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Report on the in-depth review of the third national communication of the Netherlands

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I. INTRODUCTION AND NATIONAL CIRCUMSTANCES RELEVANT TO GREENHOUSE GAS EMISSIONS AND REMOVALS

A. Introduction

1. The Netherlands's Third National Communication under the Framework Convention on Climate Change, hereinafter referred to as the NC3, was received by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat on 23 November 2001. An in-depth review of the NC3 was carried out from November 2002 to October 2003, including a visit to The Hague from 9 to 13 December 2002. The review team comprised Mr. Ranjan Bose (India), Ms. Irina B. Yesserkepova (Kazakhstan), Mr. Hrvoje Glamuzina (Croatia), Ms. Erja Fagerlund (Finland) and Ms. Katia Simeonova (UNFCCC secretariat, coordinator).

2. During the country visit, the review team had a number of meetings and discussions on the key aspects of the Dutch climate policy as summarized in the NC3. During these meetings with governmental officials, academia, business and environmental non-governmental organizations (NGOs), the team was provided with a great deal of additional material that supported the information provided in the NC3 and contained information on the steps taken to advance the national climate policy objectives after the publication of the NC3. During these meetings the review team formed an impression of very effective cooperation between the government and various stakeholders, including environmental NGOs and industry associations, which underlines the progress in implementation of some policy instruments, e.g. voluntary agreements.

B. National circumstances

3. The Netherlands is a small and low-lying country. Its total area including inland and coastal waters amounts to 41,526 km^2, with the land area amounting to only 34,000 km^2. Around 59 per cent of the land area is agricultural land, 9 per cent forest and 5 per cent natural land; the remaining 27 per cent is taken up by urban areas, infrastructure and other uses. The Netherlands has a temperate climate, which is strongly influenced by the ocean.

4. The population of the Netherlands totalled 15.92 million in 2000 (table 1), having grown at a relatively high annual rate (0.6 per cent) between 1990 and 2000. With a population density of 468 persons per km^2, the Netherlands is one of the most densely populated countries in the world. The increase in population and life expectancy, together with an increase in the number of households and decrease in their average size, is a major driver for the increase in demand for space heating and for the noticeable growth in demand for transport and associated growth in emissions of greenhouse gases (GHGs).

5. The Netherlands has an advanced and outward-looking economy, with exports of goods and services totalling more than the entire gross domestic product (GDP). Its geographical location and economic tradition have contributed to the openness of its economy. It also has the largest port in Europe, Rotterdam, and the activities of this port alone contribute 10 per cent of the GDP. The country enjoyed a steady economic growth of around 3 per cent annually in the 1990s, and in 2000 the GDP reached US$ 497 billion. Success in attracting foreign companies and related investment also contributed to this growth: between 1998 and 2000, foreign direct investment amounted to US$ 134 billion. Services are by far the most important sector of the economy, contributing 71 per cent of the GDP in 2000, followed by industry with 26 per cent and agriculture with only 3 per cent. The large amount of energy-intensive industry, such as chemicals, oil refining and metal processing, and highly intensive agriculture, underpins relatively high levels of energy consumption, energy intensity and associated GHG emissions.

6. The Netherlands has the second largest natural gas reserves in Europe, comparable with those of Norway. This, together with the limited availability of non-fossil fuel resources, has determined the energy profile of the country. Annual natural gas production amounts to around 54 million tonnes oil equivalent (Mtoe). The most important primary energy sources are natural gas, and oil and oil products,

which in 2000 accounted for 46 and 38 per cent respectively of the total primary energy supply (TPES), followed by coal (11 per cent) and combustible renewables and waste (2 per cent), with electricity imports and nuclear energy from the Borssele reactor (450 MW) making up the rest. Between 1990 and 2000, the TPES grew by 14 per cent, compared to the growth of 33 per cent in GDP, and reached 75.8 Mtoe. This growth was primarily attributed to the growth in supply of oil and oil products, while the supply of coal dropped by 13 per cent. Natural gas is the fuel of choice for electricity production (55 per cent in 2000), followed by coal (37 per cent), with oil, nuclear power and renewables accounting for the rest. The share of combustible renewables and waste in electricity production increased from 1.3 per cent in 1990 to 2 per cent in 2000.

7. The final energy consumption (FEC) grew by 16 per cent between 1990 and 2000 and reached 60.4 Mtoe in 2000. With a growth of 34 per cent, transport was by far the fastest growing sector; all other sectors increased their consumption in proportion to the growth of the FEC. In 2000, other sectors, including residential, commercial and agriculture, accounted for a relatively large share of the FEC (38 per cent). Agriculture and, in particular, horticulture accounted for 7 per cent. The share of industry is also large (34 per cent), reflecting a high degree of industrialization with a heavy reliance on energy-intensive industries. Structural changes in the economy, associated with a growing share of services and policy to promote energy efficiency, resulted in a decrease in energy intensity of 1.6 per cent annually on average during the 1990s. This improvement was consistent with the underlying objective of the energy policy, which aims to achieve sustainable energy economy through liberalization of the energy markets and enhanced competition.

Table 1. Main macroeconomic indicators and GHG emissions

	1990	2000	Percentage change between 1990 and 2000
Population (millions)[a]	14.947	15.920	7
Gross domestic product – GDP (billions of US$ of 1995)[a]	373.47	496.95	33
Total primary energy supply – TPES (Mtoe)[a]	66.47	75.80	14
Electricity consumption (TWh)	78.018	104.459	34
GHG emissions (Gg CO_2 equivalent)[b]	210 347	216 916	3
GHG emissions per capita (Gg CO_2 equivalent)	0.0141	0.0137	–3
GHG emissions per GDP unit (kg CO_2 equivalent per US$ of 1995)	0.563	0.436	–23

[a] The population, energy and GDP data, expressed in 1995 prices using purchasing power parity, are from the IEA database. GHG emission data are from the Netherlands 2002 inventory report.
[b] Without accounting for emissions and removals from land-use change and forestry (LUCF).

C. Institutional framework and recent developments in climate policies

8. The Netherlands is a constitutional monarchy, with a two-chamber parliament which holds the legislative power. A distinctive feature of the political system is the Council of State with the Queen as its head. This council has a consultative role on all bills and legislative proposals. The executive power is distributed between the central government and 12 provinces, which oversee the activities of some 600 municipalities.

9. The competencies for implementation of policies, including climate change policies, are distributed between the central and local governments. In particular, local governments are responsible for the implementation of some environmental policies, e.g. waste management, whereas municipalities are responsible for environmental permits, licences and housing policy. Central government retains most of the responsibilities relating to climate change, including the responsibility to conclude covenants[1] with the local governments and municipalities aimed at fostering the implementation of climate policy at local level. These covenants, which represent a unique feature of the country's institutional arrangement, focus on the building sector, renewable energy, agriculture and transport.

[1] According to the Dutch law the covenant is a civil law agreement.

10. The Ministry for Environment, Housing and Spatial Planning (VROM) has a central role and coordinates activities relating to environmental issues, including climate change, among the other 14 ministries involved, especially the ministries dealing with economic affairs, transport and public works, and agriculture. Specific activities are carried out by some of the other ministries, e.g. the issues of emissions trading and joint implementation (JI) are handled by the Ministry of Economic Affairs.

11. The team noted the very good coordination on environmental matters between the relevant ministries and especially within the well-established high-level Central Group for Environment[2] which is made up of the heads of the relevant ministries, including the National Institute of Public Health and the Environment (RIVM), the Foreign Office and the ministries of economic affairs, agriculture and fisheries, transport, water management and financial affairs. In keeping with the political and institutional tradition of the Netherlands, in formulating policy, the central government works closely with the different levels of local government, targeted groups and interested organizations with a view to achieving a high level of acceptance by society. This is guided by the Environmental Policy Act. Also, the institutional powers and legal structure of the country make it possible to consider the negotiated targets, including energy efficiency targets, as legally binding once a clear commitment and agreement between the government and industry has been achieved.

12. Climate change became a prominent issue in the Dutch policy agenda in the late 1980s and early 1990s, and carbon dioxide (CO_2) was declared as a pollutant as early as 1990. Since then, the Netherlands has demonstrated leadership at international and national levels in addressing climate change and also in enhancing international cooperation on this matter. An important recent document that sets the foundation of the current climate policy is the National Climate Policy Implementation Plan (NCPIP) (see paragraph 40). The NC3 summarizes the policies as laid down in the NCPIP, and provides information on the status of their implementation at the beginning of 2001. The current report provides additional information on the implementation of these policies by the end of 2002.

13. The Netherlands ratified the UNFCCC on 16 September 1993. Under the UNFCCC the Netherlands contributed to the aim for the developed countries to return individually or jointly GHG emissions in 2000 to their 1990 levels by slowing down their emission growth. Even so, in 2000 the total emissions, without emissions and removals from LUCF, were 3 per cent higher than in 1990. The main factors contributing to this level of emissions included the relatively high growth rate of population and GDP throughout the 1990s, and improvements in energy efficiency being insufficient to decouple growth in energy demand from economic growth. Also, the initial policies and measures were of a "no-regret" nature, with an emphasis on financial incentives, public information and covenants rather than on economic instruments. Finally, the full-scale implementation of these policies took longer than expected.

14. The Netherlands ratified the Kyoto Protocol on 31 May 2002.[3] Under the Kyoto Protocol, the commitment of the Netherlands in the first commitment period (2008–2012) is for 8 per cent reduction of emissions below the 1990 level, whereas under the EC burden-sharing agreement the commitment is for 6 per cent reduction.

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[2] The group is known in Dutch as the Rijks Milieuhygiënische Commissie.

[3] The Netherlands ratified the Protocol jointly with the other European Community (EC) countries. In the 1998 Coalition Agreement, it attached a number of conditions for this ratification, the most important of these being ratification by the US and Japan, an introduction of a EC-wide energy tax in 2002, and sufficient flexibility (by 50 per cent) to achieve the reduction target through offshore reductions. Although some of these conditions were not met, the Netherlands ratified the Kyoto Protocol in 2001.

II. GREENHOUSE GAS INVENTORY INFORMATION

A. Inventory preparation

15. The VROM inspectorate is responsible for the compilation of the GHG emission inventory in collaboration with Statistics Netherlands, RIVM, the National Reference Centre for Agriculture, the National Institute of Water Management and Waste Treatment, and the Netherlands Organization for Applied Scientific Research. VROM is also responsible for the submission of national inventory reports to the UNFCCC secretariat and to the EC Greenhouse Gas Monitoring Mechanism.

16. Six expert groups have been set up, including groups for the main sectors of emission inventories and a group on GHG emission monitoring, led by VROM, which is in charge of formulating a protocol for the monitoring of activities of each of the sectoral groups relating to data collection, validation, storage, management and dissemination. The Coordination Committee for Monitoring of Target Groups under the leadership of VROM is entrusted with coordinating activities among all six groups on definitions, methods, emission factors and emissions. To bring the system for inventory preparation in line with the UNFCCC guidelines for national systems in a timely manner, a separate monitoring improvement programme is being implemented, guided by a working group formed by representatives from relevant ministries and organizations. The review team commended the Netherlands for being well ahead in its preparations for the national system under the Kyoto Protocol.

17. The information in the inventory section of the NC3 is based on the emission estimates for 1990–1999[4] contained in the 2001 inventory submission to the UNFCCC secretariat. It contains initial estimates of emissions as well as temperature-corrected values for CO_2 emissions from energy. It covers all gases and all Intergovernmental Panel on Climate Change (IPCC) categories of emission sources/sinks, including CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). It also covers emissions of gases with indirect greenhouse effect, also known as precursors, such as oxides of nitrogen (NO_X), carbon monoxide (CO), non-methane volatile organic compounds (NMVOC) and sulphur dioxide (SO_2). Emissions from international bunkers and CO_2 emissions from biomass combustion were estimated, and according to the IPCC Guidelines[5] were reported separately and not included in the national totals.

18. The review team noted that the inventory section of the NC3 conforms to the UNFCCC guidelines.[6] It includes a summary of the reporting tables with emission estimates and tables with emission trends. The factors and drivers underlining emission trends are clearly explained.

