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

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I. NATIONAL CIRCUMSTANCES RELEVANT TO GREENHOUSE GAS EMISSIONS AND REMOVALS

A. Introduction

1. The secretariat received Norway's Third National Communication under the United Nations Framework Convention on Climate Change, hereinafter referred to as the NC3, on 2 May 2002. An in-depth review of the NC3 was carried out from September 2002 to March 2003, including a visit to Oslo from 7 to 12 October 2002. The review team consisted of Mr. Nabil Mina (Lebanon), Mr. Leif Bernergård (Sweden), Ms. Dalia Streimikiene (Lithuania), Ms. Xin Ren (UNFCCC secretariat) and Ms. Katia Simeonova (UNFCCC secretariat, coordinator).

2. During the country visit, the review team had a number of meetings and discussions on all aspects of the Norwegian climate policy, as summarized in the NC3. During these meetings with government officials, academics, and business and environmental non-governmental organizations (NGOs), the review team was provided with a range of additional material and information that supported the information provided in the NC3.

B. National circumstances

3. Norway stretches 1,752 km from 57°N to 71°N latitude. The total area of the mainland is 323,758 km², including 29 per cent managed forestland and only 3 per cent agricultural land. The rest is made up of other cultivated land, coastal scrub and heath, marginal forest and sparsely vegetated mountains and mountain plateaus. Most of Norway has a subarctic climate: average annual temperatures range from 5.7°C in Oslo to 1.3°C in the northern town of Vardø. Consequently the winter season is relatively long, with significant energy demand for heating and lighting in buildings.

4. The population of Norway was only 4.52 million in 2002, and the country has the second lowest population density in Western Europe (after Iceland). The population is unevenly distributed across the country, with around 50 per cent concentrated in the south-east, including the capital Oslo. The settlement pattern and economic structure underpin the strong and growing demand for transport, with associated growth in emissions of greenhouse gases (GHG), and make certain kinds of public transport relatively costly.

5. Norway's economy is small and open, with exports making up almost half the gross domestic product (GDP). The GDP has increased steadily for the past decade, by an average of around 3.3 per cent annually (Table 1). However, the GDP growth has somewhat slowed down in recent years. According to World Bank data, Norway's GDP reached US\$ 170.4 billion in 2000 and US\$ 165.5 billion in 2001¹ which resulted in Norway's ranking second in the world in terms of GDP per capita of around US\$36,000.² Offshore oil and gas industries have been the main drivers of this growth, as they accounted for around 16 per cent of GDP and 40 per cent of export revenue between 1998 and 2000, depending on world oil prices. As a result, Norway became the second major exporter of oil and gas in Europe after Russia and the budget surplus stood at US\$25 billion in 2002, by far the largest in any member state of the Organisation for Economic Co-operation and Development (OECD). Also, the oil and gas industry has become the second largest sector in Norway in terms of GHG emissions. The growth of this industry is expected to continue for another 5–10 years, then level off and eventually decrease.

¹ Data from the World Bank group: www.worldbank.org/data/ (October 2002). The recent appreciation of the Norwegian krone by 20 per cent against the United States dollar may lead to even higher estimates of the GDP expressed in US\$.

² According to Statistics Norway, GDP was 1,469.1 billion Norwegian kroner (Nkr) in 2000 and 1,526.6 billion Nkr in 2001, while GDP per capita was 327,100 Nkr in 2000 and 338,200 Nkr in 2001. In 2002, GDP was 1,520.7 billion Nkr.

6. The impact of the strongly growing oil and gas industry and transport sector activities on the growth of GHG emissions has been, at least in part, offset by structural changes in the Norwegian economy, which has become increasingly service oriented. The service sector grew steadily throughout the past decade, and sectors other than oil (agriculture, forestry, fishing and manufacturing) have gradually declined in terms of their share of GDP. In 2001, services (including the public sector) accounted for 58.4 per cent of GDP, followed by the manufacturing sector (18.8 per cent); agriculture, forestry and fishing (2 per cent) and the oil and gas industry made up the rest.

7. Structural changes, together with some energy efficiency improvements, led to a growth of energy-related carbon dioxide (CO₂) emissions that was slower than economic growth. In addition, because electricity production is almost entirely based on renewable resources (hydro power), per capita CO₂ emissions in Norway remained fairly close to the European average and lower than the OECD average, although per capita electricity consumption is the highest in the world.

Table 1. Main macroeconomic indicators and greenhouse gas emissions for Norway, 1990–2000

	1990	2000	Change (%)
Population (millions)	4.24	4.49	6
Gross domestic product – GDP (billion US\$ of 1995)	122.33	170.45	39
Total primary energy supply – TPES (Mtoe ^a)	21.45	25.62	19
Electricity consumption (TWh)	99.055	113.093	14
GHG emissions ^b (Gg CO ₂ equivalent)	51 965	55 263	6
GHG emissions per capita (Gg CO ₂ equivalent)	12 253	12 305	0
GHG emissions per GDP unit (kg CO ₂ equivalent per US\$ of 1995)	0.42	0.32	–24

Source: The population and energy data are from the IEA database. GHG emission data are from Norway's 2002 Inventory Report. GDP data are from the World Bank database.

^a Millions of tonnes of oil equivalent.

^b Without accounting for land-use change and forestry (LUCF).

8. Several national circumstances have major implications for the country's emission profile and related policies: (1) In the energy sector, almost all the electricity comes from hydro power, and electricity meets about half of the energy demand. In 2002, the installed hydro power capacity amounted to 27,596 MW. There was 271 MW thermal capacity, and 13 MW from wind power plants. In addition, the oil and gas industry forms the most important sector of the Norwegian economy. (2) As a result of active forest management the standing volume of the forests has increased significantly in the last decades, but harvesting has remained broadly constant. This increase was much higher than in most of other industrialized countries. It led to almost doubling of the net CO₂ uptake by forests, which corresponded to around 20 per cent of Norway's total GHG emissions (without CO₂ emissions or removals from land-use change and forestry (LUCF)). (3) Norway joined the Agreement on the European Economic Area (EEA) in 1994.³ Most European Community (EC) legislation in the environmental field is also relevant to the EEA. This means that although Norway is not a member of the EC, it has to a very large degree implemented relevant EC directives at national level.

C. Institutional framework and recent developments in climate policies

9. Norway is a constitutional monarchy and the legislative power lies with the parliament (Storting). Executive power is distributed between central government and two levels of local government: 19 counties and more than 400 municipalities. The overall climate change policies are set by the parliament and implemented by the central government through direct regulations and economic instruments. The municipalities are responsible for implementation at the local level. This includes

³ The EEA includes the 15 EC member states and three European Free Trade Association (EFTA) countries, i.e. Norway, Iceland and Liechtenstein.

climate-related regulations such as the Planning and Building Act and related codes, energy use and waste management. The counties are responsible for roads and public transport. Representatives of central government and ministries in each county monitor the implementation of various policies and regulations. For example, each county is instructed to report its environmental state, including issues related to climate change, to the Ministry of Environment (MoE).

10. The MoE has assumed overall responsibility for climate change policy in Norway: its international section deals with negotiations related to climate change, and its national section handles domestic policies. Since the late 1980s, most relevant ministries have been involved in climate change activities. In 1989 an inter-ministerial committee (now called Klisur) was set up mainly for the exchange of information on various issues, including climate change policies and to some extent policy development and coordination. In recent years, policy development has increasingly taken place at political level.

11. The MoE also took the lead in the preparation of the NC3, with significant inputs from its implementing agency, the Norwegian Pollution Control Authority (SFT) as well as the Ministry of Finance and Statistics Norway. The Ministry of Finance and Statistics Norway were responsible for projections of CO₂, while SFT was responsible for the projections of non-CO₂-emissions. SFT and Statistics Norway, in cooperation with other institutes, were responsible for the preparation of the GHG inventory. The Centre for International Climate and Environmental Research – Oslo (CICERO) coordinated the work on research and systematic observation, impacts and adaptation. All relevant ministries have been consulted on the relevant sections of the NC3 during the course of its preparation. Environmental and business NGOs actively participated in the discussion of climate change policies, but not in the preparation of the NC3.

12. The cooperation among governmental institutions on climate change policy formulation and preparation of the NC3 is based on an agreement among MoE, SFT, the Ministry of Finance and Statistics Norway, and has proved to be effective. The review team was informed that at the time of the review there appeared to be no need for a formal coordination body, e.g. a national climate change committee, in addition to Klisur.

13. Norway is among those countries that have shown leadership in addressing climate change. In the domestic context, it was one of the first to introduce a CO₂ tax in 1991 and since then it has continued to implement a climate policy based on cost-effectiveness principles. In the international context, Norway proposed a range of solutions for the emerging global climate regime under the United Nations Framework Convention for Climate Change (UNFCCC) and its Kyoto Protocol, e.g. joint implementation. Norway's strong commitment to both the convention and its protocol forms the basis of its national climate change policies and builds consensus for them.

14. Important milestones in recent climate policy development include the previous government's submission to parliament in June 2001 of a White Paper (Report No. 54, 2000/2001) on climate policy and measures in relevant economic sectors. It proposed a domestic emissions trading system from 2008, which is intended to cover at least 80 per cent of emissions. In March 2002, the current government submitted a supplementary White Paper to parliament (Report No.15, 2001/2002). The supplementary White Paper recognized the need to pursue a more proactive climate policy and outlined a proposal for an earlier start of domestic emissions trading, involving mainly energy and emissions intensive industries as of 2005–2007. As a result of the outcome of the parliamentary debate on these papers, the government has started drawing up a legal proposal for the implementation of the emissions trading system. This proposal will be presented to Parliament for consideration and approval.

