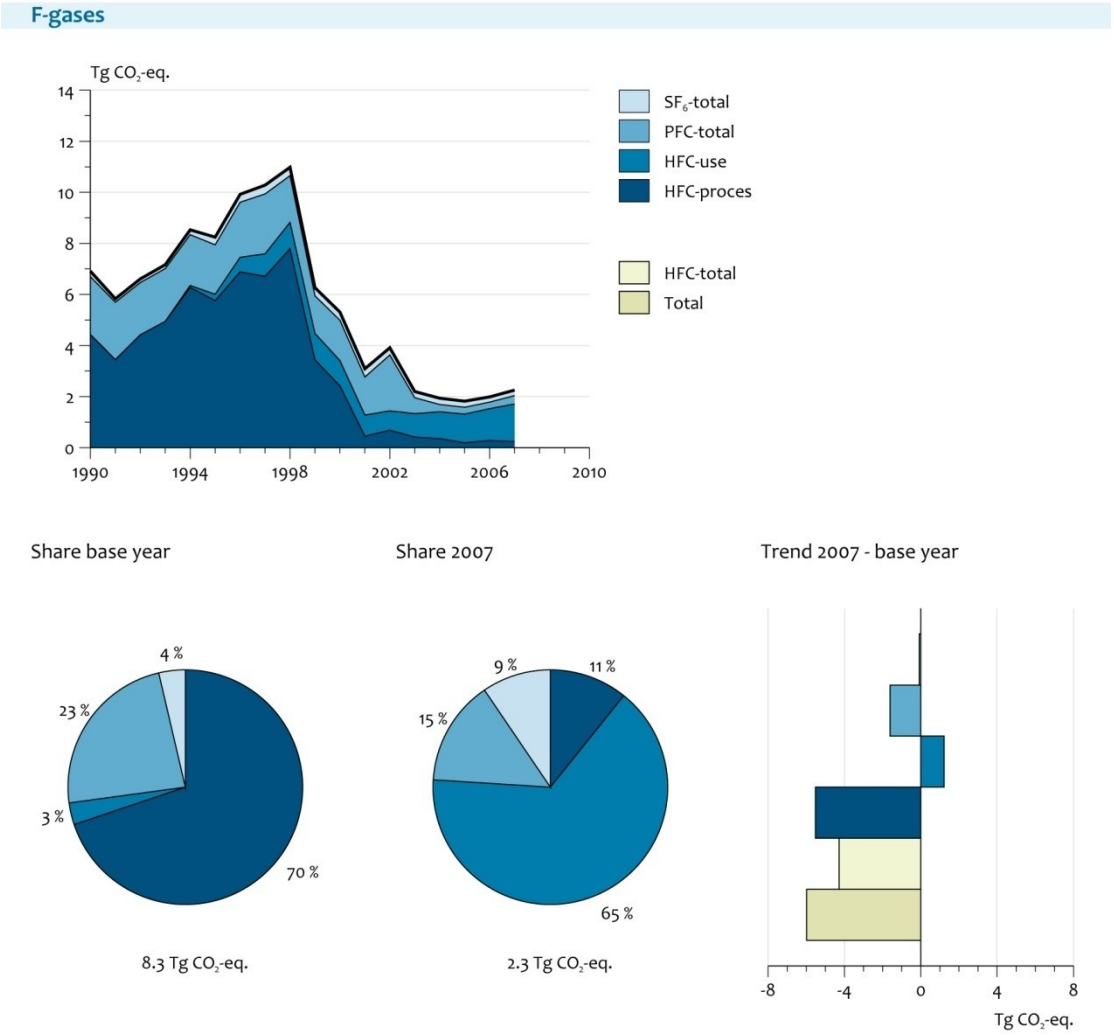


Figure 3.5 Fluorinated gases: trend, emission levels and percentages of individual F-gases, 1990–2007

Emission trends specified by source category

Figure 3.6 provides an overview of emission trends per IPCC sector in Tg CO_2 equivalents. The IPCC Energy sector is by far the largest contributor to the total greenhouse gas emissions in the national inventory (contributing 72% in the base year and 81% in 2007). The relative share of the other sectors decreased correspondingly. The emission level of the Energy sector increased by approximately 9% in the period 1990–2007, and total greenhouse gas emissions from the Waste, Industrial Processes and Agriculture sectors decreased by 53%, 38%, and 18% respectively in 2007 compared to the base year. Compared to 2006, greenhouse gas emissions in the Energy sector increased by about 0.4 Tg (mainly CO_2) in 2007. The emission of CO_2 from the combustion of fossil fuels in this category increased by approximately 2.8 Tg.

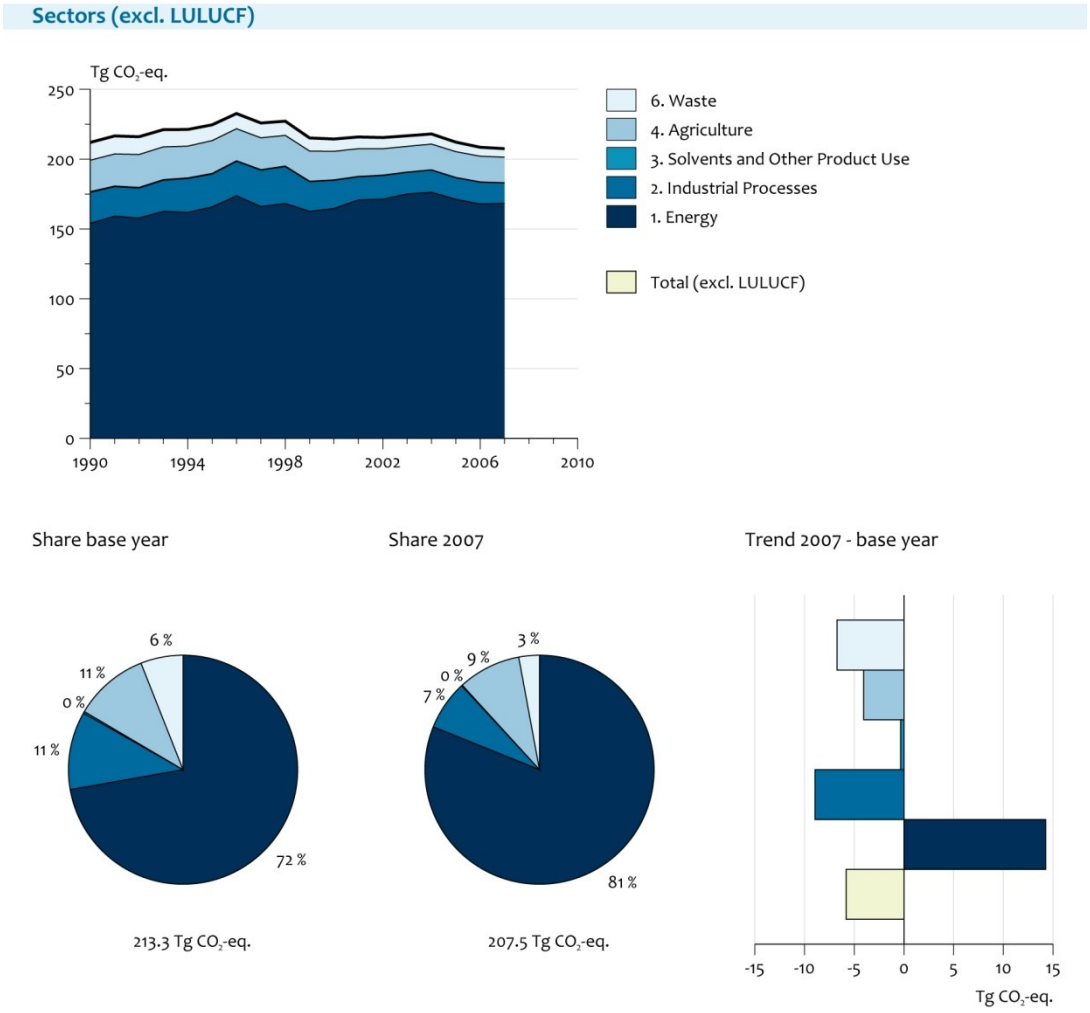


Figure 3.6 Aggregated greenhouse gases: trend, emission levels and sector percentages, 1990-2007

Emission trends for indirect greenhouse gases and SO_2

Figure 3.7 shows the trends in total emissions of carbon monoxide (CO), nitrogen oxides (NO_x), non-methane volatile organic compounds (NMVOC) and sulphur dioxide (SO_2). Compared to 1990, the CO and NMVOC emissions were reduced in 2007 by 50% and 66% respectively. For SO_2 this was as much as 69%, and for NO_x, the 2007 emissions are 47% lower than the 1990 level. With the exception of NMVOC, most of the emissions stem from fuel combustion.

Because of the problems identified with annual environmental reporting, CO emissions from industrial sources are not verified; however, experts have suggested that possible errors will have a minor effect on total emission levels. Due to lack of data, the time series for 1991–1994 was interpolated between 1990 and 1995.

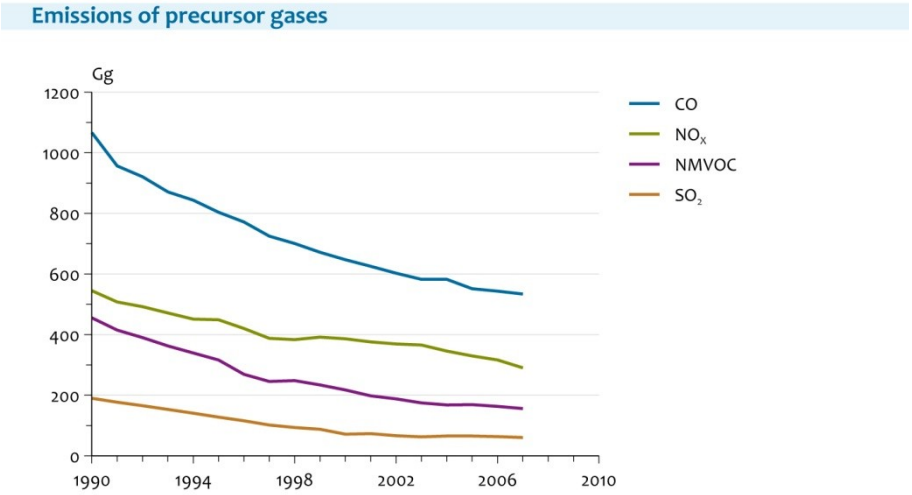


Figure 3.7 Emission trends of NO_x, CO, NMVOC and SO_2 (Units: Gg)

In contrast with the direct greenhouse gases, the calculations for emissions of precursors from road transport are not based on fuel sales according to the national energy statistics, but are directly related to transport statistics on a vehicle-kilometre basis. To some extent this is different from the IPCC approach (see Section 3.5.4.).

3.3. (C) DESCRIPTION OF THE NATIONAL SYSTEM

3.3.1. Scope and objectives of the National System

Introduction

As Party to the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, the Netherlands has in place a National System for estimating anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol. The Netherlands established its National System in 2005. During the initial review it was found to comply with all the necessary requirements. Since then, the system as such has remained unchanged, with the exception of an organisational change that will come into effect as of January 1st 2010. This report details the system as it operates on December 31st 2009, including also the change as from January 1st 2010, describing how the required functions are performed in the Netherlands, following the outline from the reporting guidelines (see Box 1).

Objectives of the National System

Under the Kyoto Protocol, a National System[4] 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 the estimation and reporting of anthropogenic GHG emissions by sources and removals by sinks[5];
- to facilitate meeting the commitments under Articles 3 and 7;
- to facilitate the review of the information submitted;

[4] Definitions used in this report are those used in UNFCCC guidelines

[5] 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)

- to ensure and improve the quality of the inventory.

SenterNovem coordinated the establishment of the National System and was subsequently also assigned the role of 'single national entity' (NIE).

Box 1 Outline

Institutional and organisational aspects (Section 3.3.2), including:
(a) the name and contact information for the national entity and its designated representative with overall responsibility for the national inventory of the Party;
(b) 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 3.3.3), including:
(c) a description of the process for collecting activity data, for selecting emission factors and methods, and for the development of emission estimates;
(d) a description of the process and the results of key source identification and, where relevant, archiving of test data;
(e) a description of the process for recalculating previously submitted inventory data.

Quality management aspects (Section 3.3.4), including:
(f) 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;
(g) a description of the procedures for the official consideration and approval of the inventory.

3.3.2. Institutional, legal and organisational aspects

Name and contact information for the national entity

(a) The name and contact information for the national entity and its designated representative with overall responsibility for the national inventory of the Party:

National Entity:
Contact information: SenterNovem, PO Box 8242, 3503 RE Utrecht, the Netherlands.
Designated representative with overall responsibility for the inventory: Harry Vreuls, h.vreuls@senternovem.nl*, telephone: ++031 46-4202258.*

The Minister for Housing, Spatial Planning and the Environment (VROM) has appointed SenterNovem by law as the single national entity (NIE).

Roles and responsibilities regarding the inventory process

(b) The roles and responsibilities of the 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.

Section 3.C.2.2. describes these elements, distinguishing between arrangements for data collection, data processing and reporting.

Introduction
The Ministry for Housing, Spatial Planning and the Environment (VROM), is the coordinating Ministry in the Netherlands for Climate Change Policy. The Minister of VROM has been given, by law, the authority to appoint a single national entity (also known as NIE), as defined in the guidelines

under Article 5.1 of the Kyoto Protocol. The Minister has appointed SenterNovem as NIE with overall responsibility for the national inventory. SenterNovem is, among other things, responsible for assembling and providing the annual reports to the UNFCCC, coordinating the QAQC process, operating as focal point for the UNFCCC for the report, including supporting the UN review process. Parts of the annual report are provided by other organisations.

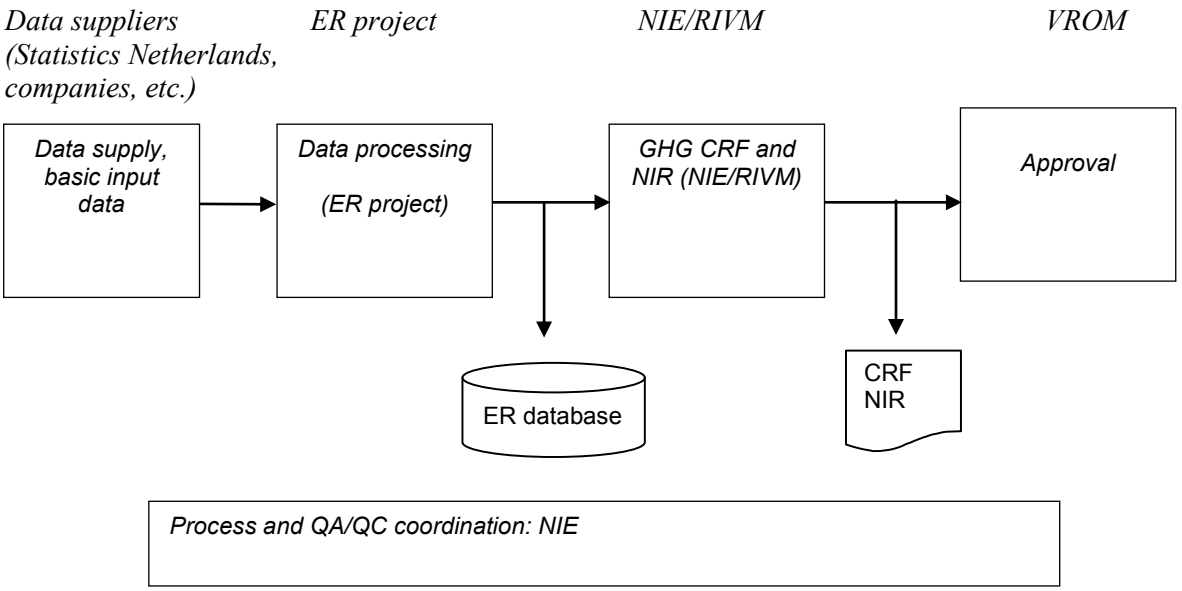


Figure 3.8. Schematic overview of the main steps in the primary process. In practice, there are various feedback loops

The inventory and reporting process is illustrated in Figure 3.8 and briefly described below in three parts:

- arrangements for data collection;
- arrangements for data processing;
- arrangement for reporting.

Arrangements for data collection

The emission data are taken from the national emissions registrations project (ER). This is a collaborative project (started around 1974), involving a series of institutes and ministries in the Netherlands. The objective of the project is to agree on one national dataset for emissions inventories covering some 350 pollutants to air, water and soil; this dataset is used for a variety of international and national applications. Its coordination was assigned to PBL (and its predecessor MNP) during the period 2004-2009. As of January 1st 2010 it will be assigned to RIVM, an agency under the Ministry of Health, Welfare and Sport.

The data sources, methods and processes used for elaborating the greenhouse gas emission estimates are described in the National System documentation, notably in the form of protocols. These are elaborated and maintained by SenterNovem (the NIE); this is achieved in cooperation with the relevant emission experts. The protocols are officially approved by the SCER, the Steering Committee for the ER project, which consists of representatives from the relevant ministries and institutes.

The ER project uses primary data from various data suppliers:

Statistical data

- Most general statistical data are provided by Statistics Netherlands (CBS) as part of their legal tasks (see box) or the priorities set by the Central Commission for Statistics.
- Most statistical data on agriculture, land-use change and forestry are provided by agricultural institutes (i.e. Alterra, LEI) as part of their legally required research tasks (WOT).
- Waste data are collected by the Waste Coordination Platform from SenterNovem under a longer term assignment from the Ministry (VROM).

Provision of statistical data is not part of greenhouse gas-related contracts. To ensure that data and supporting activities for greenhouse gas inventories will be supplied by these organisations, covenants or agreements have been established between the ER and the aforementioned organisations.

Data from individual companies

- A large number of companies are legally required to submit an annual environmental report (MJV). These are validated under the 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 EU emission trading system (ETS), under the BEES/A regulations[6] or within the framework of environmental covenants. The ER 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 taken from environmental reports from industry, energy, refineries and waste handling are mainly used for verifying the 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 by CBS in national emission estimates.

Additional greenhouse-gas-related data

Where sectors are not sufficiently covered in the aforementioned 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 (the Netherlands Organisation for Applied Scientific Research) on preparation of the CRF (Common Reporting Format);
- SenterNovem contracts with consultants to provide annual F-gas emission estimates from cooling and product use.

Arrangements for data processing

The calculation of greenhouse gas emissions and sinks is the responsibility of the ER project. Data are collected and processed by five task groups (TG) according to predetermined methods described in the Monitoring Protocols (see box 2).

Arrangements for reporting, QA/QC coordination and review

The data are stored in the ER's Central Database system. The CRF is generated automatically from this ER database.

The overall annual report for the UNFCCC is elaborated and coordinated by SenterNovem (the NIE). To ensure the involvement of the relevant experts from the various institutes (CBS, TNO, PBL, RIVM, etc.) that supplied the relevant emission estimates, this is implemented as an annual project, in which each section of the NIR is assigned to one lead author; this lead author usually involves other experts. A co-author is assigned for mutual checks. The NIE is closely involved, but the coordination and tuning of the contents of Part 1 of the NIR is delegated to PBL (and from January 1st 2010 to RIVM) to ensure consistency with the ER data. Overall coordination, including the elaboration of Part 2 of the NIR is carried out by SenterNovem/NIE. The elaboration of Part 2 involves various institutes, including the Ministry of Agriculture, Nature and Food Quality.

[6] Legal requirements for large combustion installations

SenterNovem/NIE submits the annual report to the UNFCCC after approval by the Ministry of VROM. SenterNovem has also been assigned overall QA/QC coordination of the inventory, its process and the national system, facilitation of UNFCCC reviews and coordination of requests for clarification.

Box 2 Monitoring protocols

Emission Registration (ER)

Responsibilities for coordination of the ER project

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 PBL. After January 1st, 2010 this may change as a consequence of the shift of coordination of the ER to RIVM. Possible changes will be reported in the NIR and the next National Communication.

The ER project leader at PBL (as from January 1st 2010 this will be RIVM) acts as coordinator 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 via contracts, covenants or other agreements.

Task forces

Various emission experts from the participating organisations participate in the Task Forces that calculate the national emissions from 1200 emission sources. A formal agreement is drawn up by all the participating organisations. After intensive checking, the national emissions are accepted by the project leader of the Emission Register and the dataset is stored in the central database.

The 1200 emission sources are logically divided into 55 work packages. An emission expert is responsible for one or more work packages, the collection of the data and the calculation of the emissions. The experts are also closely involved in developing the methodologies to calculate the emissions. Work packages are grouped into five Task Forces as described below:

Task Force on Energy, Industry and Waste Management (ENINA):

Covers the emissions to air from the sectors Industry, Energy Production, Refineries and Waste Management. ENINA includes emission experts from the following organisations: Netherlands Environmental Assessment Agency, TNO, Statistics Netherlands, SenterNovem Waste Management Department and FO-Industry.

Task Force on Transportation

Covers the emissions to soil, water and air from the transportation sector (aviation, shipping, rail and road transport). The following organisations are represented : Netherlands Environmental Assessment Agency, Statistics Netherlands, Centre for Water Management, Deltares and TNO.

Task Force on Agriculture

Covers the calculation of emissions to soil, water and air. Participating organisations include the Netherlands Environmental Assessment Agency, LEI, Alterra, Statistics Netherlands, EC-LNV, TNO, and the Centre for Water Management.

Task Force on Water - MEWAT

This Task Force calculates the emissions from all sectors to water, and includes the Centre for Water Management, Deltares, Netherlands Environmental Assessment Agency, Statistics Netherlands and TNO.

Task Force on Consumers and other sources of emissions - WESP

Covers emissions caused by consumers, trade and services. The members are emission experts from Netherlands Environmental Assessment Agency, TNO and Statistics Netherlands.

After January 1st, 2010 this may change slightly as a consequence of the shift of coordination of the ER to RIVM. Possible changes will be reported in the NIR and the next National Communication.

Legal arrangements for the National System
The Greenhouse Gas Monitoring Act became effective by the end of 2005. This Act determines the establishment of a National System for monitoring greenhouse gases and empowers the Minister of Housing, Spatial Planning and the Environment (VROM) to appoint an authority responsible for the National System and the National Inventory. The Minister has appointed SenterNovem as this authority (NIE) [2005, official Government Gazette (the 'Staatscourant')].

The Act also specifies that the National Inventory must 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 an announcement of publication in the official Government Gazette (the 'Staatscourant').

3.3.4. Methodological and process aspects

(c) A description of the process for collecting activity data, for selecting emission factors and methods, and for the development of emission estimates, are included in the methods and processes to be used.

The roles and responsibilities in the process of collecting activity data, selecting emission factors and the development of emission estimates are described the previous section. This paragraph describes the methodological and process aspects herein.

The choices with regard to activity data to be used, emission factors to be selected, the methods to be selected and the steps in development of the emission estimates have been established in various ways:
During the establishment of the national system an improvement programme was implemented with the relevant institutes and experts, as well as with independent experts. This assessed all relevant data, factors and methods. This was achieved, for example, during workshops and through special (background) studies. Choices were made, in line with the IPCC and UNFCCC guidelines, as to (changes in) methods, data and factors. These were made together with the experts and a special committee in which relevant institutes participated. The resulting data sources, emission factors, methods and working processes were laid down in protocols.
The annual QAQC cycle (see below) guarantees a continuous attention to possible further improvements needed and/or possible. The results of internal and external QAQC and review processes are an important base for this.
In addition, a cycle of about 5 years is implemented in which a more thorough systematic review of methods, processes, data and factors is implemented, gradually covering all sectors. This aims at longer term improvements by timely assessing the consequences of developments in new policies, guidelines and science for the methods and processes to be used.

More detailed information is given on the way the processes are implemented, by describing (in Section 3.C.3) the implementation of the various functions of a National System as part of an annual management cycle in the Netherlands.

Introduction
The annual cycle 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;

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.

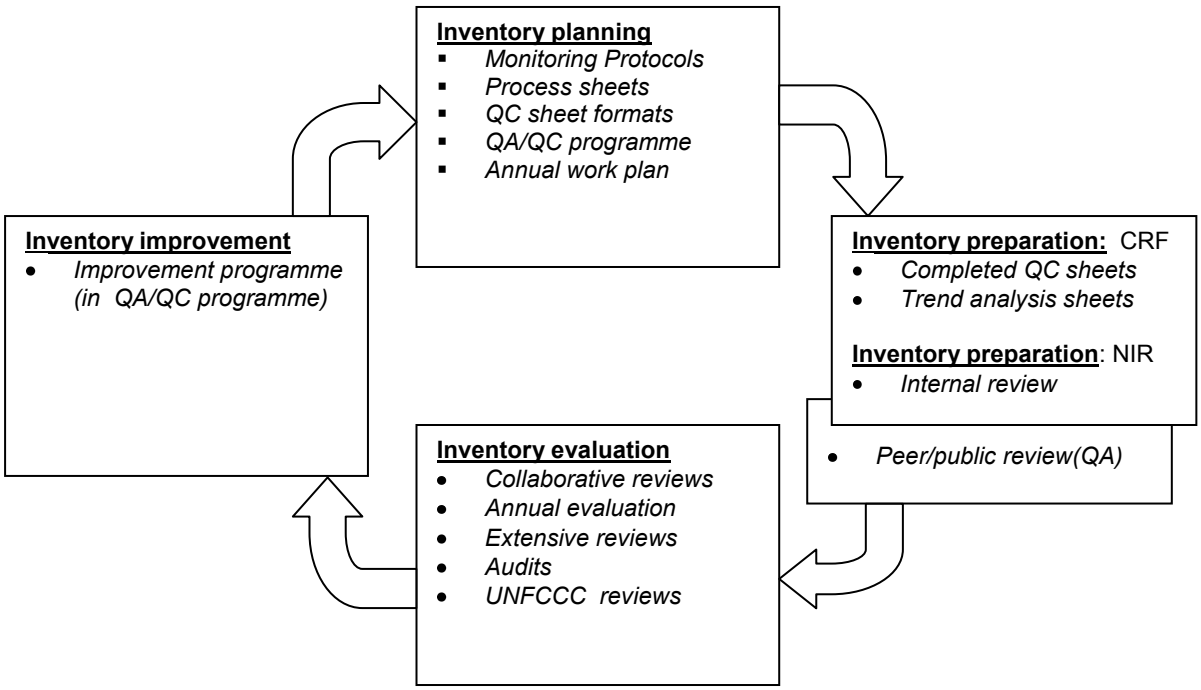


Figure 3.9.Annual cycle

Inventory planning

The National System, among other things, encompasses the following functions and elements:

- agreements on the basic institutional, legal and organisational structure. These have been laid down in contracts, legal arrangements and covenants (see previous section);
- the 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 nearly 40 Monitoring Protocols. These describe the choice of method, activity data and emission factors, as well as specific tasks, responsibilities, working processes and time schedules. The Protocols constitute part of (and are listed in) the annual inventory report and are also published on the National System website (www.greenhousegases.nl) and the Ministry (VROM) website;
  - a set of Procedures for other relevant processes, e.g. the preparation of CRF and NIR, documentation and archiving, key source and uncertainty analyses;
- a QA/QC programme, including quality objectives and a plan/time schedule for QA and QC activities (see following section). This programme includes an improvement plan.

The agreements, protocols, procedures and QA/QC programme are reviewed annually, updated (if necessary) and approved for use in the next cycle. Changes to the Monitoring Protocols require the approval of the Ministry of VROM and the ER Steering Committee. SenterNovem is responsible for updating the QA/QC programme, including the improvement programme. Updates are approved by VROM, in consultation with the Consultative Committee NIE[7]. For LULUCF issues, VROM will seek agreement from 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

[7] Consisting of representatives of the Ministries (VROM, LNV) and institutes (CBS, ER, NEa) involved.

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[8], after mutual consultation.

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 is 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;
- elaborating the CRF and NIR in accordance with the related procedures.

(d) A description of the process and the results of key source identification and, where relevant, archiving of test data:

The key source analysis is part of the annual process for the NIR (part 1). This will be done by the ER under auspices of its coordinator, after the annual emissions have been calculated. Any changes in key sources, as well as the results from the uncertainty analyses, will be taken into account by the NIE in the improvement programme and planning for the next cycle. Performing the key source and uncertainty analyses, as also described in the Procedures of the National System.

(e) A description of the process for recalculating previously submitted inventory data

If necessary as part of the inventory preparation process, recalculations are also performed and documented in accordance with the related IPCC guidelines. Methods can only be changed after formal approval of the revised methods and Protocols by SCER and VROM, since these also have to be included in the Protocols. This is achieved using the motivation of the initiator for a change in methods, data or factors as to why this is better and/or needed. This assessment also looks into whether the change has been sufficiently reviewed and documented.

Changes can be initiated by all parties involved; they can be based on UN review team recommendations as well as on new scientific improvements and/or developments in data availability.

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 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:
    - around June: evaluating the previous cycle and updating the QA/QC programme;
    - around October: updating Planning and Protocols, if needed, for the next cycle.

Inventory improvement

The improvement programme, an integral part of the QA/QC programme, will be updated as part of this annual cycle. If results, notably those from UN reviews, give rise to urgent improvement actions, additional actions may be decided. Improvements that influence methods or may induce recalculations

[8] For the ER, approval is given by the Steering Committee ER.

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.

Inventory management
Management of the inventory in the Netherlands encompasses:

- documenting and archiving the relevant information for each cycle, using an annual file of relevant documents. The Netherlands' archiving system is centrally accessible for the NIE, with the exception of confidential information. Confidential information is maintained and archived by the 'owner'. It is on request available for UN review in line with the CP decision and the code of practice. Non-confidential key documents are, to the extent possible, made accessible through the National System website www.greenhousegases.nl.
- facilitating UN reviews and responding to any related requests for clarification under the EU monitoring mechanism and the UNFCCC.

3.3.5. Quality management aspects

(f) 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.

The QAQC system, programme, plan and their implementation are described in this section, which also highlights information on internal and external evaluation, as well as review processes and their results.

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. Over the last few years, various improvements have been implemented. The main inputs were the results of internal and external evaluation and review processes. Section 3.C.4.4 describes the process of official consideration and approval of the inventory.

QAQC programme
The QA/QC programme describes the quality objectives of the inventory, 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 is held available for UN review. SenterNovem is responsible for the coordination and implementation of the programme. It will be updated, if needed, about once a year, usually in the autumn as part of the planning cycle.

The objectives are further elaborated in the programme into more specific quality objectives related to improving transparency, consistency, comparability, completeness and accuracy (the 'inventory principles').

The QA/QC plan consists of four groups of activities:

- quality control;
- quality assurance;
- documentation and archiving;
- evaluation and improvement.

Generally the main actions include:

Quality control

- maintaining a transparent system through Protocols, Procedures and QA/QC programme. This step is essential for the planning phase. It defines requirements and outputs;
- regularly 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 the IPCC Good Practice Guidance and, where applicable, source-specific QC procedures for selected sources. The main responsibilities for implementation lie with the ER. The NIE regularly checks whether activities and outputs (still) comply with the guidelines.

Quality assurance

This is primarily implemented by staff not directly involved in the inventory process coordinated or implemented by SenterNovem. The main activities include:

- peer review process:
  - annual basic peer reviews before submission of NIR/CRF to the UNFCCC;
  - extensive review process: coordinating a 5-year cycle of extensive reviews of relevant sectors. This includes possible intra-EU collaborative reviews;
- annual audit on selected part(s) of the National System. The main focus is determined annually by the NIE in consultation with the NIE's Advisory Board (Klankbordgroep).

Documentation and archiving

The main activities relate to the cycle as a whole:

- providing documentation and archiving.
- facilitating reviews and responses for clarification. The NIE coordinates this process.

Evaluation and improvement

The main activities include:

- implementation of the annual evaluation and improvement cycle, as mentioned above;
- implementing the improvement programme. Activities are determined annually in the QAQC programme, based on experiences from reviews and QAQC actions.

Results from internal and external evaluations and reviews

Various actions were taken to improve and maintain the quality of the National System. During the initial phases of the National System these were based upon:

- expert workshops that made a preliminary assessment (around 2000) of the inventory process, any weak spots and potential areas for improvement. A long-list of actions was identified. An interdepartmental committee (WEB) prepared a shortlist of prioritised actions, to be included in an improvement programme. In 2001 SenterNovem assumed the practical coordination of this programme; the programme was finalised in 2005;
- extensive sectoral reviews and studies;
- UNFCCC reviews. These provided a crucial input for improvement actions, being the main indicator of 'customer' satisfaction. Recent reviews led to a number of improvement actions, the main ones are illustrated in the box below.

Special attention was also paid to improvements in the LULUCF. The methods in this sector were improved and upgraded for forests and complemented for soils, to reflect the recently adopted GPG for LULUCF and the adjustment discussions with the UN review team on the LULUCF estimates in the initial review.

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; based on UN review recommendations the Protocols were further improved during 2008/2009 with additional information, rather than (readily) referring to background documents;
- uncertainties: in 2006 a Tier 2 uncertainty analysis was implemented (Ramirez, 2006). This showed that Tier 2 analysis did not lead to significantly different overall uncertainty estimates, as with Tier 1. It was decided to implement Tier 2 updates only about once every 5 years or after major methodological improvements;
- the UN review called for better descriptions of uncertainty estimates and of sector-specific QC actions. Through a series of workshops (with involved and non-involved experts) this improvement action was implemented in 2009.

Sectoral improvement projects (examples, not exhaustive):

- energy: the emission factors of various fuels were studied, better substantiated and updated. Data consistency between ETS data and NIR data was assessed and explained.

Official consideration and approval

(g) a description of the procedures for the official consideration and approval of the inventory.

The Ministry of VROM gives approval for the NIR/CRF to be submitted by the NIE to the UNFCCC, after consulting the findings of the checks by the NIE and, if needed, after consulting with the Ministry for Agriculture on LULUCF issues.

3.3.6. Programmes to improve the quality of local emission factors, activity data and/or models (Art.10 of the Kyoto Protocol)

The Netherlands actively pursues the continuous improvement of its inventory. The previous sections describe its quality improvement cycle and programmes and the main results. In addition, the Netherlands actively participates in what may be considered a 'regional programme' activity; with the EU the experts regularly convening to discuss experiences with their respective inventories, with the aim to identify and, where relevant, implement improvement actions. This is achieved through expert workshops, working group meetings and joint EU research programmes.

The Netherlands also participates in special programmes whereby government-to-government expert assistance programmes (G2G) experiences with inventories are exchanged. This was recently implemented, for example, with Croatia (on ETS issues) and with Romania (on various issues).

3.4. (D) National Registry

This section describes the National Registry of the Netherlands. It follows the outline for presenting information, taken from the guidelines on reporting of information under Article 7.2. of the Kyoto Protocol.

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

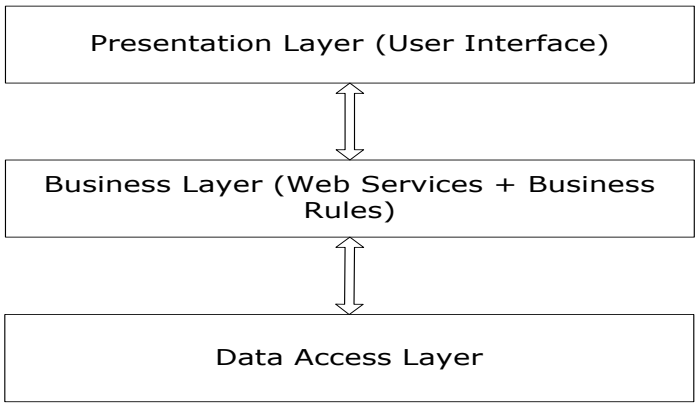
The names of the other Parties with which the Party cooperates by maintaining their National Registries in a consolidated system.

The Netherlands maintains its National Registry as a separate system. The registry is developed and improved in cooperation with other Parties (Sweden, Netherlands, Norway, Ireland, Italy, United Kingdom, Slovenia, Bulgaria, Romania and Iceland) under the leadership of the UK Department of Energy and Climate Change (DECC). This cooperation scheme is called Greta.

From the beginning of 2012, the Netherlands intends to implement the Kyoto Registry in a consolidated manner with all the Parties that are also members of the European Union. To this end, a proposal (by the European Commission) was made on behalf of these Parties to the UNFCCC Secretariat. The Secretariat is currently reviewing this proposal.

A description of the database structure and capacity of the National Registry

The Registry system architecture consists of three layers, as the following diagram illustrates.



The Presentation Layer allows the user to interact with the Registry. In general terms the user interface element consists of all code above the Web Service Layer.
The Business Layer is where company-specific (Kyoto) rules and processing are performed. This layer interacts with the Data Access Layer below and the Presentation Layer above. In practice, this layer is implemented as two sub-layers. The Web Services Layer is visible to the Presentation Layer modules with pre-defined interfaces, and the Business Rules layer is visible to the Web Services.
The Data Access Layer manages accessing to the database for data retrieval and applying updates. It interacts with the Business Layer above.

The GRETA Registry System is implemented using a Microsoft SQL Server relational database management system with a dedicated data model for supporting Registry operations. The absolute maximum size of an SQL Server 2000 database is 1,048,516 Terabytes or 50 Terabytes per single file entry, and it supports up to 32 processors with 64 gigabytes of memory. This is well within any reasonable demand for capacity, which means the chosen technology is not a limiting factor.

The hardware that the Registry runs on will be upgraded before 2010 for support reasons. The new hardware will, at a minimum, have double the capacity of the current hardware. The current hardware has proven to have capacity to spare for running the Registry. This upgrade will substantially increase the spare hardware capacity, thus ensuring that the hardware is not a limiting factor.

The Netherlands' Registry is actively used by traders, and therefore the Dutch database is comparatively large. In the five years that the Netherlands has been running the Registry we have learned that the best Key Performance Indicator (KPI) for the capacity of the registry is the following:

The maximum number of unit blocks that can be involved in a single transaction
In November 2009 the software of the Registry was upgraded to increase the maximum number of unit blocks that the registry can process in a single transaction. With this upgrade the current capacity is calculated to be 9,000 unit blocks. This is well within the required capacity for the foreseeable future, and much larger than the estimated current ITL (International Transaction Log) capacity of 2,500 unit blocks.

Work is also underway to determine the maximum number of unit blocks that can be held on a single account in the Registry. If required, software or hardware improvements will be made to increase this limit to a level that is high enough to facilitate any reasonable future increase in demand for capacity. We are confident that the Registry has ample capacity to facilitate trading in the current and future commitment period, assuming no significant changes are made to the design of the scheme. If significant changes are made to the Kyoto scheme, or any new scheme is adopted, the capacity will need to be reviewed accordingly.

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)[9]
The GRETA registry software has been developed to implement the EU Emissions Trading Scheme and the Kyoto Emissions Trading Scheme. Both schemes require Registries to be compliant with the UN Data Exchange Standards (DES) referred to in the Kyoto Protocol. Through ongoing development the Greta registry software is continuously being kept up to date with the current version of the DES specifications. The current version of the DES is v1.1.2 of 21 April 2009.

The GRETA registry software implements functionality to perform issuance, conversion, external transfer, (voluntary) cancellation, retirement and reconciliation processes using XML messages and web services as specified in the DES.

Additionally the GRETA registry software implements functionality for 24-Hour Clean-up, Transaction Status enquiry, Time Synchronisation, Data Logging requirements (including Transaction Log, Reconciliation Log, Internal Audit Log and Message Archive), Replacement of tCERs and lCERs, Carry-Over, Expiry Date Change (for tCER and lCER), ITL Notices (and the Notification Log) and the various identifier formats as specified in the DES.

The functionality that has been developed in the GRETA registry software has been tested with STL, ITL, CDM registry and other Registry Systems, before connecting to the ITL. Conformance with the current DES is always confirmed before deploying a new version. This is achieved by testing with the aforementioned Registry Systems.

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,

[9] See decision 24/CP.8.

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

In order to minimise discrepancies between the Registry and the Transaction Log, the following approach has been adopted for the development of the Registry software:

Communication between the National Registry and the ITL is achieved via web services using XML messages – as specified in the DES. These web services, XML message formats and the processing sequence is as specified in the DES. As far as possible, the Registry validates 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 minimises the sending of incorrect information to the ITL for approval.

All units that are involved in a transaction are 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.

The web service that receives transaction proposal messages logs and confirms the receipt of these messages if they are technically valid. The content validation and processing is then performed sequentially. This separation allows for swift communication with the ITL while still performing extensive business checks. This also significantly improves the transaction handling capacity of the Registry System.

Where a 24-hour clean-up message is received from the ITL regarding a transaction, the web service will roll back the units that were involved in this transaction, thereby ensuring the unit holdings in the Registry reflect the unit holdings as recorded in the ITL.

If an unforeseen failure were to occur, any data discrepancies between our Registry and the ITL can be corrected via a manual intervention function within the Registry. Following this, reconciliation will be performed to confirm that the data are again in sync between the Registry and the ITL.

Within the current DES protocol a situation can arise in which a Registry is marked discrepant, even though the Registry has followed all the rules. This can be seen as a protocol bug. The Netherlands and Greta have actively worked with other Parties and the Secretariat to improve the DES. These efforts have resulted in a specific proposal for a DES change that is currently being evaluated.

An overview of security measures employed in the National Registry to prevent unauthorised manipulations and to prevent operator errors, and a description of how these measures are kept up to date

The following security measures have been taken for our Registry:
Access to the Registry can only be obtained by providing a valid user name and password.

- The operations that a user can perform are controlled by a permission system, thus preventing unauthorised access to restricted operations.
- All actions performed in the Registry are recorded in an audit trail, showing who performed which actions by whom, and when.
- 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.
- A secure channel is used for the exchange of any privileged information between the Registry and a Registry user. This is achieved by using the strong encryption standard known as SSL-128 bit.
- A dedicated development team is available to make any further security enhancements as and when required.

- In order to prevent operator errors, our Registry software incorporates the following points:
- Validation of all user inputs to ensure that only valid details are submitted for processing.

- Confirmation of user input to help the user spot any errors that have been made.
- Implementation of an internal approval process for secondary approval of relevant operations before submitting the details to the ITL for processing.

A list of the information publicly accessible by means of the user interface to the National Registry

The Registry consists of a public and a restricted area. The public area is accessible to everyone through the following web address: http://www.emissieautoriteit.nl.. The restricted area is only accessible to authorised users through the following web address: https://co2register.nederlandse-emissieautoriteit.nl. Users wanting to access the restricted area are redirected to the restricted area through the public area. Although the public and restricted areas are technically distinct, referral links between these areas ensure that – combined - users perceive them as one area. The home-page of our website is linked to the CITL, which contains all information required by the European Regulation on Registries (2216/2004).

All publicly available information required under the rules of the Kyoto Protocol and COP/MOP decisions is published on the public section of the Registry: http://www.emissieautoriteit.nl/english/public-information-kyoto/publications-2008 .
The user terms and conditions are also available through the public area of the Registry: http://www.emissieautoriteit.nl/emissierechten/register-co2-emissiehandel/gebruikersbepalingen

The Internet address of the interface to the National Registry

The main entry point to the National Registry is http://ww.emissieautoriteit.nl.

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.

Physical security

The physical security of the building and computer rooms is carried out by the Security department of Getronics (formerly named PinkRoccade Infrastructure Services b.v., 24 hours a day, 7 days per week. The department uses technical and procedural means. Visitors are only allowed after invitation by one of the Getronics employees. Access to the computer rooms is severely restricted and only possible after showing proof of identity and obtaining high-security clearance. All security rules can be found in the book: 'Beveiligingsregels PinkRoccade Infrastructure Services' (in Dutch).
The back-up and production environments are (geographically) separated in the locations Apeldoorn and Amsterdam. The distance between these locations is approximately 100 km.

In the event of calamities, a backup server is available at the site in Amsterdam. According to the Service Level Agreement (SLA – available in Dutch), this backup server should be operational within 48 hours after the decision is taken to use this server. Daily backups of production environment data are stored in a secret third location somewhere in the province of Gelderland, the Netherlands.

In the event of the production environment being lost, the backup from the day before will be transferred to the site in Amsterdam. The relevant data will be retrieved and installed on the backup servers. After confirming connection with the ITL and ensuring the data is in sync with the ITL, users of the Registry are directed to the secondary site.

Technical details regarding backup scenario:
Full backups (meaning databases as well as applications) are made on a daily basis (7 days a week). Every week, a backup is transferred to the secret external location. The backup is kept for two weeks. Restore time during business hours is no more than four hours. There is a physically guarded computer

area.

System security
Standard (continuous) monitoring of the servers making use of the following security components: Intrusion Detection System and Firewalls. Both the web server and the database are dedicated to GRETA. A dedicated firewall is also in place. The systems are only accessible though the Registry website. Continuous monitoring by Intrusion Detection Services is performed to prevent unauthorised access to the machines. Log files are checked each month with regard to security issues and further analysis in case of irregularities. Security systems are periodically audited. The latest audit was performed in the second half of 2009 -a report is available. The audit results are discussed with the IT supplier to agree on areas for improvement.

The operating system and system applications are kept up to date with security patches, as needed and in a controlled manner. In the event of a disaster, the following recovery procedures have been incorporated into the design of the Registry system:
Local information in the database is held over a mirrored disc array with automatic error detection and recovery. Any data failure will be reported and the Registry will automatically use the correct redundant information. Data is also archived every hour and electronically transferred to the secondary site in addition to the daily backups.

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
For the connection to the ITL digital certificates a VPN tunnel is used to ensure secure communications. Before connecting to the ITL this connection has been tested as part of connectivity testing. The connection was found to be secure and operational.

Before connecting to the ITL, the Registry system has been tested with ITL, STL, CDM and Parties Registry systems. The Registry was found to be compliant with EU and UN technical standards (DES).

The performance of the system has been tested by performing transactions with a large number of unit blocks. The conclusion from this testing is that the Registry system has ample performance to provide all foreseeable transaction processing capacity, for both incoming and outgoing transactions.

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, while Section 4.4 goes on to describe 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 supplementary 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 (A) Policy-making process

4.2.1. The Netherlands' emission-reduction targets

The Netherlands, which is a Member State of the European Union (EU), ratified the Kyoto Protocol on May 31st 2002. At the time of signing of the Protocol the EU agreed upon a greenhouse gas reduction percentage of 8% for the Union as a whole. This common target was subsequently divided amongst the EU Member States in the so-called 'Burden-Sharing Agreement' (European Council decision 2002/358/CE). For the Netherlands this resulted in an emission-reduction target of 6% below the emissions level in the base year, for the period 2008-2012. This base year is 1990 for emissions of CO_2, CH_4 and N_2O, and 1995 for the F-gases.

Under the Kyoto Protocol this implies that during the five years of the Kyoto period (2008-2012) emissions should not exceed approximately 200 Mton of CO_2 equivalent per year, since the so-called ‘assigned amount’ of the Netherlands amounts to some 1,000 Mton over the entire period. Of this, 437 Mton are reserved for emissions by Dutch companies participating in the EU Emissions Trading Scheme (ETS). If emissions exceed this ceiling, companies must compensate for their excess emissions by purchasing foreign emissions credits.

The remaining 563 Mton of CO_2 equivalent are available for the sectors that do not participate in the ETS (such as consumers, agriculture, transport and services). If domestic emissions exceed this amount, the government will have to compensate for the surplus by buying foreign emissions credits.

In 2007, the new government coalition agreement stipulated firm targets for reducing greenhouse gas emissions, while increasing both energy efficiency and renewable energy sources. An ambitious working programme was issued entitled: 'New Energy for Climate Policy: The Clean and Efficient Programme[10] (Nieuwe energie voor het klimaat: Werkprogramma Schoon en Zuinig). This programme elaborates the government's climate policy ambitions, which are aimed at setting a trend change. This policy is mostly regarded as WAM in this National Communications.

The main policy targets are:

[10] The Working Programme in PDF-format: http://www.postbus51.nl/html/postbus51/document_download.cfm?useassetdir=true&pdf_name=11BR2007G486%2D2008122%2D154154.pdf&doc=11BR2007G486%2D2008122%2D154154%2Epdf&doc_name=11BR2007G486%2D2008122%2D154154%2Epdf

- reducing emissions of greenhouse gases, especially CO_2, by 30% in 2020, compared to the 1990 level;
- an average energy-saving tempo over the coming years of 2% a year between 2011 and 2020;
- enhancing the sustainable energy share in the energy mix, from approximately 2% in 2007 to 20% of the total national energy consumption in 2020.

4.2.2. National Climate Policy

The national climate policy implementation plan (NCPIP, issued in two parts in 1999 and 2000) outlines how the Netherlands intends to meet its emission-reduction commitments under the Kyoto Protocol. An important aspect of the Netherlands' climate policy is the fact that Kyoto target will be achieved both by domestic policies and measures as well as through the use of Kyoto Mechanisms, Joint Implementation and Clean Development Mechanism. 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 emission reduction targets under the Kyoto Protocol. The NCPIP was described extensively in the 3rd National Communications of the Netherlands.

The measures stipulated in the 'Clean and Efficient' working programme were adopted in 2007. These measures are described in the next paragraph. This programme presents a coherent package of policy measures. The main core of the plan concerns a three-pronged approach:

- a roll-out of measures that have already been prepared and are ready to be implemented;
- accelerated development of measures which need some more preparation;
- implementation of an innovation agenda for the medium and long term.

In an assessment of the programme ECN and MNP concluded that it is possible to bring about the anticipated trend change (Menkveld et al., 2007). Greenhouse gas emissions can be reduced from 212 Mton in 2005 to 158 Mton in 2020. This depends on the EU, as a whole, committing itself to a 30% emissions reduction of GHG in 2020 compared to the base year 1990, and pursuing an ambitious policy.

In March 2009 the Dutch government coalition negotiated an additional policy agreement (Ministry of General Affairs 2009) for energy and climate measures. An important element is a long-term policy agenda for sustainability and energy. A number of measures for promoting a sustainable economy have been defined and extra money reserved: € 621 million for 2009 and € 606 million for 2010.

4.2.3. Monitoring and evaluation of progress with climate change measures

Monitoring and evaluation of 'Clean and Efficient'
The central coordination of the climate policy progress is the responsibility of the Programme Board 'Clean and Efficient', which reports directly to the Minister of Housing, Spatial Planning and the Environment (VROM). A system has been developed for this programme board to monitor both the progress of the emissions as well as the results of the 'clean and efficient measures'. This system also forms the basis of the justification to Parliament. The system will be used for the annual monitoring and periodic evaluation of climate policy and the national trends during the period 2008-2020. A monitoring report was presented to Parliament in April 2009 (Hanschke et al., 2009).

In another report (Dril et al., 2009) from April 2009, the projected effects of both the implemented and the planned 'Clean and Efficient' policy measures were assessed compared to an updated reference scenario (Daniels et al. 2009), in which the total reduction target for 2020 has increased in relation to the previous 2005 reference scenario. Higher emissions are expected in the industry/energy sector due to an increase in new gas and coal-fired power plants. In the agricultural sector, increased

emissions are related to a strong increase in Combined Heat and Power installations (CHP). In the other sectors, expected emissions for 2020 are (on average) somewhat lower.

The development of greenhouse gas emissions is being monitored through the emission inventory system (described in Chapter 3). Emissions under the EU-ETS are being monitored through the annual reporting under the EU-ETS.

Monitoring of environment
In September 2009 the Environmental Assessment Agency (PBL) published a document entitled The Environmental Balance, which is an annual report on the current status and future trends in the Dutch environment in relation to government policies and societal trends. According to this study, Dutch emissions of greenhouse gases fell in 2008 by 1.5 Mton to 206 Mton of CO_2 equivalents. This decline can largely be attributed to the reduction in emissions of nitrous dioxide (N_2O) due to reduction measures at the nitric acid plants. The economic recession will cause emissions to fall further, to between 186 and 206 Mton in 2010. Thereafter, if the economy picks up, emissions will rise again to between 192 and 213 Mton in 2012. Without the economic recession, emissions would have risen to between 203 and 224 Mton in 2012.