19. The Netherlands mainly uses country-specific methodology for emission estimations. In a few instances the IPCC methodology was used, e.g. for estimates of CO_2 emissions in subcategories "Changes in Forest and Other Woody Biomass Stocks", estimates of CH_4 and N_2O emissions from transport, and estimates of emissions of fluorinated gases from production and consumption of halocarbons and SF_6. In most cases, the country- or plant-specific emission factors were used. In the remaining cases, the IPCC default factors were applied.

20. The uncertainties of the inventory estimates were assessed using the IPCC good practice guidance. The overall uncertainty for total annual emissions was estimated as ±5 per cent, resulting from the uncertainty of annual emissions for CO_2, CH_4, N_2O and fluorinated gases of ±3, ±25, ±50 and ±50 per cent, respectively. The uncertainty of the trend of total emissions is ±3 per cent, resulting from trend uncertainties of emissions for CO_2, CH_4, N_2O and fluorinated gases of ±3, ±25, ±50 and ±50 per cent, respectively. The review team commended the inventory team for the comprehensive assessment of inventory uncertainties.

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[4] Estimates for 1999 were considered preliminary.

[5] *Intergovernmental Panel on Climate Change (IPCC) Revised Guidelines for National Greenhouse Gas Inventories.*

[6] UNFCCC guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications.

21. The inventory data reported in the NC3 are consistent with the data from the 2001 inventory. The review team did not identify any differences between the two data sets. Compared to the second national communication (NC2), emission estimates for years covered in both documents have changed as a result of recalculations as information on new data, methods, emission factors and new emission sources became available. As a result, the estimates of total emissions fell by 6,000 Gg CO_2 equivalent between the NC2 and the NC3. The difference stemmed mainly from downwards revision of CO_2, due to revision of the energy consumption data (energy used for feedstocks and statistical difference which were accounted in the NC2 as a source), estimates of fluorinated gases and upwards revision of estimates of CH_4 and N_2O (table 2).

Table 2. Comparison of 1990 and 1995 emissions reported in the NC2, NC3 and 2002 inventory (Gg CO_2 equivalent)[a]

	NC2		NC3		2002 inventory	
	1990	**1995**	**1990**	**1995**	**1990**	**1995**
CO_2	174 000	185 900	161 173	177 130	159 630	172 659
CH_4	23 200	22 300	27 147	24 620	27 143	24 571
N_2O	15 900	18 100	19 757	22 380	16 524	18 173
Fluorinated gases	8 700	12 300	7 020	8 763	7 050	8 206
Total emissions (without CO_2 from LUCF)	**221 800**	**238 600**	**215 800**	**232 900**	**210 350**	**223 600**

[a] Discrepancies in totals in this and the following tables are due to rounding errors.

22. In 2002, after the publication of the NC3, the Netherlands submitted its 2002 inventory, containing data for 1990–2000. Comparison of the 2002 inventory and the NC3 inventory shows a difference in the national totals of 5,400 Gg CO_2 equivalent for 1990 and 9,292 Gg for 1995. The difference originates mainly from the following recalculations: (1) CO_2 emissions for 1990 and 1995–1998, as a result of revisions of the statistical differences in the energy balances;[7] (2) N_2O emissions from road transport and industrial processes, e.g. nitric acid production; and (3) fluorinated gases, as a result of new measurements. Also, a few new emission sources were included in the 2002 inventory: (1) emissions of CO_2 from cement clinker for 1990–1992, which were accidentally omitted; (2) CH_4 emissions from enteric fermentation by horses for 1998–1999; (3) SF_6 emissions from production of double-glazed windows.

23. A recent study has identified around 60 "new" sources of non-CO_2 gases. Of these, the following minor sources are yet to be included in the inventory: (1) N_2O from large-scale compost production; (2) minor sources of SF_6; (3) N_2O from agricultural residues in the soil; (4) indirect N_2O emissions from nitrogen deposition; and (5) non-CO_2 emissions from domestic air traffic and LUCF categories 5B–5E. The review team noted that figures in the 2002 inventory were recalculated for several sources only for 1990, 1995, 1998 and 1999, which leads to inconsistency of the time series. The analysis in the current report is based on the 2002 inventory submission, version 2.

B. Emission profile and trends

24. The GHG emissions of the Netherlands totalled 216,916 Gg CO_2 equivalent in 2000. The overall growth in emissions of 3 per cent between 1990 and 2000 was a result of two countervailing tendencies: a growth of CO_2 and N_2O emissions by 9 per cent and 3 per cent respectively, and a decline of CH_4 and fluorinated gases by 24 per cent and 18 per cent respectively (table 3).

25. The Netherlands has an emission profile that is typical for Annex I Parties, with CO_2 being by far the most important gas and energy being by far the most important sector in terms of emissions. In 2000, CO_2 accounted for 80 per cent of total emissions, followed by CH_4 and N_2O with 9.5 per cent and

[7] In the past, Statistics Netherlands used two methods to track the energy consumption: balancing the production, import and export, and estimating the total of energy consumption by energy users. The difference between the two methods was then considered as a "statistical difference" (it stemmed mainly from energy use outside the country). Recently, Statistics Netherlands has produced only one figure, based on the two methods, and has eliminated the statistical difference.

7.8 per cent respectively, and fluorinated gases making up the rest. In the same year, the energy sector, including transport, accounted for 81 per cent of emissions, followed by industrial processes and agriculture with equal shares of 7 per cent, and waste 4 per cent.

Table 3. Total GHG emissions and emissions by gas, 1990–2000 (Gg CO_2 equivalent)

Emissions	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
CO_2 (without LUCF)	159 630	167 489	165 702	167 934	168 764	172 659	179 706	168 973	175 057	172 061	173 527
CH_4	27 143	27 487	26 399	25 747	25 262	24 571	24 635	23 115	22 357	21 793	20 638
N_2O	16 524	19 195	19 669	19 696	20 204	18 173	20 258	21 109	17 822	17 362	16 980
Fluorinated gases	7 050	7 358	6 745	7 294	8 378	8 206	9 616	10 753	11 309	6 614	5 771
Total (with net CO_2 emissions/removals)	**208 925**	**220 001**	**217 027**	**218 866**	**220 677**	**222 376**	**232 818**	**222 771**	**225 165**	**216 594**	**215 502**
Total (without CO_2 from LUCF)	**210 347**	**221 528**	**218 515**	**220 672**	**222 607**	**223 608**	**234 215**	**223 951**	**226 545**	**217 830**	**216 916**

Carbon dioxide

26. Total emissions of CO_2 in the Netherlands in 2000 amounted to 173,527 Gg (table 4, figure 1). The 9 per cent growth of emissions between 1990 and 2000 was underpinned by the notable growth of emissions from transport (21 per cent), and energy industries (electricity and heat production) (15 per cent), followed by emissions from energy use in industry (3 per cent). Emissions from several sources declined: industrial processes (20 per cent), waste (10 per cent) and energy use in other sectors (1 per cent). Emissions from international bunkers (not included in the national totals) showed the greatest increase (35 per cent): emissions from aviation bunkers almost doubled and emissions from marine bunkers increased by 23 per cent.

Table 4. Carbon dioxide emissions by source, 1990–2000[a] (Gg)

Source and sink categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Energy	157 440	165 889	164 332	166 724	167 324	171 103	178 006	167 101	173 180	170 292	171 714
Energy industries	*51 513*	*52 190*	*54 130*	*53 800*	*55 980*	*56 589*	*59 306*	*58 200*	*60 379*	*57 911*	*59 085*
Energy use in industry	*41 889*	*42 660*	*42 510*	*39 920*	*40 950*	*43 084*	*42 239*	*39 010*	*43 244*	*43 150*	*43 003*
Transport	*29 085*	*29 119*	*30 362*	*30 944*	*31 184*	*32 130*	*32 610*	*33 047*	*33 984*	*34 682*	*35 120*
Other sectors[b]	*34 952*	*41 920*	*37 330*	*42 060*	*39 210*	*39 300*	*43 851*	*36 845*	*35 574*	*34 549*	*34 507*
Industrial processes	1 690	1 500	1 270	1 210	1 440	1 442	1 700	1 727	1 319	1 316	1 360
LUCF	–1 422	–1 528	–1 487	–1 806	–1 929	–1 232	–1 398	–1 180	–1 380	–1 236	–1 413
Waste	500	0	0	0	0	113	0	145	557	453	453
Total CO_2 emissions/ removals with LUCF	**158 208**	**165 962**	**164 214**	**166 129**	**166 835**	**171 426**	**178 308**	**167 793**	**173 677**	**170 825**	**172 114**
Total CO_2 emissions without LUCF	**159 630**	**167 489**	**165 702**	**167 934**	**168 764**	**172 659**	**179 706**	**168 973**	**175 057**	**172 061**	**173 527**
International bunkers	39 765	41 290	42 400	44 280	42 860	44 286	45 445	48 509	49 531	51 214	53 500

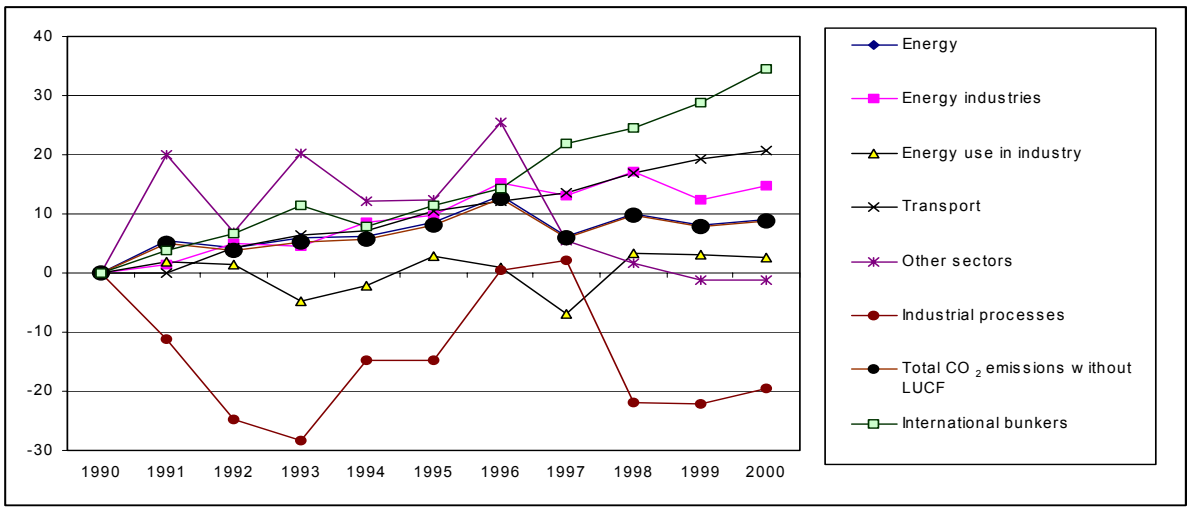
[a] Emissions from agriculture and solvents remained equal to zero throughout 1990–2000, so they are not shown in the table.

[b] Other sectors includes emissions from residential, commercial, institutional, services and agriculture.

27. The growth of emissions from transport was driven by the increase in transport activity and the constantly growing number of cars. There was a steep increase in the proportion of diesel-engined cars, with an associated growth of the share of diesel fuel from 43 per cent in 1990 to 51 per cent in 2000. The growth of emissions from electricity and heat production was driven by the growth of energy demand, which was defined by the continuing economic growth. The increase of electricity from gas-fired power plants was partly offset by the increase in efficiency in some power plants. The emissions from these sources levelled off in 1999 due to a temporary increase in imported electricity and a decrease in the use of coal in favour of oil and natural gas because of lower oil prices in that year. The growth of emissions resumed in 2000, partly as a result of the rise of gas prices and a further increase in the use of coal.

28. The growth of emissions from energy use in industry (3 per cent) was well below the growth of industrial output (17 per cent). This significant difference is explained by the effects of energy conservation, estimated at 142 PJ energy saved and 8,500 Gg emissions saved annually. The decrease of emissions from industrial processes was a result of reduced emissions from the use of lime for mineral products and from the "Other" category. The trend of emissions from energy use in the "Others" sector was broadly upwards and somewhat erratic until 1996, but then declined and in 2000 reached a level 5 per cent lower than in 1990, despite the increase in population and the number of households. This result is believed to stem from energy conservation in agriculture and households, and in particular from increased use of highly efficient heating appliances and improved insulation of buildings. The effect is pronounced in emissions from horticulture (accounting for 80 per cent of emissions from agriculture), which dropped by around 20 per cent.