15. Norway ratified the UNFCCC on 9 July 1993. In comparing the emission levels with the aim of the UNFCCC, the review team analysed the information provided in the NC3, together with data from the most recent inventory of Norway, which contains data on 1990–2000 emission trends. The results of this analysis suggest that, in 2000, Norwegian GHG emissions exceeded 1990 levels by 6.3 per cent, without considering CO₂ from LUCF. Norway also ratified the Kyoto Protocol on 30 May 2002 as one of the first industrialized countries. When the Protocol enters into force, Norway will be bound by a target limiting its GHG emissions to 1 per cent above its 1990 level over the first commitment period (2008–2012). In the context of the Kyoto target, the estimates of the effect for Norway from Article 3.3 of the Kyoto Protocol, referring to afforestation, reforestation and deforestation activities, which Annex I Parties shall use in meeting their Kyoto target, are insignificant due to the long rotation period of the Norwegian forests. According to the 2002 White Paper, Norway does not intend to make use of activities under Article 3.4.⁴

II. GREENHOUSE GAS INVENTORY INFORMATION

A. Inventory preparation

16. On behalf of the MoE, the SFT is responsible for preparing and reporting on the national inventory and submitting the relevant reports (common reporting format and national inventory report) to the UNFCCC secretariat. In collaboration with Statistics Norway, SFT undertakes among other things, assessment and approval of the emission factors, collection of emission data from point sources and emission data from landfills, collection of emission data from point sources, and emission data from landfills and hydrofluorocarbons (HFCs). Statistics Norway is responsible for activity data, emission models and calculations.

17. Norway's NC3 is based on the National Greenhouse Gas Inventory Report submitted in April 2001 (NIR 2001) and contains emission estimates for 1990–1999. The inventory covers emissions of all GHGs from practically all sources and sinks, as well as precursors required by the UNFCCC guidelines.⁵ This encompasses emissions of the six gases controlled under the Kyoto Protocol, i.e. CO₂, methane (CH₄), nitrous oxide (N₂O), perfluorinated hydrocarbons (PFCs), HFCs, and sulphur hexafluoride (SF₆). It also encompasses emissions of indirect gases, or precursors, such as nitrogen oxides (NO_x), carbon monoxide (CO), non-methane volatile organic compounds (NMVOCs) and sulphur dioxide (SO₂). Some small sources of emissions were yet to be covered during the review visit, for example emissions and removals of CO₂ from agricultural soils, N₂O emissions from manure management, and CH₄ and N₂O emissions from field burning of agricultural residues. The two last sources have already been included in Norway's 2003 inventory report.

18. The inventory assessment is based mainly on internationally recommended methodologies such as the Intergovernmental Panel on Climate Change (IPCC) guidelines⁶ and Corinair/EEA/UNECE.⁷ However, according to the IPCC Good Practice Guidance, country-specific methodologies have been used when they were considered to better reflect Norwegian conditions. In particular, Norway uses the inventory model "Kuben" (the Cube) together with more detailed models for several emission sources, e.g. road traffic, air traffic and solvents. These methodologies are based on detailed official reports on activity data, emissions and emission factors for large industrial plants and sources, e.g. oil and gas extraction, refuse disposal flaring and the production of iron and steel, ferrous alloys, aluminium and magnesium.

⁴ Under Annex Z of the Marrakesh Accords, Norway could use up to 1,470 Gg CO₂ from forest management activities under Article 3.4 annually to meet its Kyoto target.

⁵ Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part II: UNFCCC reporting guidelines on national communications. Document FCCC/CP/1999/7.

⁶ "Revised IPCC 1996 Revised Guidelines for National Greenhouse Gas Inventories", IPCC, 2000.

⁷ Corinair is the methodology used by the European Environment Agency (EEA) and the United Nations Economic Commission for Europe (UN ECE).

19. The overall uncertainty level of the inventory is around ± 21 per cent, which is due mainly to the uncertainty in N_2O emissions from soil. The trend uncertainty is believed to be about ± 4 per cent. Uncertainty can be linked to emission factors, activity data, assumptions in the models or inaccuracy in the measurements. A special SFT report estimates the uncertainty levels of the main gases as ± 5 per cent for CO_2 and SF_6 , ± 50 per cent for CH_4 , and a factor of 3 for N_2O . Uncertainty estimates are obtained by a Monte Carlo procedure and are undertaken as part of the quality control/quality assurance procedure, which is yet to be established fully. However, a set of verification steps is already conducted to ensure reliability of data and reduce uncertainty.

20. As required by the UNFCCC guidelines, the GHG emission levels reported in the NC3 are consistent with the data presented in the NIR 2001. However, for the period 1990–1995 these levels differ from the data reported in the NC2 for almost all gases except SF_6 . These differences range from 100–400 Gg for CO_2 , 60–130 Gg for CH_4 , 1–1.7 Gg for N_2O , 0.02–0.07 Gg for tetrafluoromethane (CF_4), 0.001–0.002 Gg for hexafluoroethane (C_2F_6), and 0.003–0.115 Gg for HFCs. These differences in the data seem to be mainly attributed to recalculations made for CH_4 , N_2O and HFCs, and rounding in the CO_2 figures. In particular, SFT provided the following explanations for some of these differences to the review team: (1) Changes in CH_4 emissions mainly resulted from recalculations in emissions from enteric fermentation and from emissions from solid waste disposal on land. (2) Changes in N_2O emissions resulted from recalculations of emissions from agricultural soils.

21. During the visit the review team was also provided with the most recent National Inventory Report (NIR 2002) containing data from 1990 to 2000, as well as preliminary data for the year 2001. A comparison of the 1990–1999 emission levels as given in NC3 and NIR 2002 shows slight variations in estimates of CO_2 , CH_4 and N_2O originating from recalculations in all sectors except LUCF. These recalculations resulted in 0.12 per cent and 0.27 per cent changes in the total emissions expressed in CO_2 equivalent for 1990 and 1999 respectively. The analysis below is based on the latest NIR 2002 data.

B. Emission profile and trends

22. The total GHG emissions of Norway in 2000 amounted to 55,263 Gg CO_2 equivalent, an increase of about 6 per cent over the 1990 level (Table 2). The increase is mainly attributed to economic growth which resulted in higher CO_2 emissions from most sources, notably the oil and gas sector (46 per cent) and transport (19 per cent). Emissions of CH_4 grew by only 6 per cent and emissions of N_2O remained broadly stable. Emissions of PFCs and SF_6 dropped sharply and partly compensated for the effect of increased CO_2 emissions on total emissions; emissions of HFCs increased.

**Table 2. Total greenhouse gas emissions and emissions by gas, 1990–2000
(Gg CO_2 equivalent)**

Emissions	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Net CO_2 emissions/removals	25 573	21 799	21 039	22 312	21 979	24 116	23 329	24 694	23 726	23 975	22 530
CO_2 emissions (without LUCF)	35 163	33 499	34 289	35 822	37 659	37 756	40 940	41 193	41 313	41 743	41 273
CH_4	6 454	6 484	6 597	6 723	6 836	6 888	6 966	7 022	6 913	6 850	6 814
N_2O	5 130	4 966	4 289	4 650	4 752	4 826	4 828	4 771	5 023	5 268	5 154
HFCs	0	0	0	2	9	26	53	88	133	179	232
PFCs	3 032	2 524	2 016	1 980	1 710	1 562	1 440	1 377	1 267	1 122	899
SF_6	2 186	2 066	688	719	854	578	543	548	695	841	891
Total (with net CO_2 emissions/removals)	42 375	37 838	34 630	36 386	36 141	37 996	37 158	38 499	37 757	38 235	36 520
Total (without CO_2 from LUCF)	51 965	49 538	47 880	49 896	51 821	51 636	54 769	54 998	55 345	56 003	55 263

23. In 2000, CO₂ remained the most important gas, making up 75 per cent of total emissions, followed by CH₄ (12 per cent), N₂O (9 per cent), PFCs and SF₆ (2 per cent each), and HFCs (less than 1 per cent). Norway's emission profile is distinct from that of other Annex I countries as its electricity sector is almost entirely hydro based and emissions from energy originating mainly from the oil and gas industry and fuel used for heating in industry. Hence, energy accounted for 64 per cent of the total GHG emissions and transport alone accounted for the largest share of that (25 per cent), followed by industrial processes (19 per cent), agriculture (9 per cent), waste (8 per cent), and solvent and other product use (0.3 per cent). LUCF contributed to a net removal of 18,700 Gg CO₂ in 2000, almost double the 1990 amount, which is equivalent to 34 per cent of the total GHG emissions of this year.

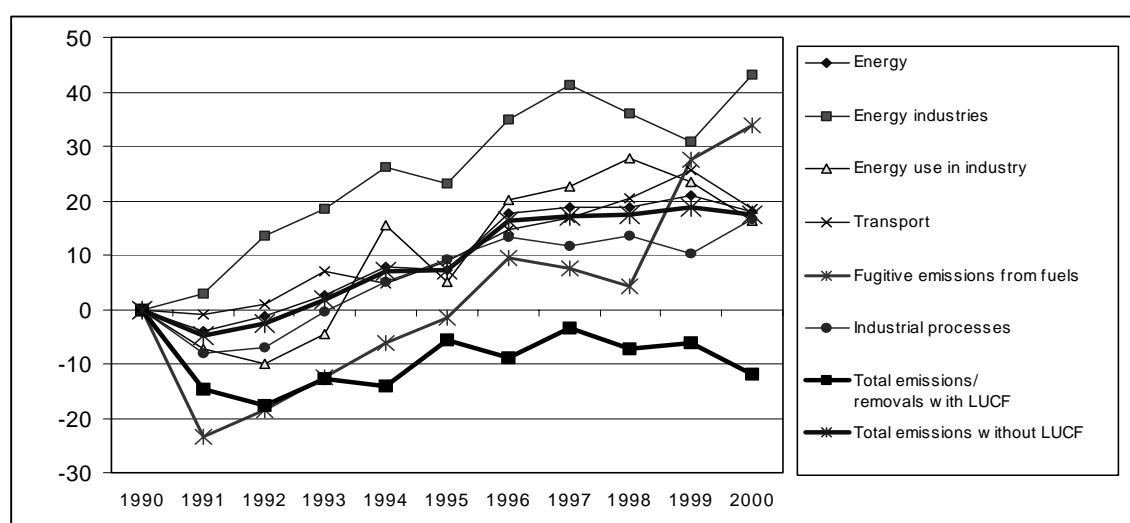
Carbon dioxide

24. In 2000, CO₂ emissions amounted to 41,273 Gg, an increase of 17 per cent over the 1990 level (Table 3). This increase was underpinned by the growth of emissions from the oil and gas industry (43 per cent), followed by transport (19 per cent) and energy use in industry and industrial processes, which each exhibited almost the same growth (16 and 17 per cent) (Figure 1).