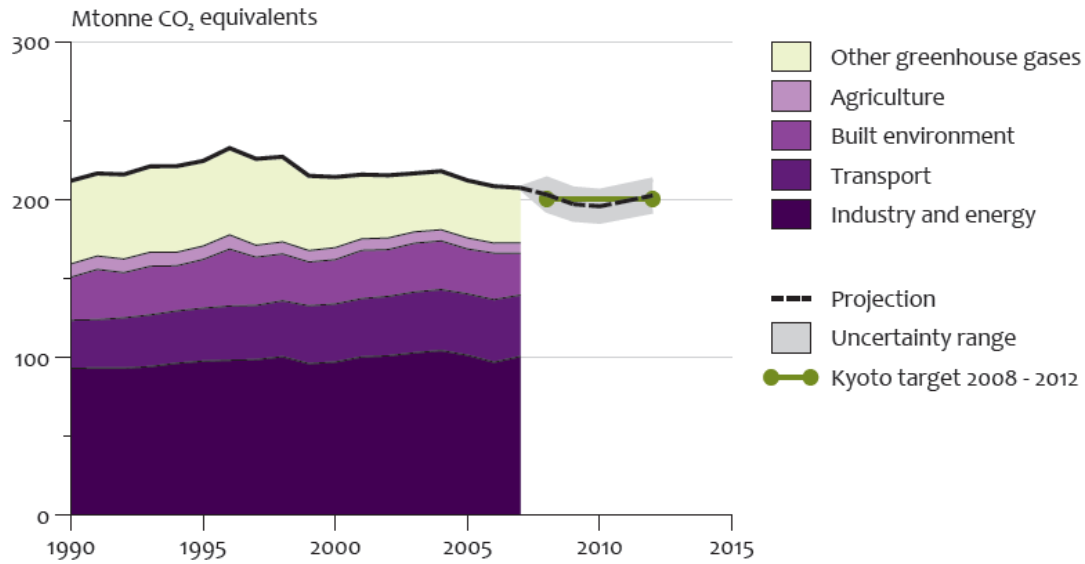


Figure 4.1 Historic emissions and projections (figure includes economic recession and therefore differs of figure 5.14)

Kyoto Protocol climate targets will be achieved
The economic recession makes it easier to achieve the Kyoto target. It would also be achieved without the recession, but both the public and private sectors would then have to buy more foreign emissions credits.

Due to the recession, domestic emissions will decline until 2010. It is not clear how fast the economy will pick up again after this date. If the economy grows by 2.7% per year in 2011 and 2012, the non-ETS sectors will emit 555 to 615 Mton of CO_2 equivalents during the entire Kyoto period. The emission allocation of 563 Mton lies within this range, which means that the government probably will have to use a maximum of 52 Mton of foreign emissions credits in order to remain within its national allocation. Enough foreign emissions credits will be available – via the Clean Development Mechanism (CDM) and Joint Implementation (JI) projects – so the target will be achieved.

4.2.4. Climate policy after 2012

Additional measures are needed to meet the emission target for 2020
The Dutch government aims for a 30% reduction in greenhouse gas emissions (from 1990 levels) by 2020, bringing emissions down to a maximum of 150 Mton of CO_2 eq. The government is therefore pursuing a more ambitious goal than the European Commission, whose current target is a minimum reduction of 20%. Under its Clean and Efficient programme the government is developing policy instruments not only to realise these emission reductions, but also to achieve the targets for energy efficiency and renewable energy. At the moment the work programme contains adopted policy instruments as well as policy proposals and options to be worked out in more detail.

Policy gap for ETS sectors is 16 Mton in 2020
The 2020 emissions target for the ETS companies is a maximum of 59 Mton of CO_2 eq, based on a 30% reduction from 1990 emissions. From 2013 the Dutch will operate under a single European emissions ceiling in a single European market for emissions credits. Under these conditions it seems impossible to formulate a separate emissions target for Dutch ETS companies, especially because the Dutch government has no instruments to force compliance with such a target.

Nevertheless, the government does want to achieve a national target for greenhouse gas emissions. To assess whether that target will be met, the government assumes that the emissions reduction by the Dutch ETS companies will equal the reduction target for all European ETS companies. Under this assumption, in 2020 the Dutch ETS companies will emit 75 Mton of CO_2 eq, or 16 Mton above the target set by the Clean and Efficient programme.

The government hopes that negotiations on the post-Kyoto climate agreement will result in a European emission-reduction target of 30% between 1990 and 2020. In that case the Dutch ETS companies (like their European colleagues) will have to achieve a 30% reduction in emissions, in line with the Dutch target in the work programme.

Policy gap for non-ETS sectors is -2 to 16 Mton in 2020
The 2020 emissions target for the non-ETS sectors is a maximum of 89 Mton of CO_2 eq, again based on a 30% reduction from their 1990 levels. Implementation of European climate policy and the adopted and proposed policies in the Clean and Efficient programme will result in these sectors emitting 88 to 105 Mton of CO_2 equivalents in 2020.

In round figures, this is between 2 Mton lower and 16 Mton higher than the national target. This range reflects the uncertainties in economic growth, the prices of energy and CO_2, the capacity of the non-ETS production sectors and the rate at which policy instruments are deployed. The last uncertainty can be reduced through further elaboration and tightening of the measures set out in the Clean and Efficient programme. This work programme will be officially evaluated in the spring of 2010. The government will then introduce additional policy measures if the results of this review indicate the necessity.

Renewable energy slow to take off
The government wants 20% of the energy supply in 2020 to come from renewable sources. This target is based on avoided primary (fossil) energy use. If the current budgets for the incentive schemes for ‘Sustainable Energy Production’ (Stimulering Duurzame Energieproductie, SDE) and ‘Environmental Quality of Electricity Production’ (Milieukwaliteit Elektriciteitsproductie, MEP) run until 2020, and if the capacity of offshore wind power generation is expanded in line with the ‘Working on the Future’ (Aanvullend Beleidsakkoord) supplementary policy agreement, renewable energy is expected to provide about 5% of the national energy supply in 2020.

In 2020 renewables can supply a maximum of 15% of all energy consumption if additional policy measures can bring the renewable electricity share of total electricity generation up to 35% and biofuels make up 20% of road transport fuel. To meet the 20% renewable energy target, additional policy measures are needed for green gas (biogas) and for supplying heat from renewable sources (such as geothermal energy).

More energy efficiency
For the period 2011-2020 the government wants energy savings to increase by an average of 2% per year. Under adopted and proposed policies energy saving will rise from about 1.1% per year now to an average of 1.4% per year in the period 2011-2020. If the proposed policy measures are made more stringent, energy saving can rise to 1.8% per year. The government currently relies on primarily voluntary instruments to encourage energy saving, such as voluntary agreements, or 'covenants', but additional and possibly more binding policy measures will be needed to achieve this target. The government is currently looking into the possibilities. The fall in the prices of oil and CO_2 credits is also having an inhibiting effect on investments in energy-saving measures.

4.3. (B) Domestic and regional programmes and/or legislative arrangements, as well as enforcement and administrative procedures

4.3.1. Arrangements and procedures: 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 (CCPMs) relevant to climate change. These include *inter alia* the European Council Decision 2002/358/CE on the burden sharing of the EU's emission-reduction target for the Kyoto Protocol; Decision 280/2004/EC on the so-called Monitoring Mechanism, which ensures that EU progress towards meeting the Kyoto target is assessed annually and that Member States must provide sufficient information to the European Commission to achieve this aim; and Directive 2003/87/EC, which introduces the European system for CO_2 emissions trading. Other CCPMs 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) reduces 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 CCPMs that have no impacts beyond the national policies that were already in place before the adoption of the CCPM.

4.3.2. Arrangements and procedures: national policy context

Apart from the institutional arrangements explicitly in response to the Netherlands' signing of the Kyoto Protocol, which are described in Section 4.2, there are more general legislative arrangements and enforcement, and administrative procedures in place to ensure compliance with environmental rules and regulations. These arrangements pre-date the ratification by the Netherlands of the Kyoto Protocol.

The Environmental Management Act provides the legal basis for most environmental regulations that effect emissions of greenhouse gases (for example in the fields of waste prevention and landfill policy, environmental permits and CO_2 emissions trading). The 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 regulates enforcement of the legal measures. It denotes which authorities are responsible for enforcement and requires them to designate officials to be charged with monitoring compliance. In the event of violations authorities have several means to impose sanctions. 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 licence. Another option is the criminal sanction. Public prosecutors may bring cases against offenders in criminal court, which could result in high financial penalties or even imprisonment (maximum of six years).

The Housing Act provides the legal basis for the energy performance standards (EPN and EPC) that apply to new buildings. The standards are laid down in the Buildings Decree pursuant to the Housing Act. Furthermore the Buildings Decree empowers municipal authorities to grant building permits. In the event of violations of building permits 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.

4.3.3. Provisions to make arrangements and procedures publicly accessible

After adoption, all laws and underlying legislative arrangements in the Netherlands are published in one of several official government bulletins and/or directly on the website www.overheid.nl, as indicated in Section 2.1. 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. Under the Act of December 22, 2005 the Freedom of Information Act was extended with a provision for the reuse of official government information, in accordance with Directive 2003/98/EG of the European Parliament and the European Council of November 17, 2003 for the reuse of government information.

4.3.4. Arrangements and procedures relating to participation in the mechanisms under Articles 6, 12, and 17 of the Kyoto Protocol

Institutional arrangements

- *Government use of the project-based mechanisms*
The government use of the project-based mechanisms to comply with the Kyoto target of 1.000 Mtonne CO_2-eq. in the commitment period 2008-2012 (an average of 200 Mtonne per year) is within a range of 0 till 50 Mtonne.

The Ministry of Housing, Spatial Planning and the Environment (VROM) was designated as National Authority (DNA) for the Clean Development Mechanism (CDM) and Joint Implementation (JI) in the Netherlands on September 10, 2002. VROM has delegated the activities as National Authority for JI to the Ministry of Economic Affairs, which acts as the Netherlands JI Focal Point.
The DNA for the CDM (VROM) and the Focal Point for JI approves the voluntary participation in a CDM or JI Project activity. Such an Approval is required on the basis of the CDM and JI project cycle.

- *Clean Development Mechanism*
Various types of instruments are deployed by the government in order to acquire Certified Emission Reductions (CERs). For the selection of CDM projects and the purchase of CERs that meet the quality

specifications of the government, various intermediary organisations have been contracted along four tracks:

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

In order to stimulate the implementation of CDM projects, voluntary and not legally binding Memoranda of Understanding (MoUs) have been signed with Argentina, Bolivia, Brazil, Colombia, Costa Rica Ecuador, El Salvador, Guatemala, Honduras, Indonesia, Mexico, Nicaragua, Panama and Uruguay.

To assist developing countries, especially those in sub-Sahara Africa, to improve their level of participation in the CDM, the government is working together with the national development bank, the "Nederlandse Financieringsmaatschappij voor Ontwikkelingslanden (FMO)", and the governmental agency SenterNovem, on developing and implementing CDM projects and programmes of activities in Sub-Sahara Africa and the Least Developed Countries. At this moment one project has been developed and implemented in Tanzania.

- *Joint Implementation*

The government has developed three instruments for obtaining Emission Reduction Units (ERUs) from JI projects:

1. the governmental agency SenterNovem conducted several public procurement procedures called ERUPT;
2. framework contracts with the Worldbank (a cooperative arrangement between the IBRD and the IFC) and the European Bank for Reconstruction and Development (EBRD);
3. the participation in a carbon fund: the Prototype Carbon Fund (PCF).

Voluntary and non-legally-binding MoUs on the implementation of JI projects are concluded with: Bulgaria, Czech Republic, Croatia, Estonia, Hungary, New Zealand, Romania, Slovakia en Ukraine.

- *Greened Assigned Amount Units*

In 2009 the government signed an agreement with Latvia to purchase Assigned Amount Units. The financial revenues will be used for climate change related activities in Latvia.

- *Situation as of July 1, 2009 with regard to the Kyoto target:*

Instrument	Clean Development Mechanism		Joint Implementation		International Emission Trading
	Organisation	**Mtonnes expected**	**Organisation**	**Mtonnes expected**	**Mtonnes Expected**
Tenders	SenterNovem	1,5	SenterNovem	10,0	---
Multilateral and regional financial institutions	CAF, IBRD, IFC	34,5	EBRD, IBRD, IFC	7,0	---
Private financial institutions	Rabobank	2,0		---	---
Participation in Carbon Funds	CDCF, PCF	2,0		---	---
Bilateral agreements		---		---	3,0
Total expected		**40,0**		**17,0**	**3,0**
			60,0		
Total delivered		**9,3**		**1,7**	**3,0**
			12,3		

Financial arrangements

The government has reserved roughly € 600 million for the acquisition of CERs, ERUs and AAUs.

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

The approximately 360,000 hectares of forest in the Netherlands, which cover 10% of the total surface of the country, have a number of functions, such as recreation, nature, landscape, CO_2 sequestration and wood production. The market for wood and wood products in the Netherlands is growing. The lion's share of this wood is imported: less than 10% comes from domestic woodlands. Because the produce from the inland woods is large enough to increase the domestic wood production, the national administration is trying to stimulate the harvesting of this produce.

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

4.4 (C) 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 those that are known on July 31, 2009.

Most policies and measures described in the Netherlands' 4th National Communication (NC4) have been continued and therefore reappear in this 5th National Communication. In addition, the most important new policies and measures that have been implemented since NC4 have been included in this communication. In April 2008 the successful MEP Subsidy Programme (Environmentally Friendly Electricity Production Programme), which ceased on October 18, 2008, was followed by the SDE (Stimulating Renewable Energy Production). This new programme is described in Section 4.4.2.

Policies and measures that have been repealed and are no longer in place are listed in Section 4.6.

The section below is organised 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, and not, as in the IPCC source categories, on the basis of the processes that cause greenhouse gas emissions. The Buildings Sector has also been added. Table 4.2 provides 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 clustered in the transport sector, and emissions from flue gas desulphurisation 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 are described in detail. The sections need to be read in conjunction with Table 4.3, which provides the following information by sector.

Each section closes with a summary table showing the effects realised in the sector, in terms of avoided emissions in the year 2000 and 2005, as well as projected effects in the years 2010, 2015 and

2020. The projected effects have been estimated against the background of the Global Economy (GE) scenario described in Chapter 5.

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, food stuffs 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 desulphurization 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 1A2f), agricultural tractors (part of 1A4c) and mobile equipment from 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 services sector (part of 1A4a) is included in transport.

Table 4.1 Sectors used in this report related to IPCC source categories

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 emissions source or activity.
In order to gain insight into the relative merits of different policies at a lower level of aggregation, each year one sector is evaluated at a more in-depth ex post level for (cost-) effectiveness.

Interaction of policies
The policy descriptions 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).

Information on non-GHG mitigation benefits and on costs of policies and measures
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 included in the text where possible and in § 4.4.9, but are not presented in the Summary Tables. The methods for cost calculation used in the Netherlands are described in the box below.

At the request of the Dutch Ministry of Housing, Spatial Planning and the Environment and the Ministry of Economic Affairs, the Energy research Centre of the Netherlands (ECN) and the Netherlands Environmental Assessment Agency (MNP) periodically update the so-called 'Options Document for Energy and Emissions (Optiedocument Energie en Emissies)'. With the help of the data of the Options Document the options for additional domestic reductions in greenhouse gas emissions additional energy saving and additional renewable energy can be identified; this Option Document also includes cost estimates. See for the Option Document Daniels and Farla, 2006.

The document answers the following policy questions:
- What are the possibilities for domestic reductions in greenhouse gas emissions?
- What are the possibilities for increasing the rate of energy saving?

Methods for calculating costs

The **Financial Costs Method** expresses costs as these 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 economic sectors. 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** 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 will often benefit 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%.

Box 4.1 methods for calculation costs

Government use of the project-based mechanisms

During the years 2008-2012 the emissions of greenhouse gases should be reduced by 6% compared to the base year (1990). The emission ceiling is formed by the emissions budget, which consists of the Kyoto Protocol commitment, increased by the CDM/JI-permits. At present that ceiling is 200.3 Mton. The Kyoto policy has two main aims:

- restrict national emissions as much as possible;
- where national emissions exceed the 200.3 Mton CO_2 eq level, the difference will be compensated by buying CDM/JI emissions permits.

In its 2008 Spring Policy Document the government announced that a total of CDM/JI 65 Mton of emission permits is necessary to comply with its commitments for 2008-2012. This equals 13 Mton/year. This revised share of CDM/JI is the result of an amendment by two Members of Parliament - Samsom and Atsma (Second Chamber/TK II, 2007–2008, 31 239, no. 16). In their amendment they state that domestic emissions will not exceed 209 Mton/year. If this number is taken as the emissions target, around 9 Mton of JI/CDM is needed to comply with the Kyoto commitments. In order to be able to counter some variation between years, the target for JI/CDM has been set at 13 Mton/year, which creates a margin of 4 Mton. The aim of the present government coalition is to keep the total annual greenhouse gas emissions in 2011 at the same level as that of 2007, which is 209 Mton (ETS included, CDM/JI not included).

4.4.1 Cross-Sectoral Policies

Some policies apply to more than one sector. Existing instruments which are cross-sectoral include: Energy Investment Tax Deduction (EIA), CO_2 Reduction Programme/General, Reduction Programme for Non-CO_2 Gases (ROB), 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, except for the Reduction Programme for Non-CO_2 Gases and CO_2 Emissions Trading, which are described in this section.

In the different paragraphs below a clear distinction is made between ‘existing measures’ (WEM), ‘additional measures’ (WAM), or both (WEM+WAM)

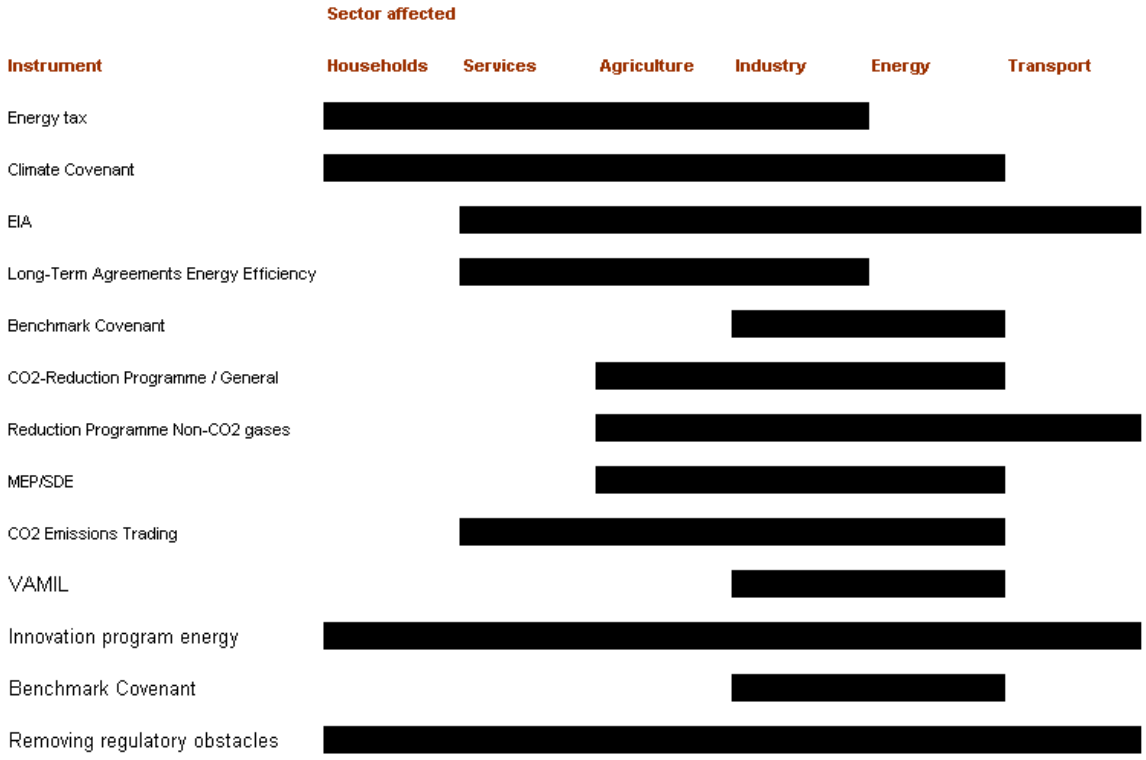


Figure 4.2 Cross-sectoral policies and measures

Reduction Programme for Non-CO_2 Gases (WEM+WAM)
This Programme (Dutch acronym: ROB) was set up in 1998 and focuses on the reduction of Dutch emissions of non-CO_2 greenhouse gases. The aim is a reduction of 8-10 Mton CO_2 eq in 2020, towards the desired level of 25-27 Mton CO_2 eq. This would mean a reduction of 50% in these gases compared to the reference year (1990). From 2009 onwards the programme will focus entirely on working towards the ambitions of the programme Clean and Efficient, which encompass the Kyoto targets. The main target sectors for implementing reduction measures are cooling, agriculture, waste disposal, the semi-conductor industry, aluminium production and the nitric acid industry.

The operation of the ROB Programme, which is managed by SenterNovem, is based on close cooperation between the government and private companies, research institutions, universities, and provincial and municipal authorities. Each year the most promising emission-reduction proposals concerning research and development, feasibility studies, demonstration projects and market introductions are eligible for subsidy. Completely new initiatives are always welcomed. The number of sectors covered was extended in 2007. Owners of cold stores could apply for subsidy to fund feasibility studies on using natural cooling agents. Furthermore, projects for removing non-technical hindrances for the market introduction of innovations could also be subsidised. The amount of subsidy available was € 1.5 million. In 2008 this was reduced to € 1.25 million. The eligibility of feasibility studies for the use of natural cooling agents was extended to supermarkets and the fishing fleet. Since the introduction of the programme in1998, more than 170 projects have received financial support.

In the Clean and Efficient-programme's assessment in 2007 the emission reduction of N2O in the nitric acid industry was estimated at 2,9 tot 3,6 $MtCO_2$-eq in 2011, and 3,3 tot 4,0 $MtCO_2$-eq in 2020. In 2008 the Climate Commission of EU Member States consented in admitting N2O emissions in the EU Emissions Trading System, ETS. For the two producers of nitric acid in the Netherlands together, the allowed emissions of N2O are set at 1,2 $MtCO_2$-eq in 2010.

At national level, in recent years the focus has been on F-gas reduction in the buildings sector, including ICT data centres, and on the transportation of refrigerated goods. In 2009 the focus has

shifted towards cooling equipment in supermarkets, cold stores and industrial processes in the chemical and food industry. Measures and activities are aimed at improving the management of installations and stimulating alternative cooling techniques that also affect the energy efficiency, as well as on communication.

CO_2 Emissions Trading (WEM+WAM)
As prescribed by Directive 2003/87/EC, a trading system for CO_2 emissions started within the EU on January 1st, 2005. Its initial focus was on CO_2 from large industrial emitters. It is a 'cap and trade' system, where participants are assigned a set amount of allowances upfront 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 Section 4.5). Member States were required to develop a national allocation plan, stating the total number of allowances allocated in the first trading period (2005-2007), and how many allowances were granted to each installation covered by the scheme. New allocation plans had to be written for the second trading period (2008-2012).

The Netherlands finalised its Allocation Plan in August 2008, followed in November by the allocation decision. During the first allocation period, 206 installations were included in the scheme, covering about 40% of the total CO_2 emissions in the Netherlands. For the second trading period, 341 installations are included. The national allocation decision is final and is no longer open to appeal. The Registry has been operational since 2005. Emission permits have been granted to almost all installations concerned, which means that their monitoring protocols have been verified and approved by the Netherlands Emissions Authority.

4.4.2 Energy

CO_2
CO_2 policies relating to the energy sector have traditionally fallen into two general categories, i.e. those aimed at: - encouraging the use of renewable energy and increasing the market penetration of combined heat and power. Emissions trading entered into force in the Netherlands, based on EC Directive 2003/87/EC, on January 1st, 2005. A few important policy instruments currently in effect are described below.

Intergovernmental Wind Energy Agreement (BLOW) (WEM)
The BLOW target of 1500 MW of onshore wind power in 2010 was reached in 2007. Today there are about 2,000 MW realised, which mitigates about 2.6 Mton CO_2 eq per year. The new policy (WAM) of the 'Clean and Efficient' programme is to add an extra 2,000 MW through licensing and subsidies in 2007-2011. The longer term perspective is a total of 6,000 MW capacity of onshore wind in 2020. Since March 2009 the Government Coordination Rule applies for onshore wind projects above 100 MW. This means that, for these projects, the Minister of Economic Affairs is responsible for spatial planning and coordinates the attribution of environmental and other permits.

Stimulating Renewable Energy Production (SDE) (WEM+WAM)
The SDE scheme was introduced in April 2008 and provides subsidies for investments in renewable electricity and renewable gas for both companies and citizens. Every year the Minister of Economic Affairs sets a subsidy budget, parts of which can be allocated to specific categories of sustainable energy production. Profits at uneconomic projects are being made up for 12-15 years. In 2009 subsidies are available for photovoltaic energy, onshore wind energy, offshore wind energy, biomass and hydropower. The main differences with the former MEP (Environmentally Friendly Electricity Production Programme) scheme are the extent of the subsidy, which is related to the estimated development of the electricity and/or gas price, and the introduction of a subsidy ceiling.

Sustainable Heat (WAM)
The objective of the subsidy scheme for sustainable heat in the built environment is to prepare the market for more large-scale implementation of solar heat, (hybrid) heat pumps and micro-CHP after

2011, in the existing built environment. There is a considerable potential for the application of CHP in buildings. With large-scale implementation after 2011, the reduction potential of CO_2 emissions for 2020 is substantial.

The Knowledge Centre for Heat first started in 2009. Its main objective is to supply knowledge and expertise concerning heat to decision-makers in the built environment, leading to CO_2 emission reduction. From 2010 onwards the industry sector will participate in the Knowledge Centre.

4.4.3 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 (LTA) with industrial sectors backed up by environmental permits based on the Environmental Management Act, and the Energy Investment Tax Deduction regime within the corporate tax system (known as EIA). The CO_2-reduction Programme/General, a cross-sectoral subsidy scheme described in Section 4.4.1., is also available to firms in the industrial sector.

Benchmarking covenant (WEM)

The national and provincial governments and representatives from the industrial sector (energy-intensive companies with an annual energy consumption of 0.5 PJ or more) agreed that the latter are committed to achieving (and/or maintaining) a position among the most energy-efficient companies in their sector worldwide, no later than 2012. By January 15, 2005 most of the energy-intensive companies in the Netherlands (a total of 102 with 184 installations) had joined the covenant.

This covenant was followed in 2009 by the Long-term Agreement Energy Efficiency ETS enterprises (LEE) for ETS enterprises (WAM)

This voluntary long-term agreement, aims at promoting energy savings in the Netherlands. LEE is signed by four Government Ministers (Economic Affairs; Agriculture, Nature and Food Quality; Spatial Planning, Housing and the Environment and the State Secretary of Finance), the Confederation of Netherlands Industry and Employers (VNO-NCW), the participating ETS enterprises and relevant trade associations and commodity boards. This agreement has the following objectives:

- Each ETS enterprise draws up an Energy Efficiency Plan (EEP) and implements it, which shall at least contain an overview of:
    - possibilities for adopting profitable measures at existing facilities at the time of joining and the result of those measures, expressed in the percentage of energy efficiency improvement per year and the avoided CO2 emission related to that;
    - the goal for the energy efficiency improvement and the avoided CO2 emission related to that during the period to which the Energy Efficiency Plan applies, including an indication of which measures are to be taken at which time.
    - profitable measures are taken to mean measures that have a positive net cash value at an internal interest rate of 15 percent. Alternatively, a cost recovery period of 5 years may be applied.
- Each ETS enterprise will bring its Energy Efficiency Plan up to date by 1st October 2012 at the latest for the period 2013-2016 and by 1st October 2016 at the latest for the period 2017-2020.

Long-Term Agreements on Energy Efficiency (WEM)

The year 2001 saw the first series of Long-Term Agreements (LTA / MJA1). In 2007 there were three different categories of LTAs: for companies and organisations in the tertiary sector (services sector); for companies in the agricultural sector; for industrial companies with an energy consumption up to 0.5 PJ/year. Companies with higher energy consumption can join the Energy-Efficiency Benchmarking Covenant, unless they can prove that joining an LTA makes more sense.

Negotiations between the government and less energy-intensive industries have resulted in a second generation of Long-Term Agreements on energy efficiency (MJA2). The government supports these agreements with fiscal incentives such as the EIA (see below) and enforces them with environmental permits. Companies not participating in MJA2 are required (in their permits) to implement 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.

A marked difference between MJA1 and MJA2 is that the latter not only aims at energy efficiency but also at the so-called 'verbredingsthema's' (broadening themes). These include energy-efficient product development, sustainable energy use and energy saving in production chains.

Thanks to the positive results of LTAs in the past, the government has decided to intensify, prolong (to 2020) and further broaden their scope in MJA3. The different economic sectors will be asked to prepare strategic visions for 50% energy saving in 2030, as a continuation to the work that has still to be completed by 2020 (WAM).

Energy Investment Tax Deduction (WEM)
The Energy Investment Allowance (EIA) is a tax relief programme. It gives a direct financial advantage to Dutch companies that invest in energy-saving equipment and sustainable energy. Entrepreneurs may deduct 44% of the investment costs for such equipment (purchase and/or production costs) from their company's fiscal profits, over the calendar year in which the equipment was purchased. Investment costs up to a maximum of € 113 million may be reported per calendar year.

N_2O

Low N_2O Nitric Acid Production[11] (WEM)
Recently the Climate Commission of European Member States ratified the European Commission proposal to incorporate the nitrous-oxide emissions (N_2O) in the European Emissions Trading System for greenhouse gases. In the Netherlands, two nitric acid production facilities are affected by this decision (DSM and Yara), with an allowed emissions ceiling of 1.2 Mton CO_2 eq in 2010 and 1.0 Mton CO_2 eq in 2020.

HFC

Low-(H)CFC production (WEM)
There is only one producer of HCFC-22 (chlorodifluoromethane, CHClF2) in the Netherlands. The HCFC-22 is being produced as a base material for the production of fluoropolymers (Teflon) and is also sold as a cooling agent. In 2015 the latter purpose will be phased out and only the production for own use will continue. In the production process HFC-23 is emitted, which contributes less than 0.5% to the total Dutch greenhouse gas emissions. The total emission of HFC-23 in the described production process amounts to 4% of the production of HCFC-22 if no reduction measures are taken. Since 1998 several measures have been taken to mitigate the emissions of HFC-23). The destruction-efficiency of the applied Thermal Converter is more than 99.99%[12].

PFC, SF_6

Low-PFC, SF_6 semiconductor industry (WEM)
Both PFC and SF_6 are used for cleaning processing chambers and in the etching process in the semiconductor industry. SF_6 is also used in the power current sector and for the production of double

[11] Tussenstand van een aantal onderdelen uit het werkprogramma Schoon en Zuinig / H.E.Elzenga, A.W.N. van Dril. - Bilthoven: PBL, 2008 [nov.]
[12] According to a once-only assessment by the producer based on measurements.

glazing and electron microscopes. The total Dutch emissions of SF_6 (as reported under IPCC sector 2F8) contribute less than 0.5%.

In the Netherlands there is only one producer of semiconductors, with a single production location. In 2002 and 2003, this company investigated the feasibility of reducing PFC emissions through process optimisation and committed itself to reducing PFC emissions by 10%, compared to 1995. Considering the growth in production this would equal a reduction of 80-90%.

Low-PFC aluminium production (WEM)
The PFC emissions of the aluminium industry contribute around 1% to the Dutch greenhouse effect every year. These PFCs are emitted during the production of primary aluminium, and consist mainly (80-90%) of tetrafluoromethane (CF4) and, to a smaller extent (10-20%), of hexafluoroethane (C2F6). The two producers in the Netherlands, both with a single production location, have in the past (1999 and 2003) shifted their production process from Side-Worked Prebaked to the more environmentally friendly Centre Worked Prebaked. This shift accounts for a reduction in PFC emissions of 95%.

4.4.4 Transport

CO_2

Biofuels (WEM+WAM)
The European Directive 2003/30 on promoting the use of biofuels or other renewable fuels for transport has been implemented into the Dutch legislation. The European Directive 2003/30 states that Member States should ensure that a minimum proportion of biofuels and other renewable fuels is placed on their markets and shall set national indicative targets.

On October 20, 2006, the 'Besluit biobrandstoffen wegverkeer 2007' (Transport Biofuels Act 2007) was published and the biofuel targets of the European directive 2003/30 were copied.

	2007	2008	2009	2010
Target share	2.00	3.25	4.50	5.75
Petrol (minimum share)	2.00	2.50	3.00	3.50
Diesel (minimum share)	2.00	2.50	3.00	3.50

Table 4.2 The minimum share of biofuel in fuels for road transport (percentage)

However, in 2007 and 2008 food prices went up and problems with unsustainable biofuels reached the newspaper headlines. In reaction to this, at the end of 2008 the Dutch government adjusted the percentage of biofuels to 3.75% (for 2009) and 4% (for 2010).

At the same time as the European Directive was implemented in Dutch legislation, a subsidy programme for Innovative Biofuels for Transport was launched in 2006. In total € 60 million was set aside for the production of innovative biofuels in the Netherlands. The first tender had a budget of €19.4 million and four projects were supported. The next tender is scheduled for 2010.

Filling Stations for Alternative/Biofuels (WAM)
In addition to the European Directive and the subsidy programme Innovative Biofuels the government has launched a new subsidy scheme, entitled Filling Stations for Alternative (Bio)fuels.

Investments in filling stations for CNG (Compressed Natural Gas), bio ethanol (E85) and (later on) bio diesel (B30) are eligible for subsidy. In this way the government is stimulating the use of high blends of bio fuels.

On June 5, 2009 the EU Directive 2009/28 on promoting the use of energy from renewable sources and amending, and subsequently repealing, Directives 2001/77 and 2003/30 was published, and new

targets have been set until 2020. Sustainable criteria are now also in place. This Directive will be incorporated into the Dutch legislation in 2010.

Het Nieuwe Rijden/Ecodriving (WEM+WAM)
The Dutch Ecodriving programme is based on a long-term strategy and was started in 1999. From 2010 onwards, the programme will be transferred to market parties.
The programme aims to motivate (professional) drivers and fleet owners to purchase and drive passenger cars, delivery vans, lorries, buses and trains in a more energy-efficient and safer way. The impact of the programme is being evaluated annually. Results over 2008 show that directly attributable CO_2 effects amount to 0,4 Mton. The cost-effectiveness of the programme was calculated at 9 euro/ton of CO_2 reduction.

The overall level of recognition (both spontaneous and prompted) of the Dutch Ecodriving brand Ecodriving has increased from 18% in 2000 up to 80% in 2008. In 2008, around 35% of drivers applied all main driving-style tips, while 75% applied one or more.
Further information: www.hetnieuwerijden.nl

Kilometre charge - road pricing (WAM)
The Dutch government has decided to implement a road pricing scheme. Fixed car taxes such as the vehicle purchase tax (BPM) and motor vehicle tax (MRB) will be eliminated. The House of Representatives agreed to this government proposal in July 2008.
Goods traffic will be the first category to deal with road pricing. The new regime will be introduced in stages for all other traffic categories, so that eventually everyone will pay per kilometre driven and there will be no more fixed car taxes left.

Energy labelling of passenger cars (WEM)
The market share of relatively efficient passenger cars (with an energy label A or B) among the sales of new cars in the Netherlands has been varying between 15 and 25% since 2001. In 2006 and 2007 the market share of cars with an A-label rose to 6%, from 0.5-3.5% in 2001-2005. This is partly thanks to the no-claims bonus system that was introduced in July 2006 to promote the sales of these relatively efficient cars. Other factors include the increased supply of A-label cars and the relatively high fuel prices. In the first half of 2008 the sales of hybrid cars rose substantially: 6,000 were sold, compared to a total of 3,700 throughout the entire year in 2007. This is probably mainly due to attractive fiscal measures for very fuel-efficient business cars.

CO_2 emission performance standard EU (WAM)
In 2009 the legislation on CO_2 emissions from passenger cars was officially published in the form of Regulation (EC) No. 443/2009 of the European Parliament and the Council (April 23, 2009) which set emission-performance standards for new passenger cars as part of the Community's integrated approach to reduce CO_2 emissions from light-duty vehicles. The fleet average to be achieved by all cars registered in the EU is 130 grams per kilometre (g/km). A so-called 'limit value curve' implies that heavier cars are allowed higher emissions than lighter cars, while preserving the overall fleet average. In 2012, 65% of each manufacturer's newly registered cars must comply (on average) with the limit value curve set by the legislation. This will rise to 75% in 2013, 80% in 2014, and 100% from 2015 onwards. A target of 95g/km is specified for the year 2020. The modalities for reaching this target and the aspects of its implementation, including the excess emissions premium, will have to be defined in a review to be completed no later than the beginning of 2013.

Automobile scrapping regulation (WAM)
The Cabinet has approved a provisional scrapping regulation for passenger cars and delivery vans. The regulation is one of a range of measures being introduced by the Dutch government to mitigate the impact of the crisis. It was drafted in collaboration with interest group RAI Vereniging, the association of motor car, garage and allied trades BOVAG and Auto Recycling Nederland (ARN). The national government has earmarked €65 million for the regulation, and the automotive industry will contribute €20 million in the initial phase. Owners of old passenger cars will receive between €750

and €1000 for trading in their old car for scrapping when purchasing a newer, more eco-friendly car. There is a subsidy of between €1000 and €1750 for old diesel delivery vans. The regulation will end once the budget has been exhausted. As a result of the scrapping regulation, around 80,000 old, polluting cars and delivery vans are expected to be traded in for newer and less polluting vehicles.

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.

4.4.5 Agriculture

The government's ambition for the agricultural and horticultural sector is a reduction of CO_2 emissions to a level of 5-6 Mton in 2020, which is an emissions decrease of 1-2 Mton CO_2 in comparison with 'business as usual'. The government's ambition for the other greenhouse gases is to reduce emissions from 25-27 Mton CO_2 eq. in 2020, of which 16 to 17 Mton must be reduced in the agricultural and horticultural sector.

The Clean and Efficient programme discerns three separate main areas of concern in policy measures pertaining to CO_2 emissions reduction in agriculture:

- the agricultural processing industry (mainly Long-Term Agreements and innovation). Pursued by the Ministry of Agriculture, Nature and Food Quality, whereas the resulting CO_2 emission reductions falls in the 'Industry' sector;
- greenhouse horticulture: aims at energy saving and sustainable production of the remaining energy demand (electricity and heat);
- other agricultural activities (primary sectors etc.): aims at energy saving and co-fermentation, and the production of biomass to generate energy.

The Clean and Efficient policies pertaining to other greenhouse gases aim particularly at limiting the emissions of nitrous acid (N_2O) in industry, of methane (CH_4) and nitrous acid (N_2O) in agriculture and methane-slip in CHP motors.

CO_2

Policy development at the Ministry of Agriculture, Nature and Food Quality (WAM)
Based on the Clean and Efficient Working Programme, a covenant was reached, known as the Covenant Clean and Efficient Agricultural Sectors (Schone en Zuinige Agrosectoren).

The main aims of this Covenant are:

- CO_2 emissions: reduction of 3.5 to 4.5 Mton in 2020, in comparison with 1990;
- other greenhouse gases: reduction of 4.0 to 6.0 Mton CO_2 equivalents in 2020, in comparison with 1990;
- energy saving: an average of 2% energy efficiency improvement per year, in the period 2011-2020;
- approximately 212 PJ of sustainable energy in 2020 (more than one-third of the government's ambition);
- approximately 12 PJ of wind energy in 2020 from the agricultural sectors.

Secondary aims concern:

- contributing to generally making the agricultural sector more sustainable;
- presenting the agricultural sector as a producer of sustainable energy.

A plan is drawn up annually for each sector, which covers the forthcoming year. These plans describe specific projects that, in the given year, must contribute to the realisation of the final policy aim.

CH_4, N_2O (WAM)

During the first budget period of the Dutch climate policy (2008-2012), no reduction targets are imposed on agriculture. The sector is expected to take cost-effective measures that contribute to emission reductions of greenhouse gases on a voluntary basis. There are three categories of measures that can contribute to reducing emissions:

- developing Best Management Practices for reducing N_2O emissions. The emissions are reduced by diminishing nitrogen flows on farms;
- taking measures concerning cattle feed to reduce CH_4 emissions. The composition of feed can influence the production of methane via the cattle's digestive systems. In general: the better the digestibility, the lower the methane emissions;
- taking measures concerning manure storage to reduce emissions of CH_4. Manure fermentation is the main option for reducing methane emissions from manure.

N_2O

Precision soil cultivation (WAM)
Research indicates that precision soil cultivation in agriculture, using GPS, can considerably reduce N_2O emissions. By implementing this method N_2O emissions can be reduced by around 169 tons of N_2O-N per year. The effects are largest on clay ground.

4.4.6 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 wetland and terrestrial. In 2004 the government still fell short (by around 275,000 hectares) of nature reserves to complete the network. In 2008 around 120,000 hectares were acquired. An area of 155,000 hectares remains to be acquired to finish the network. Part of this will be woodland.

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. These areas will partly consist of woodland.

4.4.7 Waste (CH_4, WEM)

On May 8, 2002, an amendment to the Environment Law (Wet Milieubeheer) was implemented, which obliges the Minister of Housing, Spatial Planning and the Environment (VROM) to issue a Waste Management Plan once every four years. The validity of this plan can be extended (only once) by up to two years. Het Landelijk Afvalbeheerplan 2002-2012 (National Waste Management Plan) is the first in line, the validity of which was extended by two years, from March 2007 to March 2009.

The policy aims to minimise the amount of waste that remains for dumping and incineration, because this causes the largest pressure on the environment. This waste minimisation is achieved through prevention and through separate waste collection, which enables recycling of products and matter, and the incineration of waste for energy production. The useful application of waste must be raised from 77% (in 2000) to more than 83% (in 2012). The incineration of non-recyclable waste in the most energy-efficient incinerators and improving the energy-efficiency of existing incinerators is an extra contribution to climate policy.

Optimisation of waste management is an important contribution to the mitigation of the greenhouse effect. Dumping organic waste, for example, generates substantial emissions. This is one of the reasons why waste policy aims at maximising waste recycling and limiting waste disposal.

4.4.8 Buildings Sector (households and services, CO_2)

The building stock is considered to be an important sector where significant CO_2 emission reduction and energy efficiency improvements can be achieved, in both new and existing buildings. The policies developed by the Dutch government for the building stock (from 2005 to August 2009) can be divided into three main categories:

- New Buildings
- Existing Buildings
- Appliances (Eco-design)

Besides the further development and introduction of a broad package of policy instruments at national level, several EU Directives were implemented during this period. The relevant EU Directives in this context are the Energy Performance of Buildings Directive (EPBD) and the Eco-design Directive.

In order to achieve policy targets in the building sector, close cooperation between the government, actors on the housing market, social housing associations, private home-owners and residents is vital. The Dutch government explicitly opted for a stakeholder-orientated approach, for example, via agreements.

New Buildings (WAM)
The government has announced that, from 2011 onwards, the requirements for improving the energy efficiency of new residential buildings will be tightened by 25% and, from 2015 onwards, by 50% compared to the current standard. Furthermore, the government aims for the construction of completely energy neutral (new) buildings in 2020.

The government has also stated that, as of 2017, new non-residential buildings must be 50% more energy efficient compared to the standard (in 2005). Therefore the Energy Performance Requirement for commercial buildings will be tightened.

In April 2008 an agreement was signed with several builders' associations to underline the following aspects: tightening of energy efficiency requirements for new buildings, recasting of the calculating methodology and the introduction of 10 areas of excellence where extremely low-energy houses will be constructed.

The Built Environment Innovation Agenda describes the route along which energy innovations in the Built Environment can be encouraged and implemented on a large scale. The Agenda includes both technical and process innovation in new and existing buildings. Special attention is paid to accelerating the application of sustainable energy concepts.

Existing Building

A wide variety of policy instruments have been set up between 2005 and 2009 in order to encourage the retrofitting of existing buildings.

Agreements

- *Covenant 'More with Less' for existing buildings (WAM):* An overall agreement with building contractors, energy suppliers and the installation industry was signed in January 2008 to ensure that 500,000 existing buildings will be 30% more efficient in 2011. After 2011, 300,000 buildings each year need to be sufficiently improved. The main target for existing buildings is to realise at least 30% energy reduction in 2.4 million buildings by 2020.
- *Covenant with social housing organisations (WAM):* In October 2008 an agreement was drawn up between the Dutch government and the interest group for social housing associations, plus the interest group for tenants. The main target of this agreement is to achieve an additional energy saving of 24 PJ.

Financial instruments

- Energy Investment Deduction (WAM): The scope of the Energy Investment Deduction was broadened in January 2009. By significantly improving the energy performance of a commercial building (to level B of the Energy Performance Certificate range, which runs from G to A), or improving the assessment to two levels up - for example from G to E - owners can qualify for a tax reduction. Since June 2009, as part of the economic and financial crisis package, social housing organisations can also qualify for an Energy Investment Deduction. This means that social housing corporations are allowed to use this allowance in relation to profit tax. As of July 1st, 2009 improvements in the energy efficiency of houses are eligible for tax deduction. Furthermore, several instruments have been deployed that financially reward private home-owners for improving the energy efficiency of their homes.
- Subsidy scheme for tailor-made energy advice (WAM): A subsidy scheme was introduced in July 2009 to finance 'tailor-made energy advice' to promote improvements to the energy performance of dwellings. This subsidy scheme applies to private home-owners. The subsidy is maximised at € 200 per household.
- Several other financial instruments are also in place, such as a subsidy scheme on insulating glazing, lowering VAT on insulating glazing, and green financing (WEM).

Regulating instruments (WEM/WAM)

- Implementation of EU law:
  With the implementation of the EPBD Directive the mandatory Energy Performance Certificate was introduced in January 2008. It is continually being improved and the new model will be re-launched in October 2009.
  With a mix of standards, introduced with the European Eco-design Directive, and other stimulating measures, the Dutch government will promote the broad application of more energy-efficient appliances.
- Public buildings:
  One of the ambitions of the 'Clean and Efficient' policy programme is to set a standard in sustainability for the privately-owned sector. New government buildings must be 25% more energy efficient than the official requirements at that time.
  Moreover, the national government strives for CO_2-neutral buildings in 2012, in terms of energy-use. Therefore the purchase of energy will be CO_2-neutral. The purchase of gas will also be as CO_2-neutral as possible. CO_2 compensation will be used to achieve complete CO_2 neutrality for energy use in government buildings.
  The Long-Term Agreements on energy efficiency (LTAs) are agreements between the Dutch government and companies and institutions aiming at the more effective and efficient use of energy. From the perspective of the buildings sector, the LTAs with universities, higher professional education buildings, and university hospitals are most relevant to improving energy efficiency in buildings.

- Energy performance of new buildings (households and buildings: improving the energy performance standard and tightened energy performance coefficient, EPC) (WEM+WAM):
  The EPN for non-residential buildings differs according to the type of building and has been tightened three times since its introduction in 1995. The government has announced that, as of 2017, new non-residential buildings will have to be 50% more energy efficient compared to the standard in 2005.
- Stimulating Local Climate Initiatives (WAM):
  This new remittance scheme (Stimulering Lokale en Regionale Klimaatinitiatieven: SLOK) was opened in July 2008. The scheme is meant as an extra contribution by the national administration to realising the 'Clean and Efficient' climate policy targets of 2% energy saving per year, 20% renewable energy in 2020 and a 30% reduction in the emission of greenhouse gases in 2020. The SLOK scheme aims at reducing emissions of CO_2, CH_4 and N_2O at the local level. It is meant as a support mechanism for the climate agreement of the national administration with the Association of Netherlands' Municipalities (VNG) for the period 2007-2011, and the Association of Netherlands' Provinces (IPO) for the period 2008-2011. The available budget for supporting local climate initiatives is € 42.3 million for municipalities and € 4.7 million for provinces.

Energy sector (incl. refining)						Estimation of mitigation impact, in Mton CO2-eq		
GHG affected	**Name of Policy / Cluster of policies**	**Objective and/or activity affected**	**Type of instrument**	**Status**	**Implementing entity**	**2010**	**2015**	**2020**
CO2	Incentivisation cogeneration*	Encourage construction and use of CHP by lowering investment costs.	Economic, Fiscal	implemented	National Government	1,9	1,6	1,3
CO2	MEP renewable and other financial incentivisation of renewables (Green investment, EIA/VAMIL, Coal covenant, BLOW covenant, energy tax)*	Stimulate investment in environmentally friendly technology and machinery.	Economic, Fiscal	implemented	National Government	7,6	8,4	9,2
CO2	Benchmarking covenant and LTA-2*	participating companies are amongst the most energy efficient in the world by 2012	Voluntary/ negotiated agreement, Regulatory	implemented	national government, provincial governments, and energy intensive companies and (energy) firms	0,0	0,0	0,0
	CO2 emission trading and other policy energy sector*	Cost-optimisation of CO2 reduction efforts		implemented	National Government	0,0	0,0	0,0
CO2	Refineries*	Enhance renewable energy production (wind-solar-hydro-biomass), stimulate renewable energy (20% in 2020) and stimulate investment in energy-efficiency.	Economic, Voluntary/ negotiated agreement	implemented	national government, provincial governments, and energy intensive companies and Refineries	0,2	0,3	0,4
CO2	Electricity production*	Enhance renewable energy production (wind-solar-hydro-biomass), stimulate renewable energy (20% in 2020) and stimulate investment in energy-efficiency.	Economic, Voluntary/ negotiated agreement	implemented	national government, provincial governments, and energy intensive companies and electricity production companies	3,3	6,2	9,2
CO2	Oil and gas extraction*	Enhance renewable energy production (wind-solar-hydro-biomass), stimulate renewable energy (20% in 2020) and stimulate investment in energy-efficiency.	Economic, Voluntary/ negotiated agreement	implemented	national government, provincial governments, and energy intensive companies and oil and gas companies	0,0	0,0	0,0
CH4	CH4 gas sector*	Reduce CH4 emissions from oil and gas production by 10% in 2000 relative to 1990	Economic, Voluntary/ negotiated agreement	implemented	National Government	0,0	0,0	0,0

Table 4.3a Summary of policies and measures for the energy sector. * = policies and measures are included in the 'with measures' projections (see also table 5.1)

Industry						Estimation of mitigation impact, in Mton CO2-eq		
GHG affected	**Name of Policy / Cluster of policies**	**Objective and/or activity affected**	**Type of instrument**	**Status**	**Implementing entity**	**2010**	**2015**	**2020**
						0,0	0,0	0,0
	Covenants and subsidy industry excl cogeneration and renewables*	participating companies are amongst the most energy efficient in the world by 2012	Economic, Fiscal, Voluntary/ negotiated agreement, Regulatory	adopted	national government, provincial governments, energy intensive companies and (energy) firms	0,4	1,2	2,1
CO2	Emission trading*	Cost-optimisation of CO2 reduction efforts	Economic	implemented	National Government	0,0	0,0	0,0
HFC	Afterburner HCFC production*	reduction in emissions of HFCs	Voluntary/ negotiated agreement Regulatory	implemented	provincial government	0,0	0,0	0,5
PFC	PFC aluminium*	Reduction in emissions of PFCs	Voluntary/ negotiated agreement Regulatory	implemented	national government	0,1	0,1	0,1
N2O	N2O Nitric acid production*	Reduction Programme Non-CO2 gases	Economic	implemented	national government	4,7	5,0	5,2

Table 4.3b Summary of policies and measures for the Industrial sector. * = policies and measures are included in the 'with measures' projections (see also table 5.1)

Traffic						Estimation of mitigation impact, in Mton CO2-eq		
GHG affected	**Name of Policy / Cluster of policies**	**Objective and/or activity affected**	**Type of instrument**	**Status**	**Implementing entity**	**2010**	**2015**	**2020**
						0,0	0,0	0,0
CO2	Policy aimed at technical measures vehicles*	Develop and implement innovations in car technology, and low noise and low emissions transport systems for passengers and freight in urban areas	Voluntary/ negotiated agreement	implemented	national government, SenterNovem	0,7	0,8	0,8
CO2	Policy aimed at behaviour measures vehicles*	Increasing fuel efficiency and reducing CO2 emissions through optimisation of driving behaviour.	Information, Education	implemented	national government, SenterNovem	0,9	0,9	0,9
CO2	Policy aimed at decreasing transport demand*	Saving fuel and CO2-reduction by discouraging vehicle use through logistical improvements	Research	implemented	national government	0,0	0,0	0,0
CO2	Other (tax, CO2 reduction programme passenger transport)*	subsidize projects for CO2 reduction	Fiscal, Research	implemented	national government	0,2	0,4	0,5

Table 4.3c Summary of policies and measures for Traffic. * = policies and measures are included in the 'with measures' projections (see also table 5.1)

Agriculture						Estimation of mitigation impact, in Mtonne CO2-eq		
GHG affected	**Name of Policy / Cluster of policies**	**Objective and/or activity affected**	**Type of instrument**	**Status**	**Implementing entity**	**2010**	**2015**	**2020**
CO2	Greenhouse horticulture policy*	increase energy efficiency by 65% in period 1980-2010	Economic, Fiscal, Voluntary/ negotiated agreement, Regulatory, Research	implemented	national government	0,3	0,5	0,8
CH4	Size of cattle stock*	milkquota, livestock reduction; ended in 2015	Regulatory	implemented	national government	0,3	0,2	0,0
N2O	Ammonia and manure policy*	Reduce emissions through manure and ammonia management	Regulatory	implemented	national government	0,6	0,3	0,0

Table 4.3d Summary of policies and measures for the agricultural sector. * = policies and measures are included in the 'with measures' projections (see also table 5.1)

Waste						Estimation of mitigation impact, in Mtonne CO2-eq		
GHG affected	**Name of Policy / Cluster of policies**	**Objective and/or activity affected**	**Type of instrument**	**Status**	**Implementing entity**	**2010**	**2015**	**2020**
CH4	Landfill policy*	Reduction in amount of landfilled waste, reduction of CH4 emissions from landfill sites	Voluntary/ negotiated agreement, Regulatory	implemented	national government	4,0	5,0	6,0

Table 4.3eSummary of policies and measures for the Waste sector. * = policies and measures are included in the 'with measures' projections (see also table 5.1)

Built environment - Households						Estimation of mitigation impact, in Mtonne CO2-eq		
GHG affected	**Name of Policy / Cluster of policies**	**Objective and/or activity affected**	**Type of instrument**	**Status**	**Implementing entity**	**2010**	**2015**	**2020**
CO2	EPN, energy tax (new housing)*	improve energy performance of residential buildings	Fiscal Regulatory	implemented	national government	0,3	0,7	1,0
CO2	EPBD, EPA, EPR, energy tax (existing buildings)*		Fiscal Regulatory, Information	implemented	national government	0,5	0,7	0,9
CO2	Energy labelling, EPR electric appliances*	improve energy performance of existing residential buildings	Information	implemented	national government	0,6	0,8	1,0
CO2	Energy efficient lighting, MAP*	improve energy performance of existing residential buildings	Information	expired	national government	0,0	0,0	0,0
Built environment - commercial and industrial building						**Estimation of mitigation impact, in Mtonne CO2-eq**		
GHG affected	**Name of Policy / Cluster of policies**	**Objective and/or activity affected**	**Type of instrument**	**Status**	**Implementing entity**	**2010**	**2015**	**2020**
CO2	EPN, EINP (new housing)*	promoting energy saving and renewable energy in the non-profit sector	Regulatory	implemented	national government	0,2	0,3	0,3
CO2	EPA, EPBD, EIA/EINP (existing buildings)*	promoting energy saving and renewable energy in the non-profit sector	Fiscal Regulatory, Information	implemented	national government	0,0	0,0	0,1
CO2	Energy labelling, EPR electric appliances*	improve energy performance of existing non-residential buildings	Information	implemented	national government	0,0	0,0	0,0
CO2	Energy tax*		Fiscal	implemented	national government	0,0	0,0	0,0

Table 4.3f Summary of policies and measures for the Built environment. * = policies and measures are included in the 'with measures' projections (see also table 5.1)

NOTE FOR ALL TABLES: Mitigation impact is calculated compared to a reference scenario which already includes some of the measures. Therefore, the impact of the measure can be zero in some cases. Termination of these measures will lead to higher emissions.