Figure 1. Carbon dioxide emissions, percentage change from 1990, by source



Methane

29. In 2000, CH_4 emissions amounted to 983 Gg (table 5, figure 2). Agriculture and waste were by far the most important sources with 41 per cent each, and energy (mainly fugitive emissions), with its share of 17 per cent, made up for the rest together with some small sources (industrial processes and solvents) amounting to 1 per cent. Emissions from agriculture mainly came from enteric fermentation, 78 per cent of the total CH_4 emissions of the sector, with manure management accounting for the rest.

30. Emissions of CH_4 declined dramatically (by 24 per cent) between 1990 and 2000 as a result of reduced emissions from all sources. The decline of CH_4 emissions from waste by 29 per cent and from agriculture by 19 per cent contributed the most to the overall emission trend. Emissions from energy also followed a downward trend and dropped by 23 per cent.

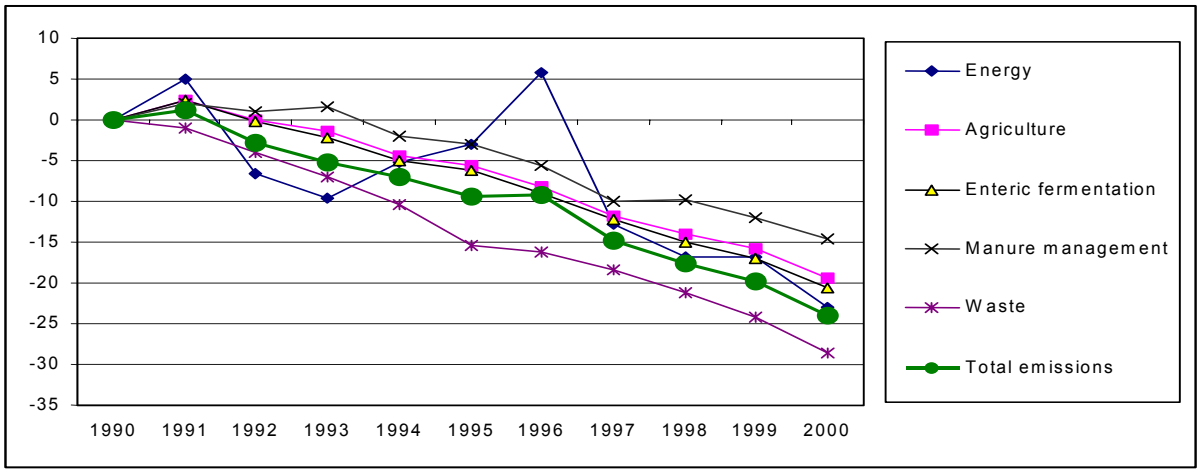
31. The decrease of emissions from waste reflected the advance in waste management policy. In absolute terms, the amount of waste going to landfills dropped almost threefold and in 2000 it accounted for only around 7 per cent of the total amount of waste. Also, the share of CH_4 recovered from landfills increased markedly from 5 per cent in 1990 to 18 per cent in 2000. Emissions from agriculture declined, mainly due to a reduction in the number of cattle as a result of the EC Common Agricultural Policy (CAP) and milk quota. The discernible decline in fugitive CH_4 emissions resulted mainly from implementation of cost-effective measures to prevent venting of natural gas during oil and gas production, and gradual replacement of old pipes by modern materials that reduce leakages from the distribution network.

Table 5. Methane emissions by source, 1990–2000 (Gg)

Source and sink	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000

categories											
Energy	213.18	223.86	199.11	192.52	202.28	206.97	225.37	185.89	177.23	177.33	163.96
Agriculture	505.33	517.09	505.78	497.83	483.13	477.04	463.58	445.80	434.71	425.01	407.78
Enteric fermentation	*401.86*	*411.63*	*401.22*	*392.69*	*381.67*	*376.72*	*365.86*	*352.64*	*341.39*	*333.89*	*319.43*
Manure management	*103.47*	*105.46*	*104.56*	*105.14*	*101.46*	*100.32*	*97.71*	*93.16*	*93.32*	*91.13*	*88.35*
Waste	568.69	562.45	546.51	528.79	509.96	481.31	476.42	464.32	448.32	430.79	406.31
Others (solvent and other product use) and **Industrial processes**	5.33	5.50	5.70	6.90	7.60	4.70	7.74	4.70	4.34	4.65	4.70
Total emissions	**1 292.53**	**1 308.90**	**1 257.10**	**1 226.04**	**1 202.97**	**1 170.03**	**1 173.11**	**1 100.71**	**1 064.60**	**1 037.78**	**982.75**

Figure 2. Methane emissions, percentage change from 1990, by source



Nitrous oxide

32. In 2000, the total N_2O emissions amounted to 54.77 Gg (table 6, figure 3). Agriculture (mainly emission from soils) and industrial processes (mainly emissions from nitric acid production) were the most important sectors, with almost equal shares of 44 and 42 per cent respectively. "Other" sectors, including polluted surface water, waste and solvent use, and energy (mainly emissions from mobile combustion in road vehicles), accounted for 9 and 5 per cent respectively.

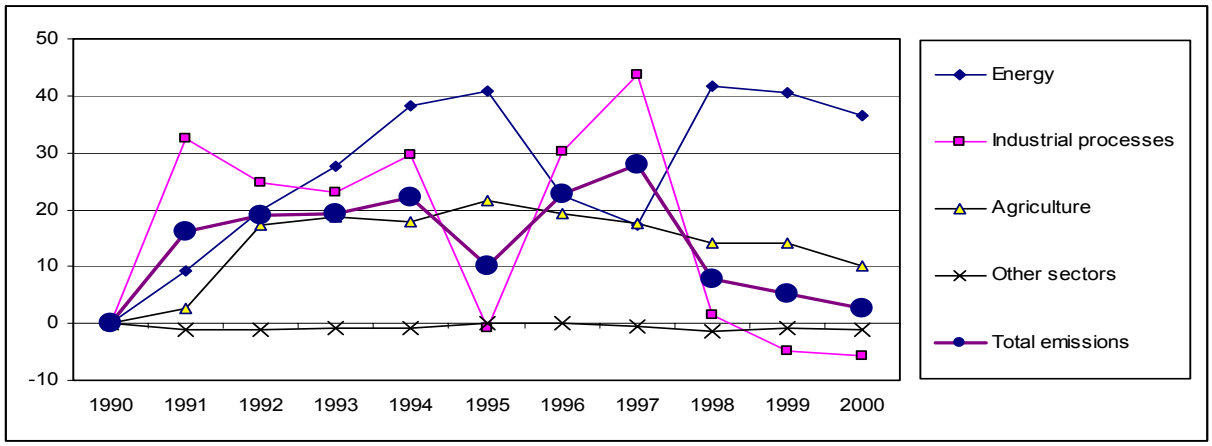
33. Emissions of N_2O increased by 3 per cent between 1990 and 2000. Growth of emissions from agriculture by 10 per cent contributed the most, given the large share of emissions from this sector. Two countervailing factors underpinned this growth: the amount of N_2O in manure applied to agricultural soils decreased by around 5 per cent as a result of the implementation of the EC directive on prevention of underground waters from ammonia pollution; and the application method has changed, leading to higher emissions. Emissions from road vehicles increased most, by 37 per cent, because of further market penetration of catalytic converters in cars. This growth was partly offset by the growing share of diesel cars, which have much lower emission factors than catalyst-equipped gasoline cars, and the introduction of a new generation of catalytic converters with lower N_2O emission factors. However, these emissions did not influence the overall N_2O emissions trend greatly because of their small share. Emissions from industrial processes, mainly from nitric acid production, remained broadly stable because output was stable and control measures were not implemented. There are inconsistencies in estimates for 1991–1994 and from 1996–1997 because the figures for these years had not yet been recalculated in the 2002 inventory.

Table 6. Nitrous oxide emissions by source, 1990–2000 (Gg)

Source and sink categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000

Energy	1.88	2.06	2.26	2.41	2.60	2.65	2.31	2.21	2.67	2.65	2.57
Industrial processes	24.37	32.30	30.40	30.00	31.60	24.17	31.70	34.98	24.70	23.22	22.96
Agriculture	22.11	22.68	25.91	26.23	26.07	26.85	26.40	25.99	25.25	25.24	24.35
Other sectors	4.94	4.88	4.88	4.90	4.90	4.95	4.94	4.92	4.87	4.90	4.89
Total emissions	**53.30**	**61.92**	**63.45**	**63.53**	**65.17**	**58.62**	**65.35**	**68.09**	**57.49**	**56.01**	**54.77**

Figure 3. Nitrous oxide emissions, percentage change from 1990, by source



Fluorinated gases

34. In 2000, total emissions of fluorinated gases amounted to 5,771 Gg CO_2 equivalent: emissions of HFCs accounted for 68 per cent, followed by PFCs (26 per cent) and SF_6 (6 per cent) (table 7). Emissions of HFCs were estimated at 3,917 Gg CO_2 equivalent. They occurred mainly as a by-product of HCFC-22 production, but around one third resulted from consumption of HFCs. They fell by 19 per cent between 1990 and 2000 as a result of the installation of a thermal afterburner, which compensated for the increased emissions from the use of HFCs due to their use as substitutes mainly for HFC-134a. Emissions of PFCs, including tetrafluoromethane (CF_4) and hexafluoroethane (C_2F_6), were estimated at 1,526 Gg CO_2 equivalent. They came mainly from primary aluminium production, and fell by 27 per cent as a result of a change in the production process (from side feeding to point feeding at one of the two plants). Emissions of SF_6 were estimated at 327 Gg CO_2 equivalent. They increased from 1990 to 1995 and stabilized thereafter.

Table 7. Emissions of fluorinated gases, 1990–2000 (Gg CO_2 equivalent)

Source and sink categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Emissions of HFCs	4 432	4 820	4 540	5 066	6 339	5 978	7 209	8 214	9 212	4 833	3 917
Emissions of PFCs	2 432	2 437	2 099	2 118	1 890	1 867	2 042	2 154	1 727	1 444	1 526
Emissions of SF_6	187	100	106	110	148	361	365	386	369	336	327
Total emissions	**7 050**	**7 358**	**6 745**	**7 294**	**8 377**	**8 206**	**9 616**	**10 753**	**11 309**	**6 614**	**5 771**

III. POLICIES AND MEASURES

35. The NC3 presents an array of policies and measures that have been implemented, adopted and planned by the Netherlands in meeting its commitments under the UNFCCC. These policies are presented in enough detail to demonstrate how policy packages have been designed to meet the objective of the UNFCCC and the Kyoto Protocol targets, and how the individual policies within these packages contributed to these objectives. In some instances, though, the status of implementation was somewhat unclear.

36. The cost of implementation of the main part of the NCPIP was reported in the NC3. The experience of the Netherlands in this area is substantial, and the review team encouraged the national experts to provide further details on cost estimates in future national communications, in view of the increasing importance of the cost and cost-effectiveness of climate policy for all Parties. Reporting of information on policies and measures was presented by gas, subdivided by sector, while the key policies were reported in a table by sector with a reference to the GHG affected, following the UNFCCC guidelines, with all necessary details, including the estimated reduction potentials from individual policies and policy packages. Overall, reporting of information was transparent and conformed to the UNFCCC guidelines.

37. VROM took the lead in coordinating climate policy and supported the implementation process, together with the other six ministries that have activities relating to climate change. The Energy Research Centre (ECN), RIVM and the Netherlands Bureau for Economic Policy Analysis provided analytical support by helping to identify effective policies, assess their effect and monitor their performance. The review team noted with appreciation the priority given to this assessment, and the rigorous and high-quality analytical work that had been done to provide robust estimates of the past and future effects of policies.

38. The ex-post evaluation of effects of policies and measures is mostly done by performance indicators. Examples of such indicators include improvement of energy efficiency in particular industries and the market shares of climate-friendly technologies. In some cases these indicators have been translated into effects on emission levels, following the emission inventory approaches. Several institutions have been involved in such evaluations, including the Netherlands Agency for Energy and the Environment (Novem) and the University of Utrecht. Also, a handbook was being prepared, to facilitate such evaluation and to enhance its uniformity by providing guidance on the methods and the choice of reference for calculations. Work has been initiated to perform such assessments by sector, and the ex-post assessment of policies is expected to became an integral part of the 2005 policy evaluation.