Table 3. Carbon dioxide emissions by source, 1990–2000 (Gg)

Source and sink categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Energy	28 543	27 427	28 177	29 287	30 785	30 622	33 556	33 902	33 887	34 542	33 662
<i>Energy industries</i>	7 247	7 453	8 226	8 589	9 148	8 919	9 777	10 244	9 861	9 489	10 370
<i>Energy use in industry</i>	3 465	3 209	3 117	3 310	4 003	3 637	4 158	4 249	4 427	4 276	4 029
<i>Transport</i>	11 086	10 988	11 194	11 846	11 632	12 067	12 706	12 944	13 342	13 937	13 138
<i>Other</i>	4 726	4 230	3 992	3 776	4 106	4 010	4 702	4 291	4 151	4 265	3 419
<i>Fugitive emissions</i>	2 020	1 548	1 648	1 765	1 896	1 989	2 213	2 173	2 106	2 575	2 705
Industrial processes	6 222	5 724	5 794	6 189	6 542	6 789	7 050	6 949	7 066	6 854	7 251
Solvent and other	144	125	130	129	139	135	143	137	137	134	127
Agriculture	217	185	151	179	155	171	152	149	134	129	108
LUCF	-9 590	-11 700	-13 250	-13 510	-15 680	-13 640	-17 611	-16 499	-17 588	-17 767	-18 743
Waste	37	37	37	38	38	39	39	56	91	83	125
Total emissions/removals with LUCF	25 573	21 799	21 039	22 312	21 979	24 116	23 329	24 694	23 726	23 975	22 530
Total emissions without LUCF	35 163	33 499	34 289	35 822	37 659	37 756	40 940	41 193	41 313	41 743	41 273
International bunkers	2 098	1 812	2 170	2 312	2 462	2 841	3 172	3 771	3 721	3 675	3 624

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



25. The increase of CO₂ emissions in the energy industry between 1990 and 2000 was mainly due to the large increase in the production volume of oil and gas as well as the export of gas in pipelines. Emissions from this sector followed an upward tendency until 1997 and decreased in 1998 and 1999. However, after 1999, emissions picked up again due to key fields reaching mature phase, and therefore, requiring more energy to produce oil and gas. Improved energy efficiency and reduced flaring have not been sufficient to offset the rise in energy consumption associated with increased production levels. Still, these technological improvements, which are believed to be in part caused by the CO₂ tax, have resulted in a decline in the CO₂ emissions per unit of oil equivalent produced.

26. CO₂ emissions from energy use in manufacturing industries and construction (mainly resulting from the use of oil and gas for heating) increased by 16 per cent between 1990 and 2000. This growth was pronounced as of 1998 because of growth in the pulp and paper industry and the commissioning of a new methanol production plant. However, a noticeable decline was recorded in the last two years, which can partly be explained by a temporary switch from fossil fuels to electricity in the pulp and paper industry. Emissions of CO₂ from industrial processes increased between 1990 and 2000 by 18 per cent, driven by the increase in production of almost all primary sectors, such as ferrous alloys, aluminium, ammonia, carbide and cement production. The "Other" sub-sector of the energy sector, including mainly energy use for heating in residential, commercial and institutional sectors, fell between 1990 and 2000 by 28 per cent, due to switching from oil to electricity, in part induced by the CO₂ tax.

27. Transport remained the largest source of CO₂ emissions and it ranked second in terms of emission growth. Emissions from transport have increased since 1992 as a result of increases in air traffic, road traffic, and water navigation. A slight decrease occurred between 1999 and 2000 mainly due to changes in fuel tax for road vehicles as of January 2000 and the resulting change of stock in trade for fuels. CO₂ emissions from heavy vehicle road transport increased by almost 34 per cent between 1990 and 2000. There was a considerable shift from gasoline to diesel for light vehicles, resulting in a 10 per cent emission drop from gasoline, which was more than offset by emissions from diesel, resulting in overall emission growth of 7.5 per cent. A relatively large share of transport emissions, 18 per cent, stemmed from coastal navigation and the fishing fleet. Domestic aviation CO₂ emissions increased by 64 per cent from 1990 to 2000, because there were more civil flights, but decreased by 9 per cent between 1999 and 2000 as a result of some saturation of demand.

Methane

28. In 2000, CH₄ emissions amounted to 324.46 Gg (Table 4). Waste was by far the most important sector, accounting for 58 per cent share of the total, followed by agriculture (30 per cent). Emissions from oil and gas extraction and fuel combustion made up the rest. Almost all emissions in waste (99.7 per cent) came from solid waste disposal; the remaining 0.3 per cent came from wastewater handling and incineration. A relatively high share (63 per cent) of waste is landfilled. Emissions from agriculture came mainly from enteric fermentation (84 per cent), followed by manure management (15 per cent) and field burning of agriculture residues (1 per cent).

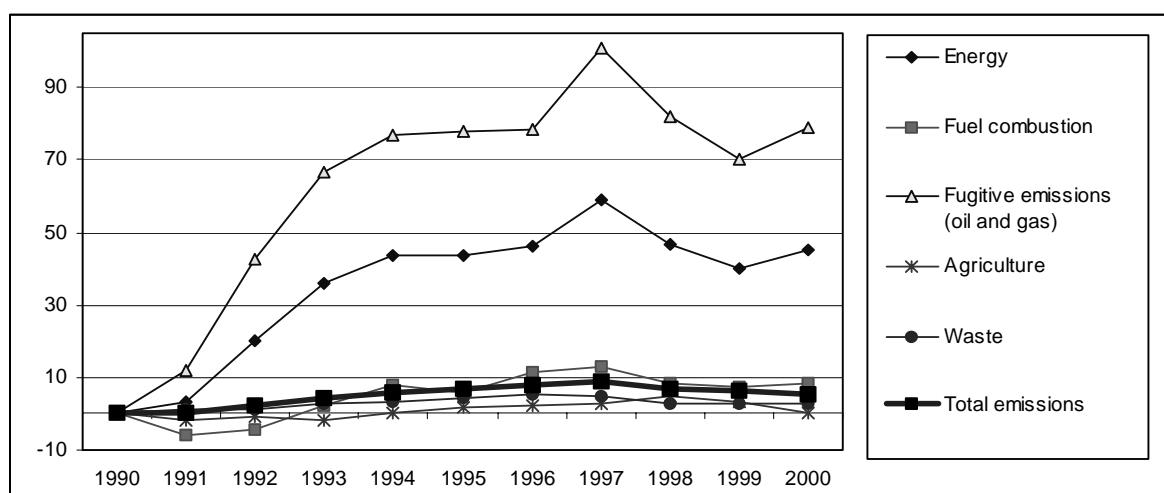
Table 4. Methane emissions by source, 1990–2000 (Gg)

Source and sink categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Energy	26.59	27.52	32.00	36.14	38.26	38.19	38.91	42.32	39.06	37.26	38.64
<i>Fuel combustion</i>	12.69	11.96	12.14	12.95	13.68	13.45	14.12	14.37	13.78	13.63	13.76
<i>Fugitive emissions from fuels</i>	13.90	15.56	19.86	23.19	24.58	24.74	24.79	27.95	25.28	23.63	24.88
Industrial processes	1.05	0.82	0.86	0.93	1.03	1.04	1.02	1.00	1.06	0.84	0.86
Agriculture	97.61	95.91	96.91	95.91	97.99	99.08	100.00	100.41	102.13	100.62	98.02
Waste	182.09	184.51	184.38	187.15	188.25	189.70	191.76	190.64	186.95	187.46	186.94
Total emissions	307.34	308.75	314.14	320.12	325.54	328.01	331.69	334.37	329.21	326.17	324.46

29. Emissions of CH₄ grew by 6 per cent between 1990 and 2000, driven mainly by the growth of emissions from the oil and gas industry and from waste; the emissions from agriculture remained relatively stable. Emissions of CH₄ from waste grew by 6 per cent. They peaked in 1996 and 1997 and declined thereafter. The reason was that higher volumes of waste were offset by increased recycling of waste and increased treatment of methane at landfills. The effect of fiscal and regulatory instruments such as tax on the final treatment of waste, and the EC landfill directive, also contributed to this. Emissions of CH₄ from agriculture remained broadly at their 1990 level, although they increased slightly at the beginning of the 1990s and dropped at the end of the decade. The drop was explained by the decrease in the number of cattle and some improvements in management practices.

30. Emissions of CH₄ from the oil and gas industry grew by 45 per cent between 1990 and 2000, and remained broadly on an upward trend with some fluctuations, following changes in production volume (Figure 2). However, a slight decline observed in 1998 and 1999 was explained as the effect of several technical and administrative measures taken since 1997. Production growth in 2000 combined with key fields reaching mature phase more than offset the effect of such measures.

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



Nitrous oxide

31. In 2000 the total N₂O emissions amounted to 16.6 Gg, with half coming from agriculture (49 per cent), a third from industrial processes (34 per cent), 14 per cent from industrial processes and emissions from wastewater handling and solvents making up the rest (Table 5). In agriculture, all N₂O emissions came from soils and in industrial processes they all came from the chemical industry, mainly from the two plants manufacturing nitrogen fertilizers. Around half of the N₂O emissions of the energy sector came from transport and the rest came from the other fuel combustion categories.