4.4.9. Policies and measures; effects on Non-Greenhouse Gas mitigation benefits and interaction with other policies

Some climate measures have similar and well-known effects on emissions of air pollutants and GHGs. An example is energy saving. This causes a reduction in energy demand for among other things, conventional fossil-fuelled power plants. And conventional power plants emit wellknown quantifiable amounts of both GHGs and air pollutants. However, the effects of some important climate measures on levels of air polluting emissions are less obvious. Particularly uncertain are the effects on the levels of air pollutants from 1) the use of biofuels in road transport; 2) the use of biomass, biofuels and biogas in stationary installations; 3) the emissions resulting from the chain of cultivation, transport and processing of biofuels and biomass, and 4) the application of various types of CO_2 capture and storage (CCS).

To identify possible effects in more detail and – where possible – fill in the knowledge gaps on the climate measures, a research programme on air and climate has been established in the Netherlands, called 'Dutch Policy Research Programme on Air and Climate' (Beleidsgericht Onderzoeksprogramma Lucht en Klimaat' (BOLK) (PBL/ECN, 2008).

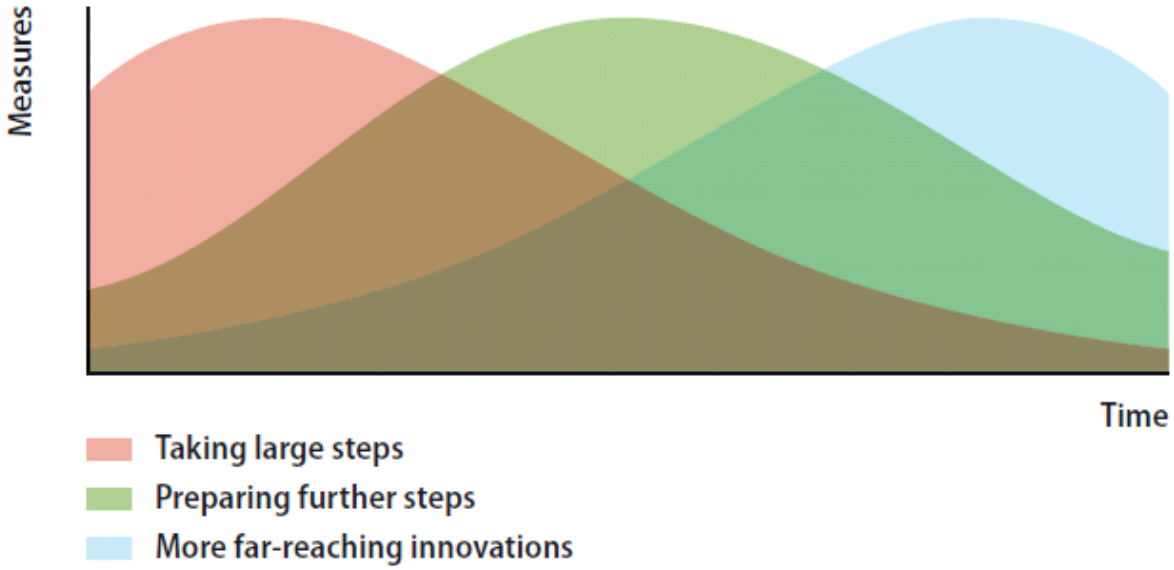
The results of the BOLK-study are:

- In general, measures to abate greenhouse gas emissions will also reduce other air polluting emissions (especially sulphur dioxide and nitrogen oxides). Climate measures in the Netherlands could reduce the additional costs of meeting the indicated national emission ceilings for air pollutants in 2020.
- When a large proportion of the climate targets for the Dutch industry would be met through the purchasing of CO_2 credits abroad, co-benefits would also occur abroad, in the form of lower sulphur and nitrogen emissions. Thus, cost savings from the reduction of these domestic air pollutants would be considerably less.
- Some CO_2 abatement measures will not necessarily reduce other air polluting emissions, for instance, the application of biofuels and biomass, and carbon capture and storage (CCS).
- The blending of biofuels in diesel or petrol creates a risk for increased emissions of air pollutants. This risk is the lowest for mixtures with less than 5 to 10% in biofuels. Using blends with higher amounts of biofuels requires specially adapted vehicles, to avoid increased air pollution. The legislation on European reference fuels, to be used in approval tests for new vehicles, should include the required blends of biofuels that meet the European biofuels targets.
- Instead of converting biomass into biofuels, it could be used more efficiently for the production of hydrogen or electricity. In addition, the air quality benefits from these green energy carriers could be larger if they would be allowed to contribute to the renewable energy target for road transport.
- Emissions resulting from the cultivation, transport and refining of biofuels, are generally higher than those generated by the production of fossil fuels (except for sulphur dioxide). This can be important since the production cycle emissions from biofuels can be larger than the emissions during its end use in road transport.
- Co-firing biomass in large coal-fired power plants will have a positive effect on air pollution. Biomass generally contains lower amounts of sulphur than coal, and changes in fuel quality and combustion can be dealt with by advanced flue-gas cleaning equipment. However, a growing number of small and medium-sized biomass, biofuel and biogas installations may increase air pollution, when emission limits for these installations remain less stringent, compared to those for larger-sized installations.
- Currently available post-combustion carbon capture and storage techniques can lead to a decrease in SO_2 emissions, but may lead to an increase in NH_3 and NOx emissions, if no additional measures are taken. In case of a high CO_2 price, such techniques might be applied in the Netherlands, by 2020. Emerging pre-combustion CCS techniques and oxy-fuel techniques will probably deliver a better environmental performance, but they may not become available before 2025.

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

The aforementioned 'Clean and Efficient: New energy for climate policy' programme has a time horizon of 2020. The policies and measures described in the previous sections are meant to be continued until 2020 and thereby contribute to a reduction in greenhouse gas emissions in the longer run. To speed up the transition to one of the most efficient and cleanest energy systems in Europe, the Dutch government is not only taking significant steps with it's cohesive package of policy instruments that can be deployed in the short term, it's also preparing 'further steps', which means working at a faster pace on options that can be fully deployed in several years but that still need more development and start-up time. This is the case in the demonstration phase of technologies and for innovations that need to be speeded up. In a number of cases, it may also be necessary to develop specific policy instruments, adapt existing instruments and/or remove non-technological barriers.

Last element of the Working programs that ensures the modification of longer-terms trends is the so-called 'Far-reaching innovations'. That is done by implementing an innovation agenda for the medium and long term, for example by pressing ahead more rigorously with the Energy Transition as a permanent source of innovation in society. This innovation is necessary to keep the momentum going.



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

Promoting sustainable development

The European Sustainability Strategy contains the targets and premises of the European Union with respect to sustainability. Alongside collaborative EU actions, the strategy strongly calls for national action. Member States must explain in their national strategies how they plan to realise their aims for climate, energy, transport, consumption and production, natural resources, public health, social inclusion, demographic development, migration and poverty. The first European Strategy for Sustainability (2001) was fundamentally revised in 2006.

The Dutch National Strategy for Sustainability was 'peer reviewed' in the spring of 2007 by Finland, Germany and South-Africa. The recommendations are included in the final report 'A new Sustainable Development Strategy: an opportunity not to be missed', which was published by the Advisory Council for Research on Spatial Planning, Nature and the Environment (RMNO).

Sustainable development is one of the priority themes for the Dutch government. Non-sustainable trends must be countered by supporting leaders in sustainability, national and international cooperation, with a strong emphasis on innovation. Sustainable development requires a broad support (from society) for change. The government has designed a three-pronged approach: policy results,

involving its own operational management to promote sustainability, and engaging in a dialogue with society. In May 2008 the government approach to promoting sustainable development was presented to Parliament. In April 2009 the government ministers presented the first Monitor on Sustainable Development with their comments on the results, an overview of the progress made so far and an accentuation of the approach. The programme is now called the Cabinet Approach to Sustainable Development (KADO in Dutch).

The core element in this approach is to bring about fundamental social changes ('transitions'), which will take 20-25 years to complete. An example of such transitions is the change to a fully sustainable mobility.
(http://www.vrom.nl/pagina.html?id=10749#a4)

Steps relating to greenhouse gas emissions from aviation and marine bunker fuels
In accordance with Article 2.2 of the Kyoto Protocol the Netherlands is still committed to achieving limitation or reduction of greenhouse gas emissions not controlled by the Montreal Protocol from aviation and marine bunker fuels, working through the International Civil Aviation Organisation (ICAO) and the International Maritime Organisation (IMO) respectively.

ICAO
The Netherlands has been a promoter of international market-based measures in the ICAO context for some time. It therefore supported the European Commission's proposal to incorporate aviation into the EU Emissions Trading System (ETS), which was discussed in February 2007 in the EU Environmental Council. In order to prevent negative effects on the EU's relationship with other countries (such as the United States), it urged that implications in the area of international law, by ICAO, should be taken into account. The Netherlands further welcomed the announcement by the Commission that it would start an impact assessment for NOx emissions. The government agreed that the European Commission should set the ceiling for the emission permits based on the average emissions over the period 2004–2006. For the allocation of permits the Netherlands supported auctioning of more than 3% of the permits, and airlines should be allowed to buy permits from other sectors via JI or CDM. In order to substantially reduce the CO_2 emissions from aviation, the Dutch government expressly wishes to include as many airline companies as possible. Therefore (eventually) an international agreement in the context of ICAO should be reached.

IMO
At its October 2008 meeting the IMO Marine Environment Protection Committee (MEPC) discussed market-based measures for reducing CO_2 emissions from shipping, and agreed to further discuss such measures at MEPC 59 (July 2009). For its deliberations on these matters, the Committee received information on Phase 1 of the updating of the 2000 IMO Study on GHG emissions from ships, which estimated emissions of carbon dioxide (CO_2) from international shipping both from activity data and from international fuel statistics. The resulting consensus estimate for 2007 was that CO_2 emissions from international shipping amounts to 843 million tonnes, or 2.7% of global CO_2 emissions, as compared to the 1.8% estimate in the 2000 IMO study. The Phase 1 update estimated future emissions from international shipping based on global developments outlined by the Intergovernmental Panel on Climate Change (IPCC) and, in the absence of future regulations on CO_2 emissions from ships, such emissions were predicted in the base scenarios to increase by a factor of 2.4 to 3.0 by 2050. For 2020, the base scenario predicts increases ranging from 1.1 to 1.3, taking into account significant efficiency improvements resulting from expected long-term increases in energy prices.

At the October 2008 meeting of the 'Milieuraad' (Environmental Council) in Luxembourg, the European Union formulated global targets for CO_2 reduction. A reduction of 20% was agreed for the shipping industry.

Minimising adverse effects

The Kyoto Protocol was adopted in pursuit of the ultimate objective of the Convention, and hence its full implementation by the Netherlands is intended to contribute to preventing dangerous anthropogenic interference with the climate system. Ambitious mitigation goals are necessary to ascertain a future for all countries.

In striving to develop policies and measures to reduce greenhouse gas emissions, Parties to the Kyoto Protocol should implement those policies and measures in a way such as to minimise adverse effects, including the adverse effects of climate change, effects on international trade, and social, environmental and economic impacts on other Parties, especially developing country Parties identified in article 4, paragraphs 8 and 9 of the Convention.

Adverse impacts on developing countries are reduced if global temperature increase is limited to 2 degrees Celsius, if dependence on fossil fuels decreases, and if Annex I Parties are able to develop low-carbon energy systems and reduce fossil fuel consumption.

The European Community actively undertakes a large number of activities to have positive impacts on third countries and their ability to tackle climate change, specifically capacity building and technology transfer activities. During the climate conference in Bali in 2007, it was agreed that also adaptation should be part of a new climate convention. To achieve this, technologies and financing mechanisms need to be developed further and made available to developing countries that are seriously affected by climate change. These include low-lying areas such as Vietnam and Bangladesh, islands that barely rise above sea level (the Maldives and parts of Comoros), and mountain states that are losing their glaciers (and therefore their sources of water). The Dutch government, through the Development Minister has adopted 'the polluter pays' as the guiding principle in financing adaptation in developing countries. This means that those who emit high levels of CO2 pay for the adaptation to climate change of others whose emissions are low but who suffer the consequences. The latter are mostly developing countries.

The discussions and negotiations on climate, and the Netherlands' contribution to them, have so far largely had an international character. As said, in the 2007–2008 period adaptation became an important element in international climate negotiations. In 2008 a number of countries pledged € 6 billion for an international climate fund for mitigation and adaptation to be managed by the World Bank. As a result of Dutch efforts, this fund is to have a special facility for renewable energy programmes in developing countries. In addition, partly as a result of Dutch efforts, avoided deforestation has been placed on the agenda for the negotiations on a new climate convention. Avoided forestation means that countries are offered financial compensation for preserving their forests, thereby helping to avoid increases in CO2 emissions.

For the ultimate impact in developing countries, one significant development is that an increasing number of actors are becoming aware of environmental degradation and the need to adapt to climate change. New forms of cooperation, modified technologies and financing mechanisms are being developed so that developing countries can adapt to the consequences of climate change. Attention to adaptation is also increasing at national level. In 2008, for example, the new Ministry of the Environment in Peru made adaptation one of its main policy priorities. A number of areas in the Peruvian Andes are of great importance for the climatological conditions throughout the entire Andes region. Peru has therefore decided to take on a leadership role at regional level in developing an adaptation policy for the international climate negotiations. The ministry is working closely with local NGOs, such as the Asociación Especializada para el Desarrollo Sostenible (AEDES), on this. The Dutch organisation Both ENDS and other NGOs are following this process closely, so that they can contribute to the policy.

In 2007 Dutch civil society organisations, united in the national HIER climate campaign, took the initiative to organise a national meeting on adaptation for representatives of environmental and

development organisations. The latter are becoming increasingly convinced of the need to take account of the effects of climate change in their programmes and projects. An example of adaptation is a programme run by the Dutch Red Cross Climate Centre, which builds the capacity of national associations in developing countries to deal with increasingly frequent extreme weather systems. A start has also been made on developing new forms of cooperation between universities, insurance companies, DGIS, the Ministry of Housing, Spatial Planning and the Environment, and environmental organisations.

The flexible mechanisms under the Protocol - Emissions Trading, Joint Implementation and the Clean Development Mechanism - are all tools incorporated 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.

Dutch policies and measures on the promotion of renewable energies contribute to reduction of dependence on fossil fuels, meeting rural electricity needs, and the improvement of air quality. Similarly Dutch activities on the promotion of energy efficiency and CHP measures can reduce energy costs and contribute to the improvement of air quality.

A recent impact evaluation by the World Bank shows that increased use of electricity leads to improved quality of air in homes (through better cooking facilities), better health provisions (including refrigeration for medicines, good light for operations), and greater availability of information (reading lights, radios, the Internet). This enables the poor to more easily meet their basic needs. The Netherlands has set itself the target of providing 10 million people in developing countries with modern energy by 2015. Between 2004 and 2007, through a variety of programmes funded by the Netherlands, 5.5 million people started to make use of modern, sustainable forms of energy, including biogas installations, small-scale hydraulic power stations, solar panels etc. On the basis of the most recent calculations, the total number of people benefiting had reached 6.3 million by the end of 2008.

Multilaterally, the Netherlands cooperates in the Energy Fund for Africa (the World Bank, the IFC and the African Development Bank), the Asia Sustainable Technology and Alternative Energy (ASTAE) programme for Southeast Asia, and the Energy Sector Management Assistance Programme (ESMAP). The results of this cooperation include knowledge on the application of renewable energy, strengthening national organisations for renewable energy and access to renewable energy for the poor. For example, hydraulic power stations have been set up in Zambia, and solar energy programmes in Mongolia. In Southeast Asia energy loans are provided to projects that use renewable energy.

Bilaterally, the Netherlands participates in a regional programme for the Great Lakes region, in the renovation of existing hydraulic power plants, the transmission of electricity, extending the electricity network and decentralising energy programmes. Methane excavation from Lake Kivu has a prominent place in these activities. In Rwanda a national energy plan has been developed in which renewable energy has been integrated and, in the DRC, a programme has been elaborated to renew the electricity network in Kisangani. In Indonesia, a number of Dutch energy partners, including SenterNovem, are supporting a nationally operating energy programme, together with the World Bank and GTZ. As a result, thousands of households are now connected to the electricity network and solar panels and small-scale hydraulic power stations have been installed. Cleaner energy is now also available in the form of biogas and vegetable oils.

A large number of new initiatives have been developed in cooperation with civil society organisations and the private sector. The Netherlands Development Organisation (SNV) conducts biogas programmes in Asia and a biogas programme is being set up, together with SNV and Hivos, in six African countries. The Global Village Energy Partnership strengthens local small-scale private enterprises in developing countries. The Free Energy Foundation works to increase the use of solar power in Africa. Partnerships with Nuon, Philips and the FMO's Access to Energy fund collaborate with local companies that supply consumers with electricity on the basis of renewable energy. This

helps to make low-energy products available in local markets. Here, too, the results contribute to poverty reduction and economic development, help reduce the growth of CO2 emissions and strengthen the position of women.

Changes to subsidies under the EC Common Agricultural Policy (CAP) now link payments to environmental, food safety and animal welfare standards, not to agricultural production volume. This encourages responsible agricultural practices.

Promotion of biofuels
Expectations are that the worldwide use of biomass in the energy supply will increase considerably in the coming decades. This will be accompanied by the large-scale planting of energy crops. New areas will be opened up for agriculture. Countries and producers will see opportunities for new activities. But at the same time there is a growing concern that this must not be at the expense of other important values for nature, environment and society. To accommodate these feelings, criteria will be needed that indicate whether biomass has been produced in a responsible manner.

At the request of the government the project group 'Sustainable production of biomass', under the chairmanship of Prof. Dr. Jacqueline Cramer, from the beginning of 2006 has been bringing together the different views on sustainable production. On this basis the project group has drawn up a framework for the testing of the sustainability of biomass production. This report describes this 'testing framework for sustainably produced biomass' and its elaboration in the form of criteria and indicators. The project group defines the sustainability of large-scale production of biomass on the basis of six relevant themes. These themes are for the greater part linked to the 'Triple P' of sustainable development: People, Planet and Profit,
supplemented with specific themes for biomass.

The project group distinguishes six relevant themes:

- Greenhouse gas emissions: Calculated over the whole chain, the use of biomass must produce fewer emissions of greenhouse gases net than on average with fossil fuel. For electricity production the emission reduction must now amount to at least 50-70%, for the application in transportation fuels at least 30% . These percentages must increase further by innovation in the future. The percentages are minimum requirements. Here the basic principle must be that policy instruments should promote a higher percentage above the minimum requirement by differentiating strongly on the basis of the emission reduction of greenhouse gases. The project group thinks it desirable to achieve, in about ten years' time, at least 80 to 90% emission reduction in relation to the current fossil reference. This means that in 2010 it will have to be evaluated to what degree the minimum requirement will have to be tightened up in 2011 to attain the objective of 80 to 90% in ten years'time. This aim can be achieved when innovative biofuels are applied and a much more efficient cultivation for the production of energy. The development of new acreage for the planting of biomass for energy must not lead in the longer term to the release of large quantities of carbon that had been stored there (in soil or vegetation).
- Competition with food and other local applications: The production of biomass for energy must not endanger the food supply and other local applications (such as for medicines or building materials). Criteria for this have not been determined yet; reporting on changes in land use in the region and in prices for food and land is of great importance here.
- Biodiversity: Biomass production must not affect protected or vulnerable biodiversity and will, where possible, have to strengthen biodiversity. Often local laws and regulations have already been grafted on international agreements about biodiversity. Vulnerable areas and areas with a high value for biodiversity must be spared, where possible restoration of biodiversity is desirable.
- Environment: In the production and processing of biomass, the quality of soil, surface and ground water and air must be retained or even increased. This makes demands, for example, on the use of fertilizers and pesticides, but it also requires the application of the 'best practices' for instance to prevent erosion or additional emission of harmful substances.

- Prosperity: The production of biomass must contribute towards local prosperity. Criteria for this have not yet been developed. Reports that fit in with descriptions according to the Global Reporting Initiative can indicate if, for instance, the economic value of the biomass production will directly benefit the local community
- Social Well-being: The production of biomass must contribute towards the social well-being of the employees and the local population. The production of biomass must at least comply with international principles that have been laid down by the International Labour Organisation, in the UN Universal Declaration or Human Rights and in other treaties. Reports must also bring to light any violations of property rights or corruption.

4.6. (D) Policies and measures no longer in place

The following sections contain a summary of policies that have been repealed or have expired since the Netherlands' 4th National Communication.

- An important policy change in 2006 was the sudden termination of the MEP (Environmentally Friendly Electricity Production Programme) on August 18, 2006. The MEP was introduced in July 2003. It provided subsidies for environmentally friendly electricity generation, specifically based on renewable electricity and combined heat and power. This subsidy was granted for a maximum of 10 years (renewable electricity) or 1 year (CHP), and the sum depended on the moment of investment and the type of installation. For sustainable electricity the subsidy programme was terminated on August 18, 2006 and for CHP it ended on December 31, 2007.

  Companies that were already receiving an MEP subsidy before August 18, 2006 will continue to do so for the remainder of the subsidising term, which is 10 years, except for CHP-installations (1 year).

  The MEP subsidy programme has been replaced by the SDE subsidy programme for sustainable energy and CHP. Because the subsidy for sustainable electricity was granted for 10 years, most producers of renewable electricity with MEP still receive MEP subsidies, many of them until 2017.

- The Flight Tax, which was introduced on July 1, 2008 and repealed per July 1, 2009.
- EPR (Energie Premie Regeling), which was repealed in 2003.

5 PROJECTIONS AND THE TOTAL EFFECT OF POLICIES AND MEASURES

5.1. Introduction

The previous National Communication described the projections made in 2005, the so-called referentieraming (Dril *et al*., 2005). These associated emissions with two socioeconomic scenarios (the Strong Europe and Global Economy scenario respectively). Changes in prices, policies and other relevant developments justified a recent update of the Global Economy variant of these projections. This update was made in 2009 (Daniëls et al., 2009) and is used for the overview presented in this chapter.

Section 5.2 presents the 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 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. (A) Projections

Scenarios used, and major changes relative to the previous National Communication
The scenarios underlying the emission projections in the 2005 'referentieraming' have been taken from two of the four economic scenarios described in Bollen (Bollen *et al*., 2004)[13]. The projections are based on a further elaboration for the Netherlands of two of these European scenarios, namely Strong Europe (SE) and Global Economy (GE). Although 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 through relatively even income distribution, greater social security and investments in education and research.

The GE scenario is sharply oriented 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.

The 2009 update is based on the GE scenario, since this scenario is increasingly used as a reference. The update could not provide a full inclusion of the effects of the economic crisis; however it considers the effects of lower economic growth as part of the uncertainty analysis. It includes two energy price variants. Apart from the energy prices the main changes include the higher CO_2 price assumed in the emission trading system, the inclusion of plans for new power plants, the recent surge in the new horticultural use of combined heat and power, the new policies for renewable energy electricity and the inclusion of new transport projections. These developments may also affect the emissions of air pollutants. Major changes that are specifically relevant for the emissions of air pollutants are the agreements with refineries and electricity producers on SO_2 emissions.

[13] 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).

Projections 'with measures'
The projections presented are the 'with measures' projections based on the above scenario. These projections only include policies that have already been decided on in their definitive form, hence the results only include part of the present Clean and Efficient (Schoon & Zuinig) programme.

The assumptions for future economic growth and demography still originate from the Global Economy scenario. However, the results for the period 2005-2008 now reflect historic realisations, where data availability allows us to do so.

The emissions are higher than in the Reference Projections 2005-2020, which is mainly due to the surge of new power plants. However, these emissions are included under the cap of the European CO_2 emissions trading system, and therefore they do not affect the emissions as defined under the National and European targets. The changes in emissions that are not included in the trading system are much smaller.

Projections 'with additional measures'
As mentioned above, the projections only include existing policies and measures. The effects of the planned policies and policies that are still under development within the framework of the Clean and Efficient programme have not been included. These were subject of a separate study (Dril 2009). Although this study did not include a fully fledged projection, it draws a series of relevant conclusions that are briefly described in Section 5.3.1.

Projections 'without measures'
Figure 5.14 (section 5.3.1.) presents an estimate of the without measures projections.

5.2.1. Description of policy variants

The table below list which policies and measures are included in the 'with measures' projection. For a description of these policies and measures see chapter 4.4 and , table 4.3.

Energy sector (incl. refining)
Incentivisation cogeneration
MEP renewable and other financial incentivisation of renewables (Green investment, EIA/VAMIL, Coal covenant, BLOW covenant, energy tax)
Benchmarking covenant and LTA-2
CO_2 emission trading and other policy energy sector
Refineries
Electricity production
Oil and gas extraction
CH_4 gas sector
Industry
Covenants and subsidy industry excl cogeneration and renewables
Emission trading
HFC industry
PFC aluminium
N_2O Nitric acid production
Reduction programme other greenhouse gases[14]

[14] This programme is not included in table 4.3 because it is a intersectoral programme. The programme is decribed in section 4.4.1. (Reduction Programme for Non- CO_2 Gases).

Traffic
Policy aimed at technical measures vehicles
Policy aimed at behaviour measures vehicles
Policy aimed at decreasing transport demand
Other (tax, CO_2 reduction programme passenger transport)
Agriculture
Greenhouse horticulture policy
Size of cattle stock
Ammonia and manure policy
Waste
Landfill policy
Built environment - households
EPN, energy tax (new housing)
EPBD, EPA, EPR, energy tax (existing buildings)
Energy labelling, EPR electric appliances
Energy efficient lighting, MAP
Built environment - commercial and industrial building
EPN, EINP (new housing)
EPA, EPBD, EIA/EINP (existing buildings)
Energy labelling, EPR electric appliances
Energy tax

Table 5.1 policies and measures included in the 'with measures scenario'

5.2.2. Projections by sector and gas

Annex 5.1. presents the emissions projections data following the template presented by the UNFCCC Workshop on Emissions Projections held in Bonn (2004). The figures below present the projections graphically by sector and by gas for the two alternative developments considered in the update projections, i.e. the UR-GE[15] and UR-GE (H) variants. The difference between these two lies in a higher energy price assumed under the UR-GE (H)

[15] UR-GE stands for Update Raming GE scenario. (H) stands for High energy price variant)

Energy sector

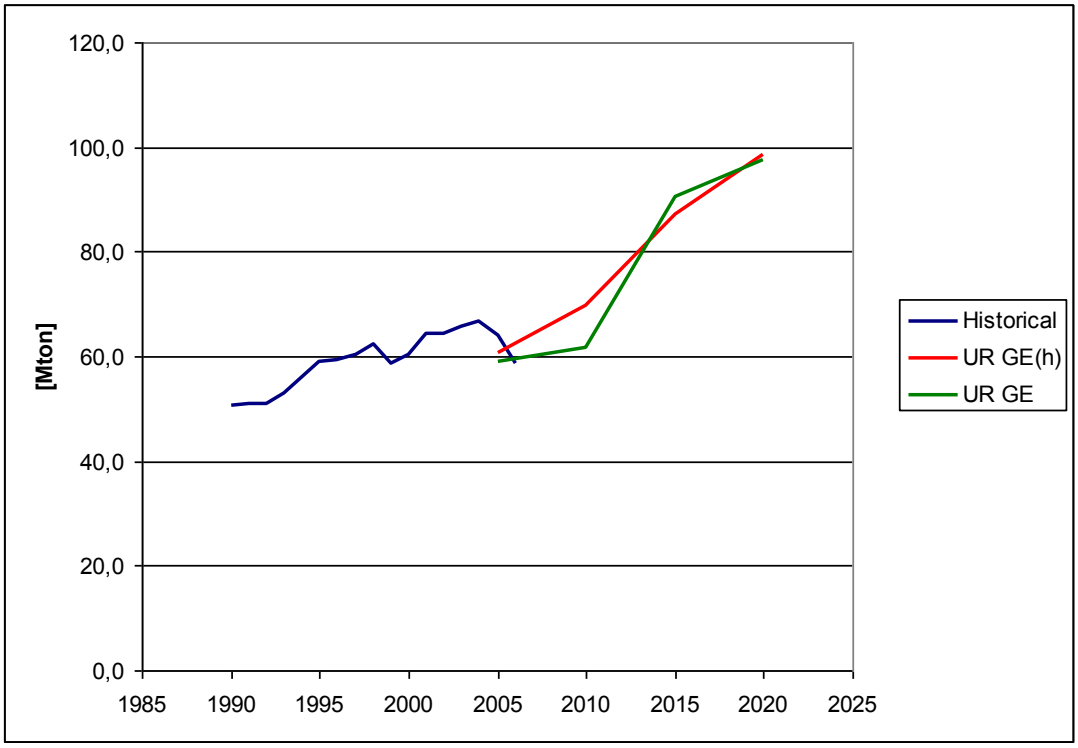


Figure 5.1 CO_2 emissions in the energy sector. Source: (Daniëls et al., 2009)

The scenario results show that between 2010 and 2015, the growth in the amount of coal used is much higher in the UR-GE scenario compared to UR-GE(h), and (after 2015) it is lower than the growth in UR-GE(h), which explains the difference between the CO_2 amounts for UR-GE and UR-GE(h) shown in the figure above.

Transport sector

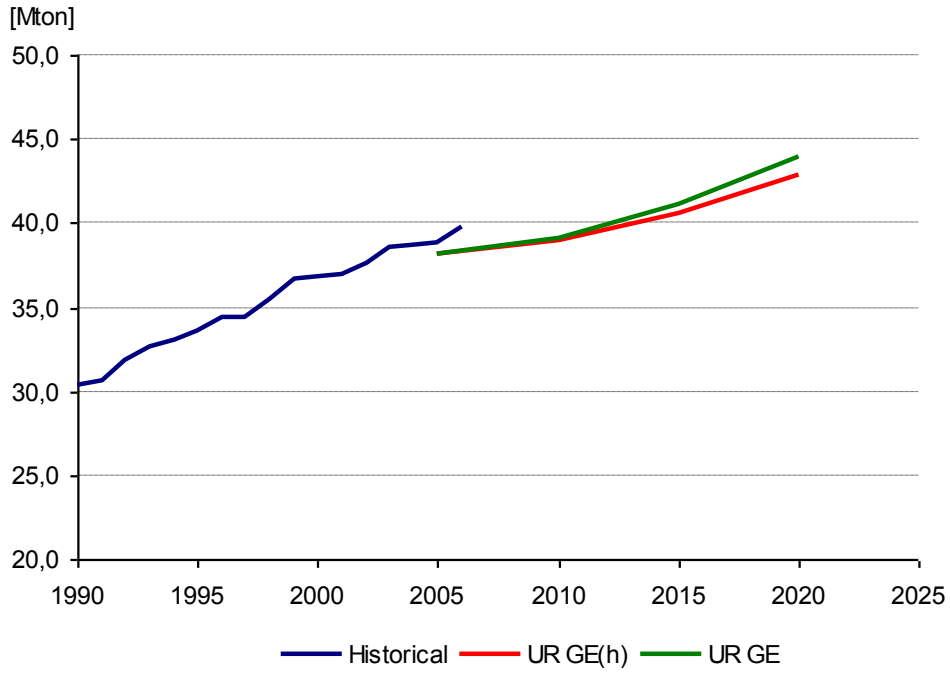


Figure 5.2. Transport sector: projected emissions Source: (Daniëls et al., 2009)

The projected CO_2 emissions from the transport sector follow the historic trend. Policies include increasing the amount of bio fuels (to be increased in 2008) in the fuel mix and fiscal incentives for purchasing energy-efficient cars.

Industrial sector

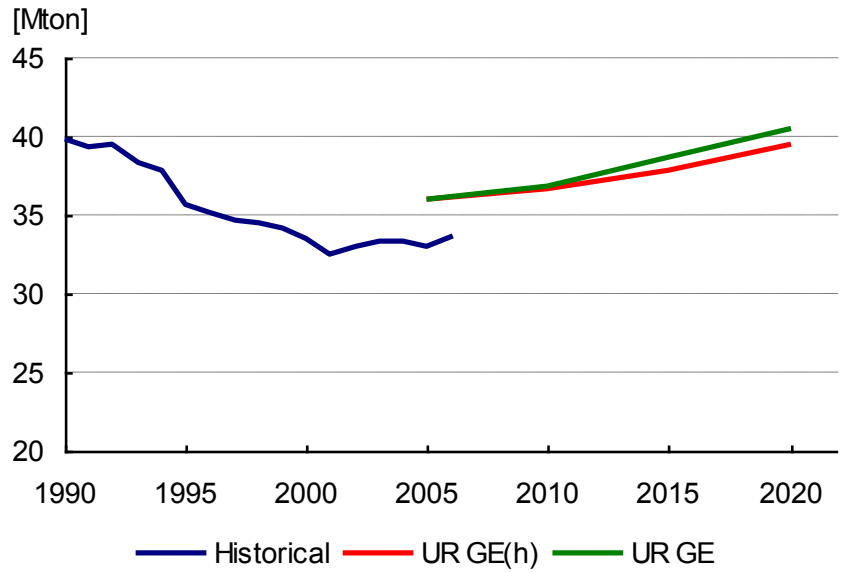


Figure 5.3.. Industrial sector: Projected CO_2 emissions Source: (Daniëls et al., 2009)

The projections for Dutch industry show that emissions will return to the level of 1990. However, most of these emissions are included under the cap of the European CO_2 emissions trading system and do not affect the emissions as defined under the Kyoto targets. The projections start at a higher level in 2005 due to the inclusion of combined heat and power generators (CHP/WKK) in the industrial sector. In the emissions report (NIR), CHPs are not allocated to the industrial sector but are generally included under the IPCC category 'energy industries'.

Agricultural sector

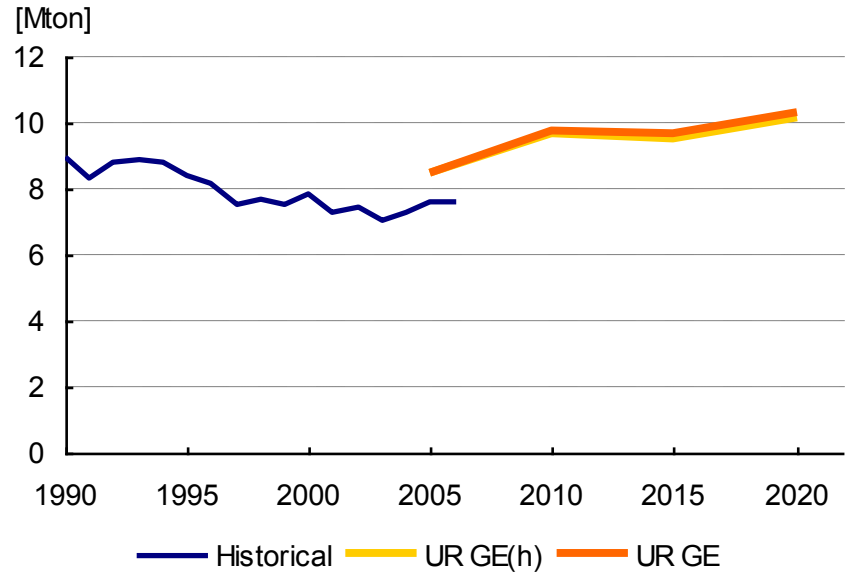


Figure 5.4.. Agricultural sector: projected CO_2 emissions. Source: (Daniëls et al., 2009)

The projected growth in CO_2 emissions from agriculture is a result of an increase in combined heat and power generators for greenhouse horticulture. The discrepancy between the emissions and projected emissions is again due to the inclusion of CHPs in the projections for this sector.

Forestry sector

As yet, no significant changes are assumed for the projections for the forestry sector. Table 5.1 shows the emissions and sinks for this sector, based on the present situation (see NIR 2009).

[Mton CO_2]	2007	2010	2015	2020
Forest Land remaining Forest Land	-2.7	-2.7	-2.7	-2.7
Land converted to Forest Land	-2.2	-2.2	-2.2	-2.2

Table 5.2. Projected developments for the forestry sector

Waste management sector

The emissions for the waste management sector are detailed under non-CO2 greenhouse gases in the paragraphs below; in figures 5.7-5.10.

Other sectors

Figure 5.5 presents the emissions for households, services and agriculture. The trend does not change until 2015, after which CO_2 emissions stabilise. This is the combined result of a less decreasing trend in households, a slightly decreasing trend for the services sector and an increase in agriculture between 2015 and 2020. The increase in agriculture between 2005 and 2010 was still compensated by the higher decrease in the other two sectors. Growth in agriculture is caused by more CHP.

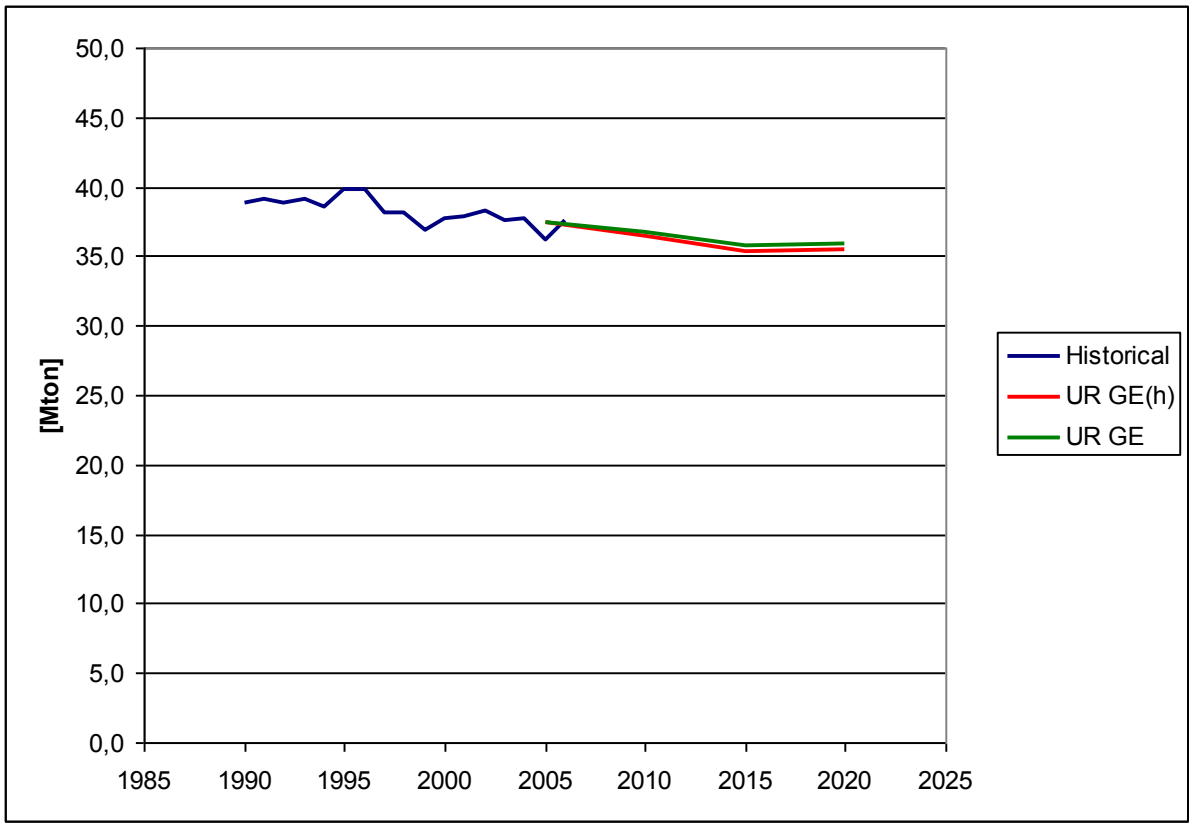


Figure 5.5 Emissions for households, services and agriculture. Source: (Daniëls et al., 2009)

Non-CO_2 greenhouse gases

Figure 5.6 shows the projected development of the various non-CO_2 greenhouse gases on a gas-by-gas basis.

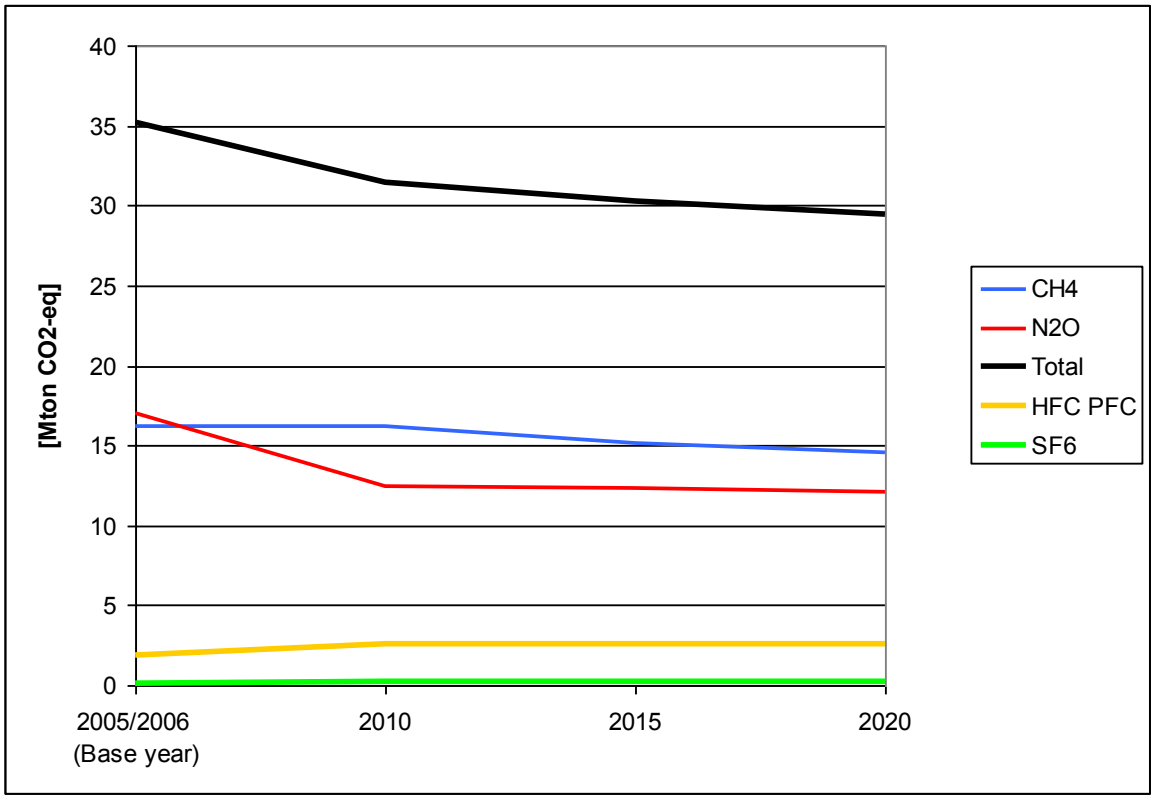


Figure 5.6. Non-CO_2 greenhouse gases on a gas-by-gas basis (within the GE scenario). Source: Daniëls et al., 2009.

Figures 5.7 to 5.10 present the emission projections for CH_4, N_20, HFCS and PFC, and SF_6 per sector in CO_2 equivalents (Daniëls et al., 2009), only per sector when emitted. The projections show no difference for various scenarios.

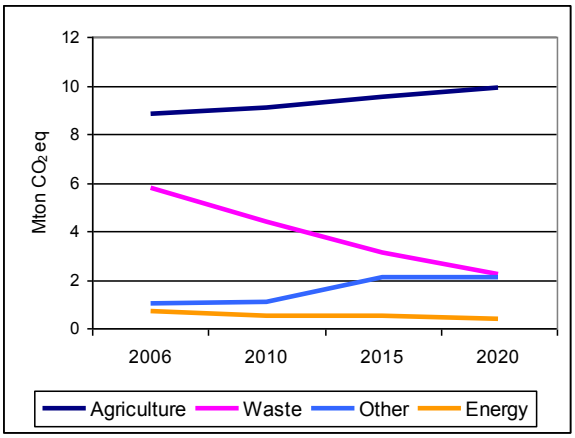


Figure 5.7 CH_4 emission projections in Mton CO_2 eq per sector

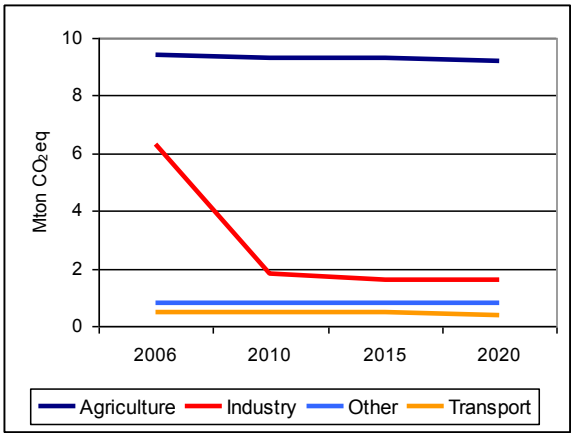


Figure 5.8 N20 emission projections in Mton CO_2 eq per sector

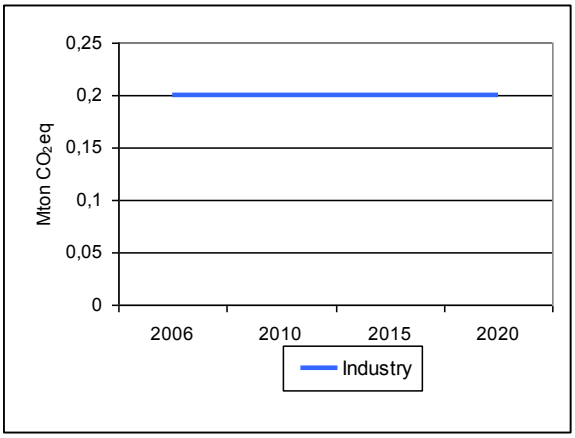


Figure 5.9 SF_6 emission projections in Mton CO_2 eq per sector

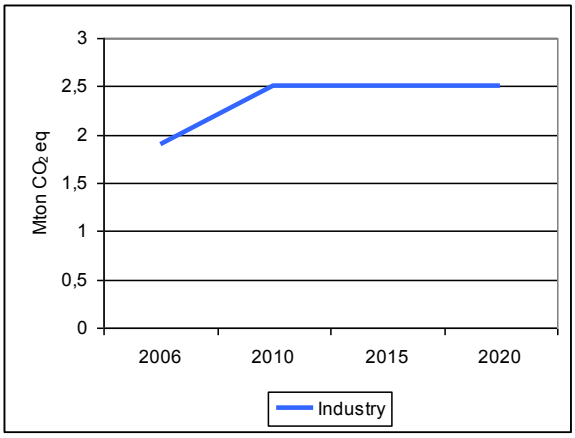


Figure 5.10 HFC and PFC emission projections in Mton CO_2 eq per sector

Aggregated greenhouse gas emissions in CO_2 equivalents per sector and for the national total

The total emissions under the Kyoto Protocol per sector and for a national total (in CO_2 equivalents) are presented in Figure 5.11a and 5.11b below.