39. Every year VROM prepares an overview of climate policy development in the past year. It is based on annual inventory data and results from monitoring activities relating to all individual policies and measures. The report for 1999 was used for the preparation of the NC3. The review team was provided with the report for 2001, *Climate Policy Accounting 2001: Annual Report to the Parliament on the Progress of Dutch Climate Change Policies.* It presents climate change policies by gas and by sector, including industry, transport, agriculture and buildings. The report described well the actual emissions by sector compared to the reference emission level, and the emission level according to sectoral policy goals. The review team was also given the 2002 RIVM/ECN report *Reference Projection for GHG in the Netherlands*. The review team noted with appreciation the assessments included in these two reports and the possibility of replicating such an assessment in other countries, notwithstanding its inherent difficulties.

A. Cross-cutting issues

40. Policies and measures reported in the NC3 reflect the content of the NCPIP. The NCPIP was adopted in two stages, in 1999 (Part 1: Measures in the Netherlands) and 2000 (Part 2: Measures abroad). It was prepared by the government in response to the need to come up with a robust plan and strategy to attain the Kyoto target. The technical options paper issued by the ECN and RIVM in 1998, containing 61 emission reduction options in six major sectors, served as the analytical foundation for the preparation of the NCPIP. The overall effect of all options identified was close to the emission reductions needed to attain the Kyoto target, which that time was estimated at 50,000 Gg.

41. The policies forming the core of the NCPIP were selected from the technical options available, taking into consideration several guiding principles and approaches. The first of these principles was to achieve around half of the required emission reductions in the Netherlands and half abroad, through the use of the Kyoto mechanisms. The Dutch experience in Activities Implemented Jointly (AIJ) between 1996 and 2002 is noteworthy, and sets a foundation for successful use of these mechanisms. These

mechanisms establish a new market which has quite a low price for emission allowances for the moment, but this could quickly change. This introduces some uncertainty for the NCPIP reductions abroad.

42. Cost-efficiency is the most important criterion applied to choose policies from the technical options available. Also, it was agreed that there should be a fair distribution of efforts in emission reduction among sectors, of around 10 per cent. The combination of these criteria has led to reduction efforts of around 70 per cent for CO_2 and 30 per cent for non-CO_2 gases, and also to placing slightly more emphasis on reduction of fluorinated gases in relation to their share of the total emissions. Some policy-specific targets were set, e.g. to achieve 5 per cent of renewable energy in the TPES mix by 2010.

43. In 2002 the EC directive on emissions trading was in preparation, with plans to adopt it in 2003 and to initiate emissions trading at the beginning of 2005. This system is believed not only to ensure regulation of the traded emission quantities in a way that will make the achievement of the Kyoto targets more likely, but also to ensure more flexibility for the installations covered by the scheme in choosing the means for emission reduction. As of 2002, the Netherlands did not have plans for a national emissions trading scheme, but it will participate in the EC-wide scheme. The principle of splitting the mitigation effort equally between domestic emission reductions and reductions abroad will then become less relevant.

44. Importantly, the domestic part of the NCPIP was designed in three steps or packages. The first is the basic package, which contains a range of measures covering practically all sectors, split into CO_2 measures and non-CO_2 measures. This package aimed to deliver half of the 50,000 Gg overall emission reductions needed. The estimated cost of the package amounted to €450 million annually for CO_2 measures, and €65 million for non-CO_2 measures. The second step is the reserve package, containing measures to be phased in if some of the measures from the basic package fail to deliver the effects expected in the light of policy evaluations envisaged in 2002 and 2005. The purpose of these evaluations is to ensure that emission levels are in line with the Kyoto target. The measures constituting the core of the reserve package include increasing the energy tax, raising the excise on motor fuels, reducing N_2O from nitric acid production, and underground storage of CO_2. The third step is the innovation package, containing measures for the period following the first commitment period under the Kyoto Protocol (2008–2012).

45. This phased approach to the design of the NCPIP makes it possible to strengthen the implementation over time and include new measures if necessary without changing its underlying principles. This approach also ensures continuity and gradual transition from the short- and near-term measures centring on energy efficiency, renewable energy and non-CO_2 emissions reductions in the first commitment period to the innovative policies and measures for the post-Kyoto period.

46. The first of the policy evaluations was *The Progress of the Netherlands Climate Change Policy: An assessment at the 2002 evaluation moment* (VROM, 2002), hereinafter referred to as the 2002 Climate Policy Evaluation. The overall conclusion was that, notwithstanding the effect from policies implemented in the 1990s, which brought about a saving of 27,000 Gg of emissions annually, or around 12 per cent from the national totals, the goals for climate policies in the lead-up to 2000 were not met (see paragraph 13). However, several specific targets were met, including the target of 8,000 MW of new combined heat and power capacity (CHP) and the target for the long-term negotiated agreements (LTAs) on energy efficiency. Other specific targets were not met: the market share of renewable energy in 2000 was only 1.5 per cent compared to the 3 per cent target, and the energy efficiency index for greenhouse horticulture was 56 per cent in 2000 compared to the 50 per cent target set. The broad conclusion was that most of the NCPIP policies were either implemented or at a final stage of preparation. With these policies, emissions of non-CO_2 gases are expected to continue to follow a downward trend and to compensate for the continuing growth of CO_2 emissions. This is expected to lead to stabilization of domestic emissions in 2010 at their 2000 level. In order to meet the Kyoto target the Netherlands will make use of JI and the Clean Development Mechanism (CDM).

47. Another important development, after the NC3 was published in 2001, was the change of government in mid-2002. The new government introduced some changes in the implementation of the NCPIP, which are reflected in the Strategic Accord document and have an effect on emission trends. These include limiting subsidies for renewables (the effect was offset by guaranteeing an operational subsidy for 10 years) and energy conservation; removing some of the incentives for environmentally oriented policies in transport; and extending the operation of the Borssele nuclear power plant. These changes largely offset each other and were estimated to increase emissions by 200 Gg in 2010.[8]

48. In addition to the sectoral policies described below, at the beginning of 2002 the central government concluded a covenant for climate policy with the provinces and municipalities. To support activities under this covenant, aimed at promoting energy efficiency in the building sector and renewable energy at local level, as well as energy efficiency in small agricultural and transport companies, the government is providing a subsidy scheme amounting to €35.6 million annually. This covenant is expected to foster the implementation of climate policy at local level.

B. Energy

49. The natural gas endowment of the Netherlands and its essential role in the TPES (46 per cent in 2000), in combination with the relatively small proportion of coal, contributed to a carbon intensity of the economy that is around the average for the Organisation for Economic Co-operation and Development countries. This places the Netherlands in a favourable position compared to coal-dependent countries, but somewhat limits its capacity for emission mitigation through fuel switching. This explains the pivotal role of energy efficiency in the national climate strategy.

50. One of the effective policy instruments to promote energy efficiency and associated emission mitigation that affects the entire energy sector is the energy tax. The original tax rates were based half on the energy content of fuels and half on the CO_2 emissions. Over the years the rates have changed. The tax scheme contains various provisions for exemption of "green electricity", e.g. electricity produced from renewables or from gas-fired CHP. The tax levels have increased steadily and substantially in the last seven years, and the coverage of the tax has become broader than originally planned (table 8). This has increased incentives for energy-saving measures and improved their economic feasibility. A further increase is possible, as envisaged in the reserve NCPIP package. At the end of 2002, the Parliament was considering a bill to replace these provisions by a single subsidy programme with the same impact on emissions. The intention is to boost the domestic green electricity market by shifting the incentives for green electricity from consumers to domestic producers.

Table 8. Rates of energy tax in the Netherlands, 1996–2002 (€ per unit of energy)

	1996	1997	1998	1999	2000	2001	2002
Natural gas (m^3)							
1–5 000	1.45	2.89	4.33	7.17	9.46	12.05	12.40
5 001–170 000	1.45	2.89	4.33	4.65	5.20	5.63	5.79
170 001–1 million	0	0	0	0.32	0.70	1.05	1.07
Electricity (kWh)							
1–10 000	1.34	1.34	1.34	2.22	3.73	5.84	6.01
10 001–50 000	1.34	1.34	1.34	1.43	1.61	1.94	2.00
50 001–10 million	0	0	0	0.10	0.22	0.60	0.61

Note: Natural gas consumption in excess of 1 million m^3 and electricity consumption in excess of 1 million kWh are exempted from energy tax. All consumers pay the tax up to those levels.

51. The effect of the energy taxes may have been somewhat offset by the decrease in energy prices as a result of energy market liberalization and low oil prices at the end of the 1990s. An ex-post assessment by the government of the effect from the tax from 1996 to 1999 suggests that its effect on households amounted on average to a saving of 35 m^3 natural gas and 181 kWh electricity annually. This resulted in

[8] On an annual basis, the increase of emissions from transport was estimated at 1,700 Gg, while the decrease of emissions due to the lifetime extension of the Borssele nuclear plant and effects from renewable energy were estimated at 1,500 Gg.

a saving of 900 Gg CO_2 at the national level. The effect in 2002 is considered to be even larger. The most recent ex-ante assessment suggests that this tax could lead to a saving of 1,000–1,600 Gg CO_2 for every €1,600 million of tax revenue in 2010 (the current tax revenue amounts to €6,000 million). This outcome will depend on the relative change of energy prices, which are determined by the pace of energy market liberalization and tax levels.

52. Energy market liberalization affects production and consumption patterns in all energy subsectors through energy prices, so it will also have a notable impact on emission levels. Liberalization of the electricity sector was initiated at the beginning of 1999, when consumers with capacity above 2 MW were given the option to choose their supplier. This represents around one third of the total number of power consumers, and a much larger share of the power market. In 2002 the market was extended further by including all consumers with installed capacity above 50 kW. This represents an opening of two thirds of the market. The final goal is complete liberalization of the electricity market by 2004. Similarly, liberalization of the natural gas market was initiated in 2000 by the launch of the Gas Act. Significantly, the new electricity and gas liberalization laws contain provisions for establishing the "green certificate" market described in paragraph 58 below.

53. The energy tax is only one of the broad and diversified policy instruments used to promote energy efficiency in all subsectors within the energy sector. These instruments, together with the instruments in the energy sector, are summarized in table 9 and discussed below.

Table 9. Summary of the key policies and measures in the energy sector

Policy or measure	Policy instruments used	NCPIP savings (Gg CO_2 eq.)	Comments based on RIVM/ECN and other documents provided to the review team
Reducing coal sector emissions: increased use of biomass	Voluntary agreements with the coal producers	800–6 000	The covenant was concluded only recently
Support to CHP based on natural gas	Fiscal incentives, e.g. CHP payment deduction	500	Promotion of the CHP had noticeable effect, but more incentives may be need in the liberalized energy market
Promotion of renewable energy: target of 3 per cent of renewables in the TPES in 2000 and 5 per cent in 2010		2 000–4 000	The target was not met; the share of renewables in the TPES was only 1.5 per cent in 2000, with some of it coming from electricity imports
Energy efficiency in power plants, industry and refineries	Benchmark covenant, LTA	1 400–2 300	Benchmarking covenant increased information on energy saving options
Electricity supply from nuclear plant	Extending lifetime of the plant	1 400	See projections (section IV)
Energy conservation programme for households	High energy tax on electricity; Energy Performance Advice (EPA) and support for appliances	3 300	EPA did not have permanent effects, whereas the energy tax did

Energy supply

54. Policies to promote CHP and renewable energy, increased use of biomass instead of coal for electricity generation, and increased efficiency of the coal- and natural gas-fired power plants, as discussed in the section on industry, constitute the core of climate policies in the energy supply sector.

55. An array of tax incentives, mainly through the energy tax, and investment and operating support schemes, have been used to achieve the national target of 8,000 MW installed capacity of CHP in 2000. With an installed capacity of 7,800 MW[9] in the same year this target was attained, with the growth in installed capacity coming mainly from natural gas CHP.