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

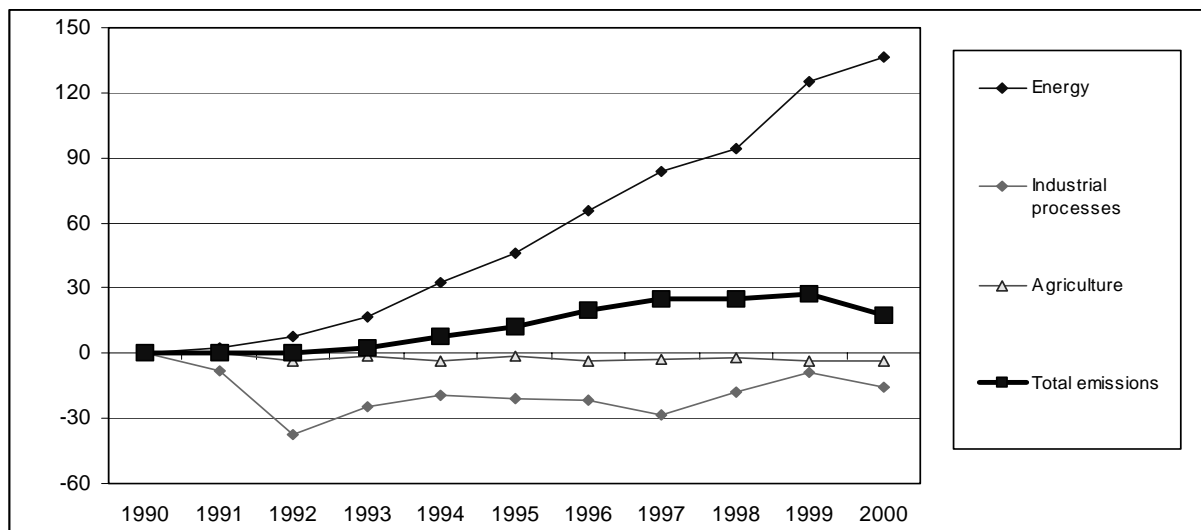
Source and sink categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Energy	1.01	1.03	1.08	1.17	1.34	1.47	1.67	1.85	1.96	2.27	2.38
Industrial processes	6.65	6.10	4.17	5.03	5.37	5.29	5.23	4.78	5.45	6.06	5.59
Agriculture	8.48	8.48	8.18	8.37	8.19	8.36	8.20	8.26	8.29	8.16	8.19
Others	0.40	0.40	0.40	0.41	0.43	0.45	0.48	0.50	0.50	0.51	0.47
Total emissions	16.55	16.02	13.84	15.00	15.33	15.57	15.57	15.39	16.20	16.99	16.63

32. Emissions of N₂O remained relatively stable between 1990 and 2000. This was the result of two opposing tendencies: growth of emissions from the energy sector, mainly from transport, and decline of

emissions from industrial processes and agriculture. Emissions of N₂O from energy increased by 136 per cent, and emissions from transport alone more than tripled because of the introduction of catalytic converters (Figure 3).

33. During the same period, emissions from industrial processes dropped by 16 per cent. Some decline at the beginning of the 1990s was attributed to changes in production processes, and fluctuations thereafter reflected fluctuations in production volumes. Emissions from the agriculture sector remained broadly unchanged.

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



Fluorinated gases

34. In 2000, emissions of PFCs, including CF₄ and C₂F₆ amounted to 0.131 and 0.005 Gg respectively. These emissions, originating from the aluminium industry, dropped by 70 per cent between 1990 and 2000. The main driver for these changes were improvements in the technology and process control undertaken by the industry on a voluntary basis, including under agreements with the MoE as of 1997.

35. In the same year, emissions of HFCs were estimated at 0.111 Gg. These emissions arise mainly from the substitution of ozone-depleting substances in refrigeration and air conditioning, but also from foam and foam blowing, fire-extinguishing products, solvents and aerosol propellants. HFC emissions grew steadily throughout the 1990s, starting from zero. Just between 1999 and 2000, the increase was 21 per cent.

36. Emissions of SF₆ in 2000 were estimated at 0.037 Gg. They came mainly from one magnesium plant. From 1990 to 1997 the emissions of SF₆ decreased by 75 per cent, which was explained by improvements in technology, process control and maintenance. However, between 1997 and 2000 emissions increased by 67 per cent as a result of increased production and a higher production share of primary magnesium versus recycled metal.

III. POLICIES AND MEASURES

37. The NC3 presents a comprehensive overview of the range of policies and measures in place or being developed by Norway to meet its commitments under the UNFCCC. Reporting of information was presented by sector and subdivided by gas, and policies and measures were summarized in tabular form

with an estimation of existing and future mitigation impact of the key policies and measures. The review team noted that the reporting of information, in general, conformed with the UNFCCC guidelines.

38. The MoE assumed the role of central coordinator for climate policy in Norway. Several other ministries have been involved in climate policies, in particular the Ministry of Petroleum and Energy, Ministry of Finance, Ministry of Foreign Affairs, Ministry of Industry and Trade, Ministry of Transport, Ministry of Agriculture and Ministry of Fisheries, and there is a lot of cooperation between these ministries. This cooperation takes place mostly within the Klisur committee, but also on an ad hoc basis.

39. The NC3 reports on the mitigation impacts of key individual policies and measures. In some sectors this information is not available, or is quite uncertain, e.g. transport and electricity sectors (Electricity production in Norway is almost entirely based on hydro power which is emission free, but mitigation impacts in terms of energy efficiency or the use of new renewable energy sources are still relevant for this sector). The review team noted that development and application of methods to quantify reduction potentials of individual measures will become even more important in the context of implementation of measures to reach the national Kyoto target. Estimation of the potential impact of measures is encouraged, even with uncertainty bounds. More systematic monitoring of effects would help to adjust the national policy when needed.

40. Norway ratified the Kyoto Protocol on 30 May 2002. The basis for its strategy to fulfil the country's commitments under the Protocol can be found in the 2001 and 2002 White Papers (see paragraph 14). The decision taken by Parliament on the climate strategy in June 2002 encompasses several key elements, including continuation of existing general policies on climate change such as taxation; launching new policies, such as emissions trading; and placing more emphasis on cost-effectiveness. Since 1991 Norway has implemented a CO₂ tax, which currently covers around half of the total GHG emissions. According to the parliamentary decision, for 2005–2007 the tax is to be complemented by an emissions trading scheme to cover most of the emissions outside the tax regime. Together, these two general instruments will cover more than 80 per cent of the GHG emissions. These general instruments will also be supported by some sector-specific instruments. From 2008, the trading scheme is planned to be expanded and to replace the tax scheme.

41. Under the Kyoto Protocol, Norway is committed to limit its emissions in the first commitment period (2008–2012) to 1 per cent over the 1990 level. With the policies and measures currently implemented, under the assumption that robust economic growth continues, total emissions are projected to rise to 63,200 Gg CO₂ equivalent, which represents a 20 per cent increase over the target level of 52,500 Gg CO₂ equivalent. According to an alternative scenario, which includes new measures, emissions in 2010 will be around 57,900 Gg CO₂ equivalent, thus closing about half of the gap. Norway is already gaining valuable experience in the use of the Kyoto mechanisms, and these mechanisms are expected to make an important contribution to filling the rest of the gap.

42. The review team noted that activities leading to the increase of GHG emissions are still subsidized in some special cases. For various reasons, Norway has subsidized the production of small quantities of coal in the remote island of Svalbard, in the North. A new, larger mine has recently started production there. The government has covered a part of the capital cost for the opening of the mine, but the running of the mine is supposed to be economically viable without subsidies. There are also some state subsidies for civil flights to small cities in the north of mainland Norway and for ferry transportation.

A. Cross-cutting measures

43. Taxation has been the main instrument for reducing emissions since the introduction of the CO₂ tax in 1991. Currently, the CO₂ tax covers 64 per cent of CO₂ emissions, which represents 47 per cent of

the total GHG emissions. The tax levels are high compared to other countries that have implemented such a tax.

44. The CO₂ tax covers petrol and diesel fuels in the transport sector, fuel oil used in the domestic sector and to a limited extent in industry, and natural gas and oil used in the oil and gas industry. Most of the emissions from industry are tax exempt, in the interest of protecting regional employment and the competitive position of certain industries. The total revenue for the tax is between Nkr 7 and 8 billion.

45. The mitigation effects of the CO₂ tax in 2000 was estimated at around 3,400 Gg of CO₂, corresponding roughly to 6 per cent of the total emissions. The review team noted that this reduction is rather low compared to other countries that have implemented a CO₂ tax, especially when the high level of the tax is considered. The reason for this is probably Norway's special circumstances and the way the tax was implemented. In particular, a large proportion of industrial emissions have exemptions for competitive reasons and a large part of the emissions subject to the tax come from sectors with rather low elasticity for price changes in fuels. Some changes in the CO₂ tax schemes have been introduced from January 1, 2003, in particular abolishing the tax on coal and coke, with a view to bringing Norway in accordance with the new guidelines on state aid for environmental protection from the EFTA Surveillance Authority. While emissions from coal and coke have been marginal in recent years, this change may lead to some emission increases.

46. Norway was among the first countries to explore the possible design of a domestic emissions trading system and possible contributions from this system to meet the Kyoto targets in a cost-effective way. To deal with this issue, a Quota Commission was established by the Government in 1998. The recommendations of this commission⁸ are reflected in the 2001 White Paper (see paragraph 14). The White Paper outlined the initial proposal to introduce emissions trading in 2008, as a broadly based system covering not only sources that are presently covered by taxes but also most other sources. In the lead-up to 2008, the White Paper envisaged the continued use of the CO₂ tax as a central instrument of climate policy, and the initiation of negotiations on voluntary agreements with industries not subject to the tax.

47. A decision to introduce an emissions trading scheme was taken by Parliament in June 2002, based on the proposals in the 2002 White Paper. The decision reflected the more ambitious stance taken by the new government to implement a limited emissions trading system, covering a large part of the emissions not currently subject to the CO₂ tax for the period 2005–2007. The most important sectors to be included are metal production (light metals and ferrous alloys), fertilizers (nitric acid production), petrochemical and methanol industry, refineries, production of carbides, and production of cement, leca⁹ and limestone. Other industries that may be included are fisheries and the use of gas onshore. These sectors represent approximately 30 per cent of the total GHG emissions, if the industrial structure remains the same.

48. The aim for the emissions trading system is to deliver a 20 per cent reduction of the emissions from the industries covered by the system compared to the emissions from the same industries in 1990. Possibilities are envisaged for adjustments for closure, increased production and new industrial facilities. The system for allocation for the first period (2005–2007) is to be based on grandfathering, for existing entities based on historical data and for new entities based on some kind of norm. The allocation principles must conform to the state aid rules. The system is, in principle, open for certified emission reductions under the clean development mechanism (CDM). It includes possibilities for domestic joint implementation with, e.g. abandoned landfills. The government is now working on a legal framework,

⁸ A Quota System for Greenhouse Gases, A policy instrument for fulfilling Norway's emission reduction commitments under the Kyoto Protocol, Oslo, 1999.

⁹ Leca is light expanded clay aggregate.

including detailed regulations which need to be in place before 2005. Industry has been invited to take part in a dialogue on the details of the system, given its ambitious nature. The scheme is intended to be compatible with the EC approach, but its coverage by sector and opening to the credits from the CDM may constitute a major difference.