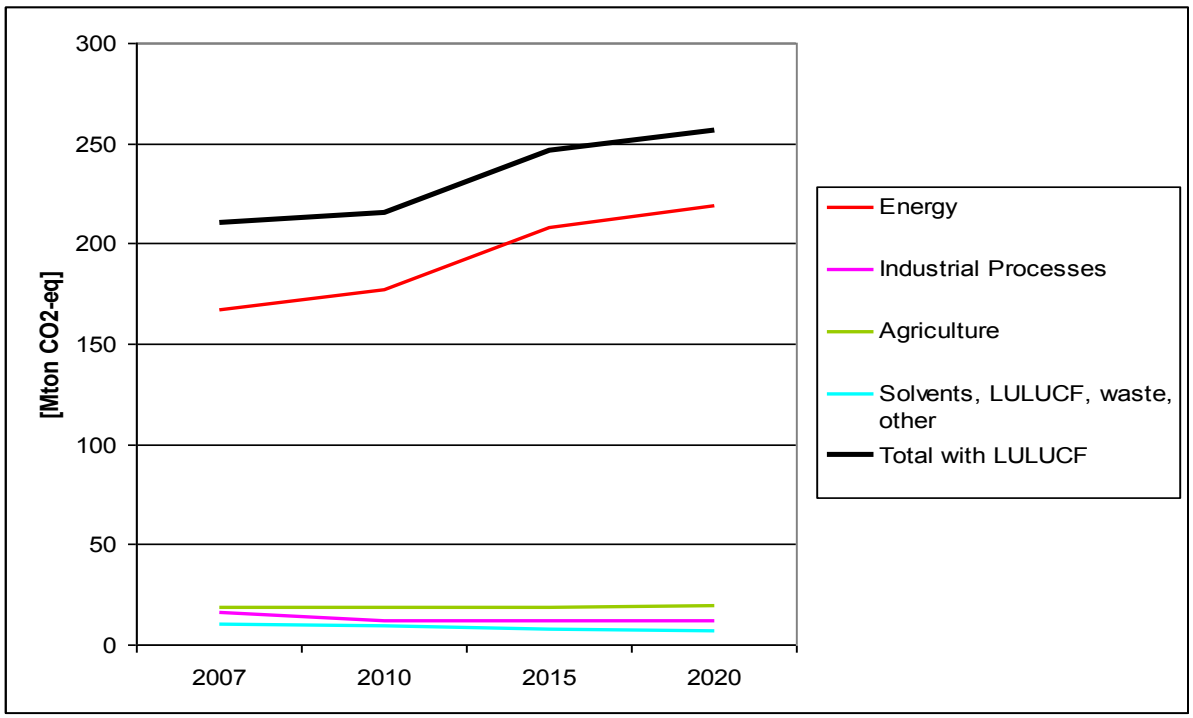


Figure 5.11a. Aggregated greenhouse gas emissions (GE Scenario). Source: Daniëls et al., 2009.

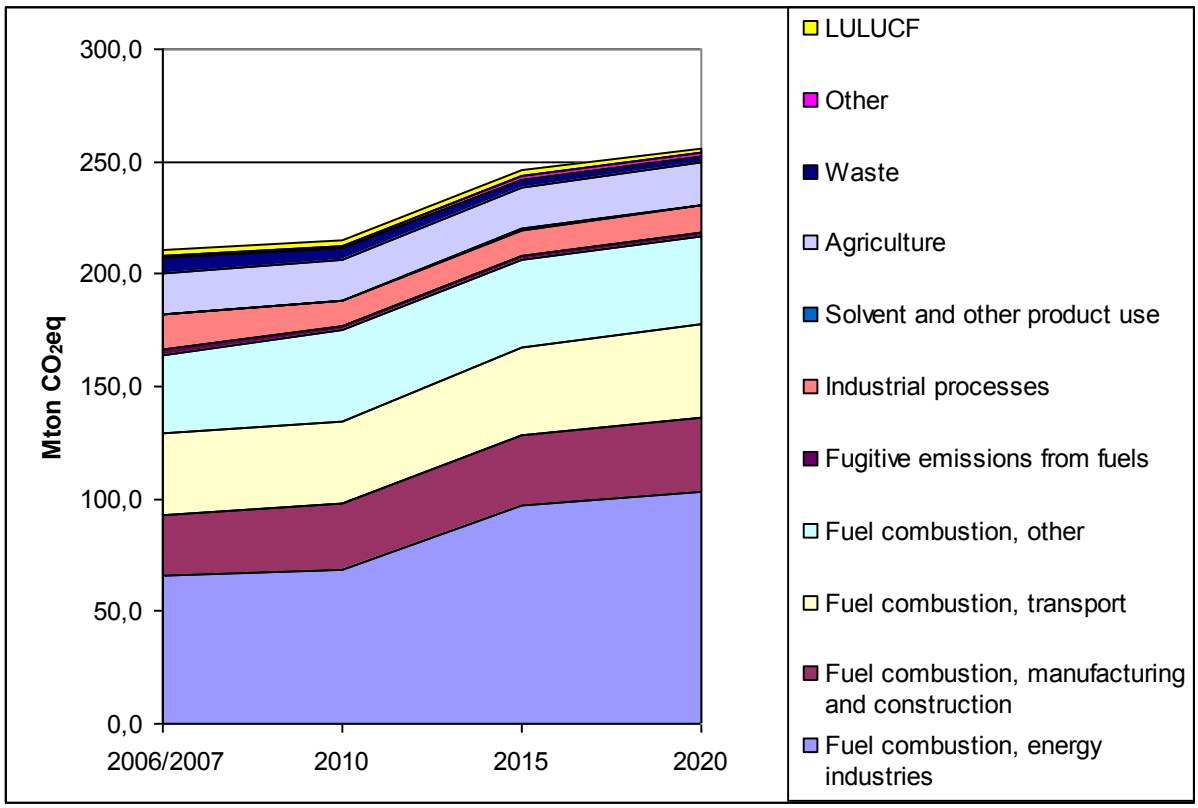


Figure 5.11b.Aggregated greenhouse gas emissions (GE Scenario). Source; Daniëls et al., 2009)

5.2.3. International bunkers

The Netherlands has also made a projection for the emissions from international navigation and aviation. These are shown in Figure 5.12.

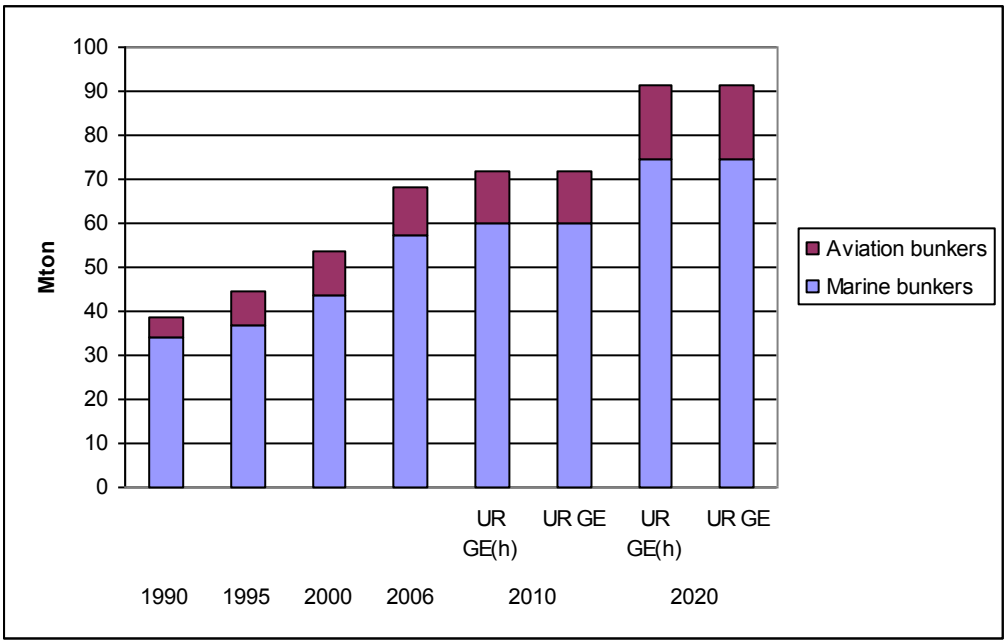


Figure 5.12. Emissions from international aviation and navigation (Daniëls et al., 2009

5.2.4. Emissions of NOx, NMVOC and SO_2

The projected developments for the emissions of the precursor gases are illustrated in Figure 5.13 below.

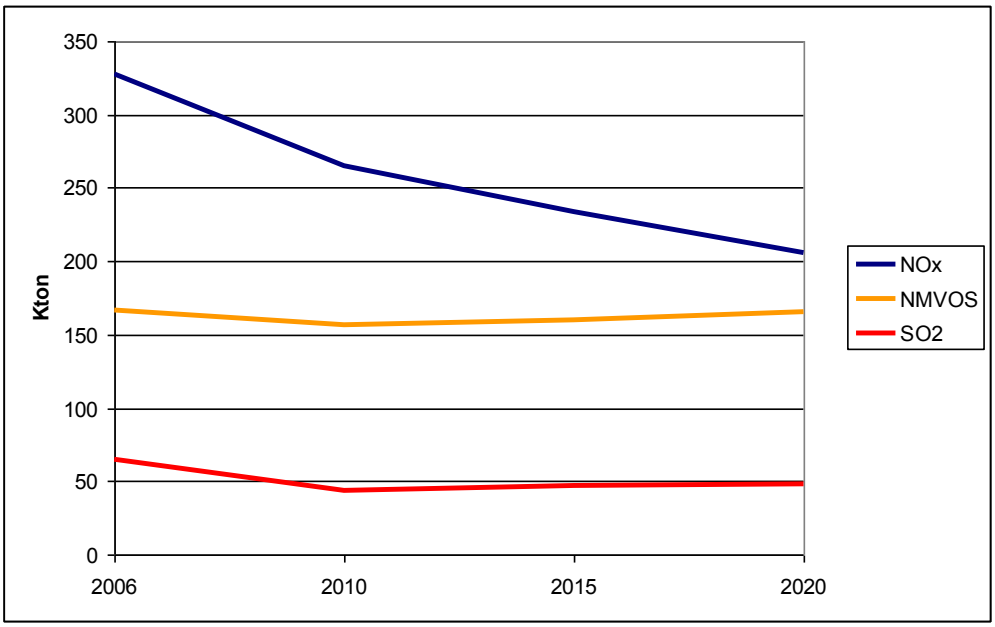


Figure 5.13. Projected emissions of precursor gases. Source: Daniëls et al., 2009

Emissions for NOx are regulated among others by law (administrative decree of order "BEES" for combustion installations) and in permits. Also the emissions of NOx in high efficient heating systems are decreasing (Daniels et al., 2009).

5.3. (B) Assessment of the aggregate effects of policies and measures

5.3.1. Effects on emissions of greenhouse gases

The 'with measures' variant includes all existing policy instruments which have been decided on in their definitive form. These instruments are described in table 4.3 of chapter 4. The effects of the planned policies and policies that are still under development within the framework of the Clean and Efficient programme have not been included. These were subject of a separate study (Dril 2009). Because this study does not include a fully fledged projection, the results are used to present a range of possible projections in the 'with additional measures' variant. Furthermore, the calculated effect of the WEM-measures are used to construct the 'Without measures' variant. To complete the picture, figure 5.14 shows also a variant including the expected effect of the flexible mechanisms.

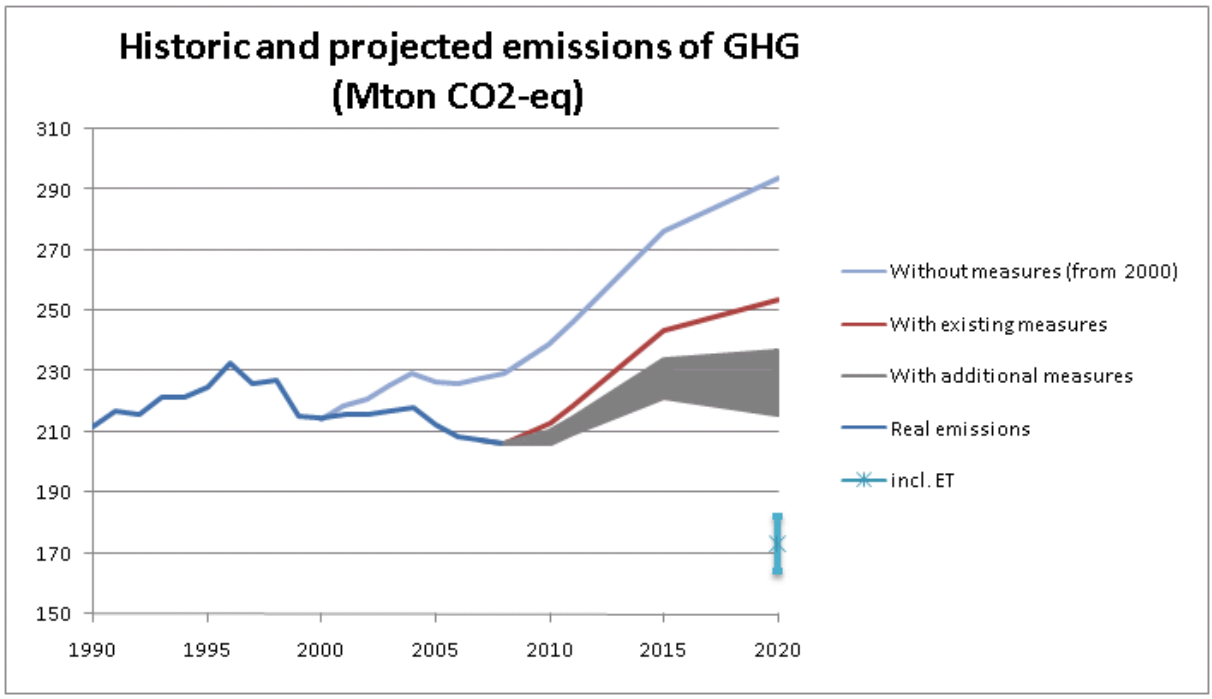


Figure 5.14 Historic and projected emissions of GHG emissions[16]

5.3.2. Sensitivity analysis and uncertainty

Starting from the UR-GE scenario the relevant experts have established uncertainty margins based on a combination of extra sensitivity analyses and expert judgement. For the projections for 2020, an inventory of uncertainties was used to establish a bandwidth of the CO_2 eq. emissions. In this process, methods were used that are also applied by the IPCC (see IPCC (2000) 'Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories'). An uncertainty propagation analysis was used, which results in a bandwidth for the projections scenario containing the emissions with a very high level of certainty (90% chance/confidence interval). This results in a bandwidth of

[16] In 2008 the Cabinet decided to include the European ETS ceiling as a policy result. The 'with existing measures' corresponds with the data in Table 4.3

–29 and +8 Mton CO_2 eq. around the projection of 254 Mton in 2020.

The following table shows the 10 most important uncertain factors per emission. The correlation indicates the degree in which the bandwidth (in the uncertain factor) contributes to the bandwidth of the total emission. The larger the correlation coefficient, the more the uncertain factor contributes to the uncertainty for the total emission. A positive coefficient denotes that an increase in the uncertain factor leads to an increase in CO_2 emission (e.g. amount of coal-fired capacity, economic growth). A negative sign means that an increase in the uncertain factor leads to a decrease in the CO_2 emission (e.g. the uncertain CO_2 price).

uncertainty factor	Importance for total bandwidth CO_2eq emission 2020 (standardized regression coefficient)
coal fired capacity electricity production	0.455
CO2 price	-0.448
data uncertainty N2O agriculture	0.346
natural gas to coal price ratio	0.332
statistical / emission factor	0.201
international position Dutch industry post 2012	0.154
growth of passenger cars kilometres	0.154
energy efficiency passenger cars	-0.152
economic growth industry, choice of location and division of growth over activities	0.151
gas fired capacity electricity production	0.145

Table 5.2 Uncertainty factors in the scenarios

5.3. (C) Supplementarity relating to mechanisms under Articles 6.12 and 17 of the Kyoto Protocol.

In this analysis, domestic actions are defined as autonomous developments and measures taken by companies, private citizens and government which 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 effect of domestic actions and the effects of domestic actions and the effect of using the project-based mechanisms.

In assessing how' significant domestic actions are, in this analysis domestic actions related to policy and domestic actions *not* related to policy are distinguished. One set of actions encompasses all policy measures taken since 1990 which still have an impact on emissions in 2008 ('related to policy' in figure 5.15). Another set includes all other domestic actions and autonomous developments (='not related to policy' in figure 5.15). The latter is calculated as the difference between the emissions 'if grown right proportional with the economy' and the 'realized emission + the effects policy related reductions'.

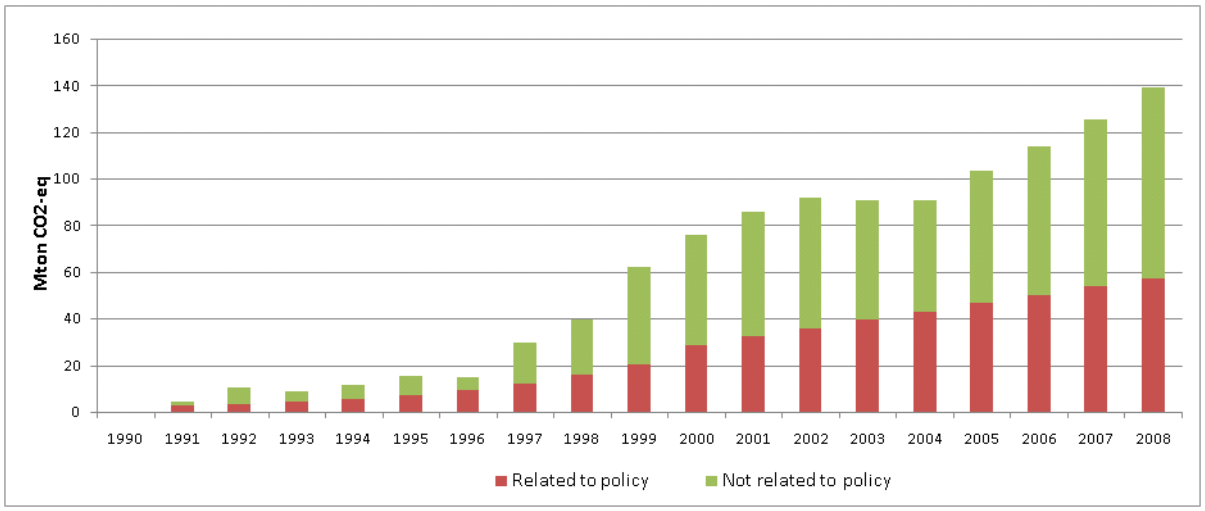


Figure 5.15: avoided CO_2-eq emissions due to domestic actions

The ratio between domestic actions and the use of the project-based mechanisms in 2008 depends on which set of domestic actions are included in the comparison. 13 Mton of CDM/JI credits (see 4.4) leads to a ratio of 139/13 when looking at all domestic reductions, while policy related efforts results in a ratio of 62/13.

5.4. (D) Description of methodology

Models and methods used

Autonomous social developments are reflected in growth series for activity data (industrial production, passenger-km, livestock numbers, etc.). These developments result, in turn, in a demand for energy, including non-energy-use of fuels (e.g. feedstock). Investments in energy technologies and efficiency improvements are modelled, using input on technological progress, policies and developments in energy prices and investment costs. Subsequently, the energy supply is modelled on similar input parameters. The final step is the calculation of 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 different 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 about 60 subsectors of importance for emissions, and together with information on developments in physical production capacity, these are used as input for the SAVE models by the Netherlands' Energy Research Center (ECN) (Boonekamp, 1994). SAVE was originally designed to project energy use and energy efficiency improvements, with both key economic parameters and structural developments as input. Results from earlier runs of the SAVE models have been compared with the NEMO model used by the CPB. The comparison between NEMO, a mixed top-down/bottom-up model, and the SAVE bottom-up models, resulted in improvements to both concepts.

The SAVE models used include households, services and the industry/CHP/agriculture model. These models simulate final energy use based on extensive information about technologies. The SAVE models also take the effect of environmental and energy policies into account. The development of energy demand can be decomposed into a volume, a structural, a climate, and an energy-saving effect.

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 with the Transport Research Centre's (AVVs) national system of models, based on a spatial planning model and economic data from the CPB. The energy used by the transport sector is calculated by the Netherlands Environmental Assessment Agency (PBL), taking into account information from the 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, developed by ECN 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 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 PBL (transport), PBL also calculates the non-CO_2 greenhouse gas emissions per sector. In this calculation, climate policy, technology and structural economic aspects affecting non-CO_2 greenhouse gas emissions are taken into account

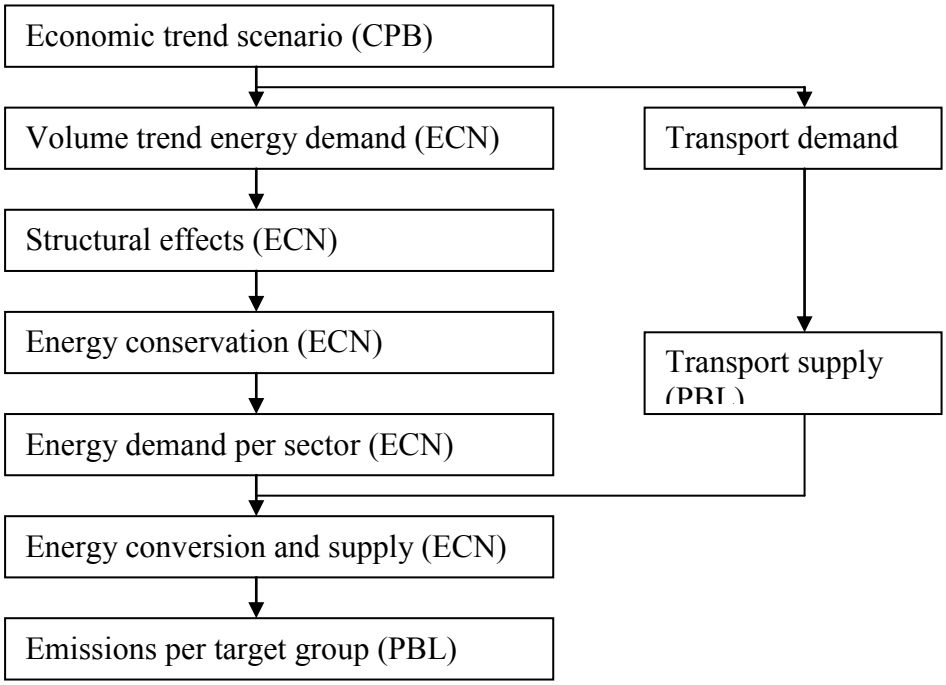


Figure 5.15. Sequence of calculations and input from various institutes

Key variables and assumptions

The key variables used in the projections are listed in Table 5.2 below. More detailed information on parameters and assumptions used is given in Annex 5.1

Assumptions for general economic parameters:		**Historic Values**				**With Existing Measures Scenario (UR-GE)**		
		1990	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
Gross Domestic Product	Value (mln. €)	243 652	305 261	417 960	513 407	618 000	713 000	822 000
Gross Domestic Product growth Rate	Annual growth rate (%)	4,2%	3,1%	3,9%	2,0%	2,9%	2,9%	2,9%
Population	Thousand people	14893	15424	15864	16306	16455	17028	17434
Population Growth Rate and Base Year Value	% of value	0,79%	0,45%	0,78%	0,18%	0,6%	0,6%	0,6%
International coal prices	€ per GJ	2,318	1,641	1,551	2,268	1,917	2,001	2,057
International oil prices	€ per GJ	4,615	2,782	6,016	7,664	7,625	8,100	8,548
International gas prices	€ per GJ	3,178	2,247	3,979	4,85	5,806	6,072	6,436
Assumptions on weather parameters								
Heating Degree Days	Annual HDD	3 059	2 995	2 928	2 861	2 797	2 762	2 727
Cooling Degree Days	Annual CDD	66,2	75,7	86,3	94,9	99	104	109

Table 5.2 Key variables used in the projections (see also annex 5.1)

6 VULNERABILITY ASSESSMENT, CLIMATE CHANGE IMPACTS AND ADAPTATION MEASURES

The climate in the Netherlands is expected to undergo significant changes over the coming decades. The most pressing consequences include warmer and wetter winters, drier and hotter 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 situated in a low-lying delta area, with four large rivers and with a high population density – will more frequently result in climate change impacts that need to be dealt with.

Over the last four years adaptation to climate change impacts has gained significant importance on the Dutch political agenda. Following a parliamentary resolution, in a combined effort the Departments of Housing, Spatial Planning and the Environment (VROM), Transport, Public Works and Water Management (V&W), Agriculture, Nature and Food Quality (LNV) and Economic Affairs (EZ), in cooperation with the Associations of Provincial Authorities (IPO), Netherlands Municipalities (VNG) and Water Boards (UvW), initiated the National Programme for Spatial Adaptation to Climate Change (ARK) in 2006. This programme is based on the shared belief that spatial adaptation to the effects of climate change is essential and a top administrative priority. The first product of this programme is the National Adaptation Strategy, which was approved in November 2007. This strategy has a broad scope and relates to the effects of climate change for water safety, nature, the various agricultural sectors, recreation and landscape, the urban environment and for industry. It emphasises on coping with the expected impacts through anticipative action, using the opportunities climate change offers and by stimulating innovation.

The effects of climate change are particularly felt in the risk of flooding or breaching of water-retaining structures (risk of social disruption), therefore adaptation in the Netherlands has been (and in the near future will be) strongly focused on the water sector. For this reason, the Cabinet appointed a ‘new’ Delta Committee in 2007. This Sustainable Coastal Development Committee (Delta Committee) has formulated a vision and policy advice on the long-term protection of the Dutch coast and its hinterland.

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. Details on international cooperation and capacity building can be found in Chapter 7. Details of research activities and programmes are described in Chapter 8.

6.1. (A) Expected impacts of climate change

In 2006 the Royal Netherlands Meteorological Institute (KNMI) published four climate scenarios for the Netherlands for 2050 and 2100. For the first time in their analyses of the future climate, the KNMI used a whole range of advanced global and regional climate models combined with information from time series of measured data, which allowed them to incorporate changes in air flow patterns in their models. Given the uncertainties about whether and how these flows are affected by the enhanced greenhouse effect, the KNMI decided to use two sets of climate scenarios: one set in which the flow patterns remain unchanged (current situation) and a second set in which the flow patterns do change (see table 6.1)

The calculations for the climate scenarios with altered circulation patterns provide strong evidence for more frequent dry summers similar to those experienced in 1976 and 2003 in the Netherlands. Both sets consist of two scenarios. In the first scenario the average global temperature in 2050 is one degree higher than in 1990, and in the second scenario it is two degrees higher than in 1990. Extreme changes – such as those that would be caused by a reversal of ocean currents and which would cause widespread social disruption – have not been included because the chances of such events occurring are low. According to current understanding, there is an 80% chance that the trends in the Dutch

climate will be within the range covered by the four scenarios. This means that in 2050 there is an 80% chance that the average winter temperature will rise by between 0.9 and 2.3°C and that the sea level will be 15 to 35 cm higher than in 1990 (see Table 6.1).

Observations in recent years indicate that the average temperature in the Netherlands is rising faster than the global average, and that extreme high temperatures are occurring more frequently. The warmer scenarios appear to describe the current situation best. The KNMI does not yet know whether these phenomena are a product of natural variability or a speeding up of climate change in the Netherlands. If climate change is speeding up, the impacts will be more severe and the costs will be higher.

2050	**G**	**G+**	**W**	**W+**
Worldwide rise in temperature	+1°C	+1°C	+2°C	+2°C
Changes in air flow patterns in Western Europe	no	yes	no	yes
Winter average temperature	+0.9°C	+1.1°C	+1.8°C	+2.3°C
Coldest winter day per year	+1.0°C	+1.5°C	+2.1°C	+2.9°C
Average precipitation	+4%	+7%	+7%	+14%
10 Day total rainfall exceeded once in 10 years	+4%	+6%	+8%	+12%
Highest average daily wind speed per year	0%	+2%	-1%	+4%
Summer average temperature	+0.9°C	+1.4°C	+1.7°C	+2.8°C
Warmest summer day per year	+1.0°C	+1.9°C	+2.1°C	+3.8°C
Average precipitation	+3%	-10%	+6%	-19%
10 Day total rainfall exceeded once in 10 years	+13%	+5%	+27%	+10%
Potential evaporation	+3%	+8%	+7%	+15%
Sea level absolute rise	15-25 cm	15-25 cm	20-35 cm	20-35 cm

Table 6.1 Climate scenarios for the Netherlands (KNMI 2006)

Recent scientific developments indicate a more extreme climate change than previously anticipated. These developments are: the observed rise in temperature in the Netherlands and Western Europe, the observed increased rate in the breaking up of Western Antarctic and Greenland ice caps, and new research on local and regional precipitation patterns. Although the changes remain within the scenarios, the research results do add to understanding the probability of scenarios occurring.

High-impact scenarios are useful when risks are high, for example concerning coastal defence - which is why these scenarios were used by the Delta Committee (see Box 6.1). However, these extreme scenarios have not yet been very well substantiated scientifically.

The evaluation results also indicate the direction for further research, which will provide the next generation of climate scenarios for the Netherlands in 2013, in connection with the 5th IPCC report.

Box 6.1

Background study Delta Committee advice

At the request of the Dutch Delta Committee, an international scientific assessment has been carried out by studying the upper boundary climate change scenarios in order to protect the Netherlands against flooding. This scientific approach is based on the latest insights from the upper values and long-term forecasts (sea level rise to 2200) of the climate caused sea level rise, changing storm conditions and peak discharge of the Rhine. It includes an analysis and review of recent studies, model projections and expert opinions of more than 20 leading climate scientists from different countries around the North Sea, from Australia and the USA. While this report builds on the previous IPCC AR4 (2007) and KNMI (2006) reports, it identifies the specific scenarios with low probability and high impact. It is precisely these 'high-impact' scenarios that are of great importance in balancing investments in infrastructure and land use in the Dutch delta, especially since it involves the long-term safety of the residents. According to upper-boundary estimates, the global average sea level could rise by 0.55 to 1.10 m in 2100 and 1.5 to 3.5 m in 2200, taking into account scenarios for higher temperature increases (up to 60°C in 2100) and additional ice efflux out of Antarctica. This would correspond to a local sea level rise along the coast of the Netherlands of up to 1.20 m in 2100 and 4 m in 2200. An increase in the peak discharge of the Rhine (from 3 to 19% in 2050 and from 6 to 38% in 2100) is foreseen. The storm regime along the Dutch North Sea coast and the associated maximum storm surges are unlikely to change significantly within this context of extreme climate change.

In order to develop the National Adaptation Strategy and Agenda, the core policy and research questions for ARK have been:

- What is the nature and scale of the observable and expected impacts of climate change for various themes and economic sectors?
- What spatial issues do they raise?
- How can we tackle these spatial issues?
- What dilemmas (technical, administrative, economic, social) will we face when trying to resolve these issues

Two elaborate studies commissioned by the ARK programme (Routeplanner 2006, PBL 2009) have pointed out the adaptation issues for the Netherlands. Climate change has both positive and negative consequences. Agriculture will benefit from higher levels of CO_2 concentration, higher temperatures and an extension of the growing season. These will also improve circumstances for recreation and tourism in the Netherlands. On the other hand, the sea level may rise faster, river discharges may increase and extreme weather (such as peak precipitation, heat, drought, hail storms, mist and storms) might occur more often. These will enhance the risks of flooding, as well as periods of drought, quality of nature changes, as well as the risks of diseases and plagues for humans, animals and crops. Health symptoms are expected to change as a result of milder winters and hotter summers, especially in the cities.

These effects and issues have resulted in the following main themes for Dutch research and policy: water safety, nature, agriculture and recreation, public health, housing and infrastructure, energy and transport. The following sections include an initial assessment of the consequences of climate change, based on above mentioned studies (Routeplanner 2006)

6.1.1. Impacts on water safety

The main effects of climate change on the water system are:

- a rise in sea level, thus raising the likelihood of coastal erosion and flooding (very likely);
- an increase in peak discharges from the rivers in the winter, thus raising the likelihood of flooding (very likely). This will also cause an increase in water levels in the IJsselmeer area and the main inland waterways of Zuid-Holland and Zeeland, thus raising the likelihood of flooding (very likely);

- an increase in flooding, during the winter, in rural areas (very likely);
- more frequent flooding in urban areas (likely);
- an increase in household consumption of drinking water in summer (very likely);
- greater penetration of saline water into surface water bodies (very likely);
- salination of groundwater resources (unknown);
- lowered ground water tables (unknown).

Over the past 100 years the sea level has risen by about 20 cm. This rising sea level leads to erosion of sand from the coast and reduces the safety levels of sites directly along the coast. The climate scenarios also predict higher wind speeds, although this increase is small and lies within the current variability in wind speed from year to year. The expected higher precipitation in winter will feed into higher discharges through the flood basin of the Rhine and Meuse. In the Rhine this effect will be reinforced by the rise in temperature, which will cause more rain and less snow to fall in the Alps during the winter.

As the sewage systems were designed to cope with less violent downpours, heavier summer storms also will mean more flooding in urban areas.

6.1.2. Impacts on nature

The main effects of climate change on the natural system are:
- an increase in surface water levels in winter (very likely);
- a decrease in surface water and groundwater levels in summer (very likely);
- wetter winters without frost periods(very likely);
- drier summers with higher temperatures (very likely).

Climate change will allow some plant and animal species from warmer, more southerly regions, to become established in the Netherlands. This is a natural process, but it also involves pest species or nuisance species. Examples include the oak processionary caterpillar and several lichens. Plant growing and flowering periods, as well as bird breeding times have shifted in response to climate change and food chains can be disrupted in the process. Hydrological changes in groundwater and surface water, as well as temperature changes, are putting ecosystems such as forests, grasslands, coasts and fenland under increasing pressure. Our aquatic and wet terrestrial ecosystems, such as stream and river systems, wetlands, wet heath and raised bog, are particularly sensitive to extremes in the weather. Rising sea levels affect the coastal ecosystems by eroding the coastal dunes and flooding salt meadows.

Although an improvement in water quality and a more robust National Ecological Network (EHS) are presumed, there will be changes in species composition.

6.1.3. Impacts on agriculture

The main effects of climate change on agriculture are:
- greater disruption in winter from high water levels and flooding in the rural areas of the lower-lying North and West of the Netherlands (very likely);
- extension of the growing season (very likely);
- more frequent and longer lasting soil water deficits during the summer (very likely);
- an increase in the likelihood of brackish groundwater seepage (very likely).

Changes in the climate will generally improve the average climatic conditions for farming in the Netherlands. Higher temperatures mean longer growing seasons and thus higher potential crop yields. However, Dutch agriculture can often react flexibly to changing climatic conditions; smaller yields in

dry years will often be compensated by higher prices .Extreme weather is expected to have only a limited effect on the economic success of the sector.

6.1.4. Impacts on recreation

The consequences of climate change for the recreation sector are:
- A longer tourist season due to higher temperatures in spring and summer (very likely)
- worsening of dune and beach erosion (very likely);
- restrictions on water-based recreation, such as reduced navigability and more delays at bridges and locks (likely);
- decline in bathing water quality (medium likelihood);
- increase in number of day trips (unknown);
- rise in number of foreign tourists (unknown).

Rising sea levels and more severe storms will increase erosion of beaches and dunes. Beach nourishment, or recharging with imported sand, will be needed on a large scale to maintain beach width, which will make coastal tourism dependent on successful beach recharging schemes. Many of the adverse effects might largely be prevented by government intervention. The positive effects will provide many opportunities for recreation in the Netherlands to strengthen, given an improved competitive position to Southern Europe.

Depending on the climate scenario, net spending in the recreation sector may rise by between 1 and 6%. However, no account has been taken of any changes in leisure and recreation behaviour. European studies show that in the months of June, July and August the temperature in the traditional holiday regions in the Mediterranean will be too high for many tourists. In the more temperate climates, on the other hand, conditions will become more favourable. The Netherlands will have a pronounced "Netherlands-Waterland'-character (the popularity of watersports is growing).The numbers of foreign tourists coming to the Netherlands may rise, and more people may remain in the Netherlands for their holidays.

6.1.5. Impacts on public health

The direct consequences of climate change for public health are:
- an increase in mortality during summer, due to heat stress (very likely);
- a reduction in mortality during winter (medium likelihood);
- an increase in mortality from flooding and high water levels (unlikely);
- an increase in stress caused by more frequent flooding and high water levels (very likely);
- higher mortality from storms (medium likelihood).

Indirect consequences are:
- Vector-transmitted diseases;
    - • increase in malaria (unlikely);
    - • increase in Lyme disease (medium likelihood);
- Diseases linked to air quality:
    - • increase in summer smog (ozone and particulates) (likely);
    - • reduction in winter smog (particulates) (medium likelihood);
- Allergies:
    - • increase in hay fever (likely);
    - • increase in house-mite allergy (unknown);
- Increase in water-related diseases (medium likelihood);
- Increase in food-related diseases (unlikely);
- Increased exposure to UV-related disorders (medium likelihood).

Many of the indirect effects are related to changes in behaviour: people are expected to go outside more often and for longer because (on average) it will become warmer and they will spend more time on outdoor leisure and recreation activities. Exposure to UV radiation, air pollution and pollen, water-borne diseases (cyanobacteria, amoebae) and Lyme disease will increase as a result. The ozone layer above the Netherlands will probably recover more quickly because of climate change, thus reducing exposure to UV radiation.

Although climate change has an influence on diseases, and thus on human health, other factors have a much greater impact. Examples include frequent travel abroad, which makes it much easier for diseases to spread, as well as infectious diseases, quality of the indoor environment, lifestyle and eating patterns (obesity and cardiovascular disease).

6.1.6. Impacts on housing and infrastructure

The consequences of climate change for housing and flood-protection infrastructure are:
- increase in corrosion due to higher precipitation and higher temperatures (likely);
- increase in damage to oil rigs, high-voltage transmission lines, roads, bridges and buildings from extreme storms (medium likelihood);
- greater occurrence of melting road surfaces in hot temperatures (very likely);
- fewer occasions when roads need to be gritted or salted (very likely);
- reduction in damage to rail tracks and roads by frost and salt/grit, and fewer inspections required (very likely);
- reduction in ice accretion on wind turbines (very likely);
- reduction in navigability of river tributaries during the summer (very likely);
- more frequent obstructions to shipping during high water in winter (very likely).

The Stern Review Report states that the economic costs of storms and floods could be very high. More precipitation combined with higher temperatures will accelerate corrosion of viaducts, bridges and other infrastructure, and inspections and maintenance work will be needed more often.

Heat stress will feed demand for ‘intelligent’ buildings built to stay cooler in summer. Existing buildings have a depreciation period of 40 to 50 years, and retrofitting these buildings is an expensive option. But given the rate of climate change, the changing functional demands being made on buildings (such as more comfort) are of greater influence than the demands made on the building by the changing climate.

Compared to the change in the levels of use (increased traffic, heavier vehicles), climate change contributes little to wear and tear, proceeding as it does at a slow pace compared to the frequency of regular maintenance work of dry infrastructure.

6.1.7. Impacts on energy and transport

The consequences of climate change for the energy sector are:
- a decline in natural-gas consumption in winter (very likely);
- an increase in electricity consumption in summer (very likely);
- an increase in the frequency of cooling water constraints for facilities such as power plants (very likely).

The consequences of climate change for the transport sector are:
- increasing problems of heavy rainfall (very likely);
- more corrosion of vehicles (likely);
- more damage to vehicles from extreme storms (medium likelihood);

- increased constraints on transport from air pollution (unknown);
- fewer problems due to extreme winter conditions (very likely);
- fewer accidents due to fewer days with frost (unknown);
- fewer delays to journeys because of snow (very likely);
- reduced transport capacity and loading capacity of river vessels due to periods when water levels are too high or too low (very likely);
- lower chance of constraints on water transport capacity from ice cover (likely).

The relatively short depreciation periods for investments in the road haulage sector allow it to react flexibly to climate change. However, investments in transport by rail and waterway require more time, and the replacement periods of materials are much longer, thus making them more vulnerable.
The effects of low river discharges could become an important factor in water transport.
Following these impact assessments, in table 6.2 the vulnerability and adaptation to climate change for the Netherlands are summarised for the vulnerable areas of interest to the UNFCCC. Most of these are further elaborated on in sections 6.2 and 6.3.

Following these impact assessments, in table 6.2 the vulnerability and adaptation to climate change for the Netherlands are summarised for the areas of interest to the UNFCCC. Most are elaborated upon in sections 6.2 and 6.3.

Vulnerable area	Examples/comments/adaptation measures reported
Agriculture and food security	**Vulnerability:** The agricultural sector is particularly wary of increasing risks for diseases and pests and an increase in weather extremes. In the coastal zones the sector is vulnerable to salination. The Netherlands are vulnerable to animal diseases because of high animal density, multiple transportations and many contacts abroad. **Adaptation:** Research still plays an important part in identifying opportunities and threats and in developing innovative strategies
Biodiversity and natural ecosystems	**Vulnerability:** Changes already occur in nature and some ecosystems show irreversible effects as a result of the rise in temperature. Dutch aquatic and wet terrestrial ecosystems, such as stream and river systems, wetlands, wet heath and raised bog, are particularly sensitive to extremes in the weather. **Adaptation:** The resistance of the natural environment will be increased by creating larger connected areas, corridors and a sufficient variety of favourable environmental conditions through the EHS. Increasing the adaptive capacity of nature, given current nature policy, calls for a transition from a focused conservation to a more development-oriented policy and / or more dynamic target species policy. Climate Buffers to a considerable extent will contribute to climate-proofing nature as they are able to grow with the pace of climate change.
Coastal zones	**Vulnerability:** Safety against flooding from the sea can be ensured with current, available methods, even in the worst case scenario of 1.5 meters sea level rise per century. At present about a quarter of all flood defences do not comply with the current standards, while we do not know whether a further 30%, roughly, are in compliance **Adaptation:** With “The coast is growing” the Netherlands are opting for sand replenishment as a way of enabling the coastal foundation zone to grow concurrently with the rise in sea levels. Where possible, this is to take place by distributing and transferring sand naturally along the coast.
Drought	**Vulnerability**: Agriculture and nature will suffer from more frequent and longer lasting soil water deficits during the summer. Water intake and with it the country’s fresh water supply, come under pressure. Urban areas will experience heat stress (heat islands) and are vulnerable to damage to foundations by decreases in groundwater levels during long periods of drought. **Adaptation:** Climate buffers in the sands and the hills, the upstream areas, will help to longer hold water from (extreme) precipitation, so the sandy soils especially will have less burden of dehydration during heat waves.

	Some municipalities are climate proofing the urban area by green-and-blue measures (green roofs and public spaces, water squares and the construction of new open water).
Fisheries	**Vulnerability:** The temperature of North Sea water has risen by 0.5 ° C and the Wadden Sea by a whole degree; cod and flatfish move away. Exotics in the absence of natural enemies can be invasive and thus cause ecological and economic damage. A familiar example is the Japanese Oyster, which in the Zeeland delta and in the Wadden Sea invades mussel beds. Already present exotics (in small numbers) may still become invasive as a result of climate change. Dutch coastal waters become less saline because more fresh water is blown out due to higher river discharges. Few marine organisms can withstand these sudden fluctuations in salinity. In the Wadden Sea the sea level rise causes a problem if it is not compensated by the import of sand and silt. Inter Tidal Areas will be uncovered less or no longer, significantly affecting the Wadden area. **Adaptation:** Innovation in the fisheries sector (sustainable fishing). The Water Framework Directive (WFD) also has the objective to protect the marine environment, but focuses on sources of the country.
Forests	**Vulnerability:** Climate change in the Netherlands will not only affect growth (positive) of trees but also the competitiveness in mixed forests and thereby the species composition (shifts). The direction of change will depend heavily on locality. Thus, the effects of wetter winters and drier summers are very dependent on soil type. So far no doom scenarios are foreseen. However, it does seem certain that more frequently occurring storms will be at the expense of certain species (WUR). **Adaptation:** To gain more insight into both short-term impact of climate change on forests and adaptability of trees in forest reserves in 2006 in five forest reserves a new method of prolonged monitoring of the thickness growth of trees was started. Climate buffers in the sands and the hills, the upstream areas, will help to longer hold water from (extreme) precipitation, so the sandy soils especially will have less burden of dehydration during heat waves.
Human health	**Vulnerability:** The Netherlands are vulnerable to flooding, with the probability of large numbers of casualties in a single flood episode. Due to the large population concentrations, the urban area is also vulnerable to increasing risks related to allergies, infectious diseases and heat stress in case of extremely hot summers. The magnitude of the health effects still seems to be limited, but it is uncertain how this could develop in worst case scenarios. **Adaptation:** Developing schemes voor contingency en evacuation plans. National Heat Plan. Green-and-blue measures in urban areas.
Infrastructure and economy	**Vulnerability:** The economic costs of storms and floods could be very high in the Netherlands, where as the effects of low river discharges could become an important factor in water transport and electricity production. The urban areas (flooding, heat stress) and the transport and energy networks also are vulnerable to the disruptive effects of weather extremes. **Adaptation:** Water safety policy; insurance schemes (in the Netherlands flood damage is not insurable, but is partly compensated by the Injury Allowance Act (WTS) in case of disasters and major accidents)
Water resources	**Vulnerability:** Water intake and with it the country's fresh water supply, come under pressure when the sea level rises and salt water penetrates further inland via the rivers and ground water. The adaptive capacity of the fresh water supply is limited in its current setting; further warming and an increasing precipitation deficit can cause considerable problems as early as 2050. Dry summers, like that of 2003, will occur more frequently, leading to damage to agriculture and shipping. **Adaptation:** Retention areas; blue services; adapting to salination.

Table 6.2 Summary of information on vulnerability and adaptation to climate change

6.2. (B) Vulnerability assessment

Vulnerability assessments are generally realised through European research projects and studies (see also Chapter 8). The most important and recent national efforts include the Delta Committee advice (2008) and the Netherlands Environmental Assessment Agency (PBL) advice (2009).

The Delta Committee's advice mainly concerns the principal water system, in relation to and cooperating with spatial planning throughout the entire country. The Committee has interpreted 'the coast' in very broad terms, as comprising the entire low-lying area of the Netherlands. Given the state of a number of dyked areas, the safety issue is considered as urgent right now and, with rising sea levels, greater variation in river discharge, and a further growth of interests that need protecting, it will only become more so. A disastrous breach in a dyke anywhere in the country would disrupt the entire country.

The current legal standards for dike safety date from the 1960s. At present about a quarter of all flood defences do not comply with the current standards, while we do not know whether a further 30%, roughly, are in compliance. In the Delta Committee's view we should anticipate a sea level rise of 0.65 to 1.3 metres in 2100 and from 2 to 4 metres in 2200. This includes the effects of land subsidence. These values represent possible upper boundaries; it is sensible to work with them so that the decisions made and the measures adopted will be sustainable over the long term, set against the background of what we can possibly expect.

Rising temperatures and possible changes in air circulation will lead to declining summer discharges and increasing winter discharges in the Rhine and the Meuse. There is a limited discharge capacity for the Rhine in Germany, which means that the upper Rhine discharge limit that the Netherlands can expect (around 2100) may reach 18,000 m^3/s. For the Meuse we should anticipate a design discharge of at most 4,600 m^3/s around 2100.

Water intake, and with it the country's fresh water supply, come under pressure when the sea level rises and salt water penetrates further inland via the rivers and ground water. Dry summers, like that of 2003, will occur more frequently, leading to damage to agriculture and shipping. Other economic sectors would also be harmed as a result.

In the Delta Committee's view, assessment of the safety level of various dyked areas must be based on three elements:

- the probability of fatalities due to flooding;
- the probability of large numbers of casualties in a single flood episode;
- possible damage, involving more than economic harm alone. It is the Committee's view that damage to the landscape, nature and cultural heritage assets, societal disruption and a harmed reputation must be explicitly incorporated.

In combination, these three elements result in a single, amended standard for water safety. The Committee assumes the level of flood protection must be raised by at least a factor of 10 with respect to the present level (This proposal is now being examined in the context of the Security part of the Delta Programme. where other calculations are also considered).

PBL, the national institute for strategic policy analysis in the field of environment, nature and spatial planning, was recently asked to provide inputs for climate-proofing the Netherlands, resulting in a series of coherent adaptation measures, complementary to the Delta Committee advice.

The Dutch coastal defences, for example, have a high resistance and a low resilience to climate change: they can hold back a limited rise in sea level and more powerful storms, but once breached they would take a long time to recover to their previous state. The cooling systems in power stations, on the other hand, have a low resistance and high resilience: they will consistently fail when the temperature of the river water rises, but as soon as the temperature falls they function normally again.

The analysis of the vulnerability, translated into adaptive capacity, offers a varied picture. The risk of flooding is the best studied. Safety against flooding from the sea can be ensured with current, available methods, even in the worst case scenario of 1.5 meters sea level rise per century. Possibly this scenario calls for a different type of structural measures after 2100, especially for the control of peak discharges

of the rivers. The adaptive capacity of the fresh water supply is limited in its current setting; further warming and an increasing precipitation deficit can cause considerable problems as early as 2050. More frequent heat waves will cause more frequent peaks in the demand for water. Some surface water abstractions (for example at Ridderkerk) will experience more frequent periods when the water is too saline for treatment and the intake has to be temporarily shut down. Preparing drinking water from poorer quality or even brackish water is technically possible, but very expensive. On the other hand it is expected that the fresh water bodies under the dunes and under inland hills (like the Veluwe, Utrechtse, Drentse en Overijsselse Heuvelruggen) will expand due to higher precipitation levels. These water bodies are also used for preparing drinking water.

The agricultural sector is particularly wary of increasing risks for diseases and pests and an increase in weather extremes. The urban areas (flooding, heat stress) and the transport and energy networks are also vulnerable to the disruptive effects of weather extremes. Given the population concentration in urban areas and the importance of transport and energy networks for society to function well, a detailed analysis of the vulnerability and possible action is required. The impacts of climate change on Dutch agriculture were assessed in a recent qualitative study (Alterra, 2008). 'Blue-tongue' reached the Netherlands in 2006. As a result of climate change and international transports, outbreaks of other animal diseases that have not yet occurred in the Netherlands, are more likely in the future. The West Nile Virus and Rift Valley fever, diseases that are also dangerous to humans, will advance further and further into Europe - and thus to the Netherlands. The Netherlands are vulnerable to animal diseases because of high animal density, multiple transportations and many contacts abroad. The Netherlands is the third exporter in the world, with a global export value of more than € 10 billion.

Changes are already occurring in nature and some ecosystems, such as the IJsselmeer, which shows irreversible effects as a result of the rise in temperature. Consequently the feasibility of the current goals of preservation in nature policy becomes increasingly uncertain with ongoing climate change. While knowledge about the further effects of climate change on species and ecosystems is still limited, there is knowledge about the possible measures that might be taken to strengthen the adaptive capacity of nature. These are international and national corridors between nature areas and the improvement of environmental conditions and the connection to the hydrological system. The possible increase in the risk of epidemics and diseases to humans, animals and plants is uncertain, but the adaptive capacity seems limited. Further research into the potential of control is desirable, especially given the occasional far-reaching social consequences.

The urban areas (flooding, heat stress) and the transport and energy networks also are vulnerable to the disruptive effects of weather extremes. Given the population concentration in urban areas and the importance of transport and energy networks for society to function well, a detailed analysis of the vulnerability and possible action is required.

6.3. (C) Adaptation measures

The Netherlands National Adaptation Strategy highlights an innovative and inter-sectoral approach and encourages parties to reflect, cooperate, reconsider and take action. It presents an incomplete overview of measures that will be taken in the near future. These measures are being elaborated upon and will be included in the first National Adaptation Agenda to be published soon. The agenda will among other things include 25 regional initiatives (Provincial Impuls projects) on adaptation strategies, initiated by the Association of Provincial Authorities (IPO). These initiatives cover a wide range of topics ranging from climate in the city to international natural corridors. Under the new Spatial Planning Act (Wro 2008) provinces in addition work on new regional plans in which their visions on the policy strategy for spatial planning are described. Several studies are running to embed adaptive capacity in planning instruments, such as planMER, Water Assessment and Building Act. [Fore additional information, visit the website: www.MaakRuimtevoorKlimaat.nl]

The focus of climate change adaptation is on mainstreaming and 'no regret' strategies. Actual implementation is often passed on to regional and local authorities (project implementation), though aided by agenda-setting from the ARK programme, especially where major spatial developments are concerned.
On the regional and local level the implementation of adaptation strategies demands an integrated approach (see example in box 6.2).

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, on large-scale research and (small-scale) demonstration activities. On the other hand, we do see an increase in regional and local initiatives and developments in most sectors. Important developments here are: the Climate Agreements between the National government and the Associations of Provincial Authorities (IPO) and the Netherlands Municipalities (VNG), the Hotspot projects in KvR and KvK programmes, the Provincial Impulse projects, the role of the Climate Alliance (both nationally and internationally - AMICA project Interreg), forerunners in mitigation policies and practice turn to adaptation as well, thus contributing substantially to the build up of knowledge and experience. The Ministry of the Interior and Kingdom Relations ('Binnenlandse Zaken') is responsible for coordinating response strategies in the event of a (threatening) crisis.