56. However, as a result of increased prices of natural gas and increased competition from foreign electricity producers in the liberalized EC electricity market, the CHP market share did not subsequently extend further. To give further impetus to CHP, in 2002 the government increased the operating support for electricity from CHP to €0.0057 per kWh delivered to the grid, increased the cap on the electricity from CHP delivered to the grid from 200 MW to 1,000 MW and exempted small CHP from

[9] This figure includes waste incineration plans and excludes centralized CHP based on coal.

environmental permits. The results of these actions are being carefully monitored. The liberalized EC electricity market will continue to define to a large extent the effectiveness of the approaches taken to promote CHP, and further actions may be necessary.

57. To mitigate emissions from coal-fired power plants, in 2002 the government concluded a Coal Covenant covering the period 2008–1012, which by the time of the review covered practically all plants.[10] This is a new measure, not reported in the NC3. The Coal Covenant commits power plants to participate in the Efficiency Benchmarking Covenant (EBC) (see section on industry below) and to substitute some coal by biomass. The emphasis is clearly on efficiency improvement, as coal is expected to remain the fuel of choice on a price competitive basis. The initial estimates were that the Coal Covenant could bring 6,000 Gg emission reduction, including 4,000 Gg from the switch to biomass, but recent estimates have scaled this down to 2,000–4,000 Gg.

58. The policy to promote renewable energy has been target driven. In particular, the NC3 reports on a target of 5 per cent of renewable energy within the TPES in 2010, which seems ambitious given the starting level of only 1 per cent in 1995. When achieved, this target is expected to result in 2,000 Gg CO_2 saved. The target is feasible, given the government estimates on considerable potential for wind energy of around 6,000 MW offshore and 1500 MW onshore, and some potential for biomass use. Several instruments have been put in place, including subsidies, fiscal instruments, "green certificates", agreements on construction of windmills and voluntary agreements with housing corporations. However, the NC3 contains little detail on how these instruments mutually support each other, which of them are expected to contribute most to the target set, and how to operationalize renewable policy in a cost-effective way.

59. In 2000, the results achieved were modest: the share of renewable energy in the TPES amounted to around 1.5 per cent,[11] but part of it came from electricity imports and the domestic component came mainly from combustible renewables and waste. This result reflects the difficulties associated with the limited availability and high technology cost of some renewable resources, including solar, and uncertainty among investors on the future investment climate and, in particular, on extension of the current financial incentives into the future. This also reflects some lack of acceptance of and administrative barriers for wind energy schemes, such as lengthy procedures to obtain permits for them. The government has taken up initiatives in the framework of the 2002 Covenant for Climate Policy with the provinces and municipalities to address some of these barriers.

60. The "green certificates" scheme, launched as an integral component of energy market liberalization, aimed at ensuring environmental objectives in this process. It is also among the central instruments for promoting renewable energy in the Netherlands. Under this voluntary scheme, gas and electricity consumers acquire "green certificates", which can be used to finance renewable energy and energy efficiency projects. The system operates in parallel with the "green label" trading system, which aims to help the distribution companies achieve the renewables target. The scheme has had a rapid positive response among consumers, almost 1.5 million of whom joined the scheme after its launch in 2001. The response among suppliers was modest, because foreign suppliers were very competitive.

61. Another important instrument is research and development, which is expected to help to bring down the current relatively high prices of renewable energy and to solve some of the existing technical problems, which hinder the penetration of renewable energy from the supply side at domestic level. In 1999, in response to concern over the slow penetration of renewable energy, the government decided to spend around 166 million Dutch guilders (€75.5 million) on renewables demonstration programmes.

62. The new government has taken a decision to extend the operation of the only Dutch nuclear plant in Borssele beyond the previously planned phase-out year of 2004, possibly until 2013. The effect of this decision is estimated to be around 1,400 Gg CO_2 saved.

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[10] This included six companies with total installed capacity of 4,000 MW and annual emission level of 25,000 Gg.

[11] The interim target for 2000 was a 3 per cent share of renewables in the TPES compared to the indicative target for the Netherlands for the share of electricity from renewable energy, which was set at 9 per cent in 2010, according to the EC directive on promotion of renewable energy.

Industry

63. The two core elements of the NCPIP in industry are the EBC for energy-intensive industries, including power plants, refineries, basic chemicals, pulp and paper, aluminium, and steel, and the LTAs on energy efficiency improvement for less energy-intensive industries. Indeed, the energy intensity of the Dutch economy has decreased from 0.18 Mtoe per billion US$ in 1990 to 0.15 Mtoe per billion US$ in 2000. However, around two thirds of this improvement is attributed to autonomous processes, such as technical developments and structural changes, while the rest is attributed to measures such as the LTAs and supporting subsidies and financial incentives.[12] Altogether the EBC and LTAs are expected to deliver emission savings of between 1,400 and 2,300 Gg by 2012.

64. The LTAs were initiated in 1993, and by 1998 the first generation of them covered around 90 per cent of industrial energy consumption. The second generation of LTAs was concluded in 2001 and will last until 2012. The agreements cover 16 sectors with energy consumption of 100 PJ annually. The main requirements for the industries are to apply all the conservation measures with a payback period less than five years, to prepare and implement an energy conservation plan and to introduce systematic energy management. Other requirements include utilization of renewable energy and development of energy-efficiency products.

65. In 1999, the Dutch Government concluded EBCs with six major energy-intensive industries. These industries have undertaken a commitment to become part of the top 10 per cent of industries that are world leaders in terms of energy efficiency by 2012. The covenants envisage setting benchmarks for different types of processes by a consultant, and approval by the Ministry of Economic Affairs. Also, companies should prepare and implement an Energy Efficiency Plan to achieve the benchmark. When the EC emissions trading system is introduced, the stranded cost of investment made before the introduction of the system will be balanced by the relevant provisions for emission permits allocation.

66. By the beginning of 2002, around 84 per cent of potential participants had joined the covenants. Importantly, 40 per cent of the emission reductions in 2012 are expected to come from improvements that surpass the current most efficient processes in the world. The interim evaluation of the performance of the EBCs by the ECN and RIVM suggests that they are on track to meet the targets. However, these are relative targets and in absolute terms the level of emissions will also depend on the production volume. The 2001 annual report to the parliament concluded that more attention should be given to industry, given that the current policies are not sufficient to attain the estimated levels in 2010.

Residential and commercial sectors

67. Climate change policy in the residential and commercial sectors focuses on energy efficiency improvement of the building sector and appliances. The NC3 describes two measures: the 1999 Energy Performance Advice (EPA) and the 2000 Energy Premium programme for energy-efficient appliances and insulation, which together are expected to deliver 3,300 Gg CO_2 reductions in 2010. The EPA provides technical support, advice for behavioural changes and a subsidy scheme, including the Energy Premium programme for efficiency improvement in existing buildings. It is supported by a mass media campaign. The Energy Premium programme, which is linked to the EPA,[13] provides a partial rebate for consumers for the purchase of the most effective appliances of their class and for efficient insulation. The funding under the programme is some €200 million for 2002 and €54 million for 2003.

68. The report *Climate Policy Accounting 2001* suggests that the effects of policies and measures in this sector was lower than expected as a result of increased energy consumption. In response, energy performance standards set for new buildings were tightened for non-residential buildings in January 2003. Their implementation was backed by the Energy Premium available as of 2002 through Green Project arrangements. Also, energy taxes in the household sector have a role in promoting energy efficiency by

[12] *National Environmental Policy Plan 4,* 2001, p. 9.

[13] Households that take measures recommended by the EPA may receive a €159 rebate from their energy company for the cost of the EPA, in addition to the bonus of 25% in the Energy Premium for the measures they take.

providing a signal to consumers through energy prices. The new ENTER project launched in 2002 in this sector is described in paragraph 122.

C. Transport

69. The 21 per cent growth of emissions from transport between 1990 and 2000 was underpinned by a 25 per cent growth in total transport demand. To meet this demand, the government increased investment in roads, which by far exceeded investment in the railways. The main drivers for the increase in road traffic and emissions between 1990 and 2000 included GDP growth (32 per cent) and population growth (7 per cent), resulting, as in most developed countries, in dependence on energy-intensive road-based passenger cars and vans. To mitigate this effect, in 2000 the government launched *A New Way to Drive,* a programme to promote the purchase of fuel-efficient cars and encourage safe and efficient driving behaviour. The funding amounts to €11 million and the effect is estimated at 40 Gg emissions. To improve efficiency of new passenger cars, in January 2001 the government introduced energy labels with information on both absolute and relative fuel consumption, and launched an information campaign.

70. A number of other policies and measures from the NCPIP basic package, aimed at reducing the emission growth from the transport sector, were implemented using two instruments – voluntary agreements and fiscal incentives. They targeted an emission reduction of around 2,000 Gg in 2010, as reported in the NC3. Some of the measures are being implemented and others are yet to be adopted. When fully implemented, these policies will bring overall cost savings of around €215 million annually, and will help to offset around one third of the overall cost of the CO_2 measures envisaged in the NCPIP.

71. Policies and measures which are being implemented include the EC agreement on new cars (ACEA Covenant), a voluntary agreement that requires European car manufacturers to achieve 25 per cent reduction in average CO_2 emissions of new cars between 1995 and 2008. Other measures include discouraging commuter traffic and personal use of company cars, increasing tyre pressure, improving enforcement of speed limits and improving efficiency of goods transport.

72. The basic NCPIP package also envisaged road pricing (estimated emission reduction of 200 Gg in 2010), which was later abandoned in favour of a kilometre tax (also aimed at managing travel demand and reducing congestion), but the plans for implementation of this tax were discontinued after elections in mid-2002. These measures were expected to reduce emissions by 1,700 Gg annually by 2010. The new government also reduced gasoline taxes, announced new investments in roads and cancelled the rebates for fuel-efficient cars.

73. Emissions of N_2O from transport in 2000 were about 2,000 Gg, or 4 per cent of the total N_2O emissions, coming mainly from road traffic as a result of the introduction of catalytic converters. No specific measures to reduce these emissions have yet been introduced.

74. The review team noted that although both the NC2 and the NC3 contained measures and programmes aimed at reducing the number of vehicle kilometres travelled, with special attention to the improvement of public transport, explicit and effective additional policies may have to be pursued to slow down the growth of emissions from this sector. These measures could also help to respond adequately to problems of congestion and transport emissions, which are growing despite the fact that, compared to other developed countries, the Netherlands has a much higher share of cycling and walking and relatively high oil product prices. They could include: encouraging modal shifts to more efficient, cost-effective, and less polluting forms of public and freight transport; reducing traffic congestion through traffic demand management measures; promoting further use of non-motorized transport, e.g. through physically separated road lanes and networks, and traffic calming; and promoting further integrated land-use planning.

D. Industrial processes

75. Policies in this sector, together with policies to mitigate emissions from some non-industrial uses of fluorinated gases and waste, have been implemented in the framework of the Reduction Programme on

non-CO_2 gases (ROB). The ROB was initiated before the NCPIP and later became a part of it. Its goal is to identify cost-effective mitigation options, to support the implementation of specific measures and to reduce uncertainties associated with the emission estimates. The programme covers, among other things, development of technology to replace HFC emissions and to reduce N_2O emissions from nitric acid production, design of standards for leakages from cooling installations, reduction of HFC emissions from inhalations, and reductions of SF_6 emissions from end-use applications.

76. In 1999, as a part of the NCPIP basic package, the ROB was envisaged to deliver around one third of the required domestic emission reductions, or 8,000 Gg. As a part of the reserve package the envisaged reductions were 10,000 Gg (mainly emissions from nitric acid production). The overall budget was set at €204 million, including €75 million in tax incentives. In 2001, when the NC3 was prepared, the budget was scaled down to €195 million. At the end of 2002, the content and the budget of the programme were revised again, mainly because of the discontinuation of three projects with a very small reduction potential and the lack of technology for some other options, e.g. application of HFCs and PFCs as replacements for HCFCs controlled by the Montreal Protocol. The new budget was set at around €140 million, including tax incentives, and emission reductions were estimated at 6,600 Gg as part of the basic package and 5,500 Gg as part of the reserve package. These new estimates were a result of the ROB programme, which gave better insights into emissions and related cost-effective measures.