49. According to some preliminary estimates of the effect of the initial trading scheme for the years 2005–2007, a 1,600 Gg reduction, corresponding to 3 per cent of the total Norwegian emissions, could potentially be realized at a low price. If the price for the emission rights is around Nkr 100 per tonne, the cost for industry is estimated at around Nkr 160 million per year. The system is expected to have marginal macroeconomic effects and no significant effects on employment. It is expected to provide Norway with valuable early experience with trading and Kyoto mechanisms, and establish trading institutions.

50. For the years after 2007, one emissions trading system covering all sources previously covered by the tax or the initial emissions trading scheme is foreseen. This system will be linked to the international emissions trading scheme under the Kyoto Protocol from 2008 and cover over 80 per cent of the sources. Details for such a system are yet to be formally decided. A summary of the key policies and measures, including the CO₂ tax and emissions trading system, is provided in Table 6.

Table 6. Effects of key policies and measures (Gg CO₂ equivalent)

	Emission reductions	
	2000	2005
Implemented measures		
CO ₂ tax, petroleum sector	2,600	2,600
CO ₂ tax, energy use onshore	>800	>800
Carbon reinjection in oil and gas industry	1,000	1,000
Agreement with aluminium industry	700–3,000	700–3,000
Voluntary reductions, magnesium production	1,500	Not estimated
Voluntary reductions, nitric acid production	800	Not estimated
Voluntary reductions, cement production	<500	Not estimated
Pollution Control Act on Waste	500	>500
Agreement with industry on waste	600	>600
Planned measures		
Emissions trading system	Not available	1,600
Other new measures	Not available	3,400

B. Energy

51. The natural resource endowment of Norway, especially its hydro resources and proven reserves of oil and natural gas, define a unique energy and emission profile for the country. It is a large producer of oil and gas, and total energy production is about nine times higher than the total primary energy supply. Thus, a large part of Norway's GHG emissions come from the production of oil and gas, which is mostly exported to other countries. These emissions have increased steadily during the 1990s, reaching a level that is around 45 per cent higher than the 1990 level by the end of the decade. Electricity production is based almost entirely on hydro power, which is free of CO₂ emissions. Energy use in the manufacturing and residential sectors is higher in Norway than in most other countries. There are two main reasons for this: the cold climate and a high level of energy-intensive industries because of the availability of low-cost hydro power.

52. The 2001 White Paper introduces a goal to reduce the use of oil for heating by 25 per cent in the period 2008–2012, compared to the average in the period 1996–2000. This target seems realistic, as the White Paper noted that use of oil for heating had already reduced by 50 per cent between 1980 and 2000. The details of how to achieve the goal are yet to be decided.

53. Further targets for renewable energy and energy saving were approved by parliament in spring 2000. These targets require: (1) limiting energy use considerably more than would be the case if developments were allowed to continue unchecked; (2) increasing annual use of central heating based on new renewable sources, heat pumps and waste heat by 4 TWh/year by the year 2010; and (3) constructing wind generators with a production capacity of 3 TWh/year by the year 2010.

54. A new public enterprise, ENOVA, was created in 2002 to ensure cost-effective use of the public funding available and to serve as a main vehicle to reach these targets together with promoting environmentally friendly natural gas solutions.

Electricity production

55. The total power production in Norway in a normal year is 119 TWh, but there is a large variation, depending on the amount of precipitation. It is estimated that upgrading and expansion has a theoretical potential to increase production of hydro power by around 10 TWh/year. In the period from 1990 to 1999 the annual rise in electricity consumption was much higher (around 1.5 per cent) than the average annual rise in production capacity (around 0.6 per cent). If this trend continues hydro power will not be able to fulfil the demand, and the choice will be either to build new capacity, or to import.

56. At present emissions from the production of electricity are very low, but there are plans for new gas-fired combined-cycle power plants. Licences have been granted for three new gas-fired power plants. Two plants will have an installed capacity of about 400 MW, corresponding to an annual production of about 3 TWh each. The third plant is a co-generation facility in a pulp and paper plant with an installed capacity of 800 MW, corresponding to production of about 6.4 TWh of electricity and 1.5 TWh of heat per year. These plants would emit 4,400 Gg CO₂ per year, which would increase the overall CO₂ emissions by around 10 per cent. The construction of these plants has not yet started. The review team learned that the building of these plants depends very much on future prices for gas and electricity on the Nordic market, as well as the situation for the pulp and paper industry, so it is unclear whether or not these plants will be built before 2010.

57. In October 2001 a committee was appointed to review various environmental issues related to gas-fired power plants. The committee submitted a report in March 2002, with a thorough review of issues connected with the use of hydrogen and gas-fired plants with CO₂ sequestration technology.

58. The electricity market in Norway has been liberalized and meets the requirements of the EC directive on energy market liberalization. Norway is one of the leading countries in this field. Norway is also well integrated into the North European electricity market, together with, inter alia, Denmark, Finland and Sweden, and this provides some flexibility in meeting electricity demand.

Oil and gas production

59. Emissions of CO₂ from oil and gas production were about 10,000 Gg in the year 2000, about 25 per cent of the total CO₂ emissions, having grown by 40 per cent since 1990. This increase is expected to continue for some years, with an expected peak in 2006. This growth depends mostly on increased production of oil and gas, but in recent years also on higher emissions per unit produced. This is related to the age structure of the fields: production in mature fields requires more energy and leads to higher emissions. Between 1990 and 1996 the emission of CO₂ per unit was reduced, but since then it has grown.

60. Emissions of NMVOCs from oil and gas production were about 240 Gg in 2000, about 64 per cent of the total emissions in Norway, and they increased by 22 per cent in the period from 1990 to 2000 as a result of increased production. Emissions of CH₄ from the oil and gas industry were around 25 Gg

in the year 2000, which is about 8 per cent of the total emissions. CH₄ emissions increased by about 65 per cent in the period from 1990 to 2000.

61. The Petroleum Act includes a requirement for an Environmental Impact Assessment (EIA), which is required in the exploration, development and closing phase. The Pollution Control Act regulates discharges to the seas and emissions of NMVOCs. Emissions from the petroleum sector are mainly related to energy production in gas turbines. Efforts to increase the energy efficiency of gas turbines are continuing.

62. The main policies for CO₂ reduction in the petroleum sector are the CO₂ tax and flaring restrictions, which means that flaring is permitted only for safety reasons. The effect of the CO₂ tax on the petroleum industry is monitored by the Norwegian Petroleum Directorate, and reported annually. In the NC3, the annual effect of the CO₂ tax on the petroleum sector in 1999–2000 was estimated at 2,600 Gg CO₂.

63. One of the most promising and potentially important measures is CO₂ separation. The first plant to separate CO₂ from produced natural gas is in operation on the Sleipner West field and reduces the CO₂ emissions by 1,000 Gg annually. The same solution has been chosen for the Snovit field. Other measures include more efficient energy generation; combined cycle systems where the waste heat from gas turbines is used to produce steam for additional electricity; recovering of flare gas; and supplying electricity from land to offshore fields.

64. A recovery system to reduce emissions of NMVOCs has been installed at one oil terminal, with recovery of about 60 per cent. The emissions are subject to plant-by-plant regulation under the Pollution Control Act. Operators are required to recover about 70–80 per cent of NMVOCs released in connection with offshore loading and storage of crude oil, and this should increase to 95 per cent of the offshore loading and storage of crude oil in the year 2005. This should result in a reduction of NMVOC emissions by 103 Gg in 2006 compared to a “business as usual” scenario.

Industry

65. The emission of CO₂ from energy use in industry was about 4,000 Gg in the year 2000, an increase of 16 per cent since 1990. The CO₂ tax applies to energy-related emissions from the use of fuel oil, but these account for only a small proportion of the industry’s emissions, so most of the emissions are not covered by policies. It is proposed that these emissions, including emissions from refineries and methanol production, should be included in the emissions trading scheme from 2005.

66. Licences for point sources are issued according to the Pollution Control Act. As a rule, emissions of GHG are included in these permits. So far, few requirements to reduce emissions of greenhouse gases have been included in the permits for point sources. The government intends to make arrangements to allow flexible implementation of measures to reduce emissions in accordance with the Pollution Control Act. The implementation of the EC directive on integrated pollution prevention and control requires major sources to use best available technology that should lead to reduced emissions.

Residential and commercial sector

67. The emissions of CO₂ from energy use in this sector were about 3,400 Gg in the year 2000, a decrease of 28 per cent since 1990. ENOVA is the main agency responsible for achieving the targets set for renewables and energy efficiency (see paragraph 53). To achieve these goals, ENOVA will receive up to NKr 5 billion over 10 years. For the first year, 2002, the budget is set at NKr 480 million. This budget comes partly from a levy on electricity production (NKr 200 million) and partly from state grants (NKr 280 million). A joint target for energy savings and increased environmentally friendly production of a total of 10 TWh for the year 2010 has been set. Within this joint target the minimal targets set by

the Parliament for renewable heat (4 TWh) and wind power (3 TWh) shall be met. The operational target for the first four years (2002–2005) is to achieve energy savings and increased production of renewable energy of 4.5 TWh by 2005. A progress report will be submitted each year and the results will be evaluated after a four-year period.

68. ENOVA will also support the provision of information on energy savings to consumers and producers, and enhance networking for stakeholders. The review team noted the strong interest in such projects at the local level.

C. Transport

69. Emissions of CO₂ from transport were about 13,100 Gg in 2000, an increase of 19 per cent since 1990. More than half of these emissions came from road traffic and the rest from ships and aviation. Norway has a relatively high demand for transport, because of the decentralized living patterns. This also means that public transport is quite costly, compared to many other countries. In the last 40 years mobility has increased by a factor of four, but this increase has been almost entirely in road traffic; public transport has remained almost the same. This continuously enhanced demand is the main driver for the increased emissions, and thus the number of private cars has increased significantly over the last decade as a result of increased living standards.

70. The CO₂ tax is the main instrument for limiting CO₂ emissions in the transport sector. In 2002 the rates were Nkr 315 per tonne of CO₂ from petrol and Nkr 186 per tonne of CO₂ from auto diesel and other mineral oils. This tax also applies to fuels used for transport by sea, but a reduced rate applies to fuel for domestic goods transport. Domestic air traffic is also subject to the tax (Nkr 108 per tonne of CO₂), but international air traffic is exempted. Norwegian taxes on transport fuels are among the highest in the world. This has led to some shifting of fuel purchasing to neighbouring countries.