Insight into the costs of adaptation has been extended by the Routeplanner study and the Delta Committee advice. However, adaptation measures are not yet significantly included in the assessment of the costs of implementing climate change policy (PBL, 2009)

The following sections summarise how the most affected policy sectors deal with adaptation, in both recent national policy plans and implementation.

Box. 6.2. Hotspot Groningen

The province of Groningen (mainly agricultural) is currently working on a new provincial area plan, which integrates the policies on space and water, traffic and transport, and the environment. The economic and welfare policies are also contained in the provincial plan. The province will simultaneously face the consequences of climate change on coastal protection, water retention, a changing nature and agriculture and heat problems in the city. The spatial impact of a sustainable energy supply in the province has also been studied and mapped (Grounds for Change). Climate-proofing will be the guiding principal in implementing the plan.
The energy analysis made for the provincial area plan and the outcomes of the Grounds for Change project led to the view that a major part of the energy can be produced sustainably and locally, and that most of the CO_2 emissions can be avoided. Furthermore, an analysis of the adaptation measures brought insights about the changes and effects on different functions. The hotspot is elaborating on the impact of climate and energy, and how a provincial area plan can interpret the spatial opportunities.

6.3.1. Adaptation for water safety

Overall National Policy outline
Climate change and adaptation measures are strongly integrated into the water policy agenda. Over the last decade, the Fourth National Policy Document on Water Management (Vierde Nota Waterhuishouding), the Water Management in the 21st Century Advisory Committee (Commissie Waterbeheer 21e eeuw) and the National Administrative Agreement on Water (Nationaal Bestuursakkoord Water) represented an important impulse for water management. Nevertheless, it has

been recognised 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.

With the Outlook on Water (Watervisie) in 2007, the Dutch government set out the aim of stepping up its ambitions and pursuing sustainable and climate-resistant water management. To achieve this aim, the Cabinet established the second Delta Committee to advise on water policy for the next century and beyond. In 2008, the Delta Committee proposed increasing flood protection and securing freshwater supplies in the long term. The first policy-based detailing of this vision now forms part of the National Water Plan. To guarantee the continuity and cohesion of this approach in the long term as well, the Cabinet will be introducing a Delta Bill (Deltawet) in 2009, addressing the legal basis for a Delta programme (Delta Programma) (Ministry of Transport Public Works and Water Management 2009)

The central government's ambition is to invest in flood protection and defence to allow more space for water, in working together to implement water policy, 'go with the flow' and to enhance the role of water adaptation and spatial planning.

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.

Adaptation measures

Alongside all these plans for ensuring the future safety and liveability of the Netherlands, the implementation of measures is already in full swing. These include:

Coastal zone: with 'The coast is growing' the Netherlands is opting for sand replenishment as a way of enabling the coastal foundation zone to grow concurrently with the rise in sea levels. Where possible, this is to take place by distributing and transferring sand naturally along the coast. In addition, the Cabinet is opting for a cohesive approach to area development that allows for a balanced development of nature, economy and accessibility in the existing coastal areas.

Rivers: the Flood Protection Programme (Hoogwaterbeschermingsprogramma) and programmes for river widening, Room for the River (Ruimte voor de Rivier), and the Meuse projects (Maaswerken) are making good progress. By 2015, the Rhine will be able to handle a peak discharge level of 16,000 m^3/s and the Meuse a discharge level of 3,800 m^3/s. Where possible and cost-effective, measures can already be taken for discharging 18,000 m^3/s from the branches of the Rhine and 4,600 m^3/s from the Meuse, for example, by establishing a link between the water task and spatial developments. To anticipate the safety task after 2015, lands should be set aside and where necessary, purchased, outside (and possibly also inside) the dykes.

Several subsidy schemes have been implemented over the last four years, providing funds to make up arrears in water management (NBW, dredging programmes). Aspects of adaptation were also incorporated into some of these projects. A new programme addressing water issues is in preparation for 2010 (MIA Water).

Regional and local measures

Provinces and Water Boards are responsible for the water adaptation measures at the regional level. Most of the measures consist of creating 'space for water' during peak discharges, generally taking place in winter. Common measures are retention areas, river widening and bypasses. Preferably these measures are of an integral character, combining water issues with other space-demanding issues

(housing, leisure, biodiversity, farming etc.), in order to create more value for the area as a whole (see also Section 6.3.2).

The municipality of Tiel has a water problem in the eastern part of its territory. The old part of Tiel lies on a natural high bank of the river Linge. However, at the beginning of the 19th century this high bank was fully built over and people moved into the low-lying areas. Today, Tiel-East is sandwiched between the Waal, Amsterdam-Rhine Canal and the Linge - if the water level increases, through seepage, the groundwater level in Tiel- East rises along with it. One downpour can cause the district to flood.
In developing a vision for Tiel-East 2030, a set of measures for the long and short term has been established. In these of demolition and new construction, space is reserved for water storage, there is a drainage system for the rapid, direct drainage of rainwater and the dyke will no only be raised but also widened so that it is suitable for (high altitude) buildings

Municipalities are encouraged to develop a Water Plan. At present most of the Dutch municipalities have defined such a plan. An increasing number of municipalities also include adaptation measures in their Water Plans (see box 6.3). The aim is to increase green spaces and water in city developments, making urban areas more attractive and liveable, which can contribute towards a climate-resistant city. Measures focus on separating the run-off 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 process.

Cooperation in preparing for adaptation
In addition to the cooperative actions on national and regional levels, the Netherlands also actively cooperates with other countries in low-lying delta areas that also face challenging climate adaptation: to learn from each other, to protect them against floods, and to ensure sufficient amounts of clean water. In doing this, the Netherlands will be entering into long-term cooperation agreements. These partnerships will be based on the existing Partners for Water (Partners voor Water) programme. Box 6.4 gives an example. Chapter 7 provides more extensive information on international cooperation.

Box 6.4. Jakarta Flood Management Project (Hotspot project KvK)

Jakarta is a densely populated delta region, where several spatial developments take place and which is therefore vulnerable to climate change. By joining forces, knowledge is exchanged with international partners encountering similar problems.
Jakarta suffers from major, recurring problems in water management. Subsidence, deforestation, extensive urbanisation, insufficient capacity in the river system, poor sewage and waste management are all causes of flooding. Climate change - rising sea levels, higher rainfall - will worsen these problems over time. The Dutch government supports Indonesia in its water management efforts, for example via the Jakarta Flood Management project.
Many of the problems around the river Ciliwung are not so much the result of climate change, but of behaviour. Behavioural changes by the residents and governments in the region can help to resolve these problems. For example, farmers could easily plant fruit trees and put their crops around these. The trees provide shade and healthy food and the roots will effectively retain the soil, thus preventing it being washed away. There are more relatively minor measures that have a considerable effect. In other words, if 20 million people change something small, this creates a large-scale transition. Mobilising social participation is therefore crucial. This requires a different governance structure, which is the aim of this hotspot project.

6.3.2. Adaptation for nature and agriculture

Overall National Policy outline
Within the context of the UNFCCC and ARK programmes, the Ministry of LNV is preparing to respond to climate impacts on agriculture, forestry, nature and fisheries. Climate change is likely to exert considerable effects on current biodiversity conservation goals. This requires reassessment of aspects, such as the effectiveness of the Dutch National Ecological Network (EHS) under climate change, and of the resilience and adaptation options of agriculture, both at home and abroad. Solutions will often have strong spatial impacts in the already intensively used Dutch landscape. Bottlenecks in land-use planning relating to agriculture, nature and water management need to be identified, and possible solutions explored. This generally requires regional approaches.

Research still plays an important part in identifying opportunities and threats and in developing innovative strategies in the relevant domains for LNV. So far three promising areas have been identified:
1. Innovation on the level of whole areas (vital countryside) by capitalising on the large, coupled transitions in energy, water and land use (which also means innovation at the crossroads of change in the EU Common Agricultural Policy and the EU Energy Policy);
2. Renewal of agriculture and horticulture, in view of globally increasing salinity of delta areas and innovations on the production level;
3. Renewal of nature management, responding to climate change.

The resistance of the natural environment can be expected to increase by creating larger connected areas, corridors and a sufficient variety of favourable environmental conditions (High-Low-Netherlands, wet-dry and fresh-salt gradients etc.). Increasing the adaptive capacity of nature, given current nature policy, calls for a transition from a focused conservation (biodiversity, target species) to a more development-oriented policy (the functioning of ecosystems, the creation of conditions) and/or more dynamic target species policy (updating the species every few years). Topics will mainly be peat and swamp nature, the sensitive nature types on the higher sandy soils, surface freshwater (which are sensitive to temperature rise and eutrophication), the South Western Delta and the Wadden Sea.

Adaptation Measures
The ‘Nederland later’ study (PBL, 2007) showed that for the Low-lying Netherlands there are important synergies between climate adaptation and nature in developing river nature landscapes, adjusting the water management in the reclaimed land (polders) and peatlands, and in developing peat nature. In the High-lying Netherlands, there are opportunities for synergy in the development and restoration of brook valley systems and seepage zones (see Box 6.6).

Climate Buffers will, to a considerable extent, contribute to climate-proofing the Netherlands as they are able to grow with the pace of climate change. This means that all damage and threats (ecological, economic, hydrological) due to climate change can be reduced or offset through specific planning, and constructing buffer zones on critical sites. Climate Buffers serve to reduce the risk of flooding (and other water problems), while simultaneously reducing the effects of prolonged drought (both agriculture and nature). Climate Buffers can also be arranged so that they create secondary positive effects for living, landscape, cultural-history and recreation. In the Netherlands, five nature conservation organisations (Natuurmonumenten, Bird Protection, State Forest Foundation, The ARK Foundation and the Wadden Association) are committed to the development of natural Climate Buffers. They are already working on Climate Buffers at 35 sites, with interesting combinations of wet and robust nature, more security and different functions (walking, living, water storage, etc.) per landscape type:

- For the river landscape, natural erosion and sedimentation are to restore a meandering pattern that, within the bed and the floodplains, creates 'room for the river'. Deepening of the floodplains, for example with side channels, reduce the impoundment of high water. This decreases the risk of

flooding and dyke breaches. The sands and the hills, the upstream areas, will have to hold water from (extreme) precipitation for a longer period, so discharge (in lower areas) is more gradual. Among other things this can be achieved by restoring the, often channelled, streams to their natural meandering pattern. An additional advantage is that the sandy soils, in particular, will have less burden of dehydration during heat-waves.

- The dunes must provide more natural local spray, from the sea surface also, so some (narrow) dunes can increase and broaden. This way, the dune area will become resilient and ultimately more defensible. In addition, high-quality ecological sea inlets can form.
- In the tidal landscape of the Wadden Sea and Zeeland, measures must be taken to restore (and further promote) the natural sedimentation, so the growth of flats, meadows, silts and salt marshes can keep pace with sea level rise (and subsidence).
- In the fenlands, the continued subsidence needs to be stopped completely. Raising groundwater levels will slow down the process. Some parts (Climate Buffers) may have to be given another destination, so even peat growth (ground rise) is possible. These areas may also be used for storing excess water and developing high-quality nature.

Agricultural green and blue services
The National Policy Plan for Spatial Development indicates that in the western peat areas subsidence should be limited. To make this work, the principle 'function follows mark' has arisen. In several experiments the effects of this principle on agricultural yield losses have been researched. Approximately 675,000 hectares of the net- Ecological Network could be wetter, including 52.900 ha of farmland. In an experiment groundwater level was increased in some agricultural fields from 110 (normal level) to 75 cm-mv (high level), without affecting yields and product quality.
The 'Farming with water' programme aims to have farmers, in addition to the primary agricultural function, actively create opportunities to incorporate water in their businesses. The aim is to help achieve water quantity and quality objectives such as (peak) water storage, water conservation and improved ground and surface water quality. Farmers are granted fees for delivering these 'blue services'.

6.3.3. Adaptation for public health, urban areas and infrastructure

The vulnerability of urban areas to climate change (with regard to water) relates to flooding after peak precipitation and damage to foundations by decreases in groundwater levels during long periods of drought. Due to the large population concentrations, the urban area is also vulnerable to increasing risks relating to allergies, infectious diseases and heat stress during extremely hot summers. The magnitude of these health effects still seems to be limited, but it is uncertain how this could develop in worst-case scenarios.

In 2007, a National Heat Plan was prepared in a cooperative project between the Ministry of Health, RIVM, the Dutch Red Cross, ActiZ and the National Health Authority (GGD). It offers a range of specific measures that can be taken locally by institutions and care providers, to ensure they are ready and act appropriately in periods of sustained heat. The exact extent of the negative climate impacts on mortality and morbidity cannot be assessed correctly, as yet, due to lack of data. For this reason the project 'Heat in the city' (KvR) looks at what climate change means in terms of temperatures in the urban environment, and subsequently to heat stress and thermal comfort. The international workshop 'Hot Places, Cool Spaces' (November 2007), provided good insight into the current state of research, knowledge and knowledge gaps, and has produced agreements for international cooperation.

Adaptation Measures
Climate-proofing of the urban area can be increased by spatial and non-spatial measures. Thus heat stress can be controlled with proper and timely information and extra care to vulnerable groups (some Area Health Authorities are developing schemes for this). In combating allergies, a combination of spatial (nature, non-allergenic plants) and non-spatial measures (monitoring, education) is possible.

The climate-proofing of the urban area against flooding can be increased by non-spatial measures (drainage, green roofs, water squares) or by spatial measures such as the construction of new open water (ditches, canals, ponds). The national Information and Technology Platform for Transport, Infrastructure and Public Space (CROW), is preparing a guidebook on ‘Adaptation of public space to climate change’, which offers municipalities information and project examples in this area.

7 FINANCIAL RESOURCES AND TRANSFER OF TECHNOLOGY

7.1. (A) Provision of new and additional financial resources

Global political, economic, social and environmental changes pose difficult choices for development policy. The Dutch government has worked to achieve the Millennium Development Goals (MDGs) ever since they were first agreed, as evidenced once more by its Agenda 2015 (Parliamentary Papers, 2007) and the Explanatory Memorandum to the 2008 Budget. Globalisation necessitates a repositioning and rethinking of development cooperation. This was presented in the policy letter '*Our Common Concern: investing in development in a changing world'* (Ministry of Foreign Affairs, 2007) by the Minister for Development Cooperation. A stronger policy focus on four areas was presented:

- security and development;
- growth and equity;
- more rights and opportunities for women and girls;
- sustainability, *climate* and energy.

The Netherlands emphasises international cooperation by increasing policy coherence between aid, trade, the environment and human security. In 2009, the Netherlands ranks high among the industrialized countries of the world in terms of support for policies that benefit poor countries (Center for Global Development, 2009)

Access to modern, reliable and affordable energy is an important condition for economic development and poverty reduction (MDGs) and climate change is a major concern. Therefore, the Netherlands will intensify its support of 'climate and energy'. In order to accelerate the achievement of MDG7, the Netherlands focuses on several key issues, including:

- greater coherence between international agreements on trade, the environment, climate and poverty reduction;
- an environmentally friendly, modern energy supply by 2015 for 10 million people who are currently dependent on traditional fuels;
- an additional investment in sustainable energy of € 500 million during the government's present term in order to increase access to energy by the poor.

At the Conference of Parties in July 2001 in Bonn, the EU+5[17] reaffirmed their political commitment to increase their annual funding for climate change activities in developing countries during 2005-2008. For the Netherlands it implies that expenditure on climate change activities in developing countries during 2005-2008 should exceed the 2001 expenditures (€81 million) by €17 million annually. The *ODA-related* expenditures on climate increased to €100.362 million in 2008 (see table 7.6). Compared to the 2001 level of funding **new and additional** funding under the Bonn declaration totalled €19 million in 2008.

It should be noted that The Netherlands meets its ODA commitment of 0,7% of GDP. Climate change policy, together with other ODA for support to environmental activities in developing countries is funded on top of this commitment raising the Dutch ODA level to 0,8% of GDP. For the period 2008-2012 another € 375 million will be added on top of the 0,8% GDP in support of renewable energy in developing countries.

In 2004, the Netherlands defined a target to provide energy services to 10 million people in 2015. In support of this target the Netherlands has allocated € 500 million to invest in renewable energy in developing countries for the period 2008-2011 of which €375 million will be new and additional to the existing 0.8% ODA (official development assistance) efforts. The overall aim of this *Promoting Renewable Energy Programme* (PREP) is to enable developing countries to develop and implement

[17] The European Union member states plus Canada, Iceland, New Zealand, Norway and Switzerland.

policies supporting renewable energy with a focus on poverty reduction. The focus is on countries in Africa and Indonesia. The following lines of action are taken in order to achieve this objective:

- direct investments in renewable energy installations;
- ensuring the sustainability of biomass production for energy purposes;
- influencing policy of important actors in the field of energy;
- capacity development in the field of renewable energy.

The Global Environment Facility (GEF) received, on average, € 30.5 million per year, part of which (40%) is dedicated to climate change.

	Expenditures			
	2005	**2006**	**2007**	**2008**
Global Environment Facility				
GEF-ODA/Montreal Fund (ODA)	24,448	40,019	33,415	24,080
GEF non-ODA	5,500	10,823	9,403	0,816
New funds related to UNFCCC				
LDCF	0	5,060	3,400	3,400
SCCF	2,400	0	0	0
Adaptation Fund	0	0,200	0,335	0,590
REDD (Readiness Fund)	-	-	-	3,000

Table 7.1: Financial contributions to the Global Environment Facility (€ x 1000)[18]. Source: HGIS 2006-2010

7.2. (B) Assistance to developing country parties that are particularly vulnerable to climate change

The Netherlands actively contributes to the Nairobi Work Programme (NWP) under the UNFCCC to support countries, particularly developing countries, in adapting to climate change and mitigating negative effects. The Netherlands provides regular updates on ongoing research and policy development and lessons learned in the Netherlands, in support of knowledge sharing, awareness raising and extending the adaptation network.

Over the period 2005-2008, € 11,86 million was provided to the GEF's Least Developed Countries (LDC) Fund.

Besides multilateral assistance, the Netherlands also provides (bilateral) support to developing countries, as they suffer disproportionately from the effects of climate change. Many have large semi-arid regions that are becoming even larger and drier, while others will suffer recurrent flooding. Although the problems they face differ, they all suffer from a lack of money, technology and infrastructure to cope with climate change. If no additional effort is made, climate change threatens not only MDG7 (more people living in a sustainable environment by 2015) but the other MDGs as well, since an inadequate energy supply leads to water and food shortages, health problems, migration and resource-based conflicts.

In its new policy letter *'Our Common Concern: investing in development in a changing world'* (Ministry of Foreign Affairs 2007), Dutch development cooperation was renewed and partner countries were organised into three profiles:

- accelerated achievement of the Millennium Development Goals (MDGs);
- security and development; and
- broad-based partnership.

[18] For 2001-2004 see National Communication 4 table 7.1 p. 94 (http://unfccc.int/resource/docs/natc/netnc4.pdf)

Development cooperation will focus on 36 partner countries, plus support to four fragile states. Within the context of development cooperation, the Netherlands adheres to the Paris Agenda on Aid Effectiveness. In all 36 partner countries, a limited number of sectors have been chosen by the partner government.

Accelerated achievement of MDGs	**Security and development**	**Broad-based relationship**
Main criteria: • Low-income country • Fragility not dominant problem • Government structures offer enough potential to work with them	**Main criterion:** • Fragility or major inequality blocking poverty reduction	**Main criteria:** • (Prospective) middle-income country • Fragility not dominant problem
Bangladesh* Benin Bolivia* Burkina Faso Ethiopia* Ghana Kenya Mali Mongolia Mozambique Nicaragua Rwanda* Senegal Tanzania Uganda* Yemen* Zambia	Afghanistan Burundi Colombia Congo, Democratic Rep. Guatemala Kosovo SC Res.1244 Pakistan Palestinian Territories Sudan	Egypt* Georgia* Indonesia Moldova Vietnam South Africa Suriname**
Development cooperation to be phased out over next four years:		
Bosnia-Herzegovina Eritrea Sri Lanka***	Albania Armenia Cape Verde Macedonia, FYR	
Comments: * = countries that also have an actual or potential security problem ** = agreement reached on phasing out of framework treaty resources *** = only humanitarian relief in response to current security situation		

Table 7.2: Classification of partner countries in profiles. Source: Ministry of Foreign Affairs, 2007

During 2005-2008, a total of 118 projects were supported, some of which were regional and world-wide projects (38). Direct bilateral support on climate change was provided to 24 countries, nine of which were non-partner countries. This is presented in the pie charts below. Support to 'worldwide' projects also entails support through non-governmental organisations, public-private partnerships and programmes with research institutes and multilateral organisations. For example it includes a large partnership programme on renewable energy with GTZ (Gezellschaft fur Technische Zusammenarbeit). The focus of these programmes is often Sub-Saharan Africa.

Deforestation is also an important source of greenhouse gas emissions. Besides support to developing countries on mitigation and adaptation, an additional effort is also made to avoid deforestation. In support of the REDD initiative (Reducing Emissions from Deforestation and Forest Degradation), the Netherlands contributes € 15 million, for the period 2008-2012, to the World Bank's Readiness Fund of the Forest Carbon Partnership Facility (FCPF).

		Expenditures				
		2005	2006	2007	2008	Total
Worldwide						
	Adaptation	6 018	4 449	5 382	6 082	21 932
	Mitigation	20 547	23 309	20 438	38 557	102 852
Africa						
	Adaptation	2 636	1 935	722	4 022	9 315
	Mitigation	1 680	2 651	2 250	5 458	12 039
Asia						
	Adaptation	2 987	8 718	5 576	4 517	21 797
	Mitigation	12 572	4 303	12 198	7 009	36 081
South America and the Caribbean						
	Adaptation	1 824	632	494	268	3 217
	Mitigation	1 580	805	676	238	3 299
Total		***50 064***	***47 987***	***48 141***	***64 575***	***210 766***

Table 7.3: Bilateral and worldwide financial contributions on adaptation and mitigation within ODA (€ 1000)

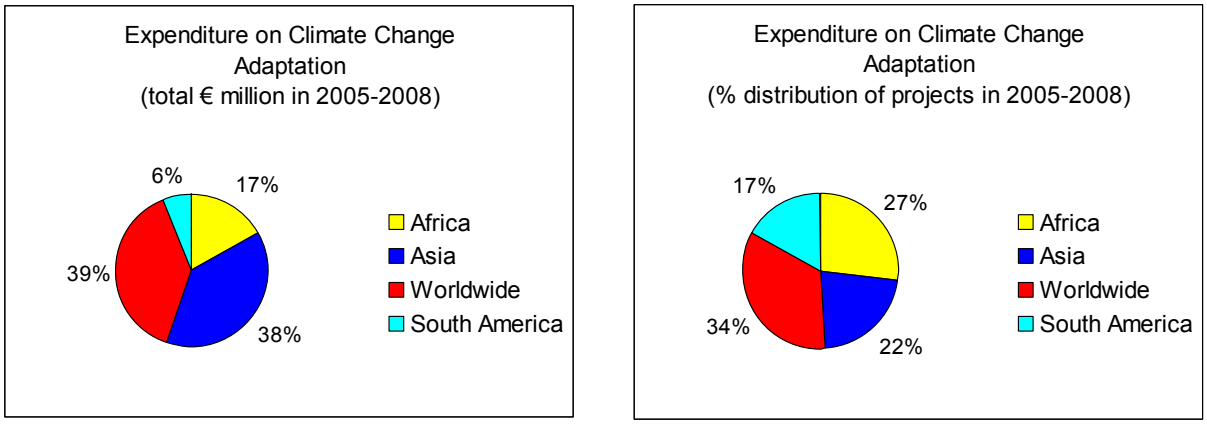


Figure 7.1: Support to climate change mitigation provided worldwide and per continent

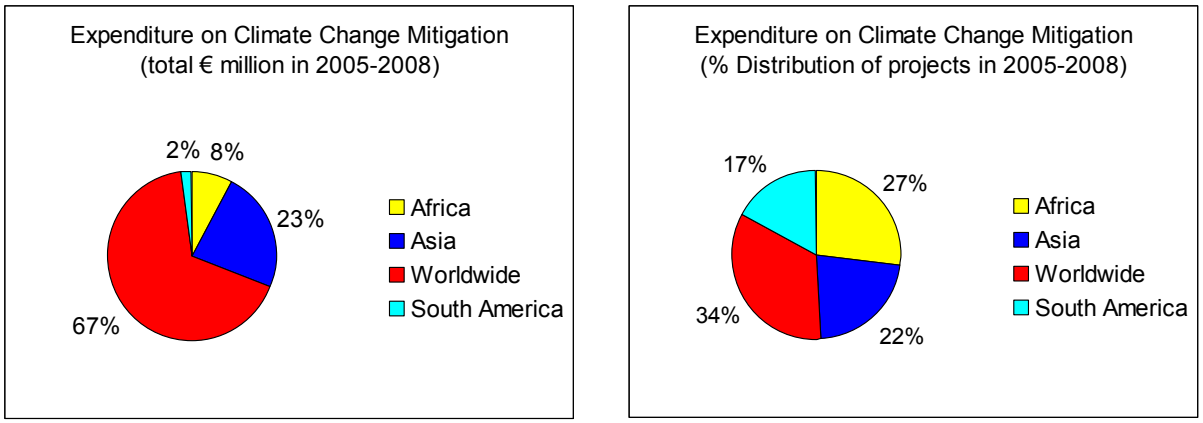


Figure 7.2. Support provided to climate change adaptation, worldwide and per continent

	Mitigation							Adaptation				Both
Recipient Region	Energy	Transport	Forestry / Environment	Rural Development / Agriculture	Management	Industry / Economic Development	Capacity Building (environment)	Forestry	Water / Coastal Zone Management	Rural Development	Other	
2005												
Africa	1 665	0	0	0	0	15	0	0	2 636	0	0	0
Asia	12 518	0	54	0	0	0	107	0	2 296	584	0	0
Latin America	262	0	1 317	0	0	0	1 399	0	426	0	0	142
World-wide	13 459	0	7 088	0	0	0	6 018	0	0	0	0	78
2006												
Africa	2 636	0	0	0	0	15	0	144	1 791	0	0	0
Asia	3 071	0	118	1 114	0	0	0	0	8 077	641	0	0
Latin America	421	0	383	0	0	0	210	0	422	0	0	415
World-wide	18 691	0	4 618	0	0	0	4 449	0	0	0	0	771
2007												
Africa	2 231	0	0	0	0	19	243	0	479	0	0	0
Asia	9 692	0	0	2 506	0	0	0	0	4 644	932	0	0
Latin America	533	0	144	0	0	0	227	0	266	0	0	405
World-wide	16 694	0	3 744	0	0	0	5 182	0	200	0	0	0
2008												
Africa	5 438	0	0	0	0	20	0	0	2 022	0	0	0
Asia	5 192	0	0	1 817	0	0	0	0	3 592	925	0	0
Latin America	68	0	170	0	0	0	268	0	0	0	0	0
World-wide	31 631	0	5 726	0	0	1 200	6 082	0	0	0	0	423
Total	**124 201**		**23 364**	**5 438**		**1 269**	**24 185**	**144**	**26 850**	**3 083**		**2 233**

Table 7.4: Bilateral and worldwide financial contributions within ODA, relating to the implementation of the Convention in 2005-2008 (€ 1000)[19]

7.2.1. Mitigation

The budget for development cooperation provided support to 81 projects concerning climate change mitigation, and four projects in support of both mitigation and adaptation. Capacity building and transfer of technology is often an integral part of support programmes. Specific examples are mentioned in the next paragraph.

Projects relating to developing countries, including capacity building
The Netherlands uses various programmes to support access to renewable energy in developing countries (covers biogas, biomass, wind and solar energy). Some examples are presented below.

[19] Sector support environment not included. For the period 2001-2004 see National Communication 4, Table 7.7 p. 100 (http://unfccc.int/resource/docs/natc/netnc4.pdf)

Dutch development cooperation supports various programmes and has established several funds relating to renewable energy. The *Access to Energy Fund* has been established for the period 2006-2014, with a total budget of € 70 million. This fund provides loans for projects and aims to provide access to energy for 2.1 million people. Around 50% is related to renewable energy projects. Approximately € 21 million is currently committed.

In 2008 the Netherlands set up the Daey Owens Fund, with a budget of € 20 million. The Daey Ouwens Fund aims to provide more people in Least Developed Countries with access to energy by promoting small-scale renewable energy projects and job-creating forms of energy supply. The most important target group within the fund is the LDCs in Sub-Saharan Africa. Projects that are directed towards these countries therefore take precedence over projects in other LDCs. So far, 25 projects have been accepted and the fund aims to provide access to energy for 800,000 people.

In 2008 the Global Sustainable Biomass Fund (GSBF)[20] was prepared. This fund started early 2009 with a project budget of € 12.5 million. The GSBF helps developing countries to make their biomass production for energy uses more sustainable. In relation to the other side of the biomass production chain, the Dutch Ministry of Economic Affairs has also established a fund for Sustainable Biomass Import (budget € 7.5 million).

Since 2008, the Netherlands has also supported the governments of Indonesia and Mozambique to build their capacity in the development of sustainable biomass programmes and smallholder participation in the production chain.

The Netherlands also supports biogas programmes. With support from the Netherlands, the organisation SNV began working on biogas activities in Nepal back in 1989, and in Vietnam in 2003. Since 2006, domestic biogas programmes have also been established in Bangladesh and Cambodia, while a pilot programme in Lao PDR took off in 2007. Pakistan and Indonesia launched biogas programmes in 2009. The Asia Biogas Programme has a budget of € 12.9 million (2005-2012) and expenditures of € 5.2 million. By the end of 2008, more than 250,000 households (1.6 million people) have been equipped with biogas plants. Because of these achievements SNV has been invited by the Asian Development Bank to lead a working group on domestic biogas within the framework of the 'Energy for All Partnership'. Through this initiative, an additional one million biogas plants are planned across the Asian region by 2015.

In cooperation with Hivos, SNV's biogas activities have been expanded to include Africa. Rwanda is the first country of engagement, with another six countries (Senegal, Burkina Faso, Ethiopia, Tanzania, Uganda and Kenya) targeted under the framework of the 'Africa Biogas Partnership Programme'. This programme took off at the end of 2008 and aims to reach 70,000 households by 2013. The total budget is € 29.9 million for the period 2008-2013. Expenditures (to the end of 2008) were € 1.1 million.

The Netherlands has supported the Capacity Development for the Clean Development Mechanism (CD4CDM)[21] since 2002. The contribution between 2005-2008 amounted to € 3.3 million. The programme is implemented by the UNEP Risø Centre (URC). CD4CDM helps to establish GHG emission-reduction projects that are consistent with national sustainable development goals, particularly projects in the energy sector. It develops national capabilities so the country is capable of analysing the technical and financial merits of projects and negotiating possible finance agreements with Annex 1 countries or investors. The project aims to:

- generate (in participating developing countries) a broad understanding of the opportunities offered by the Clean Development Mechanism; and
- develop the necessary institutional and human capabilities that allow them to formulate and implement projects under the CDM.

[20] http://www.senternovem.nl/globalsustainablebiomass/index.asp
[21] http://www.cd4cdm.org/

During Phase I of the CD4CDM project, capacity and project development activities were completed in Bolivia, Cambodia, Cote d'Ivoire, Ecuador, Egypt, Ghana, Guatemala Philippines, Morocco, Mozambique, Uganda and Vietnam. Phase II of the CD4CDM project (2006-2009) will implement project activities in Algeria, Bangladesh, Peru, Mauritius, Nicaragua, Surinam and Tanzania.

Over the years, support has been given to the Global Village Energy Partnership, first through the World Bank Partnership and now directly (€ 4.5 million). The GVEP 2006-2010 programme aims to establish, for example, 300 successful small and medium-sized enterprises in East Africa, and 250 SMEs in Latin America and the Caribbean (LAC). The Netherlands' target is 900,000 people in East Africa and 250,000 people in LAC by 2010.

The Netherlands also works closely with Germany on providing access to renewable energy. Between 2005 and2008 the organisation GTZ (Gesellschaft fur Technische Zusammenarbeit) received € 46.87 million for renewable energy projects in developing countries.

As previously mentioned, the Netherlands has defined a target to provide an environmentally friendly, modern energy supply by 2015 for 10 million people who are currently dependent on traditional fuels. The aforementioned investments resulted in the use of renewable energy services by 6.3 million people by the end of 2008 (starting in 2004) Ministry of Foreign Affairs 2009).

Together with UNDP, the World Bank and the US Department of Energy, the Netherlands has supported the greening of the energy sector portfolio of multilateral development banks. This resulted in a programme to develop green energy for small-scale urban and rural users in Asia and Africa (called FINESSE: Financing Energy Services for Small-scale End-users). A result of this programme was the establishment of the Asia Alternative Energy Programme (ASTAE), which was supported by the Netherlands. In a multilateral context, support was also provided to the Energy Fund for Africa (World Bank, IFC and African Development Bank and the ESMAP programme (Energy Sector Management Assistance Programme). The results of these programme are an enhanced understanding of the application of renewable energy, strengthening of national organisations and access to energy services by the poor (examples are hydropower in Zambia, solar power in Mongolia, and credit for renewable energy projects in Southeast Asia).

Projects related to Central and Eastern Europe
Projects related to Central and Eastern Europe are described in other sections, especially in section 7.5.

7.2.2. Adaptation

Projects relating to developing countries, including capacity building
The development cooperation budget included 33 projects relating to adaptation to climate change, plus four projects in support of both adaptation and mitigation. Capacity building and knowledge sharing is considered one of the important elements of support to climate change adaptation, and includes vulnerability assessments (but these are not reported separately). An example is mentioned in the next paragraph.

In preparation of the climate change negotiations 2009, the Netherlands – together with other donors – supports, for example, the development of the World Bank study 'Economics of Adaptation'. The results are expected at the end of 2009. A noteworthy supported project is the establishment of the Red Cross/Red Crescent Climate Centre[22]. The centre's main approach is to raise awareness; stimulate climate adaptation and disaster risk reduction (both inside and outside the Red Cross and Red Crescent); analyse relevant forecast information on all time-scales, and integrate knowledge of climate risks into Red Cross Red Crescent strategies, plans and activities. The '*Preparedness for Climate Change'* programme (PfCC, budget € 1.26 million) helps national unions in 37 developing countries to

[22] http://www.climatecentre.org/

analyse the risks and implications of climate change, and to develop enhanced disaster management plans. From 2005-2008 expenditures totalled € 1.08 million. Climate change is now integrated into the strategies and plans of the International Federation (including regional offices) and in 40 national unions in developing countries. This has already resulted in fewer victims in Vietnam and Nicaragua (thanks to proper early-warning systems and community preparedness) and a better response to disasters in Mozambique and West Africa (rainy season 2008).

In relation to strengthening national institutions, the Netherlands provides some specific support as shown by the NCAP and CD4CDM (see next paragraph below).

Projects related to Central and Eastern Europe
Projects related to Central and Eastern Europe are described in other sections, especially in section 7.5.

7.3. (C) Provision of financial resources, including financial resources under Article 11 of the Kyoto Protocol

Provision of financial resources
The Dutch government maintains its ODA at 0.8% of its Gross National Income (GNI). Since 1997, 0.1% of the aforementioned 0.8% has been earmarked for assistance to the environment. Because of the increase in GNI, the overall ODA budget also increased. However, as a result of the economic downturn the ODA budget is expected to decrease over the coming years and to increase when the economy picks up again. The adjusted total environment budget for 2009 is estimated at € 635,195 million, of which € 273,263 million are expenditures directly dedicated to the environment (Parliamentary Papers 2009a), including expenditures relating to climate change mitigation and adaptation (see Table 7.4).

	Expenditures			
	2005	**2006**	**2007**	**2008**
GNI	502 590	538 640	562 745	602 466
ODA percentage of GNI	0.83	0.82	0.81	0.8
Total environment (see Table 7.6)	501.482	537.811	615.358	635 195
ODA Environment % of GNI	0,100	0.100	0.109	0.105

Table 7.5: Official Development Assistance expenditures and environment (€ million)
Source: HGIS (Homogeneous Budget for International Cooperation), 2006 -2009

The Netherlands contributes to a variety of multilateral and intergovernmental institutions – including the Global Environment Facility – that assist developing countries (see Table below). Within the total contributions to these organisations part of this money is used to support environment-related activities or mainstream environment development activities. The extent to which expenditures, through multilateral channels, contribute to the goals of the Rio Conventions (including UNFCCC) varies considerably.

A contribution is made to UNFCCC through the contribution made to the GEF (already mentioned). Support to scientific, technological and training programmes can also be an integral part of contributions through multilateral, bilateral and civil society channels. The heading ‘Civil Society Support” for example also includes support to scientific institutions and their programmes. Some examples are mentioned below (see also paragraph 2 and 4).

	Expenditures			
	2005	2006	2007	2008
ODA nature and environment				
Country-specific sectoral cooperation	138 713	156 319	172 633	187 378
Thematic cooperation countries/regions	69 402	70 318	73 457	85 885
Subtotal	*208 115*	*226 993*	*246 090*	*273 263*
Attribution Macro-support	3 897	14 054	15 532	13 210
Multilateral institutions				
GEF-ODA/Montreal Fund	24 448	40 019	33 415	24 080
UNEP	8 373	4 132	6 832	9 383
Desertification Treaty	109	234	0	131
UNDP	9 647	9 217	9 953	9 401
IFAD (10%)	3 367	3 217	8 017	8 516
FAO Partnership programme	3 750	3 000	3 842	4 409
UN Habitat	7 480	7 789	8 280	1 656
IDA and regional development banks (5%)	31 554	4 489	13 576	11 363
World Bank Partnership Fund (30%)	25 862	13 868	12 879	12 897
European Development Fund (EDF, 5%)	6 890	6 969	7 479	8 340
Attribution Budget European Union	10 489	10 328	13 295	13 505
Subtotal	*131 969*	*103 172*	*117 568*	*103 682*
Civil society support				
Special activities	20 450	36 526	24 174	30 764
TMF and MFS[2]	32 188	42 473	37 749	87 673
ORET, Miliev and ORIO	24 936	25 989	54 713	97 518
MFP	41 715	45 170	0	0
SALIN	0	0	77 830	3 163
SNV and PSO (7.5%)	13 748	16 843	15 868	14 407
MATRA	0	0	0	1 350
Subtotal	*133 037*	*167 001*	*210 334*	*215 955*
Other				
Operational expenditures	15 441	15 833	15 032	17 207
Nature and environment education	908	908	908	1 000
International Education Institutes	8 116	9 850	9 894	10 878
Subtotal	*24 465*	*26 591*	*25 834*	*29 085*
Total ODA Nature and Environment	**501 482**	**537 811**	**615 358**	**635 195**
GNI (x million)	**502 590**	**538 640**	**562 745**	**602 466**
ODA Environment % of GNI	**0,100**	**0.100**	**0.109**	**0.105**

[1] The percentage in brackets indicates the estimated proportion of environment-related expenditures within the total contribution.
[2] These are specific support programmes for civil society organisations. TMF = Thematic Co-Financing, MFS = Co-financing System.

Table 7.6: Environment-related financial contributions within ODA (€ x 1000)[23] Source: HGIS, 2006-2010

Since 2002, The Netherlands supports the **Capacity Development for the Clean Development Mechanism (CD4CDM)**[24]. The contribution between 2005-2008 was €3.3 million. The programme,

[23] For the period 2001-2004 see National Communication 4 table 7.2 p. 95 (http://unfccc.int/resource/docs/natc/netnc4.pdf)
[24] http://www.cd4cdm.org/

implemented by UNEP Risø Centre (URC) helps to establish GHG emission reduction projects that are consistent with national sustainable development goals, particularly projects in the energy sector. It will develop national capabilities so the country is capable of analysing the technical and financial merits of projects and negotiating possible finance agreements with Annex 1 countries or investors. The project aims at 1) generating in participating developing countries a broad understanding of the opportunities offered by the Clean Development Mechanism, and 2) developing the necessary institutional and human capabilities that allows them to formulate and implement projects under the CDM. During Phase I of the CD4CDM project, capacity and project development activities were completed in Bolivia, Cambodia, Cote d'Ivoire, Ecuador, Egypt, Ghana, Guatemala Philippines, Morocco, Mozambique, Uganda and Vietnam. Phase II of the CD4CDM project (2006 to 2009) will implement project activities in Algeria, Bangladesh, Peru, Mauritius, Nicaragua, Surinam and Tanzania.

In relation to strengthening national institutions on climate change adaptation the Netherlands provides some specific support through the ***Netherlands Climate Assistance Programme (NCAP)***. The Netherlands Climate Change Studies Assistance Programme (NCCSAP) was initiated in 1996, inline with commitments made in 1994 under the UNFCC to support developing countries to develop a climate policy. The *Netherlands Climate Assistance Programme* (NCAP), which is the successor of NCCSAP with similar aims, is implemented between 2003-2009 (budget €6.6 million). The stated aim of NCAP was to support a number of developing countries to prepare, formulate, implement and evaluate their policy in relation to climate change, with a view to these countries becoming self-supporting in formulating climate policy. More specifically, NCAP aimed to support developing countries by: (i) implementing studies to support the general aim; (ii) meeting commitments under the UNFCCC (in particular the national conventions); (iii) paying attention to impact and adaptation assessments (in particular for livelihood systems of poor communities); and (iv) raising awareness among policy makers, scientists and relevant NGOs. After an extensive reconnaissance and selection procedure in the first 18 months of NCAP, the following 14 countries were selected: Bangladesh, Bhutan, Bolivia, Colombia, Ghana, Guatemala, Mali, Mongolia, Mozambique, Senegal, Suriname, Tanzania, Vietnam, and Yemen. Between 2005-2008 expenditures were €3.9 million.

7.3.1. Breakdown of climate-change-related expenditures

Together with the OECD, the Netherlands developed a set of 'Rio markers' that allows it to distinguish between climate-related funding and other funding. Within these categories a distinction is made between activities marked 'principal' or 'significant'[25]. Additional markers are used to distinguish support for adaptation and mitigation. By applying the guidelines of the OECD-DAC, a distinction can be made between budget allocations for adaptation and mitigation, as presented in the tables below. The Netherlands also provides sectoral support on the environment to several partner countries. Part of this budget is also related to climate adaptation and/or mitigation. The extent of this cannot be calculated yet, and a first conservative attribution estimate has been used. Over the coming years this estimate will be assessed more carefully. The Table below shows a breakdown of climate change expenditures between 2005 and 2008. The Netherlands has also contributed to the Least Developing Countries Fund (LDCF) and the Special Climate Change Fund (SCCF).

[25] The environmental sustainability marker – 'principal' or 'significant' objective - identifies activities that would not have been undertaken without this objective or activities which includes such objectives but are not one of the principal reasons for undertaking the activity.

	Attribution	Expenditures			
		2005	2006	2007	2008
Bilateral programme and civil society support					
Mitigation		36 379	31 068	35 563	51 263
Adaptation		13 465	15 734	12 173	13 889
Mitigation and Adaptation		220	1 186	405	423
Sector Support Environment	10%	848	1 088	1 319	2 426
		50 912	*49 075*	*49 460*	*67 001*
Multilateral institutions					
GEF-ODA plus Montreal	40%	9 779	16 008	13 366	9 632
UNEP	20%	1 674	826	1 366	1 828
Desertification Treaty	20%	22	49	0	26
UNDP	20%	1 929	1 843	1 991	2 077
IFAD	10%	337	322	802	852
FAO Partnership	10%	375	300	384	373
UN-Habitat	10%	748	779	828	828
WFP	10%	2 723	2 723	3 574	3 574
IDA and regional banks	10%	3 155	449	1 358	710
World Bank Partnership Fund	20%	5 172	2 774	2 576	2 576
European Development Fund	10%	689	697	745	835
Budget European Union	10%	1 048	1 033	1 329	1 350
New Funds					
LDCF		0	5 060	3 400	3 400
SCCF		2 400	0	0	0
Adaptation Fund		0	0,200	0,335	0,590
REDD (Readiness Fund)		-	-	-	3 000
Total		79288	82,139	81,514	98,652
Total					

Table 7.7: Climate-change-related financial contributions to bilateral and multilateral institutions and programmes within ODA (€ x 1000)

In addition, the Netherlands also provided € 67,422 million in ***non-ODA*** funds to support climate change mitigation and adaptation (see Table below). Besides assistance to developing country parties that are particularly vulnerable to climate change, the Netherlands also provides support to countries in Central and Eastern Europe, especially in relation to mitigation.

	Expenditures			
	2005	2006	2007	2008
Non-ODA expenditures				
Clean Development Mechanism	16 513	22 529	21 150	40 124
Joint Implementation	9 698	6 455	11 130	9 176
GEF non-ODA	5 500	10 823	9 403	816
International Cooperation Environment	4 392	4 643	3 802	4 481
Water Management (Partners for Water)	9 891	7 460	6 832	12 825
Total	**45 994**	**51 910**	**52 317**	**67 422**

Table 7.8: Climate-change-related financial contributions non-ODA (€ x 1000). Source: HGIS, 2006 -2010

In 2008 the Netherlands supported the establishment of the Climate Adaptation Fund with a contribution of € 100,000 (in addition to the fund itself). In relation to food security, the Dutch Ministry of Agriculture, Nature and food Quality supported regional organisations in East Africa to integrate climate change adaptation into rural development programmes (€ 300,000). The Dutch Partners for Water programme combines the expertise on water and climate from various parties: the government, NGOs, companies and research institutes. In 2009 the programme will receive € 14.7 million from the Dutch Ministry of Transport, Public Works and Water Management.

Specific support programmes and related financial resources are mentioned in paragraph 7.2.

7.3.2. Breakdown of bilateral support on climate change

Between 2005 and 2008, bilateral expenditures directly related to climate change increased. During the period 2005-2008, the Netherlands supported 118 projects with an amount of € 210,766 million (excluding sector support on the environment). Most projects and expenditures were related to mitigation (see also pie charts). A total of 81 projects were related to mitigation, while 33 related to adaptation, and four projects were directly related to both mitigation and adaptation.

		Expenditures				
		2005	**2006**	**2007**	**2008**	**Total**
Mitigation						
	Principal	22 712	18 338	20 206	39 496	100 751
	Significant	13 667	12 730	15 357	11 767	53 520
	Total	*36 379*	*31 068*	*35 563*	*51 263*	*154 272*
Adaptation						
	Principal	7 898	3 890	4 928	7 053	23 769
	Significant	5 567	11 843	7 245	5 836	30 492
	Total	*13 465*	*15 734*	*12 173*	*12 899*	*54 262*
Mitigation and Adaptation	projects	220	1 186	405	423	2 233
	Sector Env. 10%	848	1 088	1 319	2 426	5 681
Total		**50 912**	**49 075**	**49 460**	**67 001**	**216 448**

Table 7.9: Climate change financial contributions on mitigation and adaptation within ODA (€ 1000)

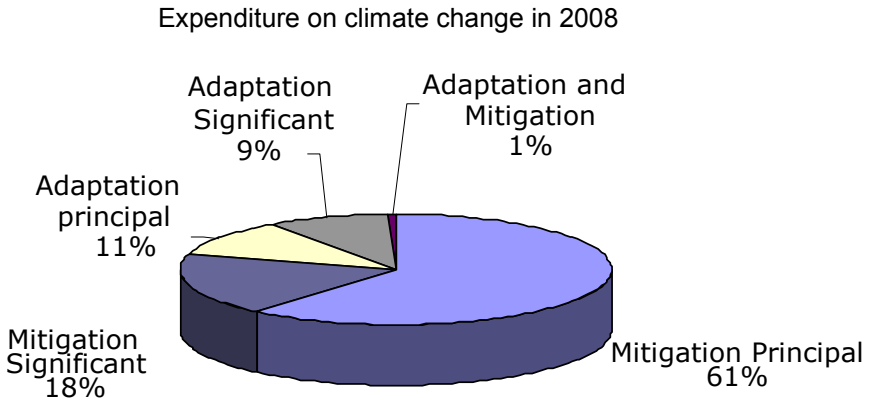


Figure 7.3a: Bilateral financial contributions 2008 on climate change within ODA

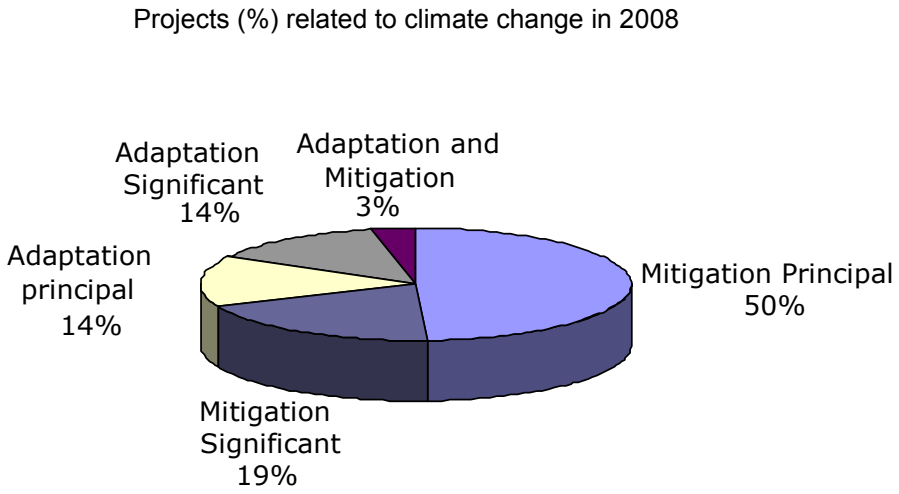


Figure 7.3b: Bilateral financial contributions 2008 on climate change within ODA

7.3.3. Financial resources, including under Article 11 of the Kyoto Protocol

Under the Treaty, developed countries must meet their targets through national measures, but the Kyoto Protocol offers the option to use additional market-based mechanisms to meet these targets. These are mainly the Clean Development Mechanism and Joint Implementation projects.

To buy carbon credits under the Clean Development Mechanism the Dutch Ministry of Housing, Spatial Planning and the Environment (VROM) has a budget of € 405 million for the period 2001-2013 (Parliamentary Papers 2009b). Between 2005 and 2008 the Netherlands spent € 150,983 million under the CDM (see Table 7.3). For 2009, expenditures are estimated at € 50 million. In total the Netherlands will buy 45 million tonnes of carbon credits in order to realise its obligations under the Kyoto Protocol, 0,9 million tonnes of which are related to the Climate Adaptation Fund.

In relation to Joint Implementation, the Netherlands spent € 53,373 million between 2005 and 2008 (see Table 7.3).

New and additional resources are mentioned in paragraph 1.

7.4. (D) Activities relating to technology transfer

The Netherlands promotes the transfer of technology through various channels, e.g. through:
- EU programmes and mechanisms;
- participation in IEA programmes;
- bilateral or multilateral programmes and schemes.

These include regional cooperation, cooperation with developing countries and promotion of private sector involvement. Examples (non-exhaustive) are given below.

Actions to support institutions and frameworks for the development and transfer of technologies

- The EU's Environmental Technologies Action Plan (ETAP),[26] helps to improve the development and wider use of eco-technologies, including climate-friendly technologies.
- The EU's emissions trading scheme (EU ETS),[27] launched in 2005, helps to improve development, deployment and diffusion of a broad range of mitigation technologies. It is linked with CDM and JI markets, which are important mechanisms for technology transfer to developing countries and economies in transition.
- The Netherlands participates, for example, under the framework of official development assistance (ODA), in activities relating to human and institutional capacity building in a wide range of developing countries (see previous sections).

Actions to encourage effective participation by the private sector

- The EU ETS, linked to the CDM and JI markets, is designed specifically to provoke private sector actors to take action, including through the development and transfer of climate technologies.
- The Global Energy Efficiency and Renewable Energy Fund (GEEREF)[28] focus on energy efficiency and renewable energy projects in developing countries and economies in transition.
- The Innovation Relay Centre (IRC)[29] network. This enables cooperation with organisations in third countries that, for example, result in technology transfer agreements with developing countries on energy and environment.
- The Netherlands provides *export subsidies* to the private sector to encourage aspects such as technology transfer. For example, the Orio programme[30] is a programme for non-commercial environmental and sustainable investments in developing countries. ORIO contributes to the development, implementation (construction and/or expansion), operation and maintenance of public infrastructure in developing countries. Governments may submit a grant application to ORIO. This can be done on the initiative of a private party. Applications which meet the criteria are evaluated in competition. The winning applications will be eligible for a grant. The remaining part must be financed by the local government in some other way; for example, from its own resources, a commercial loan, or funds provided by development banks. Expenditures during the period 2002-2008 amounted to approximately € 104 million annually. Examples of successful technology transfer via ORET/MILIEV include 150 public city buses in the capital of Ethiopia, and recovery of the mangrove forests in Vietnam.