77. The 2002 Climate Policy Evaluation concluded that most of the ROB measures are cost-effective and that the programme is broadly on track to deliver the planned emission reductions. In the aluminium industry investment decisions were made that will reduce PFC emissions by 90 per cent (1,100 Gg CO_2 equivalent), and in the HCFC industry technological improvements will bring a reduction of around 3,000 Gg CO_2 equivalent. The only measure from the ROB included in the reserve package is N_2O reduction from nitric acid; the evaluation concluded that the reduction potential of 5,500 Gg CO_2 equivalent could be achieved in a cost-effective way at a national level, but may impose a considerable investment cost for this particular industry.

78. The review team noted that the instruments applied in the framework of the ROB were soft in nature, including fiscal and research incentives, and the effect could be mainly encouragement. For some applications, such as SF_6 emissions from double glazing, some regulatory instruments are currently under discussion at the EC level.

E. Agriculture

79. The agriculture sector in the Netherlands comprises cattle breeding, crop production and greenhouse horticulture. It was responsible for about 10 per cent of the total emissions in 2000 (4 per cent of CO_2 and 37 per cent of non-CO_2 emissions, including CH_4 and N_2O). As noted earlier, the main driver behind the drop in CH_4 emissions was the decline in the number of cattle as a result of the EC CAP. The Dutch manure policy also contributed to this, by regulating manure production and application of manure and fertilizers through its systems for manure transfer contracts and mineral accounting. This policy also tends indirectly to regulate the number of cattle.

80. As a continuation of existing practices, the Netherlands has requested a derogation from the EC Nitrate Directive and a higher input standard of 250 kg of nitrogen per hectare of grassland. If the request is not met, a further decline in the number of non-dairy cattle is expected with a corresponding decrease of N_2O emissions. Also, banning the surface-spreading of manure and encouraging manure injection into the soil resulted in more nitrogen being absorbed by grasslands. As a result, the N_2O emissions from this sector, which had increased at the beginning of the 1990s, gradually decreased again and in 2000 were 10 per cent higher than the 1990 level.

81. Horticulture in heated greenhouses is carried out on a large scale in the Netherlands. Around 85 per cent of the CO_2 emissions in agriculture originate from greenhouse horticulture, which consumes 80 per cent of the energy used in the sector and 10 per cent of the natural gas used in the economy. The most important measure adopted in this sector is the Glami Covenant, which was backed by fiscal

incentives, subsidies, regulations, and research and demonstration projects. The main goal of the covenant is to reduce energy use per unit production by 35 per cent in 2010 compared to the 1980 level. The interim goal for 2000 was 50 per cent, but the level actually achieved was 56 per cent.

F. Forestry and land-use change

82. Forests cover only around 9 per cent of the Netherlands' total land area of 34,000 km^2. Over the past 15 years, the forests have become more mature, better structured and more mixed in terms of tree species. The policy goal is to expand forest area by 75,000 ha between 1994 and 2020. It has been estimated that this will increase carbon sequestration by 100 Gg CO_2 by 2010.

83. To accelerate afforestation, the government has introduced a payment discount scheme into the energy tax. Under the scheme, the National Green Fund (NGF) engages interested parties in planting new forests, maintains them in a sustainable manner for a period of at least 50 years and issues "green certificates" for newly afforested land. Any energy company seeking rights for CO_2 sequestration can deduct €4,538 from the energy tax it owes to the government, if it transfers this amount to the NGF. It is estimated that this scheme can reduce revenues from the energy tax by up to €9 million per year. The effect of these "green certificates" has been small, because of the Forestry Law, which prohibits conversion of forest land to agriculture. The government has decided to develop a national system for effective monitoring and evaluation of land use in forest and types of activities in the sector, for the purposes of reporting in the Kyoto Protocol.

G. Waste management

84. The emissions of CH_4 from landfills were estimated at 406 Gg in 2000, corresponding to 41 per cent of the total CH_4 emissions. These emissions fell by 29 per cent between 1990 and 2000, mainly as a result of the successful implementation of the waste management policy aimed at waste minimization, recycling, incineration and a high share of landfill gas recovery. An emission monitoring protocol was elaborated within the ROB, with a view to further emission reduction.

IV. PROJECTIONS AND THE TOTAL EFFECT OF POLICIES AND MEASURES

A. Preparation of projections

85. The reference scenario reported in the NC3 was initially developed as a long-term reference scenario for environmental policy evaluation in the 1997 National Environmental Outlook.[14] It was developed by ECN and RIVM. Other institutions involved included the Economic Bureau, VROM and the Ministry of Economic Affairs. The recent new "reference" scenario, also reviewed in this report, was also developed by ECN and RIVM for the latest 2002 evaluation of climate[15] and energy[16] policies.

86. The NC3 contains a set of projections on a gas-by-gas basis for each of the main GHG gases (CO_2, CH_4, N_2O), which are reported by sector or group of sectors in tabular format. Projections are presented collectively for each group of fluorinated gases (HFCs, PFCs and SF_6). Projections of indirect GHGs (CO, NO_X, NMVOCs and SO_2) were presented in aggregated format. The base year for projections was 1995, although this was not the latest year for which inventory data were available at the time projections were prepared. Projected emission levels were presented up to 2020 for the "with measures" scenario and up to 2010 for the "with additional measures" scenario. Inventory data for 1990 and 1995 reported in the NC3 and data for the same years from the model are slightly different for most gases, as a result of recalculations of historical emissions after preparation of the 1997 inventory, on which projections are based.

87. Projections of emissions associated with bunker fuels were not reported; the review team encouraged the Netherlands to report on these emissions, given that they correspond to around 25 per cent

[14] It was called the Global Competition (GS) scenario and was also used in the updated NC2, published in 1998.
[15] 2002 Climate Policy Evaluation and 2002 RIVM/ECN report *Reference Projection for GHG in the Netherlands*.
[16] *Investing in Energy: Choices for the Future 21, May 2002* (Energy report 2002) available on the website: www.minez.nl

of the total national emissions. Aggregated national emissions expressed in CO_2 equivalent using the Global Warming Potential were presented by gas but not by sector. This made it difficult to gain a clear understanding of emission trends by sector and the impact of policies and measures under different scenarios. Total projections of CO_2 emissions are given relative to both temperature-adjusted and unadjusted inventory data, whereas by sector they are given only relative to adjusted inventory data. Projections of removals from LUCF were not included, but the level of these removals is small. The review team noted that sensitivity analysis to underlying assumptions was performed, but the results were not discussed in the NC3. It encouraged the Netherlands to follow the UNFCCC guidelines more strictly when reporting on projections.

B. Scenarios, models and assumptions underlying future emission trends

88. Two scenarios are presented in the NC3. The reference scenario, which corresponds to the UNFCCC guidelines definition of the "with measures" scenario, encompasses emission projections until 2020. It includes all measures implemented by 1999 before the launch of the NCPIP and the effect from the promotion of CHP implemented after 1999. The "with additional measures" scenario encompasses the effects of policies and measures included in the NCPIP. It contains emission projections until 2010 only, because the effects of the NCPIP were estimated up to that year. This scenario includes all the measures (23 sector-specific measures) from the basic package of the NCPIP aimed at delivering 50 per cent of the emission reductions needed to reach the Kyoto target.

89. The "with measures" scenario in the NC3 is almost identical to the reference scenario in the NC2. The difference between them stems from new emission factors used for some of the emission sources, recalculated energy export and import, and some changes in modelling approach. These differences resulted in emission projections growing faster in the NC3 than in the NC2. The new reference scenario reviewed in this report reflects the inventory update, new socio-economic trends, effects of energy market liberalization and changes in energy prices. The corresponding new scenario with the revised effects from the NCPIP includes policy developments up to July 2001.[17]

90. The methodology for the preparation of the GHG emission scenarios is broadly based on projections of activity data and relevant emission factors. For energy-related emissions, energy use and energy efficiency improvements were modelled by a combination of methods, including the NEMO model, which is a top-down model used by the Central Planning Bureau, and the SAVE model, which is a bottom-up model used by ECN. Both models were originally designed to prepare projections for energy demand and energy efficiency improvement. Other models were used for the energy end-use sectors, including a state-of-the-art model for transport. Input data on price elasticity and cost curves were obtained from research carried out by universities and research institutes.

91. Energy supply was modelled using the SELPE model, which makes it possible to model energy supply development that meets energy demand defined by the NEMO and SAVE models. Finally, the RIM+ and RIVM models (also known as the Environmental Information and Planning Model) were used to perform a consistent emission calculation by gas and by sector. In addition, the market simulation models GASTALE and POWERS were used to simulate the effect of energy market liberalization. Within the energy supply sector, specific models for refineries, electricity, CHP and renewables were used. Modelling methodology changed between the NC2 and the NC3: the electricity sector model was replaced and some model-specific improvements were made. Separate spreadsheet models were used for non-energy-related emissions, e.g. projections of CH_4 from landfills, livestock, application of manure and fertilizers in soils, NO_2 from nitric acid production and the fertilizer industry, and fluorinated gases.

92. Comparison of the actual development of the key parameters between 1995 and 2000 and assumptions used in the NC3 projections suggests that the two sets of data are broadly consistent (table 10). An exception is industrial production, which was assumed to grow by 4.3 per cent a year,

[17] These are: the wind energy and climate covenants with provinces and municipalities, the CO_2 coal covenants, the kilometre tax, the new measures in the greenhouse horticulture sector, the intensification of energy conservation policies for buildings and new initiative on non-CO_2 gases.

whereas the actual growth was 2.1 per cent. Importantly, the FEC was assumed to grow by 1.6 per cent, but the actual growth was only 0.7 per cent. Assumptions in the new reference scenario reflect better the actual development of the key economic and energy indicators between 1995 and 2000. Also, assumptions on GDP reflected lower growth expectations compared to the NC3 scenarios, which came mainly from reduced expectations of growth in labour productivity.

93. In the transport sector, growth between 1995 and 2000 was driven mostly by a high (7 per cent) annual growth of freight transport. In the "with measures" scenario the growth is assumed to continue until 2010, although at a slower rate of 3.8 per cent annually. This means 50 per cent cumulative growth for this sector in 2010 compared to 1995. Passenger transport is expected to grow by less than 1 per cent annually between 1995 and 2010. Livestock population is assumed to increase by 5.5 per cent annually between 1995 and 2010, but in 1995–2000 it actually declined by 1.8 per cent annually.

Table 10. Comparison of actual growth or values of some key parameters and assumptions for these parameters in the "with measures" scenario in the NC3 and the new reference scenario

	Actual development 1995–2000	Assumptions in "with measures" scenario (GC) in NC3	Assumptions in new reference scenario
Economic growth (GNP) (%)	3.6	3.25	2.5
Industrial production (%)	2.1	4.3	2.5
Private consumption (%)	3.7	2.9	3.1
Population (%)	0.6	0.4	0.4[a]
Final energy consumption (%)	0.7	1.6	0.6
Energy end-use conservation (% improvement annually)	1.1	1.3	1.2
World oil price (US$/bbl)	25	31	15–28

[a] Calculated on the basis of population in 2010 reaching 16.6 million.

C. Results of projections

94. According to the inventory estimates available at the time of preparation of the NC3, the Kyoto target was estimated to be 206,000 Gg. The GHG emissions in the "with measures" scenario were expected to be 256,000 Gg CO_2 equivalent in 2010 and 285,000 Gg in 2020, resulting in a policy target for emission reduction of 50,000 Gg in 2010. Under the assumption of 3.3 per cent GDP growth annually, GHG emissions were projected to grow by 0.9 per cent annually and, under the "with measures" scenario, to reach in 2010 a level 13 per cent higher than the 1995 level. For the "with additional measures" scenario, GHG emissions were expected to decline by 2 per cent annually and to reach 230,000 Gg CO_2 equivalent in 2010. This is 25,000 Gg lower than in the "with measures" scenario, reflecting the effects of the NCPIP measures (figure 4).

95. According to the new reference projections, in 2010 the GHG emissions are expected to reach 239,000 Gg, without the NCPIP measures, and the Kyoto target is estimated to be 199,000 Gg. Accordingly, the new policy target for emission reduction is calculated to be 40,000 Gg. In order to compare the "with measures" scenario with the new reference scenario, it is necessary to recalculate the former with the latest emission factors used for the new reference scenario. The GHG emissions in 2000, which is a base year for the new reference scenario, are 19,000 Gg lower than the "with measures" scenario value of 222,000 Gg. The emissions in the new reference scenario with NCPIP measures are expected to reach 225,000 Gg CO_2 equivalent in 2010. The data for these scenarios are provided in table 11 and emission savings by sector are provided in table 12.