71. Prices for fuels for transport were already quite high in Norway before the introduction of the CO₂ tax, and the tax did not increase the total prices much. This, in combination with low elasticity of demand, probably modified the effect of the CO₂ tax on the transport sector. Still, the effect of this tax on transport and other energy end-uses onshore has been estimated at an annual emissions reduction of 800 Gg of CO₂ equivalent for the 1999–2000 period.

72. Coordinated land-use and transport planning may limit transport volumes and facilitate public transport, bicycling and walking in a long-term perspective. Strategic analyses are carried out in the six largest urban areas as part of the revision of the overall National Transport Plan (NTP), but specific action is yet to be taken. Moreover, a change in the existing investment pattern, which is heavily biased to investment in road transport rather than rail, may help to offset at least part of the emission growth from transport. Further emission reductions could be obtained from a more integrated approach to transport policy planning, considering the impact on emissions.

73. Additional instruments and measures relating to transport include information on CO₂ emissions from new cars, which has been legally required in the marketing of new cars since July 2001, according to an EC directive. The 2002 White Paper signals more resources to be channelled to improve public transport, especially in urban areas. It also includes the possible promotion of alternative fuels, including biofuels.

74. A general regulation, which in principle enables road pricing, was adopted in 2001. However, if local authorities decide to implement road pricing, detailed regulations will be needed and such detailed regulations have not yet been presented. An initiative from local authorities will also be necessary, and this has not yet taken place.

75. New cars are more efficient than old cars and stock turnover should, in theory, lead to lower emissions. In Norway this effect has almost been offset by the market penetration of bigger cars. This is reflected in the fact that the fuel consumption for an average car sold has remained almost unchanged; in 1990 the consumption was 0.76 litres/10 km, and in 2000 it was 0.74 litres/10 km.

76. Emissions of N₂O from transport were about 2 Gg in 2000, or 12 per cent of the total 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.

D. Industrial processes

77. Emissions of CO₂ from industrial processes were about 7,300 Gg in the year 2000, an increase of 17 per cent since 1990. The emissions of N₂O were 5.6 Gg, corresponding to 35 per cent of the total N₂O emissions. Industrial processes also accounted for almost all of the emissions of PFCs, SF₆ and HFCs.

78. In the 2002 White Paper the Government stated that most of the emissions from industrial processes will be included in the emissions trading scheme from 2005. This is expected to bring significant reductions from the sector.

79. The aluminium industry has high emissions of GHGs, mainly PFCs, but also CO₂. According to a 1997 agreement the aluminium industry will reduce emissions of greenhouse gases per tonne aluminium produced by 50 per cent in 2000 and 55 per cent in 2005, compared to 1990 levels. The agreement was met by the industry for 2000: the total reduction was close to 3,000 Gg CO₂ equivalent. Emissions of SF₆ from the magnesium industry were reduced almost threefold between 1990 and 2000 as a result of improved routines and maintenance. They will drop even further, by around 25 per cent of the 2000 level, as a result of the closure of the country's main magnesium foundry.

80. The main industrial source for emissions of N₂O is the production of nitric acid. There was a reduction in these emissions in the early 1990s, due to changes in production processes, but an increase in the later 1990s, due to increased production. The NC3 reports a reduction of about 800 Gg CO₂ equivalent in the 1990s from this sector. According to the 2002 White Paper these emissions will be included in the emissions trading scheme from 2005.

81. The main uses for HFCs are in cooling equipment, fire extinguishers and for the production of plastics. To a large extent HFCs are used as an alternative to ozone-depleting substances such as chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs). The emissions are fairly low, but they are increasing. The 2002 White Paper includes a proposal for a tax for HFCs and PFCs imported as pure chemicals or in products. This tax entered into force on 1 January 2003. In terms of CO₂ equivalent, the tax was set at the same level as that of heating oil, reflecting the high global warming potential of these gases. Government is considering combining this tax with a refunding arrangement for products containing HFCs and PFCs. The environmental authorities are working on the details of such an arrangement.

E. Agriculture

82. The emissions of N₂O from agriculture were estimated to be 8.2 Gg in 2000, corresponding to almost 50 per cent of the total N₂O emissions. The main source is soil, where emissions result from the use of fertilizers. Research is being conducted on how the fertilizers can be spread in a way that minimizes emissions. The emissions of CH₄ from agriculture were estimated to be 98 Gg in 2000, corresponding to about 30 per cent of the total CH₄ emissions. These emissions are proportional to the number of livestock, which was rather stable from 1990 to 2000. No special measures are reported for the agricultural sector.

F. Land-use change and forestry

83. The net CO₂ removal in forests has been around 14–18 Gg in recent years. It is expected to grow slowly in the next few years, reaching a level of 18–20 Gg by the end of the first commitment period. The reason for this is the gross increment of the Norwegian forests, while harvesting is expected to remain at the same level. There are some measures to promote the enhanced use of wood in products, which can lead to an increased build-up of the carbon stock in wood products.

G. Waste management

84. The emissions of CH₄ from landfills were estimated at 187 Gg in 2000, representing almost 60 per cent of the total CH₄ emissions. Landfill emissions grew in the 1990s, with a peak in 1996, and a slight reduction from 1996 to 1999. The review team noted that Norway has a higher proportion of organic waste going to landfills than neighbouring countries, around 63 per cent (17 per cent goes for incineration and 20 per cent recycling). Thus the potential for reducing emissions should be high.

85. In the 2002 White Paper the priorities in waste policy are given as first prevention and minimization of waste, second recycling and energy recovery and only third landfilling.

86. The most important measures to reduce emissions are licensing requirements under the Pollution Control Act and a tax on final waste treatment. The licensing requirements have been strengthened over time and the implementation of the EC directive on landfills has led to a further strengthening. A tax on final waste treatment was introduced in 1999. The tax discourages landfilling and encourages energy recovery from waste. The tax is set at Nkr 320 per tonne of waste going to final treatment. Facilities that recover energy from waste are exempt. There is a proposal to change the tax so that the tax reflects actual emissions in waste incineration plants, to raise it for landfills and to subsidize production of energy in final waste treatment plants. This proposal is expected to be implemented in January 2004.

87. In recent years the emissions of methane from landfills have been reduced as a result of extraction of landfill gas for energy use or for flaring. More than 40 landfills have installations for gas extraction.

88. Methane emissions from landfills are not included in the emissions trading system, according to the proposal. The 2002 White Paper allows for a special form of national joint implementation on abandoned landfills. This would provide the possibility for business entities to invest in measures at landfills and obtain emissions quotas, thus enabling certain low-cost measures that otherwise would not be taken.

IV. PROJECTIONS AND THE TOTAL EFFECT OF POLICIES AND MEASURES

A. Preparation of projections

89. The MoE oversaw the preparation and reporting on projections in the NC3, in close cooperation with several other ministries. Projections of energy-related CO₂ emissions were prepared by the Ministry of Finance with input on the future activities in the petroleum and transport sectors from the Ministry of Petroleum and Energy and the Ministry of Transport respectively. The Ministry of Finance also prepared projections for the CO₂ emissions from agriculture, with input from the Ministry of Agriculture. For non-CO₂ emissions, plant-specific information was collected from relevant industries and future levels of activity and emission levels were assessed by the SFT.

90. The NC3 contains a set of projections for all GHGs to 2010 for a single scenario “with measures”. The CO₂ emission projections included in the NC3 were prepared for the 2001 White Paper and are consistent with macroeconomic projections presented in the 2001 *The Long-Term Programme*

2002–2005. Projections are presented for eight sectors, which are not directly comparable with the IPCC categories, including oil and gas production, electricity generation, manufacturing, transport, other sectors, industrial processes, agriculture and waste by gas. Total GHG emission projections by sectors were presented relative to actual GHG inventory data for 1990 and 1999, and the base year for projections was 1995. Projections of CO₂ sequestration from LUCF were presented as a single number for the next 10–15 years. Projections of the precursors, NO_x and NMVOCs, and for SO₂ were presented for year 2010 for a “with measures” scenario. These projections were reported together with historical data for 1990, 1995 and 2000.

91. Reporting on projections broadly conforms with the UNFCCC guidelines. However, the review team noted that projections of GHG by sector and gas were presented for a single year (2010) without intermediate results, e.g. for 2000 and 2005. Projections for 2015 and 2020 were not provided. Emission projections were given for a single scenario, which made it difficult to gain a clear understanding of emission trends by sector and national totals with new measures. The NC3 does not contain a description of models used to project non-CO₂ emissions, or sensitivity analysis of projections to underlying assumptions. Uncertainty levels of projections were reported only qualitatively. Emissions projections related to bunker fuels were not reported separately.

92. It was difficult for the review team to determine consistency between inventory data and the base year for projections (1995), because the latter were not reported in the NC3. Data for 1999 presented in the projections chapter is broadly consistent with inventory data given in the NC3, with some small differences due to rounding. In addition, the CH₄ emissions for 1999 reported in the projections section and the inventory section were somewhat different. The review team encouraged Norway to improve transparency in reporting on projections and to present the information by sector and by gas, and also in carbon equivalent using global warming potential for each scenario.

B. Scenarios, models and assumptions underlying future emission trends

93. In the NC3, emission projections by gas and by sector were provided for a single “with measures” scenario, which encompasses the effect of all implemented and adopted policies reported in the NC3, including CO₂ taxes for petrol, mineral oil, coal, oil and natural gas. In this sense, projections represent future developments based on current economic and environmental policies and assumptions on future economic developments. However, the effect of new measures was presented for a single year, 2010, which made it difficult to gain a good understanding of the contribution of these measures to future emission levels, as these levels were presented for the year 2005 rather than 2010.

94. Projections of energy-related emissions (mostly CO₂ emissions) provided in the NC3 are prepared using the macroeconomic model MSG (multi-sectoral growth). The model is maintained by Statistics Norway and has been used by the Ministry of Finance since the 1960s for long-term economic analysis. MSG is a general equilibrium model with detailed presentation of all economic sectors. The MSG model is used for emission projection and for ex-post and ex-ante assessment of effects from the CO₂ tax. Energy and emissions models, including emission factors consistent with those used for the GHG inventory, form separate modules linked to the MSG and emission factors are consistent factors used for the GHG inventory. The CO₂ projections incorporate the effect of current policies, mainly CO₂ taxes.¹⁰ The MSG model is not suited for analysis of short-term adjustment problems as it may underestimate short-term costs associated with industrial adjustments in response to the CO₂ taxes and associated emission reductions. In addition, new technologies are reflected only indirectly through changes in productivity growth. Projections of emissions from agriculture, including CO₂ from liming,

¹⁰ In 2001 these taxes were Nkr 0.72 per litre for petrol, Nkr 0.48 per litre for mineral oil, Nkr 0.48 per kg for coke and coal for energy purposes, Nkr 0.72 per litre for use of oil in the North Sea and Nkr 0.72 per m³ for use of natural gas in the North Sea.