Actions to promote collaborative R&D and deployment of technologies for mitigation and adaptation

- Participation in the multi-annual EU Framework Programme for R&D.
- The European Energy Technology Platforms (ETPs)[31], set up to define common strategic research agendas at European level, which should mobilise a critical mass of national and European public and private resources. Examples of ETPs include solar PV, Biofuels, Zero-emission fossil fuel plants, Solar Thermal and Wind.
- Participation in international collaborative R&D partnerships on new energy technologies, operated as so-called Implementing Agreements under the International Energy Agency (IEA). The Netherlands is involved in many of these agreements, e.g. on hybrid and electric vehicles, energy conservation in buildings, renewable energies, advanced fuel cells, bioenergy, clean coal sciences, demand-side management, district heating and cooling, hydrogen technologies, solar PV systems, solar heating and wind energy.
- Bilateral or multilateral projects with developing countries. Examples include bilateral MOUs for cooperation in the field of environment and sustainable construction with China, various R&D

[26] More information about ETAP is available at: http://ec.europa.eu/environment/etap/index_en.html
[27] More information about EU ETS is available at: http://ec.europa.eu/environment/climat/emission/index_en.htm
[28] More information about GEEREF is available at: http://ec.europa.eu/environment/jrec/energy_fund_en.htm
[29] More information about the IRC Network is available at: http://www.innovationrelay.net/
[30] Until January 2009 this programme was calles ORET/MILIEV
[31] More information about the technology platforms is available at: http://cordis.europa.eu/technology-platforms/home_en.html

cooperation projects between Dutch universities, knowledge institutions and partnerships, on a broad range of environmental issues (water, renewable energy, agriculture, etc.). Table 7.10 below provides further examples:

TECHNOLOGY COOPERATION	Nature of Agreement	Nature of cooperation	Financing & available budgets	Country involvement
Access to modern energy services Rwanda (German/Dutch)	Bilateral	Rural electrification through grid extension and densification	2.70 MEUR	Rwanda
Sustainable utilisation of natural resources for improved food security in Ethiopia (German/Dutch)	Bilateral	Dissemination of improved biomass stoves	12.04 MEUR	Ethiopia
Conservation and management of natural resources in Benin (German/Dutch)	Bilateral	Dissemination of improved biomass stoves	12.65 MEUR	Benin
Rural Trade and Industry Promotion Project (RUTIPP) in Ghana (German/Dutch)	Bilateral	Electrification for productive use through grid extension	4.50 MEUR	Ghana
Energy Advisory Project in Uganda (EAP) (German/Dutch)	Bilateral	Energy advisory services, dissemination of improved biomass stoves, rural electrification through solar home systems and other technologies	5.45 MEUR	Uganda
Program for Biomass Energy Conservation in Southern Africa (ProBEC) (German/Dutch)	Bilateral	Dissemination of improved biomass stoves, productive use	6.19 MEUR	Southern Africa
Promotion of Private Sector Development in Agriculture in Kenya (German/Dutch)	Bilateral	Dissemination of improved biomass stoves	6.90 MEUR	Kenya
Promotion of Rural Electrification and Sustainable Supply of Biomass Energy in Senegal (PERACOD) (German/Dutch)	Bilateral	Dissemination of improved biomass stoves, afforestation, rural electrification (isolated grids, solar home systems), productive use	7.88 MEUR	Senegal
Program for decentralisation and communal development in Benin (German/Dutch)	Bilateral	Rural electrification through grid extension and densification	8.95 MEUR	Benin
The Dutch Program on Climate and Sustainable Energy	Multiple	E.g. Development of sustainability criteria for large scale biomass production; Sustainable energy supply in the African Great Lakes Region; general access to clean energy in Sub-Sahara Africa and Southeast Asia through (CEIF).	€ 500 million (2008-2011)	Netherlands
Clean Technology Fund (CTF), as part of Climate Investment Funds (CIF)	Multilateral	Demonstration, deployment and transfer of low carbon technologies	*Pledged amount ((2008-2012):* Netherlands: US$50 million	Country access will be based on: ODA-eligibility and an active MDB country programme

Table 7.10 Bilateral and multilateral projects with developing countries

Technology transfer may encompass both hardware (equipment) and software (know-how) environmentally sound technologies. The Dutch support in relation to the transfer of technology is mostly in the form of support programmes relating to the private sector (encompassing hard and soft technologies). Until 2008, the support programme was called PSOM (Programme for Cooperation with Emerging Markets). Expenditures are presented in Table 7.2. The current Dutch Minister for Development Cooperation attached a great deal of importance to private-sector development in fragile states. In order to more vigorously support cross-border investments in these countries, he requested the EVD (Economic Information Service) to design a more flexible PSOM format for a number of fragile states. This programme has been named PSOM Plus, and was opened on June 25, 2008. PSOM Plus is similar to the regular PSOM, but has some extra features in order to further facilitate investments in the private sector of these countries:

- PSOM Plus is open for private companies and corporate foundations from the Netherlands and (other) DAC Countries;
- PSOM Plus imposes fewer requirements on the local partner;
- PSOM Plus may reimburse 60% of security costs and 100% of MIGA insurance on your investment;
- PSOM Plus issues four tenders a year with compulsory intake.

The total project budget for all countries was € 825,000, of which 60% was contributed by PSOM Plus. PSOM Plus was open to the following countries: Afghanistan, Burundi, Palestinian Authorities, Sierra Leone, and Southern Sudan.

As of 2009, the programme is called PSI (Private Sector Investment Programme) and is administered by EVD. PSI is a Dutch government programme that supports innovative investment projects in emerging markets in Africa, Asia, Central and Eastern Europe and Latin America. A PSI project is an investment project, implemented by a Dutch (or foreign) company together with a local company, in one of the eligible developing countries. If this investment meets the criteria, it can be eligible for a PSI grant, which consists of a financial contribution to the costs of the investment. PSI consists of two components: PSI Regular applies to 45 countries in Africa, Asia, Central and Eastern Europe and Latin America. The contribution for a project in one of these countries is 50% of the project budget, to a maximum contribution of € 750,000. PSI Plus is similar to the previous PSOM Plus. The contribution under PSI Plus amounts to 60% of the project budget, to a maximum contribution of € 900,000. For both components, the maximum project budget is €1.5 million.

An example of a typical PSOM project is the Madagascan renewable energy project. Madagascar became an eligible country in 2007 and the first project was to establish the first national independent power provider 'Wind Factory Madagascar' (TWFM), owned by the Dutch Wind Factory and Malagasy BushProof. TWFM aims to bring a unique hybrid renewable energy system to Madagascar, which is a combination of a wind turbine and a generator. This hybrid system will supply energy to the national electricity network of the public energy and water company JIRAMA. Besides the generation of energy, TWFM will sell tailor-made hybrid (wind) systems to clients such as private sector companies, governmental agencies and NGOs. This will encourage the electrification of rural areas. The systems will be supplied along with service and maintenance contracts. The energy market perspectives in Madagascar are favourable due to the low electrification levels. The government wants to increase national coverage rate for electrification, from 15% in urban areas and less than 5% in rural areas, to 74% and 10% respectively by 2011, allowing independent power producers to access the energy market. Market prices for electricity are currently very high. Increases in supply will lower the price for the people, while volume of scale still makes the venture interesting for the investors. Wind energy can deliver power on a large scale, and, compared to thermal systems, wind systems can be installed rapidly. Moreover, Madagascar takes 5th place on the list of African countries with the highest potential for wind energy.

The tables below present selected projects or programmes that promoted practicable steps to facilitate and/or finance the transfer of, or access to, environmentally sound technologies.

Project / Programme title:			
Promoting Renewable Energy Programme (PREP)			
Purpose:			
To enable developing countries to develop and implement policies supporting renewable energy with a focus on poverty reduction.			
Recipient country:	**Sector:**	**Total funding:**	**Years in operation**
African countries Indonesia	Energy	€500 million	2008-2011
Description:			
The following lines of action are taken in order to achieve the objective: 1. Direct investments in renewable energy installations; 2. Ensuring the sustainability of biomass production for energy purposes; 3. Influencing policy of important actors in the field of energy; 4. Capacity development in the field of renewable energy.			
Indicate factor which led to project's success:			
So far political commitment by the Dutch government has been the main driver for the start-up of this programme. Implementation has just started.			
Technology transferred:			
Renewable energy technology.			
Impact on greenhouse gas emissions:			
Positive.			

Table 7.11 PRE Programme

Project / Programme title:			
Access to Energy Fund (AEF), FMO (Finance for Development)			
Purpose:			
Promoting renewable energy.			
Recipient country:	**Sector:**	**Total funding:**	**Years in operation**
FMO is targeting at least 75% of the total AEF capital for Sub-Saharan Africa and/or Least Developed Countries and a maximum of 25% in other emerging markets.	Energy	€70 million	2006-2015
Description:			
The AEF is a vehicle initiated by the Dutch government and FMO to make it possible to fund private sector projects that create sustainable access to energy services.			
Indicate factor which led to project's success:			
Providing financial leverage for renewable energy projects. The AEF can provide equity financing up to an amount that is the lesser of €10 million or 75% of a total transaction amount. Subordinated debt/senior loans can be made in the amounts of the lesser of €20 million or 75% of total transaction. The fund can offer longer grace periods and longer tenors often necessary to get such projects off the ground. The AEF can also play a role in the development of new projects by providing grants.			
Technology transferred:			
By providing financing for projects involved in the generation, transmission or distribution of energy, the Fund hopes to ultimately connect 2.1 million people in developing countries by 2015.			
Impact on greenhouse gas emissions:			
Positive.			

Table 7.12 AEF/FMO

Project / Programme title: Asia Biogas Programme			
Purpose: Introduction of renewable energy and alleviating poverty			
Recipient country:	**Sector:**	**Total funding:**	**Years in operation**
Nepal, Vietnam, Bangladesh, Cambodia, Lao PDR	Energy	€12.9	2005-2012
Description: Introduction of biogas technology for cooking and heating at household level.			
Indicate factor which led to project's success: Strong integral approach of technology transfer, capacity building and awareness and institutional support.			
Technology transferred: By the end of 2008, more than 250,000 households (1.6 million people) have been equipped with biogas plants. Because of these achievements SNV is now, at the invitation of the Asian Development Bank leading a working group on domestic biogas in the framework of the 'Energy for All Partnership'. Through this initiative, an additional one million biogas plants are planned across the Asian region by 2015.			
Impact on greenhouse gas emissions: Positive.			

Table 7.13 Asia Biogas Programme

Project / Programme title: Africa Biogas Partnership Programme			
Purpose: Introduction of renewable energy and alleviating poverty			
Recipient country:	**Sector:**	**Total funding:**	**Years in operation**
Senegal, Burkina Faso, Ethiopia, Tanzania, Uganda and Kenya	Energy	is €29.9 million	2008-2013
Description: Introduction of biogas technology for cooking and heating at household level.			
Indicate factor which led to project's success: Strong integral approach of technology transfer, capacity building and awareness and institutional support.			
Technology transferred: In cooperation with Hivos, SNV's biogas activities have been expanded to include Africa. Rwanda is the first country of engagement, with another six countries targeted. This Programme took off at the end of 2008 and aims to reach 70,000 households by 2013.			
Impact on greenhouse gas emissions: Positive.			

Table 7.14 Africa Biogas Partnership Programme

Project / Programme title:			
Preparedness for Climate Change programme of Red Cross/Red Crescent Climate Centre			
Purpose:			
Adapt to climate changes and reduce disaster risks.			
Recipient country:	**Sector:**	**Total funding:**	**Years in operation**
37 countries	General Environmental Protection	€1.26 million	2005-2009
Description:			
The Centre's main approach is to raise awareness; advocate for climate adaptation and disaster risk reduction (within and outside the Red Cross and Red Crescent); analyse relevant forecast information on all timescales and integrate knowledge of climate risks into Red Cross Red Crescent strategies, plans and activities.			
Indicate factor which led to project's success:			
Strong and capable network.			
Technology transferred:			
The PFCs helps national unions in 37 developing countries to analyse risks and implications of climate change and to develop enhanced disaster management plans. Change is now integrated in the strategy and plans of the International Federation (including regional offices) and in 40 national unions in developing countries.			
Impact on greenhouse gas emissions:			
None.			

Table 7.15 Preparedness for Climate Change programme

Technology transfer and international cooperation through flexible mechanisms

During the period 1992-1997 the Netherlands participated in the Activities Implemented Jointly (AIJ) pilot phase, where a variety of project types were implemented covering different mitigation technologies. These projects were hosted by Annex-I, as well as by non-Annex-I countries, and have contributed to both the development of CDM and JI programmes and technology transfer. Since the introduction of AIJ in 1995 the Netherlands has funded 25 AIJ projects in 14 countries. All projects involved transfer of environmentally friendly technology and know-how.

The Netherlands then became involved in technology transfer via Joint Implementation and CDM. Bilateral MOUs for long-term cooperation are implemented in the field of CDM with Argentina, Bolivia, Brazil, Colombia, Costa Rica, Ecuador, Guatemala, Honduras, Indonesia, Mexico, Nicaragua, Panama, El Salvador and Uruguay. Contracts have also been signed with the Rabobank, the World Bank, the International Finance Corporation (IFC), the International Bank for Reconstruction and Development (IBRD) and the regional development bank for the Andes (CAF). Projects stimulate transfer and deployment of technologies in these CDM projects, for example on high-efficiency power plants, cogeneration, renewable energy, harnessing of landfill waste gases, etc. More information on CDM is given in Section 4.3.

In addition to the mechanisms, the Netherlands also started exploring the potential of International Emissions Trading, in particular via Green Investment Schemes (GIS). This implies that the profits from the AAUs are used to finance environmental and sustainable activities in the seller country, which contribute to a lower GHG economy in the long term. Examples include an International Emissions Trading (GIS) agreement with Latvia and a € 15 million investment in avoided deforestation facility by the World Bank FCPF.

Technology transfer for adaptation

For the Netherlands, some essential lessons learned in relation to technologies for adaptation include the need to build a solid knowledge base and the need for a more cross-sectoral and more integrated approach. Some of the barriers consist of the lack of supportive policies, cost/benefit analyses, and the

non-availability of local/regional climate data. Furthermore, from the outcomes of activities completed under the Nairobi Work Programme, a number of gaps in present knowledge and evidence for best practise have been identified. Technologies for adaptation include 'hard' technologies, such as drought-resistant crop varieties, seawalls and irrigation technologies, or 'soft' technologies, such as crop rotation patterns. Many technologies have both hard and soft characteristics, and successful adaptation action would typically combine the two. There is also a continuing need to build better human capacity/skills for implementing and developing technologies in relation to understanding climate information and predictions (spatial analysis skills, satellite imagery etc.). Some examples of climate adaptation/technologies-related foreign support are:

- *Catalysing Acceleration of Agricultural Intensification for Stability and Sustainability.* In Rwanda, the Netherlands is providing assistance through the Strategic Alliance for Agricultural Development in Africa (SAADA). As part of the CATALIST project, the University of Wageningen is implementing a research project on the vulnerability to climate change of the Nile delta, and assessing the options for economic sectors and water management strategies and relevant technologies.
- *Consultative Group International Agricultural Research (CGIAR).* The priorities of CGIAR research are reducing hunger and malnutrition by producing more and better food through genetic improvement, sustaining agriculture biodiversity, both *in situ* and *ex situ*, promoting opportunities for economic development and through agricultural diversification and high-value commodities and products, ensuring sustainable management and conservation of water, land and forests and improving policies and facilitating institutional innovation.
- *Climate Monitoring for Africa.* This yields data that are essential for the description of the climate, detection of climate change, improvements of climate models and development of climate scenarios, both on global and regional scales, and for adaptation measures. The ongoing work will be capacity building for the climate monitoring in Africa.

Development and enhancement of endogenous capacities by developing countries
As described in the programmes throughout this Chapter, capacity building and institutional strengthening is an important element of Dutch programmes. Further examples are given in Chapter 6 (e.g. on cooperation and capacity building with developing countries on water management) and Chapter 8 (cooperation in research and development). Not only in developing countries but also with economies in transition, capacity-building actions are implemented, for example, through so-called G2G[32] projects with Croatia (on ETS), Romania (on inventories and projections), Turkey (on Long-Term Agreements with industry etc.

7.5. (E) Information under Article 10 of the Kyoto Protocol

The information on activities, actions and programmes undertaken to meet commitments under Article 10 have already been described in various parts of this National Communication, see also the summary table in Annex II. A brief summary:

Cost-effective programmes to improve quality of inventories/national systems (a)
This is described in Chapter 3.C (3.3.). Besides national programmes, the Netherlands also participates in the EU Monitoring Mechanism working groups, workshops and studies on the exchange of experiences and further improvement of inventory aspects, and in G2G projects, for example with Romania, where further exchange of experiences is implemented.

Domestic and regional programmes (b)
These are described in Chapter 4 (e.g. 4.3) and Chapter 6 (on adaptation)

Transfer of technology (c)

[32] Government to Government (G2G), see for selected projects http://www.senternovem.nl/KEI/31_projecten/index.asp (in Dutch only)

This is described in the previous section.

Research and systematic observation (d)
This is described extensively in Chapter 8 and the annexes 8.1 and 8.2.

Education and training and public awareness (e)
Chapter 9 describes the actions in the Netherlands.

8 RESEARCH AND SYSTEMATIC OBSERVATION

8.1 (A) General policy on research and systematic observation

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

- intensive participation in international and European programmes; the Netherlands Organisation for Scientific Research (NWO) and the Royal Netherlands Academy of Arts and Sciences (KNAW) coordinate Dutch contributions to the international research arena;
- clustering into a few larger national research programmes (e.g. under the framework funding regimes such as BSIK/ FES or as cluster programmes, such as 'Climate Changes Spatial Planning' or 'Energy Innovation Agenda').

The Ministry of Housing, Spatial Planning and the Environment (VROM) is the leading department on adaptation to climate change and supports research on climate-proofing the Netherlands. The Ministry of Transport, Public Works and Water Management (V&W) supports research on water and infrastructure; the Ministry of Agriculture, Nature and Food Quality (LNV) focuses on nature, agriculture and fisheries, and the Ministry of Economic Affairs (EZ) specialises in innovation.

With regard to systematic observation, the Netherlands actively participates in the various fields of climate-related monitoring, both nationally and within European and global programmes. An integrated national programme for the implementation of the Netherlands contribution to GCOS has not yet been established. However, steps are being taken to develop and implement such a strategy. More information is provided in Section 8.3 and Annex 8.1.

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

Cooperation in scientific and technical research/exchange of data
Cooperation is assured not only through clustering nationally and internationally, but also the national research programmes actively seek private-sector participation and facilitate the dialogue between stakeholders from scientific, policy and private sectors. To overcome barriers to exchanging data and information, the national research programmes closely coordinate their communication and research activities.

Monitoring activities on systematic observation and GCOS in the Netherlands are firmly embedded in international programmes such as the Framework programmes, on a European level, and GEOSS, on a global level. We also see international cooperation at individual project level, e.g. Earth and NASA missions, and data-retrieval methods. Data are exchanged internationally, and submitted to numerous databases around the world. More detailed information on the Netherlands systematic observation activities is described in Annex 8.1.

Within GCOS, the Netherlands also cooperates specifically with developing countries through the programme *Climate Monitoring for Africa.* This yields data that are essential for the description of the climate, detection of climate change, improvements of climate models and development of climate scenarios, both on global and regional scales, and for adaptation measures. The Implementation Plan for the Global Observing System for Climate in support of the UNFCCC focuses on an extensive list of all parameters that should be monitored globally, and the scientific arguments and specific actions that can be used and carried out. Recently hydrogen generators at the radiosonde stations of Abidjan and Niamey were installed to help in reviving the African Radiosonde network. The ongoing work will be capacity building for the climate monitoring in Africa.

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 often be obtained free of charge or at low cost.

For research on adverse effects see section 4.5

8.2 (B) Research

8.2.1. Cooperation in international research

The Netherlands' research on climate change is well embedded in, acknowledged by and co-steered within 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). The Royal Netherlands Meteorological Institute (KNMI) participates in IGBP and (through its WMO membership) in WCRP. The department of Environmental Policy Analysis of IVM chairs the IHDP Scientific Committee and hosts the 9th event (2-4 December 2009) in the series of annual European Conferences on the Human Dimensions of Global Environmental Change.

Extensive support is also given to the work of the Intergovernmental Panel on Climate Change (IPCC). KNMI coordinates the Netherlands' contributions to the IPCC. Research for Working Groups II and III is mainly carried out by Wageningen University and the Netherlands Environmental Assessment Agency (PBL). Ten Dutch scientists contributed as (lead) authors to the 4th IPCC assessment report, while various Dutch experts also contributed to the development of the IPCC Guidelines for National Greenhouse Gas Inventories. The Netherlands also hosts a number of international programmes that specifically aim at technology transfer and international cooperation (se chapter 7).

8.2.2. Cooperation in European research

Many of the leading Dutch institutions have research projects under the EU's 6th and 7th Framework Programmes (FP). 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 6th and 7th Framework Programmes and other programmes are listed in Annex 8.2.

8.2.3. National research programmes

General
National research programmes add to, and support, international research programmes. The national research activities in the Netherlands include:

- national research programmes under the Earth and Life Sciences (ALW) theme of NWO and the Global Change theme (KNAW);
- national research programme on climate issues, such as 'Knowledge for Climate' (KvK) and its predecessor 'Climate Changes Spatial Planning' (KvR);
- the energy innovation agenda, an interdepartmental programme (also referred to as the energy transition approach);
- more specific R&D programmes under the various government ministries, in areas closely related to climate change and variability (e.g. water), or mitigation (also on non-CO_2 greenhouse gases).

Increased attention is given to research on mitigation and adaptation and 'climate-proofing' in general. 'Climate-proofing the Netherlands' is a complex research subject, involving many research organisations. Many knowledge institutes and social actors are already partners in other research programmes such as 'Climate Changes Spatial Planning', 'Living with Water' and 'Habiforum'.

National research programmes through NWO*:*
Climate Variability (start 2005[33]) is an NWO programme aimed at fundamental research in the field of climate problems. It also aims to support and promote multidisciplinary research at the interface of mathematics and/or informatics and climate science. Within the international programmes (WCRP and IGBP) this programme contributes to CLIVAR and the Global.

The research councils of the UK, Norway and NWO (ALW) have established a joint initiative for funding research related to the thermohaline circulation and rapid climate change in the North Atlantic region, which is linked to the UK programme entitled RAPID. The joint RAPID Climate Change Programme is part of the Climate Variability research theme under NWO.

International Polar Year (IPY) (2007[34]) : the Netherlands' participation in IPY was arranged according to four main IPY-NL research themes (Changes in the cryosphere due to climate change, Changes in the Southern and Arctic ocean, Polar terrestrial and coastal ecosystems and global change, Influence of human activities on polar regions, and Influence of climate change on humans).

The National programme on Sea and Coastal Research (ZKO) [35] aims to facilitate collaboration between various research institutes in this field. Research focuses on strengthening understanding and knowledge of coastal development, the role of biogeochemical cycles and particle flows in relation to water quality, the capacity for a sustainable yield of the ecosystem, changes in biodiversity, the influence of seas and oceans on climate change and the effects of climate change on the marine system. This understanding can provide a basis for possible predictions. The ZKO programme is divided into three sub programmes, chosen by geographical location (Coastal zone and Wadden Sea, North Sea, Oceans). The research projects will be carried out during 2008-2013 (budget € 20 million).

Feedbacks in the Climate System (2009)[36]: this programme aims to generate knowledge that focuses on quantifying uncertainties in the climate system, and particularly on the development of this system in the longer term until the year 2200.

National research programmes on climate change issues

Knowledge for Climate (FES-KvK) is aimed at the short and medium term (up to 2050) with a focus on developing adaptation strategies for hotspots in the Netherlands (e.g. Schiphol Airport, Rotterdam harbour, low-land rivers) and international hotspots (e.g. New Orleans, California, two deltas in South East Asia, projects in Sub-Saharan Africa). A central role in the programme is for the Climate Knowledge Facility, which consists of a model platform and a research platform. In the model platform support will be given for the development and use of the new global climate model EC-Earth, for a regional climate model for the surroundings of the Netherlands and for a range of impact models. The results of these models provide the quantitative information required for effective adaptation. Within the model platform, problems will be handled which are relevant for all hotspots in the programme. This may include local-level issues, methodological issues, and also the weak links in climate and impact models. A total of € 50 million has been made available for the programme out of the Dutch government's Economic Enhancement Fund (FES). Through shared projects, for example, cooperation with other research is organised to avoid overlap and gain mutual benefits. Annex 8.2 and the website[37] provide more information and examples of projects.

[33] http://ict.nwo.nl/subsidiewijzer.nsf/pages/NWOA_4YSE56_Eng
[34] http://www.nwo.nl/nwohome.nsf/pages/NWOP_68SJ7F_Eng
[35] http://www.nwo.nl/nwohome.nsf/pages/NWOA_795JFX
[36] http://www.nwo.nl/nwohome.nsf/pages/NWOA_7LBEKW_Eng
[37] http://www.klimaatonderzoeknederland.nl/templates/dispatcher.asp?page_id=25223002

Knowledge for Climate subsidises research in three phases, the first focusing on the most urgent needs for knowledge. The main components of the second phase are long-term studies that generate more in-depth knowledge in where the link between generic and area-specific questions plays a central role. In order to promote cohesion of the programme, a total of eight themes were selected, which will determine the adaptation agenda.
• Water safety at national and regional level
• Freshwater supply at national and regional level
• Climate-proofing rural areas
• Climate-proofing urban areas
• Infrastructure and networks
• Improving climate projections and the set of instruments used for modelling
• Governance of adaptation

During the third phase the hotspots will need to combine the results from the various research lines in order to develop adaptation strategies.

Climate Changes Spatial Planning (KvR) tries 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 multisectoral 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 until December 2009. In order to ensure, embed and further enhance the status of the knowledge, the programme supports a 'Network on climate and spatial planning' operated by stakeholders from government, private enterprises and scientific institutes. Partners in this 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.

Examples of addressed scientific objectives include:
- increased insight into cloud and aerosol interactions;
- high-quality climate scenarios, suitable for use in various impact assessment applications;
- new multi-gas approaches to assess GHG emissions at ecosystem level;
- a prototype of a multi-platform monitoring system for land-use related GHG emissions;
- development of spatial decision support systems for cross-sectoral adaptation strategies;
- innovation of methodologies to assess costs and (ancillary) benefits for adaptation and mitigation.

Annex 8.2 and the website[38] provide more information on the main research themes.

Energy innovation (agenda, transition)
Realising a sustainable national energy economy requires a new innovative way of thinking and acting -in economic, technological, and socio-cultural terms. The Netherlands chooses to use a transition approach. Energy Transition aims to attain a sustainable energy supply within 50 years. The energy transition is an interdepartmental programme in which six ministries work together: Economic Affairs; Housing, Spatial Planning and the Environment; Transport, Public Works and Water Management; Agriculture, Nature Management and Food Quality; Foreign Affairs; and Finance. The interdepartmental programme management initiates, 'pulls' and 'powers' energy transition; it ensures effective interdepartmental policy compatibility; stimulates a dialogue between the national government and society; and promotes connection and visibility of Energy Transition activities.

[38] http://www.klimaatonderzoeknederland.nl/templates/dispatcher.asp?page_id=25223002

Within Energy Transition platforms, innovative business people, trendsetting companies, knowledge institutes and creative non-governmental organisations (NGOs) work together on central Energy Transition themes. Each platform, with a non-governmental chairperson, plays a stimulating role to get the market moving and to find new ways to realise sustainable initiatives. Altogether, seven themes have been defined on which Energy Transition should focus in order to realise a sustainable energy supply. These have been chosen because they offer the Netherlands considerable economic opportunities and are feasible for this country. A platform has been set up for each theme:

- New Gas and Clean Fossil Fuels
- Sustainable Mobility
- Bio-based Raw Materials
- Chain Efficiency
- Sustainable Electricity
- Built Environment
- 'Greenhouse as Energy Source' (in horticulture).

Meanwhile, within these seven main themes, some 25 specific innovation programmes have already started. Budget amounts to €438 Million. Extensive information (also in English) can be found on the website[39]

More specific R&D programmes, supported by various ministries

Research related to, and in cooperation with, developing countries is also supported (see Chapter 7). An example is LNV's support of a climate change and agricultural intensification study in Rwanda (CATALIST): this aims to identify the climate-relevant aspects of agricultural intensification in Rwanda and assess what knowledge is needed to arrive at adaptation strategies. CATALIST will support the sustainable development of Rwanda.

The Ministry of V&W supports research and research institutes working *inter alia* on the impact of climate change on water management. This support includes financing the KNMI and several research programmes on water management and safety (Coastal Zone Management and Flood Protection), the International Delta Alliance, the Cooperative Programme on Water and Climate, and the Living with Water programme. A special reference is made to two studies supported: the background study for the Delta Committee on sea level rise in the year 2200, and the adaptation strategies necessary to deal with this sea level rise, and the Netherlands Drought Study, which focuses on water policy and water shortage (www.droogtestudie.nl).

In addition to the energy research approach, the Ministry of EZ also supports various energy efficiency and renewable energy technology research programmes.

Table 8.1. gives an overview of energy related research with public funding, according to the categorization of the IEA.

[39] http://www.senternovem.nl/energietransitie/index.asp

	2003		2004		2005		2006		2007		2008	
	€ mln	**%**	**€ mln**	**%**	**€ mln**	**%**	**€ mln**	**%**	**€ mln**	**%**	**€ mln**	**%**
Total energy saving	16	19%	20	22%	36	30%	41	30%	60	29%	44	29%
Fossil fuels[40]	13	16%	16	18%	14	11%	13	9%	43	21%	14	10%
Renewable energy	26	31%	21	24%	40	33%	45	34%	67	31%	47	32%
Nuclear energy	19	22%	20	22%	15	12%	15	12%	20	10%	17	11%
Hydrogen and fuel cells			5	5%	7	6%	7	5%	7	3%	9	6%
Generation and storage	6	7%	3	3%	4	4%	8	6%	8	4%	9	6%
Other	4	5%	6	7%	5	4%	5	4%	4	2%	9	6%
Total	**84**	**100%**	**91**	**101%**	**121**	**100%**	**134**	**100%**	**208**	**100%**	**148**	**100%**
% of total	60%		87%		98%		97%		100%		100%	

Table 8.1. Publicly funded energy related R&D per theme (IEA categories). Source: PWC, 2008

Various Ministries (e.g. LNV, VROM) have Policy-Support Research including studies stipulated from questions from the Ministries, where appropriate in consultation with other organisations:

- the studies for VROM are clustered within the WAB, the scientific assessment and policy analysis programme on climate change issues;
- for LNV the studies are included in the Knowledge Basis (KB) research programme. KB research thematically focuses on developing expertise that can support medium-term LNV policies in the green-blue domain on aspects of :
  a) mitigation, including increasing societal pressure to achieve a transition to climate-neutral agriculture and food production, production and use of biofuels and efforts to maximise net effects on emissions, and knowledge in the area of emissions and absorption of greenhouse gases from land use. These include analysis of relevant biophysical processes, management and improving monitoring techniques;
  b) adaptation of agriculture and fisheries to actual (and expected) climate change and rising sea levels, as well as nature conservation, questioning the policy on species (and Natura 2000), and on dealing with the risks of new diseases and pests in both agricultural and nature;
  c) impacts of climate change and international climate policy on the dynamics of international markets for raw bioproduce, and hence the nature and profitability of companies in this sector.

Annex 8.2 provides examples)

8.3. (C) Systematic observation

The Netherlands actively participates in the various fields of climate-related monitoring, both nationally and within European and global programmes. Annex 8.1 provides an overview of:

- atmospheric climate observation systems, including those measuring atmospheric constituents;
- ocean climate observation systems;
- terrestrial climate observation systems.

An integrated national programme for implementing the Netherlands' contribution to GCOS has not yet been established. However, steps are being taken to develop and implement such a strategy:

- In 1998 an authoritative national study (NIMM) was undertaken to evaluate the Netherlands' contribution to international monitoring systems (English summary available at the nlgcos site

[40] In 2007 the category fossil fuels is mainly Carbon Capture and Storage (CCS)

hosted by KNMI). This report deals with five areas for monitoring activities (oceans, coast and delta, land, weather and climate, and atmospheric composition). Among 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, the study proposed designating national focal points for GCOS, GOOS and GTOS. Since the year 2000 KNMI has been acting as focal point for GCOS in the Netherlands.

- The NIMM study recommended substantial strengthening of climate-related monitoring, requiring investments and organisational structuring. At present plans are under development to implement a prototype of the monitoring system suggested in the report. To this end, national atmospheric, oceanographic and terrestrial-oriented institutes are moving towards founding a virtual centre that, amongst others, would focus on integrated climate monitoring.

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.

Monitoring activities in the Netherlands are firmly embedded in international programmes such as Framework programmes (European level) and GEOSS (global level). We also see international cooperation at individual project level, such as Earth 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.

In addition to the activities of the KNMI, systematic observation is also taking place through the combined activities of research institutes, NGOs and citizens. In order to assess the impact of climate change on nature, these organisations gather data on when this flora and fauna first appear in spring, or when migrating birds return to the Netherlands for breeding etc.

Support for developing countries to establish and maintain observation systems, and related data and monitoring systems:
Free data exchange is encouraged, within the limits of international regulations (such as the ECOMET rules). At present there is no explicit national policy for capacity building related to GCOS. Activities do take place frequently on a project level. Project descriptions will be made available at the nlgcos site hosted by KNMI.

9 EDUCATION, TRAINING AND PUBLIC AWARENESS

9.1. General policy towards education, training and public awareness

Introduction
This chapter describes governmental activities in the Netherlands regarding education, training and public awareness on climate change. It also describes actions by other parties, such as NGOs, as well as actions undertaken to cooperate in, and promote at, international development and the implementation of education and training programmes. With this information, it also reports on the efforts of the Netherlands in implementing Article 6 of the Convention and the (amended) New Delhi Work Programme

General policy of the Dutch government programme 'Clean and Efficient'
The Ministry of Housing, Spatial Planning and the Environment (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 (EZ) is responsible for industrial energy savings, renewable energy and Joint Implementation. The Ministry of Agriculture, Nature and Food Quality (LNV) is responsible for energy savings in agriculture and LULUCF, while the Ministry of Transport, Public Works and Water Management (V&W) 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. In the approach taken we may distinguish between activities responding to *general elements and needs* of climate change and related actions and activities responding to more *specific needs* of target groups of policies and measures. The latter in general are specifically designed as integrated part of the related policy measures.
The interdepartmental Dutch climate change programme 'Clean and Efficient' has set ambitious targets. Communication is crucial in achieving changes. The programme's *general* communication approach includes various steps (also in line with the New Delhi work programme):

- to inform and raise awareness among the relevant target groups (raising the sense of urgency, avoiding misconceptions, etc.);
- offer specific options for action, relevant and suitable for the target groups (e.g. the money saved by energy-saving options, energy labels, etc.);
- provide inspiring examples;
- demonstrate the exemplary function of the government (e.g. sustainable product procurement, etc.).

General trends in public awareness on climate change
Within the Netherlands for VROM (or others) rather frequently, surveys are being carried out into the awareness, knowledge, attitude and behaviour (practice) of the general public. Most of these surveys show a significant awareness of climate change. The actual more deeper understanding ('the big picture) and involvement though differs over the various segments of the public. A survey in 2008 (implemented by Smart Agency for VROM) indicated that communication could be improved by providing more specific feedback on actions of the government and effects thereof. Many respondents to such surveys also look for specific possible actions for their own environment. These types of surveys do form a basis for (learning and adapting) better understanding the specific information needs and for the national communication approach on climate change issues under the programme 'Clean & Efficient"
The significant awareness level is also illustrated by the increased attention that the media are paying to climate change. Some examples since the previous National Communication:

- 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 conducted a public survey on its website, in which 18,000 people participated. This showed that 68% were considerably worried about climate change;
- in the run-up to Copenhagen 2009 special actions have been taken, such as (for a week in September) a climate-change-related issue was discussed every day on the main television news broadcast, plus special interviews in leading opinion programmes with the Dutch delegation leader for Copenhagen, etc.

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 been further strengthened as a result of the Treaty of Aarhus being implemented into Dutch law. To this end, the Freedom of Information Act and the Environmental Management Act were both adopted 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. A lot of other information is passively available.

The government also publishes extensive information on climate change policies and plans on various websites. Important websites, both from the government and other organisations, are mentioned throughout this communication. 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 relevant periods, such as the Netherlands' presidency of the EU (second half of 2004) special press releases covering the latest issues are 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/). Since the end of 2008 VROM also maintains a special website for the climate-change-related campaign (www.beterklimaat.nl), in cooperation with MilieuCentraal (see section 9.3)

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

A trend in public awareness that has been seen over the last 5-10 years concerns increased attention for the possible consequences of climate change and adaptation in the Netherlands. This is illustrated by various campaigns listed in chapter 6 and in this chapter including 'The Netherlands lives with water'. Non-governmental organisations also focus on this issue.

9.2. Primary, secondary and higher education

Education and training are aspects of the work carried out by the intermediary organisations SenterNovem and MilieuCentraal. For example, the MilieuCentraal website includes a subsection for pupils of primary and secondary school education. Also under the SMOM subsidy programme (see Section 9.4), some projects concern educational projects. These may be aimed at all school levels, from primary schools through to universities. Examples are given in the next sections.

The Dutch Programme 'Learning for Sustainable Development' enhances learning processes on sustainability in many issues. It promotes and enhances the inclusion of climate change issues in school curricula (primary, secondary and higher education) and in teacher training programmes. It does so by supporting networks of organisations in the field of education and teachers, publications

(e.g. on how to anchor sustainable development into teaching for 4-16 year-old pupils) projects, etc. Furthermore it stimulates 'social learning'' by facilitating that professionals, (local) government officials and other participants in decision-making processes work together resolve problems, carefully balancing the interests of people, nature and the environment, and the economy (see also previous NC4). It helps students, professionals, organisations and individuals to identify and make sustainable choices.
During the period up to 2007 activities were 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. During the period 2008-2011 its general lead motive is 'from strategy to (general) practice'. Examples of projects include learning packages for schools on saving energy in primary and secondary education. Also measures in their 'own' school building are part of such learning programmes.

The programme is also the Netherlands focal point for the UNESCO Decade for Education on Sustainable Development. The programme also cooperates with governments in Croatia and Montenegro on this issue, within the framework of so-called G2G projects

Examples from the LvDO programme.
[further information: http://www.senternovem.nl/Leren_voor_duurzame_ontwikkeling/]

***Energetic Schools**: Local governments, schools and environmental organisations work together to save energy and in schools. The Parties sign a letter of intent. Scholars are developing and implementing the measures. Also the Ministry (VROM) is on of the initiators of the project.*

***The project 'From energy ambition to successful implementation in sustainable urban development'** makes available valuable lessons that can be used by professional parties in the construction sector. These lessons are gathered through evaluating the experiences in innovative projects ('early adopters') on energy saving from the twelve provinces in the Netherlands. Energy saving technologies, such as collectively owned heat pumps, solar collectors, isolation, are dealt with, is various types of housing. Examples from each province are evaluated on aspects such as cooperation, technology and financing. The valuable lessons are described in the report on the project. Partners in this project are municipalities, provincial authorities, corporations (owners of housing projects), project developers, SenterNovem.*

*The programme bureau of LvDO has co-organised **a network day** for local authorities on corporate social (sustainable) responsibilities tackling with topics such as the possible role of governments towards small and medium scale enterprises. Some 150 participants together discussed the options. Based on the outcomes the need and possibilities for support measures are identified.*

9.3. Public information campaigns

VROM and the other ministries involved in climate policy regularly organise public information campaigns on climate change. The aim is to increase energy efficiency and the use of renewable energy through low-cost and 'easy to implement' actions. Examples include:
General campaigns, such as:

- the 2008 campaign 'The Dutch climb for a better climate'. This is a multi-media campaign (TV, radio, Internet, online social networks) which shows who is addressing climate change, and how they are doing so. Examples of best practices by various actors (government, companies, educational institutes, but also civil society as well as individual citizens) are given. Furthermore, reference is made to a website where citizens can find information on how to reduce energy consumption;
- In 2009 the 'The Dutch climb for a better climate' campaign was further enhanced by adding more specific topics, e.g. on energy saving in buildings (together with partners from the building and energy sectors), energy-efficient lighting (together with producers and retailers), both supported by radio and television, online advertisements, etc.;

- In May 2009 VROM financially supported a successful Climate Street Party campaign. Further such campaigns are planned.

Campaigns related to specific policies and measures.
As mentioned in 9.1., many of the specific policies and measures also incorporate related education, training and communication activities. Examples include the activities incorporated in Long Term Agreements with industry (e.g. groups of staff of participating companies in which users and potential users of companies exchange experiences with new energy saving options), information campaigns for the programme 'More with Less' for housing and buildings, campaigns supporting reduction options for non CO2 greenhouse gasses in agriculture as part of the Covenant with the agro sector, etc. In the transport sector an intensive campaign accompanied the 'The new driving force programme' (described in previous National Communications). This programme is now running under the name Ecodriving, in cooperation with similar programmes in other countries. This is a cooperative scheme between two Ministries (VROM, the Transport Ministry), 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. A public information campaign supported the actions in media and on the website www.hetnieuwerijden.nl. In 2006 about 75% of all licensed drivers were familiar with the programme and more than 20% applied the Ecodriving method.

Campaigns on 'climate adaptation'.
The special climate adaptation programme ARK (see Chapter 6) has its own website [http://www.maakruimtevoorklimaat.nl/home.html]. A more specific example is the campaign 'The Netherlands lives with water', which was initiated 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 itself 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. This shows examples of new measures that will be taken, plus those that have already been realised. See the website www.nederlandleeftmetwater.nl. Infomercials were broadcast on national television and radio, and large posters were mounted on billboards. Surveys show that the campaign is considered informative and credible. Public awareness that the government is working on this issue has increased considerably;
- a campaign aimed at relevant local authorities;
- a campaign aimed at those people who will be directly affected by the new water policy, i.e. those living close to rivers. This communication is mostly implemented by the local authorities.

The Copenhagen Coalition 'Beat the Heat' unites a large number of NGOs and other organisations from society, which are preparing a campaign in December. This action ends with the departure of the Copenhagen Express Train, hosted by the Netherlands Railways and the Minster of VROM.

9.4. Training programmes, including exchange of personnel

The 'Learning for Sustainable development' programme (see 9.2) encompasses also training. The programme also targets professionals (public servants, etc.) to strengthen 'the learning government" in developing, implementing and improving sustainable development related policies. This is done through publications and by creating a better environment for 'learning and improving' and for

structural embedding in decision making processes e.g. through networks of governmental, knowledge and social/environmental interest organisations.

Training is also an integrated aspect of the work carried out by the intermediary organisations SenterNovem and MilieuCentraal. For example, informational material and training to increase energy efficiency are provided to companies under the framework of the Long-Term Agreements, for the eco-drive programme [Het Nieuwe rijden] driver training was organised in driver license courses on efficient driving, etc.

Various Dutch universities and institutes offer training and other professional education programmes for national and for foreign students and professionals in climate change, mitigation and adaptation related topics.

9.5. Resource or information centres

As part of their activities in education, training and raising public awareness, the ministries involved in climate policy also 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. MilieuCentraal concentrates on consumers. Both organisations are described below. Further communication activities are implemented under the framework of 'Climate changes spatial planning' programme through the Platform Communication on Climate Change. NGOs also perform information services (see next section). The most relevant activities are described further in this chapter

SenterNovem (www.senternovem.nl) is an agency under the Dutch Ministry of Economic Affairs. It implements programmes for various ministries on innovation, energy and climate, as well as the 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 innovation support programmes, renewable energy programmes, Long-Term Agreements with industry to increase energy efficiency, the reduction programme for non-CO_2 greenhouse gases and many energy transition/innovation programmes for a sustainable energy economy. Education, training and raising public awareness form an integrated part of its activities. The activities, training, information and general website mainly target **professional parties** in many sectors of society. SenterNovem also hosts the website www.greenhousegases.nl (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. This site also makes available much of the relevant background information.

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. MilieuCentraal maintains 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.

'Climate changes spatial planning' and 'Knowledge for Climate', two major R&D programmes (see also Chapter 8), together operate a website on **research results**.[

http://www.klimaatonderzoeknederland.nl/templates/dispatcher.asp?page_id=25223002] 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. It also aims to stimulate the dialogue between politicians, government officials, industry, and the transfer of knowledge by bringing together parties that may offer, or need, knowledge on climate change. Activities include publishing fact sheets, brochures and summaries of scientific reports.

Various initiatives support climate-change-related actions at **regional government level**, both in the field of mitigation measures and adaptation. As part of the 'Clean and Efficient' programme, the local climate initiative programme is implemented and supported by a website (http://www.klimaatmonitor.databank.nl/) giving information on results. Also established for quite a number of years, the association 'Klimaatverbond' is an active network of local and provincial authorities that cooperate in projects and exchange information to support and strengthen local climate-related policies. The group maintain a website (www.klimaatverbond.nl) that contains information on projects and activities. Examples include the project 'energieke scholen', a nationwide campaign for primary schools, to encourage pupils to implement energy-saving measures in their schools. It also contains teaching materials[41]. The association liaises with the international city cooperative network 'Energie-Cités'.

Also **more targeted programmes** are often supported by websites that provide important resource information for the relevant target groups. Examples include the programme 'More with Less' for the housing and buildings sector (see Chapter 4), supported by a website with resource information for both tenants, home-owners (corporations) and suppliers in the sector (http://www.meermetminder.nl/home).

9.6. Involvement and support of non-governmental organisations

Government support to NGOs

The Ministry of VROM further contributes to education, training, and raising public awareness through the subsidy programme entitled Social Organisations and the Environment (SMOM), already described in earlier National Communications. The scheme focuses on environmental projects and programmes by non-profit organisations, enabling these organisations to take the initiative, while also providing VROM with better 'insight' into, 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. In 2009 the total budget is € 6 million, with € 450 000 being reserved for projects aimed at international cooperation, reduction of greenhouse gases, energy efficiency and renewable energy. Examples of projects are given on the website http://www.senternovem.nl/smom/index.asp . Projects have different character and include e.g. support to communication campaigns on global sustainability issues (.g with the foundation Both Ends), awareness projects with children (e.g. Cool!Climate After School project, that raises awareness with children and parents after school time, using e.g. energy boxes, group discussions etc.).

The HIER campaign

In the 'Hier' (Dutch for Here) climate campaign, 40 organisations (mostly NGOs such as WWF/ WNF, Red Cross, Oxfam Novib) work together to counter the negative effects of climate change through activities such as coordinated consumer campaigns, raising awareness, joint communication

[41] This project also is financially supported by the Ministry (VROM)

efforts, and political lobbying. The campaign is supported by the Dutch government (Ministry of VROM), both financially and through cooperation. The business community is also involved.
The environmental NGOs that participate in the campaign have divided up the consumer options among themselves. The Netherlands Society for Nature and Environment, for instance, has presented a Top-ten list of energy-efficient products to choose from (refrigerators, TVs, cars etc., see www.topten.info), while the WWF has introduced the most economical cars, etc. Together these organisations developed a list of products that are allowed to display the HIER logo. Participation by the business community is growing.
Joint communication builds upon the various climate adaptation projects. These are key to convincing the general public and decision-makers that climate change is not an abstract long-term environmental problem, but increasingly a major social problem, one that has impacts at home and all over the world. Building on this growing sense of urgency, the role of environmental NGOs is to show consumers how to make the right choices. Further information: http://www.hier.nu/home/

9.7. New Delhi work programme on Article 6 of the UNFCCC

The previous sections also describe activities and efforts taken to implement the (amended) New Delhi work programme, integrated in the Dutch communication approach on climate change. A few special aspects may be further highlighted:

Development and implementation of education and training internationally (Kyoto Protocol Art.10)
The previous sections also include activities aimed at international education and training and capacity building. As mentioned e.g. in section 9.4.,various Dutch universities and institutes offer training and other professional education programmes for foreign students and professionals in climate change, mitigation and adaptation related topics. Examples for foreign students and professionals include e.g. post graduate courses and training in the field of water management, flood risk management, energy management and cleaner energy, climate change adaptation in agriculture and natural resources management.

Also universities offer MSc for foreign students e.g. in sustainable energy technology or environmental sciences [se also the website of NUFFIC, a non-profit organisation that supports internationalisation in higher education, research and professional education.
[http://www.nuffic.nl/home]
Another example is the HIER campaign (section 9.6) that also intends to be internationally relevant. Many of the participating NGOs are part of international networks. More than half of the projects take place in developing countries, especially the projects by development and humanitarian NGOs. At least half of the compensation for climate-neutral products will come from 'gold standard' CDM or VER (Verified Emission Reductions) projects. The communications approach is meant to be easily copied in other countries;

Regional cooperation

The Netherlands actively participated to the European Regional workshop on Article 6 of the Convention was organized in response to a request by the Subsidiary Body for Implementation in Bali (2007). The workshop was held in May 2009 in Stockholm, Sweden, and contributed in sharing approaches, lessons learned and best practices. The Dutch (and other contributions) are already available on the UN website:
http://unfccc.int/cooperation_and_support/education_and_outreach/items/4834.php

Youth
Most of the education programmes mentioned before are aimed at youth, as are various communication campaigns. To stimulate further involvement and participation of youth in policy processes various other actions are taken both by NGOs and by government. Some examples:

The Netherlands financially supports the participation of youth (the next generation) from developing countries to the climate change talks in Copenhagen 2009. This will be done as part of the UNFCCC efforts; UNFCCC will also take care of the selection process.

The Minister of VROM organizes an annual 'children climate talk summit' (Kinderklimaattop) just before the COP/MOP. The Minister then discusses possible measures to combat climate change with some 60 pupils from primary schools.