Figure 4. Projections of the total GHG emissions in NC3 and the Kyoto target

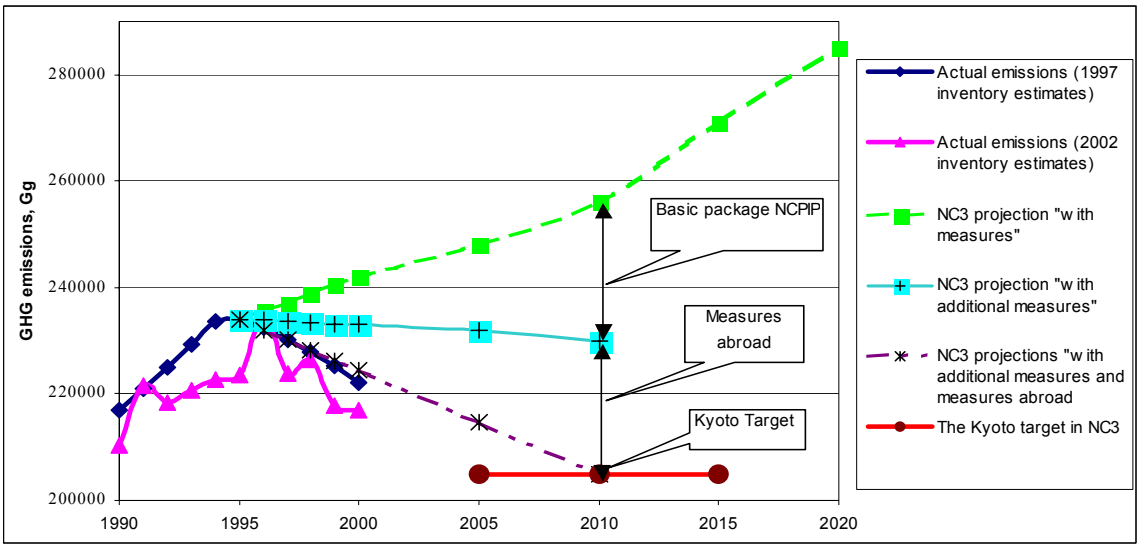

Table 11. Projections of emissions in NC3 and the new reference scenario in 2010 (Gg CO_2 equivalent)

	NC3	Recalculated NC3 scenarios	New "reference" projections"
Emissions in 2010 for "with measures" scenario, e.g. without NCPIP, including:	256 000[a]	245 000	239 000
– emissions of CO_2	207 000	203 000	199 000
– emissions of non-CO_2 gases	49 000	42 000	40 000
Kyoto target of 6 per cent emission reduction	206 000	199 000	199 000
Policy target for emission reduction	50 000	46 000	40 000
Reduction effect in 2010 of implemented domestic policies from the NCPIP, including:	26 000	23 000	14 000
– emissions of CO_2	18 000	17 000	8 000
– emissions of non-CO_2 gases	8 000	6 000	6 000
Emissions in 2010 with implemented domestic policies from the NCPIP, including:	230 000	222 000	225 000
– emissions of CO_2	190 000	186 000	191 000
– emissions of non-CO_2 gases	40 000	36 000	34 000
Reduction effect in 2010 of domestic measures in preparation, including:	n.a.	n.a.	3 000–6 000
– emissions of CO_2			2 000–5 000
– emissions of non-CO_2 gases			1 000

[a] Compared to 259,000 Gg projected in the NC2 for the "without measures" scenario. n.a. = not applicable.

96. As already noted, the new policy target was set at 40,000 Gg, compared to the previous target of 50,000 Gg reported in the NC3, whereby half of the reduction equal to 20,000 Gg should be achieved by domestic measures. However, the overall effect from policy developments between July 2001 and July 2002 was projected to lead to a decrease in emissions in 2010 of between 3,000 Gg and 6,000 Gg. In order to attain the upper end of this range, the effects expected from agreements and regulations will need to be achieved in practice. This will require close monitoring and enforcement. Facing a possible shortfall of around 3,000 Gg, the government decided to initiate the implementation of one of the measures from the NCPIP reserve package, involving the reduction of 5,500 Gg in emissions of N_2O from the production of nitric acid. With those developments, it is expected that the Netherlands will meet its policy target for domestic emission reduction of 20,000 Gg in 2010.

Table 12. GHG emissions savings by sector in 2010 (Gg CO_2 equivalent)

	CO_2 emissions		Non-CO_2 emissions		Total emissions	
	"With additional measures" scenario	New reference scenario	"With additional measures" scenario [a]	New reference scenario	"With additional measures" scenario [a]	New reference scenario
Industry	2 300	1 400	6 100	5 800	8 000	7 000
Energy	8 000	3 300	0	0	8 000	3 000
Transport	2 000	1 200	0	0	2 000	1 000
Agriculture	2 000	100	0	0	2 000	0
Households	2 300	1 000	0	0	2 000	1 000
Services	1 000	700	0	0	1 000	1 000
Total	**17 000**	**8 000**	**6 000**	**6 000**	**23 000**	**14 000**

[a] The new emission factors from the most recent inventory are taken into account.

97. Uncertainty analysis of the "with measures" projections was carried out using a Monte Carlo method. The results suggest an uncertainty margin of 14,000 Gg for the total emissions within a 95 per cent confidence interval.[18] It is worth noting that the uncertainty in projections is comparable to the emission reduction expected from the currently implemented NCPIP measures.

D. Projections by sector and estimated effect of policies and measures

98. In the "with measures" scenario, CO_2 emissions from the energy supply sector[19] will grow steadily from 47,000 Gg in 1995, to reach 54,000 Gg in 2010, and slightly decline thereafter to 53,000 Gg in 2020. The NCPIP measures for fuel switching, increased efficiency in coal-fired power plants and higher penetration of renewables are expected to result in 8,000 Gg CO_2 saved, which would bring CO_2 emissions down to 46,000 Gg in 2010. The energy sector and households are the two sectors that are expecting to bring down CO_2 emissions in 2010 to 1995 levels.

99. The industry sector, including refineries, which accounted for the largest share in total CO_2 emissions of 31 per cent in 2000, is expected to maintain steady emission growth according to the "with measures" scenario from 56,000 Gg in 1995 to 62,000 Gg in 2010 and 75,000 Gg in 2020. The expected 2,000 Gg of CO_2 saved from the NCPIP EBC will lower CO_2 emissions to 60,000 Gg in 2010.

100. Emissions of CO_2 from transport are expected to continue to grow, driven by further growth of transport activity, from 32,000 Gg in 1995 to 38,000 Gg in 2010 and 47,000 Gg in 2020. The effect of the eight transport measures in the NCPIP is expected to reduce emissions in 2010 by only 2,000 Gg and in 2010 emissions from this sector will reach 36,000 Gg.

101. The household sector, with CO_2 emissions of 22,000 Gg in 1995, is expected to maintain its emissions broadly at the same level, reaching 23,000 Gg in the "with measures" scenario in 2010. In the "with additional measures" scenario, emissions will be reduced slightly to 21,000 Gg as a result of efficiency improvements. The CO_2 emissions from agriculture, mainly horticulture, are expected to grow by around 1,000 Gg every five years, starting from 9,000 Gg in 1995 and reaching 14,000 Gg by 2010, in the "with additional measures" scenario. The NCPIP measures aimed at increased efficiency will bring emissions down by 2,000 Gg in 2010.

102. Emissions of CH_4 and N_2O are expected to decline between 2000 and 2010 in both NC3 scenarios. Jointly, these emissions are expected to reach 35,000 Gg in 2010 in the "with measures" scenario and 34,000 Gg in the "with additional measures" scenario, which represents a drop of approximately 26 per cent for both scenarios compared to 1990. Emissions of CH_4 are expected to drop by one half as a result of lower natural gas production, enhanced gas flaring and recompression, network leakage improvements, reduced livestock numbers and improved waste management. Emissions of N_2O are expected to stabilize by 2010 at the 1990 level in the "with additional measures" scenario.

[18] Uncertainty of social-economic development equals 13,000 Gg, including uncertainty for CO_2 of 12,000 Gg and uncertainty for non-CO_2 gases of 5,000 Gg. Uncertainty of emission factors was estimated at around 6,000 Gg, including uncertainty in the reference year of 2,000 Gg and uncertainty in the estimates projections in 2010 with respect to the reference year. The uncertainty numbers are not additive.

[19] The energy sector projections also contain burning of waste for energy use.

103. According to the NC3 "with measures" scenario, total emissions of fluorinated gases (HFCs, PFCs and SF_6) are expected to increase by 33 per cent in 2010 compared to 1995, while according to the "with additional measures" scenario these emissions are expected to drop by more than twofold. In the latter scenario a substantial decline of HFCs and PFCs is expected to more than offset the growth of SF_6. The reversal of the trend of HFCs and PFCs stems from technological improvements in production of HCFCs, reduced use of HFCs and PFCs as alternatives for ozone-depleting substances, and adjustments in the primary aluminium production process.[20]

104. A comparison between the expected emission reductions by sector in the "with additional measures" scenario in the NC3 and the new "reference" scenario is provided in table 12. As noted in the policies and measures section, effects from the NCPIP measures have been revised downwards.

V. VULNERABILITY ASSESSMENT, CLIMATE CHANGE IMPACTS AND ADAPTATION MEASURES

105. The information on climate change impacts, vulnerability and adaptation measures reported in the NC3 conforms with the UNFCCC guidelines. The review team commended the Netherlands' active support for general activities on climate impact and adaptation assessment and for developing integrated plans of coastal zone management, water resources and agriculture, as well as its activities in transferring experience and supporting relevant studies in many developing countries in the framework of the ongoing Netherlands Climate Change Studies Assistance Program (NCCSAP) launched in 1996.

106. At the research level, an integrated assessment of impacts, vulnerability and adaptation to climate change is being developed in the framework of the National Research Programme on Global Air Pollution and Climate Change (NRP), which targets several economic sectors, human health, and natural systems, including ecosystems and biodiversity. The NRP concluded that an increase of sea level of up to 50–70 cm this century may lead to increased erosion of the barrier islands and related impacts on groundwater level, drinking water supply and agricultural production. Also, effects of the structural erosion of the natural coastline might become visible in 50–100 years. Impacts are expected on tourism, human health and forest fires, as well as the insurance industry, as a result of the increased number of extreme events.

107. The national government places special emphasis on adaptation, taking into account the country's two most immediate risks from climate change, i.e. a rise in sea level and increased frequency of river floods, as highlighted in the third climate report of the Royal Netherlands Meteorological Institute. The Netherlands Coastal Zone Management Centre is an international organization, supported by the government. Its role is becoming increasingly important, particularly in developing the relevant adaptation measures using the experience in developing and implementing preventive measures against dangerous storm surges and strengthening erosion of the coastline.

108. A document, *Towards an Integrated Coastal Zone Policy*, was prepared[21] and will take effect in 2003. Concerted effort by the national government, provincial and municipal authorities and water boards will ensure its implementation. The main priority is to mitigate the weak links in the coastal area and for risk management in coastal towns, taking into account several scenarios for sea level rise. A national strategy based on this policy will be ready by 2005. The actual implementation of adaptation measures in the coastal zone initiated in the 1990s aimed at combating the structural erosion of the coast. The current coastal defence policy already includes anticipated changes and envisages measures, such as reserving more space for natural processes in the coastal zone. Accordingly, the relevant criteria for

[20] Projections of fluorinated gases have been revised in the Fifth Environmental Outlook to better reflect the recent inventory estimates, the links between the growth of emissions industrial production, the assumption that both aluminium production plants would be closed by 2005 and the new more precise inventory estimates. (RIVM, 2000: *National Environmental Outlook 5, 2000–2030* (in Dutch). Samson H.D. Tjeenk Willink Publishers, Alphen aan de Rijn.)