N₂O from soil and CH₄ from ruminants and manure, and projections of CH₄ and N₂O from stationary and mobile combustion are linked to the outcome of the MSG model and relevant future trends by sector.

95. Projections of non-CO₂ emissions, including N₂O and perfluorocarbons (CF₄ and C₂F₆) are based on a combination of information collected from industries and trend analysis. Projections of CH₄ emissions from landfills are calculated by a new model developed by SFT in 1999, which is based on IPCC first-order kinetics methodology. These projections take into account measures that have been implemented (licensing requirements for combustion of methane from landfills, etc.).

96. The growth in electricity demand of 1 per cent annually was assumed to be covered by new capacity. Electricity production was expected to reach 133 TWh in 2010 compared to the existing 118 TWh. This includes new hydro plants with production capacity of 0.3 TWh/year already under construction and 1 TWh yet to be licensed, 6 TWh from two new gas-fired power plants and 3 TWh of wind power. Norway is expected to maintain its electricity imports at around 1 TWh in 2010.

97. Projections of emissions from the oil sector are based on assumptions on the future prices of oil and productivity growth of the sector. Oil prices are expected to drop from NKr 220 per barrel in 2001 to a relatively stable level of NKr 135 per barrel around 2010. The oil price drop is expected to reduce activities in the petroleum industry and increase domestic use of oil products. Energy efficiency improvement varies between sectors, but is assumed to remain at an average of 1 per cent annually. Annual GDP growth was assumed to be 1.7 per cent from 1999 to 2010. The review team noted that not all key parameters and assumptions for modelling of energy-related emissions were transparently reported in the NC3, but relevant additional information was provided during the country visit.

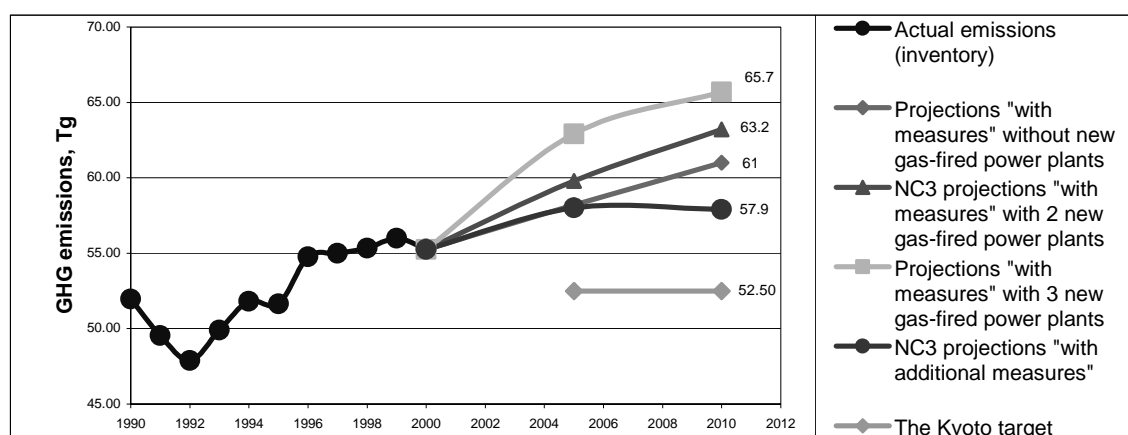
C. Results of projections

98. According to the NC3 “with measures” scenario, the total emissions are projected to reach 63,200 Gg CO₂ equivalent in 2010. The NC3 acknowledges that with new measures, mainly emissions trading, which corresponds to the “additional measures” scenario according to the UNFCCC guidelines, emissions will total 57,900 Gg CO₂ equivalent in 2010. This is 5,700 Gg (9 per cent) lower than emissions in the “with measures” scenario. The effect of existing measures was estimated in the NC3 at 15–20 per cent compared to the “with measures” scenario. Analysis of projections of total emissions suggests that emissions for the first commitment period under the Kyoto Protocol (2010 emission levels taken as average for this period) according to the “with measures” scenario will increase by 22 per cent compared to 1990 and are likely to exceed the Kyoto target of 52,500 Gg CO₂ equivalent (without removals from LUCF) by 10,700 Gg. These results are shown in Figure 4, together with the Kyoto target for Norway.

99. The total emissions growth is underpinned by an increase in CO₂ emissions, which are expected to rise by 36 per cent between 1990 and 2010. These emissions in turn are driven by a 65 per cent growth in emissions from the oil and gas industry, which will further increase the share of emissions from this industry as a proportion of the total emissions, from 14.8 per cent in 1990 and 18 per cent in 1999 and to 20 per cent in 2010. Emissions of CO₂ from manufacturing industry are expected to almost double, and transport emissions are expected to grow by 22 per cent.

100. The share of GHGs from electricity generation will rise from zero in 1990, when electricity production was almost entirely hydro based, to 3 per cent in 2010. Underlying the increase are 2,100 Gg emissions from the two gas-fired power plants with production capacity of 6 TWh. The third plant, approved in 2001, with production capacity of 6.2 TWh, would increase emissions by 2,360 Gg.

Figure 4. Projections of the total greenhouse gas emissions for different scenarios and the Kyoto target



101. For the non-CO₂ gases, emissions of N₂O are projected to increase slowly by 2010 and stabilize thereafter. Emissions of CH₄ emissions are projected to remain broadly unchanged between 1999 and 2010. In 2010, emissions of PFCs will remain stable and those of SF₆ will drop by 62 per cent compared to 1999 as a result of the closure of the main magnesium foundry in Norway. Emissions of HFCs are expected to increase significantly as the phasing out of ozone-depleting substances progresses.

102. CO₂ removal is assumed to increase slowly over the next decade, reaching 18,000–20,000 Gg in 2010. The same harvesting rate is assumed to be maintained throughout and no changes in the natural die-off and existing policy are foreseen. The gross increment rate was based on the model known as NIJOS, taking into account data on age-class distribution and growing conditions.

103. Data provided to the review team during the review visit, presented in Table 7, made it possible to compare key assumptions and projections for 1995–2000 in the NC2 and the relevant data in the NC3 against actual developments. The comparison suggests that the actual growth rates have been higher than the assumed ones for all macroeconomic variables. The difference, especially in terms of the petroleum sector, is significant for the growth in GDP. The comparison of CO₂ projections of 44,000 Gg from the NC2 for 2000 with the inventory estimate for the same year, 41,270 Gg, does not suggest substantial differences.

Table 7. Projections of key macro-economic variables used as input for carbon dioxide emissions projections

	National Account figures ^a		Projections 1995–2010 Annual average growth rate	
	Billion 1995 Nkr	Annual average growth rate 1995–1999	NC2	NC3
Gross domestic product	937.4	3.8	2.0	2.1
Mainland Norway	798.9	3.9	2.1	2.3
Manufacturing	113.1	2.1	1.9	2.8
Petroleum activities and ocean transport	138.5	3.0	1.4	–0.1
Private consumption	462.3	3.8	3.0	2.6
Government consumption	202.1	3.0	1.7	2.0
Gross fixed capital formation	186.5	7.7	1.1	0.8
Mainland Norway	134.9	7.5	2.1	1.7
Petroleum activities and ocean transport	51.7	8.1	–2.8	–2.7
Number of people employed (1000)	2 196	1.6	0.9	0.8

^a National Account figures revised June 2002.

^b Model projections, 1995 base year for the model.

104. The review team noted that, although most key macroeconomic parameters were revised upwards in the NC3 compared to the NC2, no new measures had been implemented and 2,100 Gg of emissions in 2010 from the two gas-fired power plants had been included, projections of total emissions in 2010 in both NC2 and NC3 remained broadly the same, at 63,600 Gg and 63,200 Gg respectively. This result seems to stem from projections of HFCs and SF₆ being revised slightly upwards and those of CH₄ being revised slightly downwards, while projections for CO₂ remained broadly unchanged. Projections of CO₂ emissions remained unchanged because the impact in key variables seem to off-set one another.

105. The uncertainty levels of the GHG projections are high, underpinned by uncertainties related to future activities in the petroleum sector and by the uncertain future of gas-fired power plants. In particular, future activities in the petroleum and electricity sectors will depend on factors outside Norway. World oil prices will continue to drive oil production in Norway, and the EC electricity market and electricity prices will define whether or not new gas power plants are built in Norway.

106. The NC3 does not contain quantified data on uncertainty estimates. During the country visit, the review team was provided with results from a sensitivity study conducted by the Ministry of Finance. The study suggests that in 2030 annual productivity rates of 0.5 per cent higher than the 1 per cent assumed in the “with measures” scenario would result in a 42 per cent growth of gross value added in manufacturing, a 26 per cent increase in GDP, a 21 per cent increase of consumption, and a 12 per cent increase in CO₂ emission rates compared to the “with measures” scenario. The review team encouraged Norway to systematically assess the sensitivity of projections to key variables, e.g. oil prices and GDP.

D. Estimated effect of policies and measures

107. The NC3 provides brief information on the estimates of the effect of measures already implemented, acknowledging the methodological difficulties associated with such estimates. These estimates are based on information from studies by SFT, Statistics Norway and the Norwegian Petroleum Directorate. These estimates encompass the effects from main measures, including CO₂ tax, waste, voluntary agreements with the aluminium industry, regulation of volatile organic compounds and voluntary reduction of emissions from magnesium and nitric acid production (see Table 6). The effects of other measures aimed at enhancing energy efficiency and encouraging use of renewables, as well as measures related to transport and agriculture, have not been assessed. The total cumulative effect of individual policies and measures was calculated to be between 7,600 and 10,000 Gg CO₂ equivalent, or around 15–20 per cent higher compared to a counterfactual “without measures” scenario (Table 6). By sector, projected emissions growths are summarized in Table 8 and compared to the historical growths.