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GLOSSARY

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

Gg	Giga gramme (10^9 gramme)
GJ	Giga Joule (10^9 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^{o}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

GLOSSARY

A

AAU	Assigned Amount Units
Argo	Array for Real-time Geostrophic Oceanography
AEDES	Asociación Especializada para el Desarrollo Sostenible
AIJ	Activities Implemented Jointly
ALW	Earth and Life Sciences; NWO research theme
ARK	Adaptatie Ruimte en Klimaat (National Programme for Spatial Adaptation to Climate Change)
ASTAE	Asia Sustainable Technology and Alternative Energy
AVV	Adviesdienst Verkeer en Vervoer (Transport Research Centre)

B

BLOW	Intergovernmental Netherlands wind energy agreement
BEES(/A)	Order, governing combustion plants emission requirements
BSIK	Besluit Subsidies Investeringen Kennisinfrastructuur (Subsidy scheme for the knowledge infrastructure)

C

CAF	Regional Development Bank for the Andes
CBS	Netherlands Statistics (Centraal Bureau voor de Statistiek)
CCPM	Common and Coordinated Policies and Measures (of EU)
CD4CDM	Capacity Development for the Clean Development Mechanism
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)
CoP	Conference of the Parties (to the Climate Change Convention)
CPB	Central Planning Bureau
CRF	Common Reporting Format
CROW	Information and Technology Platform for Transport, Infrastructure and Public Space

D

DECC	UK Department of Energy and Climate Change
DES	Data Exchange Standards
DGIS	Directoraat-Generaal Internationale Samenwerking (Development Cooperation)

E

EC	European Commission/European Community
EC-LNV	Expert Centrum van het Ministerie voor Landbouw Natuurbeheer en Visserij (National Reference Centre for Agriculture (formerly IKC-L)
ECA&D	European Climate Programme and Dataset
ECN	Energie Centrum Nederland (Netherlands Energy Research Centre)
EDF	European Development Fund
EDGAR	Emission Database for Global Atmospheric Research
EHS	Ecologische Hoofdstructuur (National Ecological Network)
EIA	Energie Investerings Aftrek (Energy investment tax deduction)
EINP	Energy Investeringsaftrek Non-Profit Organisaties (Energy investment tax deduction for non-profit sectors)
ENINA	Task Force on Energy, Industry and Waste Management
EPA	Energie Prestatie Advies (Energy performance advice)
EPA	Environmental Protection Act

EPBD	Energy Performance of Buildings Directive
EPC	Energy performance coefficient
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
ESFRI	European Strategy Forum for Research Infrastructures
ESMAP	Energy Sector Management Assistance Programme
ETP	Energy Technology Platform
EU	European Union
EU-ETS	European Union Greenhouse Gas Emission Trading System
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 (HFCs, PFCs, SF_6)
FAO	Food and Agriculture Organisation of the United Nations
FCPF	The Forest Carbon Partnership Facility
FINESSE	Financing Energy Services for Small Scale Energy Users
FLUXNET	Global Terrestrial Network – Carbon
FP	Framework Programme (EU research fund)
FTP	File Transfer Protocol

G

GCOS	Global Climate Observing System
GDP	Gross Domestic Product
GE	Global Economy (scenario)
GEF	Global Environmental Facility
GGD	National Health Authority (Gemeentelijke Gezondheidsdiensten)
GHG	GreenHouse Gas
GIS	Green Investment Schemes
GNI	Gross National Income
GOME	Global Ozone Monitoring Experiment
GOOS	Global Ocean Observing System
GPS	Global Positioning System
GRETA	Cooperation scheme that developed the Greenhouse Gas Registry for Emissions Trading Arrangements
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

IBRD	International Bank for Reconstruction and Development

ICAO	International Civil Aviation Organisation
ICSU	International 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)
IMAU	Institute for Marine and Atmospheric Research
IMO	International Maritime Organisation
IOC	Intergovernmental Oceanographic Commission of UNESCO
IPCC	Intergovernmental Panel on Climate Change
IPO	Interprovinciaal overleg (Association of Provincial Authorities)
ITL	Independent Transaction Log

J

JI	Joint Implementation

K

KADO	Kabinetsbrede aanpak Duurzame Ontwikkeling (the Cabinet Approach to Sustainable Development)
KPI	Key Performance Indicator
KNAW	Royal Netherlands' Academy of Arts and Sciences
KNMI	Koninklijk Nederlands Meteorologisch Instituut (Royal Netherlands Meteorological Institute)
KvK	Kennis voor Klimaat (Knowledge for Climate)
KvR	Klimaat voor Ruimte (Climate Changes Spatial Planning)

L

LTA's	Long Term Agreements
LDC	Least Developed Countries
LDCF	Least Developed Countries Fund
LEI	Agricultural Economics Institute (Landbouw Economisch Instituut)
LNV	Ministry of Agriculture, Nature and Food Quality (Landbouw, Natuurbeheer en Voedselkwaliteit)
LPG	Liquefied Petroleum Gas
LTA	Long-Term Agreement
LULUCF	Land-use, Land-Use Change and Forestry

M

MAP	Milieu Actie Plan (Environmental Action Plan)
MATRA	Social Transformation Eastern Europe Programme
MDG	Millenium Development Goal
MEPC	(IMO) Marine Environment Protection Committee
MFS	Co-financing System
MIA-Water	Maatschappelijke Innovatie Agenda Water
MILIEV	Milieu en Economische Verzelfstandiging (ORET MILIEV is a development and environment related export transactions programme)
MJA	See LTA
MJV	Milieujaarverslag (Annual Environmental Report)
MPE	Milieukwaliteit Elektriciteitsproductie (Environmental Quality of Electricity Production)

N

NASA	National Aeronautics and Space Administration
NBW	Nationaal Bestuursakkoord Water
NC	National Communication
NCAP	Netherlands Climate Assistance Programme
NCCSAP	Netherlands Climate Change Studies Assistance Program
NCPIP	National Climate Policy Implementation Plan
NeA	Nederlandse Emissie Autoriteit (Dutch Emissions Authority)
NEPP	National Environmental Policy Plan
NGO	Non-Governmental Organisation
NIE	National Inventory Entity (under Kyoto Protocol)
NIOZ	Netherlands Institute for Sea Research
NIR	National Inventory Report
NMP	Environmental Assessment Agency
NMVOC	Non-Methane Volatile Organic Compounds
NRP-CC	National Research Programme on Climate Change
NWO	Nederlandse Organisatie voor Wetenschappelijk Onderzoek (transl. Netherlands Organisation for Scientific Research)
NWP	Nairobi Work Programme

O

OCW	Ministry of Education, Arts and Science
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
OMI	Ozone Monitoring Instrument
ORET	Programma Ontwikkelingsrevelante Export Transacties (Development-Related Export Transactions). Predecessor of ORIO (see below)
ORIO	Ontwikkelingsrelevante Infrastructuurontwikkeling (Facility for Infrastructure Development)

P

PfCC	Preparedness for Climate Change
PREP	Promoting Renewable Energy Programme
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

REDD	Reducing Emissions from Deforestation and Forest Degradation
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
RMNO	Advisory Council for Research on Spatial Planning, Nature and the Environment
RMU	Removal Units

S

SAF	Satellite Application Facilities
SBI	Subsidary Body for Implementation
SCCF	Special Climate Change Fund

SCER	Steering Committee for the Emissions Registrations project
SCIAMACHY	Scanning Imaging Absorption Spectrometer for Atmospheric Cartography
SDE	Stimulering Duurzame Energieproductie (Sustainable Energy Production)
SE	Strong Europe (scenario)
SenterNovem	Governmental agency for Energy, Innovation and Environment
SLOK	Stimulering Lokale en Regionale Klimaatinitiatieven (Stimulating Local Climate Initiatives)
SNV	Netherlands Development Organisation
SMEC	Second Memorandum on Energy Conservation
SOOP	Ship of Opportunity Programme
SRON	Space Research Organisation Netherlands

T

TNO	Netherlands Organisation for Applied Scientific Research
TMF	Thematic Co-Financing

U

UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFFFC	United Nations Framework Convention on Climate Change
URC	UNEP Risø Centre
UU-IMAU	Utrecht University-Institute for Marine and Atmospheric Research
UvW	Unie van Waterschappen (Dutch Association of Regional Water Authorities)

V

V&W	Verkeer & Waterstaat (Ministry of Transport, Public Works and Water management)
VAMIL	Variable Depreciation of Energy Investments
VER	Verified Emission Reductions
VNG	Vereniging Nederlandse Gemeenten (Association of Netherlands Municipalities)
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
WFD	Water Framework Directive
WHO	World Health Organization
WMO	World Meteorological Organisation
WUR	Wageningen University and Research centre
WWF	World Wildlife Fund
WWW	World Weather Watch of WMO

ANNEX I Summary tables on emission trends

Table 1.1 Emission Trends CO_2

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007
	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)	(Gg)
1. Energy	**151158**	**151158**	**162582**	**162097**	**168201**	**168831**	**172637**	**173885**	**168691**	**165354**	**165373**
A. Fuel Combustion (Sectoral Approach)	149980	149980	161624	161408	167619	167280	171127	172378	167160	163836	163776
1. Energy Industries	52492	52492	61615	63527	67702	67068	68517	69943	67313	62409	65519
2. Manufacturing Industries and Construction	32696	32696	28582	27056	26606	27128	27667	27440	27297	27657	27749
3. Transport	26009	26009	29176	32409	32912	33617	34295	34655	34675	35548	35201
4. Other Sectors	38217	38217	41739	37832	39926	38968	40212	39901	37500	37841	34989
5. Other	566	566	512	583	474	499	437	440	375	381	317
B. Fugitive Emissions from Fuels	1177	1177	958	689	582	1551	1510	1507	1531	1518	1598
1. Solid Fuels	403	403	517	422	412	430	464	509	457	449	444
2. Oil and Natural Gas	775	775	441	267	170	1121	1046	998	1074	1068	1154
2. Industrial Processes	**7838**	**7838**	**7882**	**7353**	**6831**	**6739**	**6855**	**6947**	**6954**	**7021**	**7155**
A. Mineral Products	923	923	1432	1165	1253	1180	1138	1156	1143	1143	1148
B. Chemical Industry	3702	3702	3974	4077	3503	3401	3412	3657	3746	3717	3622
C. Metal Production	2909	2909	2184	1765	1737	1821	1968	1791	1684	1809	2078
D. Other Production	73	73	22	49	43	32	46	41	33	20	29
E. Production of Halocarbons and SF_6											
F. Consumption of Halocarbons and SF_6											
G. Other	232	232	269	298	296	306	291	301	347	332	278
3. Solvent and Other Product Use	316	316	242	169	158	160	144	133	135	135	128
4. Agriculture											
A. Enteric Fermentation											
B. Manure Management											
C. Rice Cultivation											
D. Agricultural Soils											
E. Prescribed Burning of Savannas											
F. Field Burning of Agricultural Residues											
G. Other											

5. Land Use, Land-Use Change and Forestry(	**2597**	**2597**	**2330**	**2512**	**2426**	**2336**	**2319**	**2342**	**2380**	**2400**	**2537**
A. Forest Land	-2532	-2532	-2798	-2670	-2757	-2871	-2911	-2897	-2871	-2873	-2742
B. Cropland	35	35	39	42	42	43	44	45	46	47	48
C. Grassland	4640	4640	4688	4719	4729	4741	4752	4761	4770	4779	4788
D. Wetlands	40	40	45	48	49	51	52	53	54	54	55
E. Settlements	212	212	237	254	260	266	272	277	282	287	292
F. Other Land	18	18	20	22	22	23	23	24	24	25	25
G. Other	183	183	98	98	80	85	86	79	75	81	71
6. Waste	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**	**IE,NA,NO**
A. Solid Waste Disposal on Land	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
B. Waste-water Handling											
C. Waste Incineration	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
D. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total CO_2 emissions including net CO_2 from LULUCF	**161909**	**161909**	**173036**	**172131**	**177617**	**178066**	**181955**	**183308**	**178160**	**174910**	**175194**
Total CO_2 emissions excluding net CO_2 from LULUCF	**159312**	**159312**	**170706**	**169619**	**175190**	**175730**	**179636**	**180966**	**175780**	**172510**	**172657**
Memo Items:											
International Bunkers	**38898**	**38898**	**42983**	**52431**	**56531**	**56411**	**53126**	**57590**	**65023**	**67199**	**62482**
Aviation	4540	4540	7584	9749	9539	9982	9817	10496	10876	10975	11097
Marine	34357	34357	35399	42682	46992	46429	43309	47093	54147	56224	51385
Multilateral Operations	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
CO_2 Emissions from Biomass	3878	3878	4273	6178	6486	7069	6788	7553	8679	8858	9122

Table 1.2 Emission Trends CH_4 (in Gg)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007
1. Energy	115	115	123	85	84	81	80	78	82	84	104
A. Fuel Combustion (Sectoral Approach)	35	35	44	46	45	43	43	43	45	50	61
1. Energy Industries	4	4	5	6	7	7	7	7	8	7	7
2. Manufacturing Industries and Construction	3	3	3	4	3	3	3	3	3	3	3
3. Transport	8	8	5	3	3	3	3	3	2	2	2
4. Other Sectors	21	21	31	32	32	30	31	31	32	38	49
5. Other	0	0	0	0	0	0	0	0	0	0	0
B. Fugitive Emissions from Fuels	79	79	79	39	39	37	37	35	37	34	43
1. Solid Fuels	1	1	1	1	1	1	1	1	1	1	1
2. Oil and Natural Gas	78	78	78	38	38	36	36	34	36	33	42
2. Industrial Processes	**14**	**14**	**14**	**14**	**14**	**15**	**15**	**15**	**15**	**14**	**14**
A. Mineral Products	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Chemical Industry	12	12	12	12	12	13	13	13	13	12	13
C. Metal Production	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO
D. Other Production											
E. Production of Halocarbons and SF_6											
F. Consumption of Halocarbons and SF_6											
G. Other	2	2	2	2	2	2	2	2	2	2	2
3. Solvent and Other Product Use											
4. Agriculture	**502**	**502**	**498**	**443**	**446**	**423**	**420**	**423**	**422**	**421**	**426**
A. Enteric Fermentation	359	359	349	308	314	296	298	299	298	297	301
B. Manure Management	143	143	149	135	132	127	122	124	124	124	125
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
E. Prescribed Burning of Savannas	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
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land-Use Change and Forestry	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**
A. Forest Land	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
B. Cropland	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE
C. Grassland	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

D. Wetlands	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
F. Other Land	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	**586**	**586**	**515**	**400**	**376**	**360**	**337**	**322**	**302**	**282**	**263**
A. Solid Waste Disposal on Land	572	572	500	386	363	346	323	309	289	270	250
B. Waste-water Handling	14	14	11	10	10	11	10	10	10	10	10
C. Waste Incineration	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
D. Other	0	0	3	4	3	3	3	3	3	3	3
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total CH_4 emissions including CH_4 from LULUCF	**1216**	**1216**	**1150**	**943**	**920**	**878**	**852**	**838**	**820**	**802**	**808**
Total CH_4 emissions excluding CH_4 from LULUCF	**1216**	**1216**	**1150**	**943**	**920**	**878**	**852**	**838**	**820**	**802**	**808**
Memo Items:											
International Bunkers	1	1	1	1	2	2	1	2	2	2	2
Aviation	0	0	0	0	0	0	0	0	1	1	1
Marine	1	1	1	1	1	1	1	1	1	1	1
Multilateral Operations	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
CO_2 Emissions from Biomass											

Table 1.3 Emission trends N_20 (in Gg)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	2000	2001	2002	2003	2004	2005	2006	2007
1. Energy	**1,61**	**1,61**	**2,40**	**2,42**	**2,45**	**2,42**	**2,43**	**2,44**	**2,45**	**2,43**
A. Fuel Combustion (Sectoral Approach)	1,61	1,61	2,40	2,42	2,45	2,42	2,43	2,44	2,45	2,43
1. Energy Industries	0,45	0,45	0,63	0,66	0,70	0,70	0,73	0,78	0,77	0,79
2. Manufacturing Industries and Construction	0,10	0,10	0,07	0,07	0,07	0,07	0,07	0,07	0,08	0,08
3. Transport	0,88	0,88	1,53	1,53	1,53	1,50	1,47	1,44	1,46	1,42
4. Other Sectors	0,14	0,14	0,13	0,13	0,13	0,13	0,13	0,12	0,12	0,12
5. Other	0,03	0,03	0,03	0,03	0,03	0,03	0,03	0,02	0,02	0,02
B. Fugitive Emissions from Fuels	0,00	0,00	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO
1. Solid Fuels	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
2. Oil and Natural Gas	0,00	0,00	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO	IE,NA,NO
2. Industrial Processes	**22,90**	**22,90**	**22,06**	**20,03**	**19,15**	**19,42**	**21,12**	**20,55**	**20,21**	**15,51**
A. Mineral Products	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
B. Chemical Industry	22,89	22,89	22,04	20,01	19,12	19,40	21,10	20,53	20,19	15,49
C. Metal Production	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Other Production										
E. Production of Halocarbons and SF_6										
F. Consumption of Halocarbons and SF_6										
G. Other	0,01	0,01	0,02	0,02	0,02	0,02	0,02	0,02	0,02	0,02
3. Solvent and Other Product Use	0,73	0,73	0,44	0,36	0,29	0,27	0,28	0,25	0,26	0,25
4. Agriculture	**38,50**	**38,50**	**35,75**	**34,04**	**32,33**	**31,04**	**30,91**	**31,04**	**30,82**	**30,55**
A. Enteric Fermentation										
B. Manure Management	2,63	2,63	2,88	2,78	2,84	2,34	2,60	2,78	2,74	2,81
C. Rice Cultivation										
D. Agricultural Soils	35,88	35,88	32,87	31,25	29,48	28,70	28,32	28,26	28,08	27,74
E. Prescribed Burning of Savannas	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
G. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5. Land Use, Land-Use Change and Forestry	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**	**NA,NE,NO**
A. Forest Land	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
B. Cropland	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE
C. Grassland	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

D. Wetlands	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
E. Settlements	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
F. Other Land	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
G. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
6. Waste	**1,50**	**1,50**	**1,56**	**1,55**	**1,56**	**1,52**	**1,54**	**1,56**	**1,56**	**1,60**
A. Solid Waste Disposal on Land										
B. Waste-water Handling	1,50	1,50	1,41	1,42	1,42	1,39	1,40	1,43	1,43	1,47
C. Waste Incineration	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
D. Other	0,00	0,00	0,15	0,13	0,14	0,13	0,14	0,13	0,12	0,13
7. Other *(as specified in Summary 1.A)*	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Total N_2O emissions including N_2O from LULUCF	**65,24**	**65,24**	**62,21**	**58,40**	**55,77**	**54,67**	**56,28**	**55,84**	**55,30**	**50,34**
Total N_2O emissions excluding N_2O from LULUCF	**65,24**	**65,24**	**62,21**	**58,40**	**55,77**	**54,67**	**56,28**	**55,84**	**55,30**	**50,34**
Memo Items:										
International Bunkers	**0,31**	**0,31**	**0,41**	**0,45**	**0,45**	**0,42**	**0,45**	**0,51**	**0,53**	**0,49**
Aviation	0,04	0,04	0,08	0,08	0,08	0,08	0,09	0,09	0,09	0,09
Marine	0,27	0,27	0,33	0,37	0,36	0,34	0,37	0,42	0,44	0,40
Multilateral Operations	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
CO_2 Emissions from Biomass										

Table 1.4 Emission trends F gasses (in Gg)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007
Emissions of HFCs - (Gg CO_2 equivalent)	**6.019,54**	**4.432,03**	**6.019,54**	**3.828,94**	**1.469,23**	**1.541,41**	**1.377,06**	**1.506,65**	**1.357,71**	**1.566,39**	**1.737,59**
HFC-23	0,49	0,38	0,49	0,21	0,04	0,06	0,04	0,03	0,02	0,02	0,02
HFC-32	0,00	NO	0,00	0,00	0,01	0,00	0,01	0,01	0,00	0,00	0,00
HFC-41	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-43-10mee	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-125	0,00	NO	0,00	0,06	0,08	0,06	0,07	0,09	0,09	0,10	0,11
HFC-134	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-134a	0,04	NO	0,04	0,12	0,16	0,20	0,24	0,30	0,33	0,37	0,42
HFC-152a	0,02	NO	0,02	0,02	0,01	0,00	0,00	0,01	0,00	0,00	0,00
HFC-143	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-143a	0,00	NO	0,00	0,08	0,05	0,05	0,06	0,07	0,08	0,09	0,12
HFC-227ea	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-236fa	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
HFC-245ca	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Unspecified mix of listed HFCs - (Gg CO_2 equivalent)	187,62	NO	187,62	774,76	408,12	216,39	216,05	237,14	173,03	170,88	185,48
Emissions of PFCs(3) - (Gg CO_2 equivalent)	**1.937,81**	**2.264,48**	**1.937,81**	**1.581,54**	**1.489,43**	**2.187,03**	**620,53**	**285,64**	**266,20**	**256,54**	**327,07**
CF_4	0,24	0,28	0,24	0,16	0,15	0,24	0,05	0,01	0,01	0,01	0,01
C_2F_6	0,04	0,05	0,04	0,04	0,04	0,06	0,01	0,00	0,00	0,00	0,00
C_3F_8	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_4F_{10}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
c-C_4F_8	NO	NA,NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_5F_{12}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C_6F_{14}	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Unspecified mix of listed PFCs - (Gg CO_2 equivalent)	37,03	18,26	37,03	193,35	162,71	119,70	180,25	179,04	178,19	194,46	225,58
Emissions of SF6(3) - (Gg CO_2 equivalent)	**301,26**	**217,32**	**301,26**	**318,71**	**323,37**	**282,98**	**243,47**	**246,15**	**237,92**	**202,17**	**213,95**
SF_6	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01

Table 1.5 Emission trends (Summary) (in $C0_2$ equivalents)

GREENHOUSE GAS EMISSIONS	Base year (1990)[42]	1995	2000	2001	2002	2003	2004	2006	2007
CO_2 emissions including net CO_2 from LULUCF	161909	173036	172131	177617	178066	181955	183308	174910	175194
CO_2 emissions excluding net CO_2 from LULUCF	159312	170706	169619	175190	175730	179636	180966	172510	172657
CH_4 emissions including CH_4 from LULUCF	25546	24153	19794	19328	18446	17885	17595	16832	16963
CH_4 emissions excluding CH_4 from LULUCF	25546	24153	19794	19328	18446	17885	17595	16832	16963
N_2O emissions including N_2O from LULUCF	20225	21541	19286	18104	17288	16949	17445	17142	15605
N_2O emissions excluding N_2O from LULUCF	20225	21541	19286	18104	17288	16949	17445	17142	15605
HFCs	4432	6020	3829	1469	1541	1377	1507	1566	1738
PFCs	2264	1938	1582	1489	2187	621	286	257	327
SF_6	217	301	319	323	283	243	246	202	214
Total (including LULUCF)	**214594**	**226989**	**216939**	**218331**	**217812**	**219031**	**220387**	**210909**	**210041**
Total (excluding LULUCF)	**211997**	**224659**	**214427**	**215904**	**215475**	**216712**	**218045**	**208508**	**207504**
1. Energy	154069	165900	164625	170708	171280	175071	176272	167875	168306
2. Industrial Processes	22147	23525	20221	16622	16994	15433	15845	15609	14545
3. Solvent and Other Product Use	541	440	307	269	249	227	221	216	205
4. Agriculture	22472	23503	20395	19918	18912	18442	18460	18396	18423
5. Land Use, Land-Use Change and Forestry(5)	2597	2330	2512	2426	2336	2319	2342	2400	2537
6. Waste	12768	11292	8880	8387	8040	7539	7247	6412	6025
7. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (including LULUCF)	**214594**	**226989**	**216939**	**218331**	**217812**	**219031**	**220387**	**210909**	**210041**

[42] Base year for F gasses is 1995

ANNEX II. Summary of reporting of the Supplementary information under Article 7, paragraph 2, of the Kyoto Protocol in the NC5

Information reported under Article 7, paragraph 2	**NC5 section**
National systems in accordance with Article 5, paragraph 1	3.3. (C) Description of the National System
National registries	3.4. (D) National Registry
Supplementarity relating to the mechanisms pursuant to Articles 6, 12 and 17	5.3. (C) Supplementarity relating to the mechanisms pursuant to Articles 6, 12 and 17
Policies and measures in accordance with Article 2	4.4. (C) Policies and measures and their effects
Domestic and regional programmes and/or legislative arrangements and enforcement and administrative procedures	4.3. (B) Domestic and regional programmes and/or legislative arrangements and enforcement and administrative procedures
Information under Article 10	
Art 10a	3.3. (C) Description of the National System
Art 10b	4.3. (B) Domestic and regional programmes and/or legislative arrangements and enforcement and administrative procedures and 6.3 (C) Adaptation measures
Art 10c	7.4. (D) Activities relating to technology transfer
Art 10d	8. Research and Systematic Observation and Annex 8.1
Art 10e	9. Education, Training and Public Awareness
Financial resources (Annex II only)	7.1. (A) Provision of new and additional resources 7.2. (B) Assistance to developing countries that are particularly vulnerable to climate change 7.3. (C) Provision of financial resources under article 11 of the Kyoto Protocol

ANNEX Chapter 5

5.1 Key variables and parameters projections

Table 5.1.1. Key variables projections

Assumptions for general economic parameters:		**Historic Values**				**With Existing Measures Scenario (UR-GE)**		
		1990	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
Gross Domestic Product	Value (mln. €)	243 652	305 261	417 960	513 407	618 000	713 000	822 000
Gross Domestic Product growth Rate	Annual growth rate (%)	4,2%	3,1%	3,9%	2,0%	2,9%	2,9%	2,9%
Population	Thousand people	14893	15424	15864	16306	16455	17028	17434
Population Growth Rate and Base Year Value	% of value	0,79%	0,45%	0,78%	0,18%	0,6%	0,6%	0,6%
International coal prices	€ per GJ (Gigajoule)	2,318	1,641	1,551	2,268	1,917	2,001	2,057
International oil prices	€ per GJ (Gigajoule)	4,615	2,782	6,016	7,664	7,625	8,100	8,548
International gas prices	€ per GJ (Gigajoule)	3,178	2,247	3,979	4,85	5,806	6,072	6,436
Assumptions on weather parameters								
Heating Degree Days	Annual HDD	3 059	2 995	2 928	2 861	2 797	2 762	2 727
Cooling Degree Days	Annual CDD	66,2	75,7	86,3	94,9	99	104	109

Table 5.1.2. Selected parameters per sector for projections

		Historical Value				**With Existing Measures Scenario**		
		1990	**1995**	**2000**	**2005**	**2010**	**2015**	**2020**
Assumptions for the energy sector:								
Total gross inland consumption		2 279,9	2 494,2	2 572,5	2 652,1	2 755,6	3 023,2	3 116,0
Oil (fossil)	Petajoule (PJ)	556,0	666,0	706,0	730,0	741,3	807,2	876,5
Gas (fossil)	Petajoule (PJ)	1 266,3	1 346,7	1 391,9	1 392,5	1 448,5	1 546,6	1 464,6
Solid fuels	Petajoule (PJ)	368,4	374,5	328,6	342,0	320,7	554,6	615,4
Renewables	Petajoule (PJ)	18,1	22,8	37,6	80,5	185,9	174,7	200,1
Nuclear (IEA definition for energy calc.)	Petajoule (PJ)	38,1	43,1	40,4	41,1	42,5	42,5	42,5
Net Electricity import (-+)	Petajoule (PJ)	33	41	68,1	65,9	16,7	-102,4	-83,2
Total gross electricity generation by fuel type		73 000	82 186	96 953	103 678	124 429	170 733	179 647
Energy Demand by Sector		2 233,5	2 517,7	2 605,0	2 676,8	2 738,9	3 000,0	3 070,7
Energy Industries		351,3	456,7	433,4	490,8	520,6	684,1	653,0
Industry		567,9	609,7	618,5	615,1	590,8	604,7	600,7
Commercial (Tertiary)		442,5	481,9	514,4	513,0	525,74	532,6	561,2
Residential		437,1	449,4	443,4	419,2	407,34	414,7	422,6
Transport		434,8	520,0	595,3	638,7	694,459	763,9	833,3
Assumptions for the Industry Sector (for industrial sectors contributing significantly to the national total for the base or target year)								
Gross value-added total industry, Bio Euro (EC95) 2000	Value (EUR billion)	44,676	49,358	58,078	60,519	66,331	74,323	83,696
Assumptions for the transport sector								
Freight transport (all modes), Mtkm	Mtkm	61 869	72 946	79 606	86 359	85 700	96 227	106 752
Assumptions for buildings (in residential and commercial or tertiary sector)								
Gross value-added — services, Bio Euro (EC95)	Value (EUR billion)	176,807	198,934	243,757	262,648	287,691	337,303	395,901
Assumptions in the agriculture sector								
Total Cattle	1000 heads	4 927	4 654	4 070	3 799	3 796	3 656	3 516

Dairy cattle	1000 heads	1 878	1 708	1 504	1 433	1 447	1 586	1 725
Non-dairy cattle	1000 heads	3 049	2 946	2 566	2 366	2 350	2 070	1 791
Sheep	1000 heads	1 702	1 674	1 308	1 363	1 369	1 488	1 606
Swine	1000 heads	13 900	14 400	13 100	11 300	11 291	11 236	11 181
Poultry	1000 heads	95 600	92 200	10 720	95 900	95 405	102 181	108 958
Other, (goats, horses (for scenarios also Rabbits)	1000 heads	131	176	297	425	1 480	1 547	1 614
The area of crops by crop type	Crops not included in this table due to available space							
Fertilizer Used (Synthetic & Manure)	kt Nitrogen				606	545	533	522
The implied emissions factors								
enteric fermentation Dairy cattle	Tonnes CO2e /Thousand Heads					2 772	2 829	2 877
enteric fermentation Non-dairy cattle	Tonnes CO2e /Thousand Heads					772	754	731
enteric fermentation sheep	Tonnes CO2e /Thousand Heads					168	168	168
manure management Dairy cattle	Tonnes CO2e /Thousand Heads					840	872	900
manure management Non-dairy cattle	Tonnes CO2e /Thousand Heads					132	134	137
manure management sheep	Tonnes CO2e /Thousand Heads Consistent Units					3,7	3,8	3,9
manure management Swine	Tonnes CO2e /Thousand Heads					88	90	92
manure management Poultry	Tonnes CO2e /Thousand Heads					0,53	0,47	0,42

5.2 Summary tables projections

Table 1. Emission Greenhouse gasses 2006 (Mton CO_2eq)

	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total
Agriculture	7,60	8,80	9,40				25,80
Waste		5,80					5,80
Industry	33,40		6,30	1,60	0,30	0,20	52,50
Transport	39,80		0,50				40,30
Energy	63,10	0,70					49,90
Other	28,30	1,00	0,80				33,20
Total	172,20	16,20	17,00	1,60	0,30	0,20	207,40

Table 2. Emission trends UR-GE scenario for 2010 (Mton CO_2eq)

	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total
Agriculture	9,7	9,1	9,3				28,1
Waste		4,4					4,4
Industry	36,5		1,8	2,2	0,3	0,2	41
Transport	40,1		0,5				40,6
Energy	68,4	0,5					68,9
Other	26,9	1,1	0,8				28,8
Total	181,7	16,1	12,3	2,2	0,3	0,2	212,8

Table 3. Emission trends UR-GE scenario for 2015 (Mton CO_2eq)

	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total
Agriculture	9,7	9,5	9,3				28,5
Waste		3,1					3,1
Industry	38,3		1,6	2,2	0,3	0,2	42,6
Transport	42,5		0,5				43
Energy	97,3	0,5					97,8
Other	25,9	2,1	0,8				28,8
Total	213,8	15,1	12,1	2,2	0,3	0,2	243,7

Table 4. Emission trends UR-GE scenario for 2020 (Mton CO_2eq)

	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total
Agriculture	10,3	9,9	9,2				29,4
Waste		2,2					2,2
Industry	40,2		1,6	2,2	0,3	0,2	44,5
Transport	44,8		0,4				45,2
Energy	103,7	0,4					104,1
Other	25,5	2,1	0,8				28,4
Total	224,6	14,6	12,1	2,2	0,3	0,2	254

Table 5. Emission trends UR-GE (h) scenario for 2010 (Mton CO_2eq)

	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total
Agriculture	9,7	9,1	9,3				28,1
Waste		4,4					4,4
Industry	36,3		1,8	2,2	0,3	0,2	40,8
Transport	40		0,5				40,5
Energy	75,6	0,5					76,1
Other	26,8	2,1	0,8				29,7
Total	188,4	16,1	12,3	2,2	0,3	0,2	219,5

Table 6. Emission trends UR-GE (h) scenario for 2015 (Mton CO_2eq)

	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total
Agriculture	9,5	9,5	9,3				28,3
Waste		3,1					3,1
Industry	37,5		1,6	2,2	0,3	0,2	41,8
Transport	41,8		0,5				42,3
Energy	93,7	0,5					94,2
Other	25,8	2,1	0,8				28,7
Total	208,4	15,1	12,1	2,2	0,3	0,2	238,3

Table 7. Emission trends UR-GE (h) scenario for 2020 (Mton CO_2eq)

	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	Total
Agriculture	10,2	9,9	9,2				29,3
Waste		2,2					2,2
Industry	39,2		1,6	2,2	0,3	0,2	43,5
Transport	43,6		0,4				44
Energy	104,7	0,4					105,1
Other	25,3	2,1	0,8				28,2
Total	223	14,6	12,1	2,2	0,3	0,2	252,4

Table 8 Emission trends NOx, SO2 and NMVOC (in Kton)

				Scenario			
	Historical		UR-GE		UR- GE(h)		
	2006	2010	2015	2020	2010	2015	2020
NOx							
Industry, Energy and Waste removal	88	74	83	85	79	84	87
Transport (NEC)	199	155	121	97	155	120	96
Agriculture	12	15	14	10	15	14	10
Residential	14	11	9	8	11	9	8
Trade, Commercial and Public services and Construction	13	10	8	6	8	6	5
Total (NEC)	**327**	**265**	**234**	**206**	**268**	**232**	**205**
SO2							
Refineries	32	16	16	16	16	16	16
Industry	15	16	17	18	16	17	18
Energy	10	8	14	14	10	14	14

Transport (NEC)	6	3	0	0	3	0	0
Agriculture	0	0	0	0	0	0	0
Trade, Commercial and Public services and Construction	1	1	0	1	0	0	0
Residential	0	1	0	0	1	1	1
Total NEC	**65**	**43**	**47**	**48**	**45**	**47**	**48**
NMVOC							
Industry (incl. waste removal)	40	41	44	47	41	44	47
Energy	7	8	9	9	8	9	9
Refineries	11	11	12	13	11	12	13
Transport (NEC)	47	31	25	21	31	24	20
Agriculture	2	2	2	2	2	2	2
Residential	32	34	36	38	34	36	38
Trade, Commercial and Public services and Construction	28	29	32	35	29	32	35
Totaal NEC NMVOC	**167**	**157**	**160**	**165**	**157**	**160**	**165**

ANNEX Chapter 8

8.1 Systematic Observation

Introduction

In the Netherlands several institutes contribute to the monitoring of Essential Climate Variables (ECVs). Funding can be long term (service based) as well as short term (project based). In principle, service based funded monitoring efforts are to be preferred in view of the demand for long term uninterrupted time-series. However, when carefully managed, project based monitoring can yield valuable contributions. Moreover, research elements can yield new or improved monitoring techniques that can be developed towards operational use.

In this Annex reference is made to the following institutes and consortia in the Netherlands that are involved in climate monitoring:

CESAR[43]; Cabauw Experimental Site for Atmospheric Research
Deltares; Dutch institute for Delta Technology
ECN; Energy research Centre of the Netherlands
NIOZ; NIOZ Royal Netherlands Institute for Sea Research
KNMI; Royal Netherlands Meteorological Institute
Rijkswaterstaat Waterdienst; Rijkswaterstaat Centre for Water Management
RIVM; National Institute for Public Health and the Environment
RUG-CIO; University of Groningen, Centre for Isotope Research
TNO Built Environment and Geosciences/IGRAC; International Groundwater Resources Assessment Centre
UU-IMAU; Utrecht University, Institute for Marine and Atmospheric Research
VU; VU University Amsterdam
WUR; Wageningen University and Research Centre - ALTERRA

1. Common issues

1.1. *Actions undertaken to introduce and/or enhance national coordination, as well as planning activities for the production and adoption of their own national implementation plans for observing, archiving and analysing their national contribution of observations of the ECVs*:

Climate monitoring is a multidisciplinary activity, to which KNMI and partner institutes in the Netherlands contribute. On request by the Ministry of Housing, Spatial Planning and the Environment, KNMI leads a project that aims at national coordination and planning of climate monitoring activities. A national plan was developed, and in the project report recommendations are provided for a coordinated optimized contribution from the Netherlands to the Global Climate Observing System. See "Climate Change Monitoring in the Netherlands, A Proposal Based on the GCOS Implementation Plan in support of the UNFCCC", June 2009. This study has been performed within the framework of the Netherlands Research Programme on Climate Change (NRP-CC), sub programme Scientific

[43] A consortium that has set up and operates at the Cabauw site an observational research facility with a comprehensive set of remote-sensing and in-situ equipment to characterise the state of the atmosphere, its radiative properties and intersection with the land surface for the study of physical and chemical processes, monitoring of the atmosphere and validation studies. Members are: Technical University Delft, KNMI, RIVM, WUR, ECN, ESA-ESTEC, TNO and IMAU.

Assessment and Policy Analysis, project 'Options for (post-2012) Climate Policies and International Agreement'.

1.2. *Efforts being undertaken to ensure that high-quality climate data records are collected, retained and made accessible for use by current and future generations of scientists and decision makers of all Parties:*

a) A significant part of the data is freely available. The policy is to make all data freely available by 2012.
b) There are no policy-level barriers to the international exchange of climate data and their provision to international data centres.
c) Most ECV-observing activities adhere to the GCOS climate monitoring principles (GCMPs). The less operational observations (e.g. for research) adhere to the GCMP's as much as feasible. Inhomogeneities resulting from changes in technology and observing practices are kept to a minimum. At KNMI a protocol is being developed to minimize discontinuities resulting from changes in measurement infrastructure and measurement location, and to allow for the calculation of corrections in view of long-term climate records.
d) At KNMI difficulties are sometimes encountered in protecting the integrity of long-term climate data records because of unforeseen changes in the availability and/or the environment of a site. A risk-analysis procedure is proposed to be part of the site selection to avoid this as much as possible.
e) Rijkswaterstaat Waterdienst, KNMI, Deltares and the Netherlands Organisation for Scientific Research participate in EuroGoos.

1.3. Efforts undertaken to ensure that international data centres are established and/or strengthened for all the ECVs. Specifically (full names and numbers of relevant actions in the GCOS implementation plan are given in quotes and parentheses):

(a) Actions undertaken to "prepare the data sets and meta-data, including historical data records, for climate analyses and reanalyses" (C11):
    KNMI has become a WMO Regional Climate Centre (RCC) for RA VI on daily climate data and climate indices, based on the ECA&D dataset (eca.knmi.nl).
(b) Actions undertaken to "establish sustainable systems for the routine and regular analysis of the ECVs including measures of uncertainty" (C12):
    See 1.3.a.
(c) Steps taken to "establish a sustained capacity for global climate reanalysis and ensure coordination and collaboration between reanalysis centres" (C13):
    No specific contribution.
(d) Experiences in diagnosing quality, availability and communications issues with climate data.
    A National Oceanographic Data Commission performs the role of national oceanographic data centre. The data are distributed over data bases at different institutions, but are accessible via a virtual data base at a single portal (www.nodc.nl).). Internationally (pan-European National Oceanographic Data Centres) archived data access is harmonized in the framework of SeaDataNet (www.seadatanet.org).

1.4. C*apacity-building:*
KNMI participates in the GCOS Cooperation Mechanism. The Netherlands announced a contribution of k€ 800 in total for 4 years (2007-2010) to the GCOS Action Plans for Africa at CoP12 in Nairobi, generated by two Ministries. In coordination with GCOS, projects are selected for support.
KNMI coordinates and supports (100 k€/y) the operation of a GAW station at the Meteorological Service of Surinam in Paramaribo. A plan for further capacity building at the Anton de Kom University with regard to atmospheric monitoring is under development. The radiation measurements are being upgraded to BSRN standards.

1.5. Initiatives undertaken to acquire palaeoclimate data, in particular activities to extend the data record in time and into new regions, and to improve the synthesis of these data:

KNMI carries out the processing of historical instrumental data (ship records and land based) and is involved in the "Buisman" reconstruction of 1000 year temperatures and precipitation in the Low Countries based on documentary data.
Paleoclimate reconstructions are carried out at several universities.
Paleo-oceanographic research in the Netherlands is carried out by universities and institutions for fundamental research.

1.6. Providing information required in these guidelines is not hampered by specific difficulties.
1.7. Multinational and international projects and organizations conducting climate observations, including multinational satellite agencies:
Several Dutch organisations contribute to international programmes that produce ECV derived from satellite observations (KNMI, SRON, NIVR). In particular two nationally funded satellite instruments, SCIAMACHY and OMI, are exploited to generate records of atmospheric ECVs. Moreover, KNMI has responsibility for the EUMETSAT ASCAT ocean wind vector and GOME2 ozone and aerosol products through the SAF programme.

See also 1.3.a.

2. Atmospheric Essential Climate Variables

2.1. Contributions to the monitoring of atmospheric ECVs

Contributions are made by the following institutes:
CESAR (Cabauw Experimental Site for Atmospheric Research) is an observational facility with a comprehensive set of remote sensing and in-situ equipment to characterize the state of the atmosphere, its radiative properties and interaction with the land surface, for the study of physical and chemical processes, climate monitoring and validation studies. It is a co-operation between TUD, KNMI, RIVM, WUR, ECN, ESA-ESTEC, TNO and IMAU. A database containing publicly available measurements is being operated. New technologies are being developed for atmospheric observation to reduce gaps in climate knowledge, including space and ground based instruments, improving representation of physical processes in climate models.

ECN (Energy Research Centre of the Netherlands) is monitoring atmospheric composition at the Cabauw tower since 1992 (continuous vertical gradients of CO_2, CH_4, N_2O, SF6, CO, H2 and 222Rn; continuous concentrations of halocarbons, and event sampling for isotopic analysis in collaboration with RUG-CIO), and aerosols (size distribution, size resolved chemical composition, cloud forming properties, radiative properties). It is a partner in international projects such as CarboEurope IP, NitroEurope IP, IMECC, Geomon and ICOS (Integrated Carbon Observing System). It is national focal point for ICOS. Specific activities focus on network optimisation, capacity building in Eastern Europe, higher network density, data quality, emission verification for greenhouse gases and concentration data submission to bodies like EMEP (European Monitoring and Evaluation Programme) and GAW.

KNMI (Royal Netherlands Meteorological Institute) is responsible for the operation of national networks for weather and climate monitoring, especially in the Atmospheric and Oceanic Domains. It is contributing to the global aircraft monitoring system AMDAR, as well as to the development of satellite instruments and retrieval techniques for atmospheric composition, aerosol and cloud monitoring. KNMI facilitates and contributes to observations at the Cabauw 200 m tower observatory, including a BSRN station, cloud remote sensing and in situ instruments. At a wider scope than the Atmospheric Domain, KNMI is responsible for collecting, quality controlling and identifying and filling gaps of observational time series and subsequent sustainable archiving in the National Observational Database. Twice daily upper air observations and weekly ozone soundings are

performed in De Bilt as well as continuous ozone measurements by Brewer, which are submitted regularly to WMO databases.
KNMI is the principal investigator institute of the Ozone Monitoring Instrument (OMI) on board the NASA EOS AURA satellite and is responsible for the generation and distribution of the OMI observations on atmospheric composition. KNMI is also principle investigator for the recently approved TROPOMI instrument, planned to be launched in 2014.
Other activities on climate monitoring by satellites include wind, cloud, aerosol and ozone observations through the EUMETSAT Satellite Application Facilities (SAF) and a strong involvement in future ESA missions Sentinel 5 Precursor, ADM-Aeolus, EarthCare and TRAQ. KNMI is digitizing and archiving national and a selected set of international historical observations. It is also co-organizer of a WMO workshop on data rescue for the Mediterranean area (RAVI and RAI). It contributes to national and international research to the reconstruction of instrumental and proxy series into high quality paleoclimate observational time series. Homogenisation of data sets and individual time series is done in cooperation with COST-ES0601. KNMI is also operating a measurement station in Paramaribo, Surinam together with the Meteorological Service of Surinam. KNMI participates in the GCOS Cooperation Mechanism. At CoP12 in Nairobi, the Netherlands announced a contribution of 800 k€ in total for 4 years (2007-2010) to the GCOS Action Plans for Africa, generated by the Ministries of V&W and VROM. A digitizing project of historical data in cooperation with the Indonesian Weather Service has started recently.

RIVM (National Institute for Public Health and the Environment) is operating the National Air Quality Monitoring Network, monitoring atmospheric composition (greenhouse gases, aerosols/particulate matter and other air quality parameters). On national level RIVM collaborates with partners in CESAR contributing with measurements of vertical profiles of water vapour, aerosols and clouds, and ground based measurements of aerosols/particulate matter (mass, size distribution and optical properties), UV radiation, and tropospheric ozone. RIVM is also contributing to international observation networks for ground based remote sensing of atmospheric composition, in particular EARLINET (European Aerosol Research Lidar Network) and NDACC (Network for Detection of Atmospheric Composition Change) and GALION (GAW Aerosol Lidar Observation Network). In NDACC RIVM operates a stratospheric ozone lidar in Lauder, New Zealand.

RUG-CIO is operating a 60 m tower observation station at Lutjewad (north-eastern coast) for greenhouse gas concentrations and fluxes of CO2. Besides continuous high precision concentration measurements of the gases CO_2, CH_4, CO, SF_6 and N_2O the concentrations of O_2/N_2 and ^{222}Rn are measured. Also bi-weekly resp. monthly integrated samples of $^{14}CO_2$ are taken. Weekly grab flask samples are additionally analyzed for stable isotopes of CO_2 and eventually $^{14}CO_2$. Lutjewad is equipped with meteorological instruments (7 m, 40 m, 60 m) including solar radiation.
Focal points are fossil-fuel CO_2 quantification by means of ^{14}C-analysis in the Groningen laboratory as well as observation-based ^{222}Radon-calibrated national greenhouse gas flux estimates. Research is done on ^{222}Radon soil fluxes in order to improve the latter flux estimates. -RUG-CIO operates continuous measurement equipment for O_2/N_2 and CO_2, and flask sampling on the North Sea based gas production platform F3. RUG-CIO is operating a small European flask sampling network for CO_2 (including isotopes), CH_4 and CO analysis. The feasibility of continuous monitoring of biofuel additions to power stations by means of ^{14}C is investigated. RUG-CIO also takes part in the CarboEurope-IP, CarboOcean-IP and ICOS project.

Table 1a. National contributions to the surface-based atmospheric essential climate variables

Contributing networks specified in the GCOS implementation plan	ECVs	Number of stations or platforms currently operating	Number of stations or platforms operating in accordance with the GCMPs	Number of stations or platforms expected to be operating in 2010	Number of stations or platforms providing data to the international data centres	Number of stations or platforms with complete historical record available in international data centres
GCOS Surface Network (GSN)	Air temperature	1	1	1	1	1
	Precipitation	1	1	1	1	1
Full World Weather Watch/Global Observing System (WWW/GOS) surface network	Air temperature, air pressure, wind speed and direction, water vapour	35 (land) 8 (sea)	35 8	35 8	35 8	35 8
	Precipitation	320	320	320	320	320
Baseline Surface Radiation Network (BSRN)	Surface radiation	1	1	1	1	1
Solar radiation and radiation balance data	Surface radiation	34	34	34	34	34
Ocean drifting buoys	Air temperature, air pressure	KNMI participates in	DBCP and E-Surfmar			
Moored buoys	Air temperature, air pressure					
Voluntary Observing Ship Climate Project (VOSClim)	Air temperature, air pressure, wind speed and direction, water vapour	40	40	80	40	40
Ocean Reference Mooring Network and sites on small isolated islands	Air temperature, wind speed and direction, air pressure					
	Precipitation					

Table 1b. National contributions to the upper-air atmospheric essential climate variables

Contributing networks specified in the GCOS implementation plan	ECVs	Number of stations or platforms currently operating	Number of stations or platforms operating in accordance with the GCMPs	Number of stations or platforms expected to be operating in 2010	Number of stations or platforms providing data to the international data centres	Number of stations or platforms with complete historical record available in international data centres
GCOS Upper Air Network (GUAN)	Upper-air temperature, upper-air wind speed and direction, upper-air water vapour					
Full WWW/GOS Upper Air Network	Upper-airtemperature, upper-air wind speed and direction, upper-air water vapour	1	1	1	1	1

Note: Cloud and aerosol properties are among the ECVs in the Atmospheric Domain, but are not listed in table 1b. See Chapter 5 for activities in the Netherlands on cloud monitoring.

Table 1c. National contributions to the atmospheric composition

Contributing networks specified in the GCOS implementation plan	ECVs	Number of Stations or platforms currently operating	Number of stations or platforms operating in accordance with the GCMPs	Number of stations or platforms expected to be operating in 2010	Number of stations or platforms providing data to the international data centres	Number of stations or platforms with complete historical record available in international data centres
World Meteorological Organization/ Global	Carbon dioxide	3	3 As much as possible	6	3	1
Atmosphere Watch (WMO/GAW) Global Atmospheric CO2	Methane	3	3 As much as possible	6	3	1
& CH4 Monitoring Network	Other greenhouse gases	3	3 As much as possible	6	3	1
WMO/GAW ozone sonde network	Ozone	2	2	2	2	2
WMO/GAW column ozone network	Ozone	2	2	2	2	2
WMO/GAW Aerosol Network	Aerosol optical depth					

	Other aerosol properties

2.2. Satellite measurements for the atmospheric ECVs and associated global products in which KNMI is involved are listed in Table 2.

Table 2. Global products requiring satellite observations and measurement techniques used
The Netherlands, and especially KNMI, is involved in measurements listed below.

ECVs/ Global products requiring satellite observations	**Fundamental climate data records required for product generation (from past, current and future missions)**
Surface wind speed and direction Surface vector winds analyses, particularly from reanalysis	Scatterometry
Water vapour Total column water vapour over land	GPS
Cloud properties Cloud radiative properties (initially key ISCCP products)	VIS/IR imagery
Precipitation Improved estimates of precipitation, both as derived from specific satellite instruments and as provided by composite products	Passive microwave radiances, active radar (for calibration)
Ozone Profiles and total column of ozone	UV/VIS and IR microwave radiances
Aerosol properties Aerosol optical depth and other aerosol properties	VIS/NIR/SWIR radiances

2.3. Actions taken in response to the following recommended actions on the atmospheric ECVs contained in the GCOS implementation plan (numbers of relevant actions in the plan are given in parentheses):

(a) Applying the GCMPs to all surface climate networks (A3):
All ECV-observing activities adhere to the GCOS climate monitoring principles (GCMPs). Inhomogeneities resulting from changes in technology and observing practices are kept to a minimum. A protocol is being developed to minimize discontinuities resulting from changes in measurement infrastructure and location, and to allow for the calculation of corrections in view of long-term climate records.

(b) Incorporating atmospheric pressure sensors into drifting buoy programmes (A5):
KNMI participates in DBCP and E-Surfmar.

(c) Ensuring availability of three-hourly mean sea level pressure and wind speed and direction data from GSN stations (A10):
These data are available.

(d) Implementing a reference network of high-altitude, high-quality radiosondes (A16):
- The Netherlands is not involved in the development of a Reference Network.
- KNMI and CESAR are active in a related field: the Cabauw site is part of GRUAN.

(e) Operating the WWW/GOS radiosonde network in full compliance with the GCMPs and coding conventions (A17):
KNMI operates a regular radiosonde station (2 flights per day) at De Bilt (06260), in full compliance with the GCMPs and coding conventions;

(f) Submitting metadata records and inter-comparisons for radiosonde observations to the specified international data centres (A18):
Meta-data records are submitted. There are no specific intercomparisons in the Netherlands.

(g) Developing a network of ground-based Global Positional System (GPS) receivers for measuring water vapour (A21):
A network of 35 stations is in operation since 2005. The data are archived and available.

(h) Sustained measurements of the atmospheric composition ECVs, supplementary to those activities implicit in table 1c:

ECN is monitoring atmospheric composition at the Cabauw tower since 1992 (continuous vertical gradients of CO2, CH4, N2O, SF6, Halocarbons, Rn and H2, event sampling for isotopic analysis in collaboration with RUG-CIO), and aerosols (size distribution, size resolved chemical composition, cloud forming properties, radiative properties).

3. Oceanic Essential Climate Variables

3.1. Contributions to the monitoring of oceanic ECVs.

Contributions are made by the following institutes:
Deltares is a new and independent institute in the Netherlands building on knowledge and expertise concerning water, soil, and the subsurface, and is playing a role in providing the government and private sector with applied research and specialist advice.
Concerning Climate monitoring Deltares provides feedback to monitoring programmes based on analysis and integration of information sources into decision making where climate relevant aspects play a role. (i.e. spatial planning, EU-Directive on Marine Water Quality).

KNMI (Royal Netherlands Meteorological Institute) is responsible for the operation of national networks for weather and climate monitoring, especially in the Atmospheric and Oceanic Domains. As for the Oceanic Domain KNMI contributes to the international VOS, VOSClim and ARGO networks. KNMI also contributes to the quality control of the US Maury Collection. KNMI participates in the EUMETSAT Ocean and Sea Ice SAF and is responsible for the global production of scatterometer winds.