[21] The report was prepared jointly by several institutions and stakeholders, including the Ministry of Transport, Public Works and Water Management; the Ministry of Agriculture, Nature Management and Fisheries; the Ministry of Housing, Spatial Planning and the Environment; the Ministry of Economic Affairs; the coastal provinces; the association of water boards, and several municipal authorities.

re-evaluation of dykes and dunes are reviewed every five years, partly in response to the expected climate changes.

VI. FINANCIAL RESOURCES AND TRANSFER OF TECHNOLOGY

109. The Ministry of Foreign Affairs coordinates activities related to financial resources and technology transfer in close cooperation with VROM. VROM is also responsible for activities related to the CDM, while the Ministry of Economic Affairs deals with activities related to JI and emissions trading. The reporting of information on financial resources and technology transfer in the NC3 broadly conformed to the UNFCCC guidelines, and the review team encouraged the Netherlands to adhere strictly to the format of the tables required by these guidelines. It also noted with appreciation the Netherlands' pledge for the Official Development Assistance (ODA) to be set at 0.8 per cent of its gross national product (GNP)[22] with actual contributions averaging 0.86 per cent between 1997 and 2000. Around 0.1 per cent of GNP, totalling €406 million in 2000, was earmarked for environmental aid including climate change. In terms of climate change aid as percentage of GNP, the country ranked among the top donors in the world.[23]

110. Long-term bilateral assistance programmes, focusing mainly on alleviation of poverty, include 19 countries. Many of these programmes have a substantial environmental component, e.g. in the areas of water management and rural development. The Netherlands also supports 17 other countries to implement sustainable development treaties and contributes to several multilateral bodies with activities relating to climate change, including €8.2 million annually to the Global Environmental Facility.

111. Most of the support relating to climate change has been provided under the Climate Programme, which focuses on mitigation, adaptation and capacity-building for the CDM. The most prominent element of this programme is the Netherlands Climate Change Studies Assistance Programme, launched in 1996 and supporting 15 countries in preparing their national communications. The programme was organized in an exemplary manner, and between 1996 and 2000 €4.7 million was made available through it. Support for mitigation was provided in the energy, transport, industry, agriculture, and forest management sectors.[24] Support for adaptation has increased recently, especially in coastal zone management, where the Netherlands has valuable expertise.

112. Between 1996 and 2000 the Netherlands launched one of the most comprehensive programmes for AIJ and gained valuable experience in GHG mitigation. It has already disbursed €10 million for AIJ projects and allocated another €12 million to over 20 ongoing projects. The resulting emission savings totalled 5,500 Gg CO_2 equivalent at an average cost of €3.8 per tonne of CO_2. The experience gained from all these international activities provides a foundation for successful use of the Kyoto mechanisms.

113. The government supported private sector initiatives to transfer climate-friendly technologies mainly through the Milieu Programme. In particular, it supported pollution reduction through clean and end-of-pipe technologies, mitigation of environmental degradation, application of renewable energy and material technologies and preparation of environmental policy plans. This programme disbursed €96 million in 1999 to facilitate purchase of, *inter alia*, climate-friendly technology such as energy-efficient city buses in Ethiopia and windmills in China and India, by covering a third of the cost.

VII. RESEARCH AND SYSTEMATIC OBSERVATIONS

114. The review team noted with appreciation the contribution of the Netherlands in promoting climate-related research, and the priority given by the government to supporting such research. The

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[22] The agreed United Nations target for the ODA is 0.7 per cent of GNP.

[23] In 2001 a marker was introduced to distinguish the climate change part of the ODA and as of 2003 additional markers have been introduced to distinguish the support for adaptation and for mitigation.

[24] Examples of some successful projects included solar energy projects, the Asia Alternative Energy Programme, the Renewable Energy and Energy Efficiency Fund and the Indian Renewable Energy Development Agency. Jointly with the Asian Development Bank, the Netherlands has established a trust fund, amounting to €4.6 million, to support the Renewable Energy, Energy Efficiency and Greenhouse Gas Abatement Programme. As a follow-up, it contributed €8.1 million to a four-year partnership programme on the environment between 1999 and 2003.

main research areas include participation in international research programmes; conducting some large national research programmes; coordination in topic centres; and technology-related research, primarily on energy. The review team found that the criteria adopted in reporting on research and development, by reporting on the activities on technologies that are in the pre-competitive stage in this section and the rest in the policies and measures section, contributed to transparency and helped to avoid overlaps.

115. The Netherlands actively cooperates with and provides a substantial contribution to the World Climate Research Programme (WCRP), the International Geosphere–Biosphere Programme (IGBP), the International Human Dimensions of Global Environmental Change Programme (IHDP) and the Biodiversity Programme (DIVERSITAS). Substantial support is provided for the work of the IPCC.

116. The NRP was launched in 1989. It is coordinated by five ministries, with participation from non-governmental and environmental organizations. The first phase of the NRP was implemented from 1989 to 1995 and included 150 projects with funding of €29 million. The second phase was implemented from 1995 to 2001 and included 94 projects with funding of €21 million. The NRP focused on four pivotal themes: the dynamics of the climate system, impacts of climate change, societal causes and solutions, integration and assessment. It advised the government on national climate policy. The programme ended in 2002, but a continuation was envisaged.

117. Another climate-related research programme is Climate Change and Spatial Planning, which focuses on cross-cutting themes: monitoring of air, water and soil pollution; incorporation in spatial planning; societal and socio-economic support; and institutional infrastructure and development. It includes adaptation and mitigation research, mainly on the national scale. The Dutch annual contribution for the International Group of Funding Agencies for Global Change Research is around €30–35 million, compared to the global funding of US$ 2,000 million.

118. The government has also given high priority to research in energy conservation and renewable energy, including solar and biomass energy. Total expenditure for energy-related research amounted to €310 million annually, including €140 million of public research and development expenditure. Energy conservation accounted for 40 per cent of this amount and renewable energy for 27 per cent.

119. A number of topic centres for climate research have been established in the Netherlands: the Centre for Climate Change and Biosphere Research, The Netherlands Centre for Climate Research, the International Project Office of Land Ocean Interactions in the Coastal Zone as a part of the IGBP, and the Coastal Zone Management Centre of the Netherlands. Major strengths of the research centres are in the fields of oceanography, climate modelling, river systems, coastal zones, natural emissions of GHGs (CarboEurope) and industrial transformation (including hydrogen).

120. In line with the requirements of the Global Climate Observing System (GCOS), the Netherlands encourages free exchange of observational climate data. A separate detailed report on the system following the UNFCCC reporting guidelines was submitted in annex C of the NC3. It includes a description of ground-based and satellite observational networks and oceanographic and terrestrial observations, as well as space-based observation programmes.

VIII. EDUCATION, TRAINING AND PUBLIC AWARENESS

121. The section on education, training and public awareness is well prepared and conforms to the UNFCCC guidelines. In the Netherlands the level of awareness of environment and climate change among the public is high: recent research shows that around 80 per cent of the population is aware of the climate change problem, and about 10 per cent categorized it as a major threat. A number of ongoing activities are aimed at raising further public awareness of climate change and its links with energy efficiency and green electricity. These activities are often combined with fiscal incentives such as energy efficiency labelling of cars and electrical appliances, and eco taxes.

122. The review team was briefed on the New Alternatives Programme which aims at marketing the green electricity that is indirectly subsidized through eco tax exemption. Another programme, EPA,

provides advice to households on energy savings. Also, there are programmes to promote better insulation of homes and energy-labelled appliances. All of these are supported by TV campaigns. The team was also briefed on the new ENTER facility, a programme for energy savings organized by VROM. It comprises 10 separate information dissemination projects, which target 100,000 households and aim at 5 per cent savings in electricity and heat consumption. This is the first major endeavour by the ENTER stakeholders – VROM, the Ministry of Economic Affairs, Novem, NGOs, municipalities, housing corporations and various other partners – to achieve permanent changes in consumer behaviour, thus addressing the key problem found in similar campaigns.

123. Education programmes on climate change have been incorporated into the curricula of several high schools and universities that have optional programmes on sustainable development, including climate change. Primary and secondary schoolchildren are also a target audience for issues relating to sustainable development and climate change.

IX. CONCLUSIONS

124. On the basis of the information from the NC3 and from the supplementary information and reports provided during the visit, the review team concluded that the NC3 provides a comprehensive and consistent overview of the national climate policy of the Netherlands. Key climate change policies and measures, GHG inventory, projections and other issues addressed in the NC3 are presented in a succinct and objective way. The review team also concluded that the presentation of the information, in general, conforms to the UNFCCC guidelines, and did not identify information gaps.

125. The review team commended the attempts of the Dutch inventory team to improve the quality of the inventory by using more complex methodologies, improving the quality of activity data and emission factors and reducing the uncertainties in estimates. Also, it noted that the Netherlands is well ahead in the preparation of its national system under the Kyoto Protocol. The review team encouraged the Dutch inventory team to recalculate emissions in a systematic manner when changes in methodologies are made or new sources added, to ensure consistent time series. On policies and measures, in the textual description of policies the review team encouraged the Netherlands to report by sector, subdivided by gas as was done in the summary table following the UNFCCC requirement, in particular for the non-CO_2 gases. The same comment is valid for projections, with specific suggestions noted in the relevant section of the report.

126. On the aim of the UNFCCC to return individually or jointly the emissions in 2000 to their 1990 level, the review team noted that in 2000 the total emissions without emissions and removals from LUCF were still 3 per cent higher than the emissions in 1990. Underlying reasons for these results were the relatively high economic growth, and the fact that climate policy in the 1990s was centred largely on voluntary measures aimed at relative targets. Also, targets for renewable energy and efficiency improvement in horticulture were not met. Still, the Netherlands has introduced some measures, such as the LTAs, which have led to a noticeable reduction in emissions. Their success is to a large extent explained by the important role of the industrial associations in the country. The steadily rising energy tax and the success in promoting CHP by 2002 have also brought sizeable emission reductions.

127. Under the Kyoto Protocol, the Netherlands has committed itself to a target of 8 per cent reduction in emissions in the first commitment period (2008–2012) compared to the 1990 emission level, whereas under the EC burden-sharing agreement the commitment is for 6 per cent reduction. To achieve this target, the Netherlands has put in place a comprehensive NCPIP which combines flexibility in choice of means and tools for emission reduction with the possibility of strengthening the programme over time if necessary. Given the structure of the primary energy supply and the presence of highly energy-intensive industry, it is well understood that the domestic part of the NCPIP continues to centre on energy efficiency, fuel switching, renewable energy and non-CO_2 gases, like earlier climate programmes. The covenant for climate policy recently concluded with provinces and municipalities will foster the implementation of the NCPIP at local level.

128. The team commended the efforts of the Dutch government to monitor and evaluate policy performance and to take corrective steps when necessary. The 2002 Climate Policy Evaluation suggests that in order to achieve the targets set, it was already deemed necessary to launch one of the policies from the reserve package, reduction of N_2O from nitric acid production. With these measures in place, it seems possible to reach the targets set.

129. However, this change in the NCPIP balance between measures targeting CO_2 and non-CO_2 gases will make it even more difficult to achieve far-reaching reductions in emissions of CO_2, which is the most important gas for the Netherlands. Also, there seems to be considerable uncertainty as to the relative weight of the actual emission reductions that will be achieved within the package, in particular from the energy sector and renewable energy. This uncertainty is estimated within the range of the total effect of the NCPIP and largely stems from the effect of energy market liberalization and the evolution of the EC climate policy, in particular the emissions trading scheme. The latter well illustrates the problems that a country faces when trying to find the best policy mix between approaches that best fit the national circumstances, e.g. LTAs and EBCs, and new international approaches such as emissions trading. There are also some uncertainties relating to the proportions of NCPIP reductions expected to come from the Kyoto mechanisms and to transport emissions, which are likely to continue to grow rapidly unless the more rigorous policies noted in this report are implemented. Also, if GDP continues to grow in line with the growth rate in the last decade, which is higher than the assumed growth in the new reference scenario, this could lead to higher baseline emissions and to the need for new measures to be introduced to attain the Kyoto target.

130. The review team noted with appreciation the effort to raise public awareness of climate change and to ensure wider support for achieving domestic and international policy goals. It is clear that the general public holds strong views on the need to address climate change, which has made environment and climate change an integral part of mainstream policies in the Netherlands.

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