NIOZ (Royal Netherlands Institute for Sea Research) is an institute for fundamental multidisciplinary research in coastal seas and oceans. In the framework of that research a number of climatic monitoring programmes are maintained. In the western Wadden Sea the benthic ecosystem is monitored since over 30 years, while continuous observations of sea surface temperature and salinity extend a time series, started in 1860. Moored profiling CTDs in the Irminger Sea monitor the hydrography of the Irminger Sea since 2003. A moored current meter array in the Mozambique Channel determines the ocean transport at the tropical-subtropical connection in the western Indian Ocean. NIOZ intends to submit its vast archive of sea surface temperature and salinity data to the appropriate GCOS data centre.

Rijkswaterstaat is operating the North Sea Monitoring Network covering the Dutch Continental Shelf (wave buoys, fixed sea level monitoring stations, water temperature). It also runs a chemical monitoring programme (22 offshore ship based stations (32x/year temperature, salinity, nutrients, micro pollutants etc.) and combined biological monitoring programme (phytoplankton, zoo-plankton, ((shell-) fish, birds etc.). Rijkswaterstaat Centre for Water Management also carries out a coastal research programme (local and large scale coastal dynamics related to sea level rise).

Under the National Offshore Mining Act oil and gas exploration production platforms monitor and distribute data on waves, sea level, temperature, wind etc. A yearly morphological survey and coastline monitoring (dune height and bathymetry up-to 20 m) is carried out as well. Other activities are SEPRISE (Sustained, Efficient Production of Required information Services) for real time oceanographic data, Pan-European infrastructure for Ocean & Marine Data Management (SEADATANET) for historical data and North West Shelf Operational Oceanographic System (NOOS) for North Sea monitoring and modelling capacity.

Rijkswaterstaat Directorate North Sea is maintaining a Ferrybox-line (NL-Norway) with VOS weekly service for water quality parameters. A comparable suite of sensors is installed on a fix buoy near Oysterground.

3.2. Actions in nominating national focal points for implementation of the oceanic observing system for climate and establishing partnerships between the ocean research and operational communities:

KNMI is national focal point for ARGO and for the Data Buoy Cooperation Panel.

Table 3a. National contributions to the oceanic essential climate variables – surface

Contributing networks specified in the GCOS implementation plan	ECVs	Number of stations or platforms currently operating	Number of stations or platforms operating in accordance with the GCMPs	Number of stations or platforms expected to be operating in 2010	Number of stations or platforms providing data to the international data centres	Number of stations or platforms with complete historical record available in international data centres
Global surface drifting buoy array on 5x5 degree resolution	Sea surface temperature, sea level pressure, position-change based current					
GLOSS Core Sea-level Network	Sea level				4	2
Voluntary observing ships (VOS)	All feasible surface ECVs	200	200	200	200	200
Ships of Opportunity	All feasible surface ECVs	2		4	1	0

Table 3b. National contributions to the oceanic essential climate variables – water column

Contributing networks specified in the GCOS implementation plan	ECVs	Number of stations or platforms currently operating	Number of stations or platforms operating in accordance with the GCMPs	Number of stations or platforms expected to be operating in 2010	Number of stations or platforms providing data to the international data centres	Number of stations or platforms with complete historical record available in international data centres
Global reference mooring network	All feasible surface and subsurface ECVs					
Global tropical moored buoy network	All feasible surface and subsurface ECVs					
Argo network	Temperature, salinity, current	25	25	35	25	31
Carbon inventory survey lines	Temperature, salinity, ocean tracers, biogeochemistry variables					

3.3. Actions taken in response to the following recommended actions on the oceanic ECVs contained in the GCOS implementation plan (numbers of relevant actions in the plan are given in parentheses):

(a) Improving metadata acquisition and data management for the VOSClim subset of the VOS (O6):

At KNMI data entry software (TurboWin) for VOS and VOSClim is developed and maintained. The software is kept up-to-date with the latest data and meta-data requirements according to JCOMM's SOT and ETMC advices. TurboWin complies completely with the latest VOSClim requirements.

(b) Ensuring that high-frequency (hourly or less) sea level observations are available for all coastal tide gauges, including historical records, are corrected for sea level pressure and are submitted to the specified international data centres (O13):

Rijkswaterstaat is sharing Sea level data of 5 coastal stations in the Dutch Coastal waters through EuroGOOS-NOOS. Historical SL-data is available through SeaDataNet on Pan-European scale.

(c) Including sea level objectives in the capacity-building programmes of GOOS, JCOMM, WMO, other related bodies and the system-improvement programme of GCOS (O14):

No contribution.

(d) Developing a robust programme to observe sea surface salinity, to include VOS ships, research ships, reference moorings and drifting buoys (O15):

Rijkswaterstaat is maintaining an automatic monitoring programme (Ferrybox) on a freight Coaster-line IJmuiden-Bergen (N) and runs a undulating fish and Ferrybox monitoring programme on their survey vessel (Zirfea) during weekly cruises (T, S, DO, Nutrients, light, TSM, phytoplankton).

(e) Implementing a programme for measuring surface pCO2 (O17):

No contribution.

(f) Implementing a wave measurement component as part of the Surface Reference Mooring Network (O19):

No contribution.

(g) Improving in situ sea ice observations from buoys, visual surveys (Ship of Opportunity Programme (SOOP) and aircraft) and upward-looking sonar's, and implementing observations in the Arctic and Antarctic (O23):

No contribution.

(h) Conducting the systematic global full-depth water column sampling of 30 sections repeated every 10 years (including ocean carbon inventory change) (O25):

Since 2000 NIOZ performs a bi-annual hydrographic survey of the WOCE AR7E section between Ireland and Greenland, including temperature, salinity, dissolved oxygen, nutrients, and total dissolved carbon.

(i) Performing the 41 SOOP XBT/XCTD trans-oceanic sections (O26):

No contribution.

(j) Developing capability for systematic measurement of biogeochemical and ecological ECVs (O30):

No contribution.

(k) Supporting data rescue projects and implementing regional, specialized and global data and analysis centres (O36 and O37):

At KNMI the HISKLIM project overarches different smaller projects in which data rescue is the main issue. Data from mainly Dutch, land based stations are keyed or scanned and made available to a larger audience. Special software is developed at KNMI to extract data from graphs (pluviographs, barographs, wind registrations, thermographs, etc.). In collaboration with NCDC (Asheville, NC, USA), several Dutch ship logbooks (1854-1880) will be keyed.

4. Terrestrial Essential Climate Variables

4.1. Contributions to the monitoring of terrestrial ECVs

Contributions are made by the following institutes:
Rijkswaterstaat Centre for Water Management monitors the physical, chemical and biological state of the main water system in the Netherlands. This includes water levels and discharge at the main inflow (e.g. river Rhine and Meuse) and the discharge to the North Sea. Water levels, temperature and some other physical parameters are measured on a continuous basis.
Rijkswaterstaat monitors and archives water related data as part of its legal task (MWTL - Monitoring Programme of the National Water Systems). This includes ECVs, the discharge of River Meuse and Rhine.

TNO Built Environment and Geosciences is monitoring groundwater levels and groundwater quality. Measurement series of groundwater levels and groundwater quality at approximately 20.000 sites in the Netherlands are stored in the DINO-system. The DINO-system is the central storage site for geo-scientific data on the shallow and deep Dutch subsurface and resorts under the DINO-programme, aimed at maintaining and improving the National Geological Database in the Netherlands. There is an on-going research programme to improve data acquisition, data storage and data distribution. The focus is on sensor networks and Sensor Web Enablement (SWE). Some initial research has been conducted investigating the relation between climate change and groundwater.

IGRAC (International Groundwater Resources Assessment Centre) has taken initiative to establish a Global Groundwater Monitoring Network (GGMN). The network will become operational in 2008, having a web-based application and people network as the main components. This network will provide crucial data for the climate change - groundwater analyses. It will use aggregated information from existing networks in order to represent a regional change of groundwater resources at the scale relevant for the global assessment. The main challenge is setting up a people network (read further at http://www.igrac.net/publications/281). With the GGMN, IGRAC is responsible for the global groundwater observations in the GEO (Group of Earth Observations) work plan for 2009-2011 and in the GCOS/WMO Global Terrestrial Network Hydrology (GTN-H). Besides, IGRAC is involved in several projects and initiatives related to impact of climate change on groundwater such as Initiative with Cooperative Programme on Water and Climate (CPWC) and Groundwater Resources Assessment under the Pressures of Humanity and Climate Changes (GRAPHIC).

UU-IMAU (Utrecht University, Institute for Marine and Atmospheric Research) is monitoring ice-caps and glaciers. Automatic weather stations are operated on glaciers in the Alps, Norway, Greenland and Antarctica. Mass balance measurements are carried out on the Greenland ice sheet.

The VU Amsterdam operates a GHG observation site on a fen meadow Horstermeer, where energy balance and moisture fluxes are observed, next to CO_2 and CH_4 emissions. The VU coordinates the efforts of several Dutch Institutions in the Integrated Carbon Observing System, a European ESFRI infrastructure proposal. VUA is producing maps of soil moisture from microwave radiation satellites and is active in Groundwater Resources Assessment under the Pressures of Humanity and Climate Changes (GRAPHIC). VUA is a partner in several EU funded monitoring programs such as CarboEurope, IMECC, and Watch. The VU also chairs the GCOS Terrestrial Observation Panel for Climate. VUA has developed with funding from EU and ESA a globally gridded long term soil moisture product from microwave observations.

WUR- (Wageningen University and Research centre) is monitoring soil and soil moisture parameters, land-use (change) and land bound GHG emissions. Fluxes of CO_2, water vapour, sensible heat and momentum are continuously monitored at Loobos forest site since 1994. Additional flux monitoring sites (also including N_2O and CH_4 fluxes) are being operated for shorter periods over a variety of other land cover types (crops, grasslands, peat lands, etc). This flux monitoring network is a collaborative action between WUR and a number of other universities and research centres (VU Amsterdam, ECN, TNO, RUG), largely initiated through the CarboEurope and NitroEurope projects. Data are managed

and made accessible at national and European level. It also provides observations and archiving of phenological data (Nature's Calendar).
WUR-ALTERRA also provides capacity building and incidental support for infrastructure in the field of terrestrial observations in cooperation with the Ministry of Agriculture, Nature and Food Quality.

CIO-RUG is monitoring soil moisture, fluxes of CO_2, water vapour, sensible heat and momentum at Lutjewad in cooperation with WUR.

The Netherlands Environmental Assessment Agency (PBL) coordinates Emission Database for Global Atmospheric Research (EDGAR) information system. This is a joint project of research institutes in the Netherlands, Italy and Germany. It stores global emission inventories of direct and indirect greenhouse gases from anthropogenic sources including halocarbons and aerosols both on a per country and region basis as well as on a grid. PBL also coordinates the History Database of the Global Environment (HYDE). It presents not only (gridded) time series for the last 300 years of population and land use, but also various other indicators such as GDP, Value Added, Livestock, Private Consumption, GHG emissions, and Industrial production data.

4.2. Efforts to introduce national coordination and planning of terrestrial programme activities:

A terrestrial GHG monitoring facility is currently being organised as Dutch contribution to the European ESFRI programme ICOS (Integrated Carbon Observing System, http://icos-infrastructure.ipsl.jussieu.fr/). Building on partnerships developed during the European 'CarboEurope-IP' and the national 'Climate Changes Spatial Planning' programme, a 20M€ proposal has recently been submitted to establish a monitoring and modelling infrastructure for GHG exchange and atmospheric composition covering a period of 5 year, but explicitly intended to run for many years after that. It foresees the establishment /continued operation of a number of tall-towers for high precision, multiple GHG concentration monitoring, a C14 lab, a number of fluxtowers covering the main landscape elements, aircraft operations, and inverse modelling facilities. Due to the restricted budget for infrastructures available in 2009, another application will be filed later in 2009 or 2010.

Table 5. National contributions to the terrestrial domain essential climate variables

Contributing networks specified in the GCOS implementation plan	ECVs	Number of stations or platforms currently operating	Number of stations or platforms operating in accordance with the GCMPs	Number of stations or platforms expected to be operating in 2010	Number of stations or platforms providing data to the international data centres	Number of stations or platforms with complete historical record available in international data centres
GCOS baseline river discharge network (GTN-R)	River Discharge	1	1	1	2	2
GCOS Baseline Lake Level/ Area/Temperature Network (GTN-L)	Lake level/area/ temperature					
WWW/GOS synoptic network	Snow cover Only on precipitation stations, not GOS	320 See 4.3.d	320 See 4.3.d	320 See 4.3.d	320 See 4.3.d	320 See 4.3.d
GCOS glacier monitoring	Glaciers mass balance and	See 4.3.e	See 4.3.e	See 4.3.e	See 4.3.e	See 4.3.e

network (GTN-G)	length, also ice sheet mass balance
GCOS permafrost monitoring network (GTN-P)	Permafrost Borehole temperatures and active-layer thickness

4.3. Actions taken in response to the following recommendations on the terrestrial ECVs contained in the GCOS implementation plan (numbers of relevant actions in the plan are given in parentheses):

(a) Developing a global network of approximately 30 sites based on a progressive evolution of existing reference sites to monitor key biomes and provide the observations required for the calibration and validation of satellite data (T3):

(One of the) Sites covered by the ICOS infrastructure (see 4.2) could be part of this network, being very suited because of a long term monitoring history. International coordination to become part of this reference site network needs still to be initiated.

(b) Maintaining and expanding programmes for monitoring groundwater and aquifers (GCOS-IP Milestone):

IGRAC has taken an initiative to develop a Global Groundwater Monitoring Network. This network will provide data for analyses of climatic change impact on groundwater resources. Special attention will be paid to recharge and salinisation in coastal aquifers. In October 2007 IGWCO/GARS/UNESCO groundwater working group has organized a high-profile international workshop at IGRAC to define the postulates of GGMN. In meantime, a web-based software application for GGMN is developed and the network is embedded in various projects and international working groups. IGRAC is a member of the Global Terrestrial Network – Hydrology (GTN-H), being responsible for groundwater monitoring (http://gtn-h.unh.edu/). Groundwater is one of the essential climate variables.

The data to be collected for GGMN at the territory of the Netherlands are readily available at TNO Built Environment and Geosciences.

(c) Archiving and disseminating information related to irrigation and water resources (T9):

See (b).

(d) Strengthening existing sites for observing snow cover and snowfall and recovering and submitting historical data to the specified international data centres (T10):

KNMI measures snowfall, snow cover and snow height on manned precipitation stations, on GOS stations only snowfall.

(e) Maintaining sites for observing glaciers and adding additional sites and infrastructure in Africa, the Himalayas, New Zealand and South America (T13):

UU-IMAU (Utrecht University, Institute for Marine and Atmospheric Research) is monitoring ice-caps and glaciers on a research basis at various locations, e.g. by collecting photographic documentation. Automatic weather stations are operated on glaciers in the Alps, Norway, Greenland and Antarctica. Mass balance measurements are carried out on the Greenland ice sheet.

(f) Adding the 150 additional permafrost sites identified by GTN-P to cover the high mountains of Asia, Europe and the southern hemisphere, and the North American alpine lands and lowlands, and providing data to the specified international data centres (T16):

No contribution.

(g) Reanalysing historical data concerning the terrestrial ECVs (no reference in GCOS-IP):

To the author's awareness, currently no re-analysis effort with terrestrial ECVs is undertaken.

5. Additional information

Additional information on national climate programmes that contribute observations of the ECVs not reported elsewhere in this report:

(a) KNMI contributes to the JCOM DBCP activities.
(b) KNMI participates in the EUMETNET SURFMAR programme.
(c) At KNMI ocean stress is derived from satellite observations.
(d) The CESAR consortium (8 Netherlands' Institutes) operates various ground based remote sensing systems at the Cabauw site that measure cloud and aerosol properties in view of monitoring and research. Also improved measurement techniques are being developed.
(e) KNMI coordinates the EURO4M project (2010-2013), which is a 4M€ project funded by the European Commission to improve climate change monitoring services for Europe by seamlessly combining regional reanalysis and observation datasets.
(f) IGRAC is responsible for the global groundwater observations in the GEO (Group of Earth Observations) work plan for 2009-2011 and in the GCOS/WMO Global Terrestrial Network Hydrology (GTH-N). This network is not mentioned in Table 5. See also 4.1.
(g) The Netherlands is at the forefront of the development of the Integrated Carbon Observation System (ICOS), both nationally and internationally.
(h) Deltares is responsible in EuroGOOS-NOOS as chair on the issue of coordinating monitoring activities on the NOOS-targeted area (NW Continental Shelf). The focus has been on the monitoring and forecasting of hydrodynamical variables like SL and waves and is now shifted towards the water quality (chemical/biological) related variables related to Quality Status Reporting and trend analysis related to impacts from EU-Marine Strategy Policy measures. Impact of climate change in coastal sea should be extracted from trends by Global correlations.

8.2 Research: Dutch cooperation in EU research projects and networks

Dutch cooperation in research projects and networks financed by the EU's 6th and 7th Framework Programmes (FP) and other European Funds
Climate and monitoring
● EUROCORES / EuroCLIMATE (ESF programme). Processes in the European passive continental margins/climate variability and (past, present and future) carbon cycle (Dutch participation within the projects PaleoSalt, CASIOPEIA, CHALLACEA, RESOLuTION, MERF).
● 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
● HYMN (FP6). HYdrogen, Methane and Nitrous oxide: Trend variability, budgets and interactions with the biosphere
● STAR (FP6). Support for Tropical Atmospheric Research
● ECORD (ERA-NET). The European Consortium for Ocean Research Drilling
● CIRCLE (ERA-NET). Climate Impact Research Coordination for a Larger Europe
● 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
● EU Cliwoc. Climatological database for the world's oceans 1750-1850
● EU METNET. A network grouping 20 European national meteorological services
● AquaTerra (FP6). Improved river basin management through a better under-standing of the river-sediment-soil-groundwater system
● ENCORA (FP6). European Network on Coastal Research
● European forum on Integrated environmental assessment (EFIEA)
● GMES. Operational satellite information for environmental and climate studies
● EPOCA (FP7). European project on ocean acidification
● CEOP-AEGIS (FP7). Coordinated Asia-European long-term observing system of qinghai tibet plateau hydro-meteorological processes and the asian-monsoon system with ground satellite image data and numerical simulations
● COCOS (FP7). Coordination action carbon observation system
● WISER (FP7). Water bodies in Europe: integrative systems to assess ecological status and recovery
● MICORE (FP7). Morphological impacts and coastal risks induced by extreme storm events
● DiPol (Interreg IVB / North Sea Region). Impact of Climate Change on the quality of urban and coastal waters
Carbon Cycle and Land Use
● FLUXNET, Integrating worldwide CO2 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
● EU-RURALIS. Scenario study of future land use, its drivers and consequences
● LUPIS (FP6). Land use policies and sustainable development in developing Countries
● DESIRE (FP6). Desertification mitigation and remediation of land - a global approach for local solutions
● CARBO-EXTREME (FP7). The terrestrial Carbon cycle under climate variability and extremes a Pan-European synthesis
● GENESIS (FP7). Groundwater and dependent Ecosystems: NEw Scientific basIS on climate change and land-use impacts for the update of the EU Groundwater Directive
● ALFA (Interreg IVB / North-West Europe). Adaptive Land use for Flood Alleviation
● Biochar (Interreg IVB / North Sea Region). Climate changing soils
Biodiversity
● PEER. Biodiversity, landscape planning, aquatic ecosystems, pollution and its remediation
● 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
● BiodivERsA (ERA-NET). Biodiversity Research
● MARBEF (FP6). MARine Biodiversity and Ecosystem Functioning
● LIVEDIVERSE (FP7). Sustainable livelihoods and biodiversity in riparian areas in developing countries
● MEECE (FP7). Marine ecosystem evolution in a changing environment
● MOTIVE (FP7). Models for adaptive forest management
● CLEAR (FP7). Climate change, environmental contaminants and reproductive health
● ForeStClim (Interreg IVB / North-West Europe). Transnational Forestry Management Strategies in Response to Regional Climate Change Impacts

Economic Sectors
● STELLA (FP6). Sustainable Transport
● CITYMOBIL (FP6). Towards advanced road transport for the urban environment
● ECODIESEL (FP7). High effiency biodiesel plant with minimum ghg emissions for improved fame production from various raw materials
● NEARCO2 (FP7). New participation and communication strategies for neighbours of CO2 capture and storage operations
● CO2EUROPIPE (FP7). Towards a transport infrastructure for large-scale CCS in Europe
● BIOREF-INTEG (FP7). Development of advanced biorefinery schemes to be integrated into existing industrial fuel producing complexes
● BIOTOP (FP7). Biofuels assessment on technical opportunities and research needs for Latin America
● SUSTOIL (FP7). Developing advanced Biorefinery schemes for integration into existing oil production/transesterification plants
● SUPER METHANOL (FP7). Reforming of crude glycerine in supercritical water to produce methanol for re-use in biodiesel plants
● ESPON (Interreg III). European Spatial Planning Observation Network
● URBAN-NET (ERA-NET). Urban environment, urban Sustainability
● Aquarius (Interreg IVB / North Sea Region). The farmer as water manager under changing climatic conditions
● ECCO (FP7). European value chains for CO2

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
● SWITCH (FP6). Sustainable Water management Improves Tomorrow's Cities' Health
● CREATE ACCEPTANCE (FP6). Cultural influences on renewable energy acceptance and tools for the development of communication strategies to promote acceptance among key actor groups
● Sustainable consumption policies efficiency evaluation - SCOPE2 (FP6). European contribution to climate related polar research
● ECOSTILER (FP6). Energy efficient COmmunity STimulation by use and Integration of Local Energy Resources
● STACCATO (FP6). Sustainable technologies and combined community approaches take off
● BIOENERGY IN MOTION (FP6). Production of a movie to accelerate the uptake of innovative bioenergy technologies for heating and cooling
● SORCER (FP6). Stimulating obtaining results in communities in relation to energy-efficiency and renewables
● CRRESCENDO (FP6). Combined rational and renewable energy strategies in cities, for existing and new dwellings and optimal quality of life
● CAB-CEP (FP6). Co-ordination action biofuel cities European partnership
● REMINING-LOWEX (FP6). Redevelopment of European mining areas into sustainable communities by integrating supply and demand side based on low exergy principles
● EMINENT (FP6). Early market introduction of new energy technologies in liaison with science and industry
● DESIRE (FP6). Desertification Mitigation and Remediation of land - a global approach for local solutions
● MOVECBM (FP6). Monitoring and verification of CO2 storage and ECBM in Poland
● PV catapult (FP6). Industry, consultants and research institutes working together to give a boost to EU solar energy
● CRUE (ERA-NET). Coordination of the research financed in the European Union on flood management
● IWRM-NET (ERA-NET). Integrated water resource management
● ESPACE (INTERREG III). European spatial planning adapting to climate events
● AMICA (Interreg III). Adaptation and Mitigation – an Integrated Climate Policy Approach

● AWARE (Interreg III). Attention to Warning And Readiness in Emergencies
● FLAPP (Interreg III). Flood Awareness and Prevention Policy in border areas
● MESSINA (Interreg III). Managing European Shoreline and Sharing Information on Nearshore Areas
● Wege des Wassers (Interreg III). Operational water management in the EU region Meuse-Rhine
● 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
● SUSPLAN (FP7). Development of regional and Pan-European guidelines for more efficient integration of renewable energy into future infrastructures
● REALISEGRID (FP7). Research, methodologies and technologies for the effective development of pan-European key GRID infrastructures to support the achievement of a reliable, competitive and sustainable electricity supply
● IRENE-40 (FP7). Infrastructure roadmap for energy networks in Europe
● PLANETS (FP7). Probabilistic long-term assessment of new energy technology scenarios
● EFONET (FP7). Energy foresight network
● STRACO2 (FP7). Support to regulatory activities for carbon capture and storage
● BARENERGY (FP7). Barriers for energy changes among end consumers and households
● ENSURE (FP7). Enhancing resilience of communities and territories facing natural and na-tech hazards
● WETWIN (FP7). Enhancing the role of wetlands in integrated water resources management for twinned river basins in EU, Africa and South-America in support of EU water initiatives
● MIRAGE (FP7). Mediterranean intermittent river management
● IMPRINTS (FP7). IMproving Preparedness and RIsk maNagemenT for flash floods and debriS flow events
● SAFELAND (FP7). Living with landslide risk in Europe: Assessment, effects of global change, and risk management strategies
● XEROCHORE (FP7). An exercise to assess research needs and policy choices in areas of drought
● HighNoon (FP7). Adaptation to changing water resources availability in northern India with Himalayan glacier retreat and changing monsoon pattern
● AMICE (Interreg IVB / North-West Europe). A coordinated strategy for the Adaptation of the Meuse to the Impacts of Climate Evolutions on floods and low-flows with the perspective of sustainable development in the Meuse international catchment basin
● FloodResilienCity (Interreg IVB / North-West Europe). Improved integration of increased urban development and flood risks in major cities
● Future Cities (Interreg IVB / North-West Europe). Urban Networks to Face Climate Change
● WAVE (Interreg IVB / North-West Europe). Water Adaptation is Valuable for Everybody
● IMCORE (Interreg IVB / North-West Europe). Innovative Management for Europe's Changing Coastal Resource
● MARE (Interreg IVB / North Sea Region). Managing Adaptive Responses to changing flood risk in the North
● SAWA (Interreg IVB / North Sea Region). Strategic Alliance for integrated Water Management Actions
● SUSCOD (Interreg IVB / North Sea Region). Sustainable Coastal Development in Practise
● CPA (Interreg IVB / North Sea Region). Climate Proof Areas
● CLIWAT (Interreg IVB /North Sea Region). Adaptive and sustainable water management and protection of society and nature in an extreme climate
● GRaBS (Interreg IVC). Green and Blue Space Adaptation for Urban Areas and Eco Towns
Research and development on mitigation and adaptation technologies
● HYVOLUTION (FP6). Non-thermal production of pure hydrogen from biomass
● CO2REMOVE (FP6). CO2 geological storage: research into monitoring and verification technology
● NATURALHY (FP6). Preparing for the hydrogen economy by using the existing natural gas system as a catalyst
● Zero Emission fossil fuel power plant SecretariaT - ZEST (FP6). Secretariat to support the operations of the Zero Emission Fossil Fuel Plant Technology platform (ZEFFPP-TP).
● CAPRICE (FP6). CO2 capture using amine processes: International cooperation and exchange
● IPHE-GENIE (FP6). International Partnership for a Hydrogen Economy for generation of New Ionomer membranes
● CRYSTAL CLEAR (FP6). Crystalline Silicon PV: Low-cost, highly efficient and reliable modules
● DEMOHOUSE (FP6). Design and Management Options for improving the energy performances of Housing
● NEU-CO2-III (FP6). Continuation of the "International Network Non-energy use and CO2 emissions (NEU-CO2)", Phase III
● GROW-DERS (FP6). Grid reliability and operability with distributed generation using flexible storage
● INTEGRAL (FP6). Integrated ICT-platform based Distributed Control (IIDC) in electricity grids with a large share of distributed energy resources and renewable energy sources
● SOLSILC DEMONSTRATOR (FP6). Validation of a direct route for production of solar-grade silicon feedstock for

crystalline wafers and cells
● VSYNC (FP6). Virtual synchronous machines for frequency stabilisation in future grids with a significant share of decentralized generation
● SIWT (FP6). Self installing wind turbine
● NIGHT WIND (FP6). Grid Architecture for Wind Power Production with Energy Storage through load shifting in Refrigerated Warehouses
● SE-POWERFOIL (FP6). Roll-to-roll manufacturing technology for high efficient multi-junction thin film silicon flexible photovoltaic modules
● WSSTP (FP6). Water Supply and Sanitation Technology Platform
● BIOSYNERGY (FP6). Biomass for the market competitive and environmentally friendly synthesis of bio-products together with the production of secondary enERGY carriers through the biorefinery approach
● APOLLON (FP7). Multi-approach for high efficiency integrated and intelligent concentrating PV modules (systems)
● SOLARH2 (FP7). European solar-fuel initiative - renewable hydrogen from sun and water; science linking molecular biomimetics and genetics
● BEE (FP7). Biomass energy Europe
● RELHY (FP7). Innovative solid oxide electrolyser stacks for efficient and reliable hydrogen production
● SmartGrids ERA-NET (FP7).
● CESAR (FP7). CO2 enhanced separation and recovery
● DECARBIT (FP7). Enabling advanced pre-combustion capture techniques and plants
● HYLOW (FP7). Hydropower converters with very low head differences
● PROTEST (FP7). PROcedures for testing and measuring wind energy systems
● DEBCO (FP7). Demonstration of large scale biomass co-firing and supply chain integration
● SOLASYS (FP7). Next generation solar cell and module laser processing systems
● 2NDVEGOIL (FP7). Demonstration of 2nd generation vegetable oil fuels in advanced engines
● GROUND-MED (FP7). Advanced ground source heat pump systems for heating and cooling in Mediterranean climate
● PLANTPOWER (FP7). PlantPower - living plants in microbial fuel cells for clean, renewable, sustainable, efficient, in-situ bioenergy production
● ZEPPOS (FP7). Zero Emission Platform supPOrt Secretariat
● NANOPEC (FP7). Nanostructured photoelectrodes for energy conversion
● CO2SOLSTOCK (FP7). Biobased geological CO2 storage
● ZEOCELL (FP7). Nanostructured electrolyte membranes based on polymer-ionic-ZEOlite composites for high temperature PEM fuel CELL
● HETSI (FP7). Heterojunction solar cells based on a-Si c-Si
● BIOLIQUIDS-CHP (FP7). Engine and turbine combustion of bioliquids for combined heat and power production
● ROBUST DSC (FP7). Efficient and robust dye sensitzed solar cells and modules
● CAESAR (FP7). CArbon-free electricity by SEWGS: advanced materials, reactor and process design
● GREENSYNGAS (FP7). Advanced cleaning devices for production of green syngas

8.3 Research themes of national programmes.

8.3a Main research themes of the National Research Programmes Climate Changes Spatial Planning (BSIK-KvR) and Knowledge for Climate (FES-KvK)

(more information: www.klimaatonderzoeknederland.nl)

	(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.	X	X			
Monitoring and profiling with the Cabauw Experimental Site for Atmospheric Research (CESAR).	X	X			
Representation of soil moisture and root water uptake in climate models		X	X		
The regional climate impact of aerosols	X	X	X		
Remote influences on European climate		X	X		
Climate scenarios of wind and precipitation for the Netherlands with a high-resolution regional climate model		X	X		
Tailoring climate information for impact assessment			X		
Precipitation time series information for the validation of climate scenarios		X			
Modelling and reconstructing precipitation and flood frequency in the Meuse catchment during the late Holocene	X	X			
Modelplatform - Future Weather Phase 1	X	X			
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		X			X
Integrated observations and modelling of greenhouse gas budgets at the national level		X			X

in the Netherlands						
Soil carbon dynamics and variability at the landscape scale: its relation to aspects of spatial distribution in national emission databases						X
Integrated framework to assess spatial and related implications of increased implementation of biomass delivery chains					X	X
Spatial decision support for management of Dutch fen meadows				X	X	X
The effect of the spatial arrangement of wetlands on water quality improvement and carbon sequestration in a multifunctional land-use setting					X	X
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				X		X
Strategies for optimising the nature conservation potential of the Dutch Ecological Network and the surrounding multifunctional farm landscape under predicted climate change scenarios				X		X
Adaptations in the NCP (Netherlands Continental Shelf)	X	X			X	
Adaptations to extreme events in transboundary river basins					X	X
Assessment of upstream flood risk in the Rhine Basin					x	x
Climate change impacts on inland transport systems, an evaluation of adaptation strategies				X	X	X
Financial arrangements for disaster losses under climate change					X	X
Hotspots definition study and related hotspots: - Zuidplaspolder - Tilburg - Groningen - Climate and agriculture in the Northern Netherlands - Rijnenburg Utrecht					x	x
Climate in choices for spatial planning					x	x
Future of peat area hotspot Haaglanden						
Regional specific climate information for Haaglanden and Rotterdam region				x	x	
Broad, domain-specific exploration of impacts of climate change in conjunction with future scenarios and development trends				x	x	
Demonstration project multiple space usage for water storage in greenhouses						x
Urban development - Urban water systems					x	x
Water safety areas outside the dikes (definition phase)						x
Waterfront Rijnmond						x
Heat stress in the city of Rotterdam					x	x
Secure embedded dams						x
The effects of climate change on inland navigation through the Rotterdam region					x	
Adaptive Building						x
WindVisions: an airport Wind and Visibility Monitoring System for critical weather conditions in a changing climate				x		
Climatology and climate scenarios Mainport Schiphol				x		
The impact of climate change on the critical weather conditions at Schiphol airport (Impact)				x		
Climate effects on decomposition in drained peat meadows: implications for peat subsidence and water quality					x	
Climate influence on water quality: which trends are already apparent?					x	
Managing climate effects in peat meadows and shallow lakes						x
Need to know or nice to know? Developing the knowledge agenda climate change and adaptation in the Wadden Sea					x	
Using scientific knowledge by policymakers in the Deltaregion					x	x
Climate change effects on restoration of estuarine dynamics within the Delta region				x		

Routeplanner 2010 – 2050 (nul-meting)				x	
Assessing the adaptive capacity of the Agricultural sector in the Netherlands to the impacts of climate change under different market scenarios: How can agriculture adept to changes of both climate and market; NL-North as a pilot region			x	x	
The Coastal Zone (definition phase)				x	
Exploration Southwestern Delta fresh water supply (salt-fresh meta-study)				x	x
Exploring Climate Change and Infrastructure			x		
Social Scientific literature analysis climate adaptation				x	
Climate change and its effect on nature & agriculture			x		
The effect of climate change on environmental quality			x		
Climate-proof eco-hydrologic modelling		X			
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:					
Communicating climate change: tools for framing climate risks and benefits					X
A tool for integrated analysis of emission reductions over regions, sectors, sources and greenhouse gases				X	X
LANDS: Designing national land use adaptation and mitigation strategies under changing climate conditions				X	X
Cost-benefit analysis of adaptation and mitigation options for climate change: methods and applications				X	X
PRObing, a method to Facilitate the Interactive Linking of Expert knowledge to Stakeholder assessment (PROFILES)				X	
Socio-economic scenarios for climate change assessments				x	
The Dutch institutional framework and governance of adaptation strategies				x	
Nature's Calendar			x		
Deltas in times of climate change			x		x
Adaptation scan for local governments					x
Climate change sketchbooks (including geodatabase)					x
Heat in the city, definition study					x
Water resilient building					x
Dialogue climate change and cities				x	
Biesbosch in times of Climate Change (definition phase)				x	x
Scoping study comparative assessment				x	
Climate Effects Atlas II (definition phase)			x		
Modelplatform Tailoring - Climate data and the related effects of climate change		x			
Climate in the urban environment				x	x
Modelplatform - Coupling	x	x			

8.3b Main research project in the Knowledge Basis (KB) Research for the Dutch Ministry of Agriculture, Nature and Food Quality, cluster Climate change (KB-02)

(more information: www.onderzoekinformatie.nl/nl/oi/nod/onderzoek/OND1313231/)

	(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 Socio-economic feasibility of climate policies (KB-02-004)					
Biofuels: bio-energy and biomaterials insofar as are relevant to reducing greenhouse gas emissions. This means the net climate impact of emissions in terms of land use and farming (methods) and the use of secondary (bio) materials (waste) in the form of bioenergy and biomaterials. Then there are the aspects of sustainability of certain crops and land use and the implications of bioenergy and biomaterials for other LNV policies: nature and food supply. The international aspects of bioenergy and implications for international biomass chains are also included this theme. There is direct cooperation, in a complimentary way, with the Biobased Economy theme.					
Economic valuation of climate policy				x	
Exploring multifunctional land uses as an adaptation strategy to climate change in the Netherlands				x	x
Methodology for evaluation of accumulating policies				x	
Theme 2 Foundation of climate adaptation measures (KB-02-003)					
Climate change has major implications for water management, agriculture and nature. The most pressing knowledge questions concern the resilience (adaptability) of the natural ecosystems (both terrestrial and marine) and of crops (agriculture). Is the wet nature in the Netherlands climate-proof? Does the solution for Dutch agriculture lie in a transition to salt tolerant or salt-loving crops? What does space for water mean for agriculture and nature (including water quality)? What possibilities offer the selection and modification of plants and production techniques that can withstand changing climate conditions?					
Adaptation fisheries / climate (BSIK KvR)			x	x	
Salination, wetter and drier periods in agriculture			x	x	
Mitigation & adaptation and Land use (integration Image)				x	
EHS, Nature & Climate adaptation			x		
Adaptation large rivers			x	x	
Eurolimpacs			x		
Branch			x	x	
Aquastress					x
NeWater					x
Environmental use North sea on changing climate/ Dutch continental area			x	x	
Ecological Resilience					x
(Eco)system services				x	
Theme 3 Adaptation (KB-02-002)					
Adaptation to climate change. This includes improving the climate and seasonal weather prediction techniques and linking climate					

models to impact models involving water, nature, agriculture, health, transport, planning and financial services. Then there is the development and evaluation of technical and institutional capabilities of adaptation in these sectors. Climate-proofing our Delta Metropolis and research on natural climate buffers are also part of this theme. There is direct cooperation, in a complementary sense, to the theme: coasts and sustainable Delta's, and with the Green-Blue Area theme.					
CHGs Ecosystem		x			
Nitro-Europe		x			
Biofuels and mitigation					x
Mitigation chain dairy farming					x
Biomass as new sustainable energy carriers					x
Geoland (GMES)	x	x			
Soil carbon and landscape variability		x			
Integral monitoring and modelling Greenhouse gas (GHG) budgets		x			
Carboeurope: integration	x				
Carboeurope: ecosystems and regional	x				
Nature's Calendar - Towards a daily nature report	x		x		
Theme 4 Mitigation (KB-02-001) - Increasing societal pressure to achieve a transition to climate-neutral agriculture and food production (it involves soil, crops, energy, dairy, meat and fish production and the production of other food, food processing, transportation and nature management); - Production of biofuels and use of biofuels and efforts to maximize net effect on greenhouse gas emissions; - In view of these challenges and related legal obligations and responsibilities in the areas of emissions reporting and monitoring, there is a growing social interest to develop knowledge in the areas of emissions and absorption of greenhouse gases from land use. These include analysis of relevant bio-physical processes, management and improvement of monitoring techniques.					
Carboeurope: integration	x				
Trade-offs between greenhouse gas emission and C sequestration in the soil: translating fundamental process research to mitigation options					x
Bio-energy chains and spatial arrangement (scenarios)				x	
CARBOPEAT: Carbon-Climate-Human interactions in tropical peatlands: vulnerabilities, risks and mitigation measures					x
ADAM (ADaptive And Mitigative Strategies for Climate Change)				x	x
IC2: Integrated analysis of land use based emission reduction over regions, sectors, and sources					x
Evaluation of the robustness of emission estimates for dairy farming					x
ME4: An integrated framework to assess spatial and related implications of increased implementation of biomass delivery chains					x
ME3: Soil carbon dynamics and variability at the landscape scale: its relation to aspects of spatial distribution in national emission databases		x			
Integrated monitoring and modelling of greenhouse gas emissions in the Netherlands		x			
Greenhouse Gas Emissions at the ecosystem level in The Netherlands		x			
Nitro-Europe		x			
Eagle	x				
Carbon sequestration Europe: Nitrogen-deposition, forest management & climate		x			

8.3c Main research projects to the Policy supporting programmes of the Dutch Ministry of Agriculture, Nature and Food Quality

(more information: www.onderzoekinformatie.nl)

	(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 change For 2008 the following research needs will be addressed: 1. Development of National Inventory Reporting methodologies for Land use, Land use change and Forestry focussing on the soils under forest and in agricultural systems (projects I-3 en I-4) 2. Role of Landuse Landuse Change and Forestry, with the aim to assess the current global state and threats to peat lands and forests and potential mechanisms for future climate regimes and to assist developing countries with monitoring (projects I-10- to I-12) 3. Effects of revised EU emission trade policies in December 2007 on Dutch agricultural sector (project I-13) 4. Climate change impacts on hydrological boundary conditions for nature and agriculture, with the aim to identify spatial bottle necks for the allocation of water retention and overflow areas. (project II-11) 5. Identification of spatial bottle necks for potential adaptation measures in Dutch nature and agriculture (linked to previous two issues) and of possible solutions to these. (projects II-10, II-12, II-13) 6. Climate resilience of developing countries need to be integrally assessed at both country and project level before effective adaptation options can be devised (project II-14, II-15)					
The influence of the Common Agricultural Policy and Trade Policies on Greenhouse Gas Emissions				x	
Climate change dimension of land use policies and sustainable development in developing countries				x	
Climate change and agricultural intensification in Rwanda (CATALIST)				x	x
Reporting system for NIR soil carbon		x			
National Inventory Report system forests: improvement	x	x			
National system LULUCF for Suriname		x			
Mitigation Potential for agriculture in Developing Countries		x			
Impact EU guideline CO2 emission trade for Dutch agribusiness		x		x	
Integrated adaptation strategies for spatial planning in agriculture and nature in anticipation on climate change	x				x
Adaptation of ecosystems to climate change: forests			x		x
Role and costs of Kyoto Protocol Article 3.4 for the Netherlands				x	
Nitrogen in soils		x			
Variability in CO2 & N2O emissions: meta -analyses on available measurement campaigns		x			
Climate Change in relation with nature and agriculture	x			x	
Policy-scan of IPCC-Fourth Assessment Report		x			
Coordination and Synergy in Climate Change research					
Peats and climate change				x	

Land use, land-use change and forestry: Integration of adaptation, mitigation and sustainable development in IPCC-4AR			x	
IPCC-Working Group II - Adaptation: scientific support for assembly of 4th Assessment Report			x	
Climate change and agriculture			x	
Adaptation and mitigation in multifunctional landscapes			x	
CLA IPCC 4AR (forestry)		x	x	
Case based evaluation of the possibilities for integration of the UNFCCC, UNCCD, UNCBD and RAMSAR			x	
Adapting to climate change: strategies for optimizing the nature conservation potential of the Dutch National Ecological Network	x	x		
The Influence of the Common Agricultural Policy and Trade Policies on Greenhouse Gas Emissions			x	
Inventory of LULUCF interests of selected parties in future climate regimes			x	
Report demands and feasibility with regards to LULUCF in Multi Stage Climate Regimes		x		
Variability in the emissions of nitrous oxide and the carbon sinks		x		
Development first			x	
Programming study adaptation in Agriculture and Nature				
Carbon data assimilation en modelling of terrestrial Europe (CAMELS)		x		
Inventory of methods to separate direct and indirect effects		x		
Theme 2 Water In order to make the right choices in solving the water problems mentioned, the following research topics have been chosen: 1.Implementation of Water Framework Directive and Water management 21e Century: Effectiveness and effects of measures: analysis of effectiveness, spatial aspects, and application of evaluation methods; spatial aspects, compatibility of other policy measures relations, climate proof water management and reallocation in catchment areas. 2.Improving a regional approach in solving water problems Knowledge transfer with respect to implementation of the WFD at regional scale; knowledge transfer with respect to impact of climate change in regional planning. 3.Room for the river Research with respect to a vision on safety and nature along rivers, spatial claims, nature and landscape management of flood plains				
Farming with the European Water Framework Directive			x	
Room for small rivers; case study Overijssels Vecht				x
Room for Rivers and Experience			x	
Greenblue services to a higher level				x
Expert system for the ecological effectiveness of restoration measures in streams and ditches				x
Functional claims on the land and water use of large river systems			x	
Success and failure in river restoration projects; an analysis of explaining factors				x
Water Quality and heath for cattle				x
Effect of hydrological measures				x
Small-scale on farm constructed wetlands for nitrate removal from agricultural drainage water				x
Participation in WFD working group on CBA			x	
Effects of climate change on WFD measures in streams and stream valleys			x	
Rehabilitation of regional river systems				x
Landscape ecological advice and prioritization criteria for Room for River projects				x
Climate change and the feasibility of riverine nature targets			x	
Cost-effective management of river floodplains			x	x
WaterSigns			x	
Social Cost-benefit analysis water level changes polder Zegveld			x	
Analysis of costs - benefits en cost of WFD measures			x	x
Guidelines and instrument for safe re-meandering design				x
The contribution of WFD measures to Natura 2000 policy aims in stream watersheds, case the Drentse Aa catchment				x
Knowledge transfer in order to make rural areas ready for climate change by improving water management and multipurpose measures (WFD, WB21, GGOR, manure policy)				x
Impact assessment of measures in two lowland basins to reduce flooding			x	x

Security and management nature areas					x
Mud terps					x
Ecological modelling of aquatic ecosystems		x			
Temporal inundation with surface water of grassland in sandy regions- Pilot Farming with Water Salland					x
Water management change in Krimpenerwaard BBPR				x	x
Accessibility of the borders of the river IJssel for walking				x	x
Water Framework Directive and commercial and recreational fisheries				x	
Building stone for a vision on spatial quality in the framework of the project 'Room for the river'				x	
Synchronization of a biotic boundary conditions for the EU Framework directive and Dutch Nature Reserves (Natura2000)				x	x
Effect of hydrological measures				x	x
Effects of climate change on the choices within the Water Framework Directives: streams and stream valleys				x	
Climate Change in relation with nature and agriculture				x	
Room for the River and Public Private Partnerships				x	x
Management of wetlands in floodplains modified by Room for the River measures					x
The influence of the Birds and Habitat directives on the Room for River project implementation, with special emphasis on the River Meuse				x	x
New vision on safety and nature in riverine landscapes: the role of agriculture				x	
To a water orientated development planning: Optimize the implementation of water into an area-orientated approach					x
Transfer of Knowledge related to water issues as part of the NBW of 2003				x	x
Assessment framework for regional measures					x
Analysis of costs - benefits en cost effectiveness of measures					x
Participation in WFD working group on CBA					x
Water modelling		x			
A biotic boundary conditions for waters of high and good ecological status		x			
Decision support system for the cost-effectiveness of restoration measures in streams and channels					x
Water storage and sedimentation of nutrients					x
Nature in the water distribution priority sequence					x
Belvedere low moor polder area	x				x
Salt and crops			x	x	
Water chains					x
Research platform Water Framework Directive					
NCR/TAW					
Hydrological models in an international framework		x			
Forest in Water, pilot Harderbos					x
DLG Norm costs for river nature					x
Connection between water bodies and the nature areas in the 7 subcatchments reports					x
Nature purpose types in Room for the river					x
Chances for agricultural transitions in Room for Rivers projects					x
Follow-up scenario-study South-west delta				x	
Scenarios fresh water Zeeland				x	
Natura 2000-WFD-safety interactions at large en small river confluences				x	x
Hot spots for development of riverine natural grasslands and hardwood floodplain forests					x
Claims on the floodplain area along large rivers					x
Towards a systems vision for river rehabilitation					x
Salinisation of the Dutch SW Delta: a reconnaissance survey into the viability of terrestrial breeding of sea fish					x
Linking Framework Directive Water - and other targets on areal level				x	x
Analysis of costs - benefits en cost effectiveness of measures (WFD)					x
Effects of hydrological restoration measures on nutrient richness of standing water bodies					x
Landuse consequences and opportunities of WFD objectives					x
SIMGRO in river performance assessment					x
Pilot evaluation green blue services					x

Water retention and nature; the impact of nutrient input from sediment deposition					x
Brackish and salt groundwater relations		x			
Hydrology in Eastern Europe					x
Water nuisance Argentina		x			
Ecoflood				x	x
Water management innovation for meeting WFD targets: Pilot study Lankheet					x
Knowledge coupling Framework directive water (KRW) in practice					
Tools to investigate the impact of the implementation KRW in the rural areas of the Netherlands at different scales		x		x	
Cascade approach Framework directive Water (KRW)		x			
EUROLIMPACS			x		
What about the peat areas?				x	
Development in groundwater-levels	x				
Developments in water management	x	x			
Effects of increased flooding on the aquatic ecosystems of Dutch river floodplains		x			
Seepage quality in the Holocene	x				
Effects of water storage on water quality		x			
Towards an hydrological and economic sustainable peat meadow area, in European perspective (EUROPEAT) content and organization of transitions		x			
Historic Water Management		x			
Forest in water, Water in forest					x
Aquatic ecology in a water quantity expert system		x			
Hydrology based on mapable features		x			
Soil surface drainage processes		x			
Visualisation of the drainage process		x			

8.3d Main themes in the Energy Innovation Agenda programme

The table below shows the themes that relate to research and mitigation and adaptation in the Energy Innovation Agenda (Energy Transition 2009)[44]

Portfolio Innovation Programmes Leader50		**Leader**
A. Theme-specific programmes		
Green Raw Materials (bio-based economy)	Biorefining *Pilots, demo's, see also technology roadmap biorefining*	LNV plus EZ
	Connecting chemicals, agriculture, logistics *E.g. based on a technology roadmap bio-based economy and biorefining consortia, pilots*	LNV/EZ
	Sustainable production and import biomass *EU sustainability criteria, certification, bilateral cooperation projects* Developing sustainable electricity and sustainable heat from biomass from forests, nature sites, and the entire timber chain.	EZ plus VROM, BUZA, LNV
	Plant refinement to provide raw materials for chemicals and energy *Research vision*	LNV
	Aquatic biomass *Research vision*	LNV/EZ
New Gas	Market introduction HRe boiler *Learning project 10,000 HRe boilers, training, energy label/ EPC-norms, financing*	EZ
	Green gas *Research into and SNG demo projects. Demo projects for co-fermenting manure and/or residues to produce biogas and upgrade to natural gas quality.* *Biogas legislation (Gas Law) and certification.* *Development of decentralised infrastructure*	EZ/LNV
	CO2 capture and storage *See interconnecting themes*	VROM/EZ
Sustainable Electricity Supply	Doubling onshore wind: the LUW programme *Speed up pipelines, resolve bottlenecks, concentration area policy, increase support*	EZ
	Developing 6,000 MW wind energy by allocating locations, SDE subsidies, network connections and innovative concepts	EZ/V&W plus VROM
	The network of the (decentralised) future (*smart grids*)	EZ
	PV solar energy *Continue/strengthen the Netherlands' (international) knowledge position*	EZ
	Pre-study into the Netherland's (international knowledge position	EZ
Transport (Sustainable Mobility)	Basic infrastructure green fuels *Liquid and gaseous, trial area at Schiphol*	V&W
	The electric car *Plug-in hybrid pilot, hybrid delivery vans etc.*	V&W
	Sustainable transport in town *Efficient town cars, clean fuel, town distribution, differentiating parking rates, etc.*	V&W
	Intelligent transport systems	V&W/EZ

[44] http://www.senternovem.nl/mmfiles/Energy%20Innovation%20Agenda%2009-09-2008_tcm24-281800.pdf

	Clean buses and lorries	V&W
	Hydrogen mobility *Hydrogen corridor, R'dam supplies hydrogen for A'dam transport, EU projects*	V&W/EZ
Chain Efficiency	MJA-3: 50% less energy in the chain *10 trend-setting sectors (including paper and chemicals)*	EZ
	Precision farming	LNV
	Process intensification	EZ
	Sustainable heating and cooling supply *See interconnecting themes*	EZ
Built Environment	Towards an innovative, energy-neutral suburb *Integral collaboration, integral concept development, process-style knowledge development/dissemination, coalition of trend-setters, legislation*	VROM
Greenhouse As Energy Source	The Greenhouse As Energy Source *Market commercialisation, knowledge programme 'learning to grow again', financing, legislation*	LNV
B. Interconnecting and other themes		
	Driving on natural gas/biogas	V&W/EZ
	Developing the decentralised infrastructure (gas and electricity)	EZ
	CO2 capture and storage (CCS)	VROM/EZ
	Sustainable heat	EZ/VROM
	Educational programme	OCW
	Reduction of other greenhouse gases *Research into reducing methane emissions by modifying animal fodder*	LNV/VROM
	Legislation and urban planning *Streamlining legislation, energy production gaining full place in urban planning*	VROM/EZ
	Sustainable procurement: *Assessment per product group to see if policy options can be used with respect to sustainable procurement*	VROM
	ADEM (material research programme related to energy technology)	EZ/OCW
	Climate-neutral suburbs/towns *Cohesive implementation of innovations over several themes within built environment*	VROM

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