108. The 2001 White Paper reported 6,000 Gg emission reductions that could be achieved through cost-effective new measures given an estimated international quota price at 125 NOK.¹¹ An SFT study suggests that such a level of reduction could be achieved by the following measures: (1) emissions trading and voluntary agreements with the aluminum industry, 1,600 Gg; (2) electricity supply to the offshore oil and gas industry, 1,500 Gg; (3) improved waste management, 2,000 Gg; (4) replacing fuel oil by biofuels, 1,000 Gg; (5) reducing emissions of HFCs and PFCs by the new tax, and SF₆ by voluntary agreement with the magnesium industry. Among these estimates, the reductions expected from waste have a high level of uncertainty.

¹¹ For comparison, in 2002 the CO₂ tax rates in transport were Nkr 315 per tonne for petrol and Nkr 186 per tonne for diesel.

Table 8. Emissions in 1990 by sector, historical growth in 1999, based on inventory data and projected emission growth

Sector	Emissions in 1990 (Gg CO ₂ equivalent)	Historical growth in 1999 compared to 1990 (%)	Projected growth in 2010, compared to 1990 (%)
Energy	29,100	22	43
<i>Oil and gas sector</i>	7,700	33	65
<i>Electricity sector</i>	0	0	0
<i>Industry</i>	4,800	26	38
<i>Transport</i>	13,700	23	22
<i>Other sectors^a</i>	2,900	-14	12
Industrial processes	14,000	-18	-11
Agriculture	5,000	0	2
Waste	4,000	4	4
Total	52,000	8	22
CO ₂ net emissions/removals from LUCF	-9,600	85	13
Total with CO ₂ removals	42,370	-10	2
Kyoto target (%)			1

^a Other sectors include energy use in residential, commercial and agricultural sectors.

109. The planned emission reductions of 6,000 Gg amount to around half of the reduction needed to cover the gap of 10,700 Gg between the projected level of 63,200 Gg and the Kyoto target of 52,500 Gg if two gas-fired power plants are built, or a gap of 13,150 Gg between the projected level of 65,700 Gg and the target in case the additional third gas-fired power plant is built (figure 4). The rest of the gap could be covered by the Kyoto mechanisms and removals. The estimates of emissions from gas-fired power plants were obtained under the assumption that these plants will use technology that corresponds to the best available techniques. Estimates for emission reductions from waste, although estimated as very cost effective, together with measures targeting fluorinated gases, are quite uncertain. This suggests that Norway may have to use a higher share of reductions obtained from the Kyoto mechanisms than initially intended, unless new measures are implemented.

V. VULNERABILITY ASSESSMENT, CLIMATE CHANGE IMPACTS AND ADAPTATION MEASURES

110. The NC3 details two major research programmes currently implemented in Norway: RegClim, launched in 1997 by the Research Council of Norway (RCN) and the Arctic Climate Impact Assessment (ACIA). Other programmes have also been initiated by the MoE. All these programmes have helped to increase knowledge of possible regional climate developments in northern Europe under a global warming scenario and to gain an initial understanding of climate change impacts on the most vulnerable sectors and ecosystems, but the NC3 noted a great need for further research on more comprehensive assessments of vulnerability, impacts and adaptation in Norway.

111. According to the RegClim programme, climate change in Norway over the next 50 years is expected to lead to a mean temperature increase of 0.9°C in summer and 1.6°C in winter. Precipitation is expected to increase by 10 per cent in the same period. The sectors which are particularly vulnerable are agriculture, forestry, fisheries, transport and hydro power. Accordingly, the initial work on adaptation centred on a number of priority sectors and issues for Norway, including the sectors mentioned above, together with wildlife management, water resource management, coastal and river flood defence and a better coordinated approach to infrastructure planning.

112. Several sectoral agencies have already been involved in climate change impact assessment with a view to initiating the development of adequate response and adaptation strategies. To this end, several new developments since the publication of the NC3 must be mentioned. For 2003 the RCN has allocated a budget of Nkr265 million for research on climate and energy. The main targeted areas include the

impacts of climate change and technology for clean gas-fired power plants (involving carbon sequestration). The launch of a new eight-year programme, KlimaEffekter, is planned for 2003; it will study impacts and adaptation to climate change as well as regional vulnerability. Other new programmes include KlimaProg, Polar Climate research and others. Similar programmes are envisaged to be launched under CICERO, focusing on the economic and social impacts of climate change and adaptation thereto in Norway, and regional assessment of climate vulnerability. In March 2002, the Norwegian Institute of Metrology submitted a pilot study to the Ministry of Transport on the effects and adaptation to climate change in the transport sector.

VI. FINANCIAL RESOURCES AND TRANSFER OF TECHNOLOGY

113. The Ministry of Foreign Affairs and the Ministry of Environment are the main institutions dealing with climate-related financial assistance and technology transfer. The Norwegian Agency for Development and Cooperation, which operates under the Ministry of Foreign Affairs, channels most of the registered resources used in environmental assistance. The reporting of information on financial resources and technology transfer in the NC3 conformed with the UNFCCC guidelines and all required tables were filled in. As reported in the NC3, Norway's average Official Development Assistance (ODA) for 1997–2000 corresponds to about 0.87 per cent of GNP, higher than the agreed United Nations target for ODA (0.7 per cent). Norway reported 65 per cent of its contribution to the Global Environmental Facility as ODA.

114. Although the figure is not provided in the NC3, according to information from the Ministry of Foreign Affairs around 66 per cent of the ODA can be linked directly or indirectly to climate change. This percentage is derived from a report of the Development Assistance Committee to the Organisation of Economic Co-operation and Development, which does not capture specifically climate change issues, because climate change is not its main priority. Therefore, this number may overestimate the share of climate-related ODA. The reporting of emissions avoided as a result of implemented projects and financial assistance is yet to be undertaken.

115. Norway's policy is to provide assistance for diverse projects in a large number of developing countries, from South Africa to Asia, Latin America and the Caribbean. Priority areas for cooperation, e.g. hydro power development in Africa, and long-term strategy and bilateral cooperation with Mozambique, Nepal and Vietnam, match well with the outcome from the 2002 Johannesburg Summit. The major focus is on pollution reduction and cleaner production activities, with indirect climate change impacts such as encouraging less energy use and less waste disposal. Assistance is mainly provided for institutional development and capacity-building. There is also bilateral cooperation with China, South Africa and Indonesia. Norway is planning to support the preparation of sustainable development strategies for 15 Asian countries.

116. Norway was one of the first countries to initiate projects under Activities Implemented Jointly (AIJ) and has so far spent US\$17.5 million on such activities. This includes activities under the Norway–World Bank AIJ programme and several bilateral projects, e.g. with the Slovak Republic, China and Costa Rica. Norway also actively participated in the shaping of the CDM.

117. The strategy for private sector development includes support for development in the environmental sector, efficient use of resources, hydro power and new renewable energy resources. Norway supports investments and capacity-building activities mainly for hydro power development, but this support is extended to solar energy and other renewable technologies. The private sector is regarded as the main vehicle for technology transfer, and the Norwegian government is committed to the continued promotion of both hard and soft technology transfer under its assistance programmes. As assistance to economies in transition, Norway contributes to the Nordic Environment Finance

Corporation, which is a risk capital institution financing environmental projects in central and eastern Europe, especially the Baltic region.

VII. RESEARCH AND SYSTEMATIC OBSERVATIONS

118. Research activities in Norway for all sectors and disciplines are coordinated by a single body, RCN. Climate research is a priority, as reflected by the steadily growing financial support for climate research: as mentioned above, RCN's total budget for climate and energy research is around Nkr 240 million in 2003, which is almost double the budget for 1998. Around Nkr 80 million of the budget is allocated for research on climate change, impact and adaptation, while the remaining part is allocated for research on energy-related issues, such as technologies to reduce GHG emissions, and new renewable sources.

119. There are two different categories of priority research: (1) climate change and its impacts on nature and society and (2) technology and other instruments for mitigating climate change. The climate change programme includes research on regional climate modelling, climate processes and climate system studies and past climates of the Norwegian region. It also includes research on the impacts of climate change. The technology programme includes research on technology for the reduction of emissions, e.g. capturing and sequestering of CO₂, research on renewable or alternative energy sources and research on social constraints and political instruments.

120. CICERO was founded in 1990 as a non-profit research foundation with a mission to work on the interface between basic research and political implementation. It has an interdisciplinary approach, with competences in social sciences, economy, geophysics and geography. CICERO also has the important task of providing information about climate change to the public and the research community.

121. Norway does not have a national programme of global climate observation. The Norwegian Meteorological Institute has proposed ten existing surface observing stations and one upper air station as part of such a programme.

VIII. EDUCATION, TRAINING AND PUBLIC AWARENESS

122. The Ministry of Education and MoE cooperate in environmental education and awareness raising in general, and climate change issues in particular. They have established the Norwegian Environmental Education Network and have helped to incorporate climate change topics in the schools curriculum. Other ministries and institutes are also involved. The review team acknowledged the role that CICERO has played in disseminating knowledge and information related to climate change. Jointly with other research institutes, CICERO also provides training in climate change issues.

123. Public awareness of environmental and climate change issues is thought to be fairly high in Norway, and climate change issues have been integrated at many levels of the educational system. In Norway over 90 per cent of the population (among the highest in the world) have Internet access, so since the NC2 the emphasis has been on Internet-based tools. *The State of Environment Norway*, published in 2000 by the MoE (www.environment.no), has enlarged the section on climate change. Similar reports are prepared at county level, and the first report was expected to be published by the end of 2002. The MoE is involved in this initiative, in cooperation with the United Nations Environment Programme GRID-Arendal network on reporting the state of the environment. Another new emphasis since NC2 is on the press and media: the government holds a press seminar before each Conference of the Parties and provides financial support for journalists to attend this event.

124. The transport sector has the second fastest rate of growth in emissions and a low price elasticity to demand. Hence, public awareness and education in this area could help to shift behaviour and mobility towards more sustainable patterns. Currently, the Ministry of Education and the MoE are

mainly responsible for awareness raising on energy conservation and waste management, while awareness in transport is dealt with by the Ministry of Transport, mainly through the *Back to Work* campaign. The review team noted that further joint efforts to raise public awareness in the transport sector could be warranted.

125. NGOs have been actively involved in the general discussion on climate change policies. Together with the media, they play a particularly important role in the raising of public awareness to climate change. The government has also provided support in terms of funding, for example for an NGO-produced children's film on energy conservation. Another television programme on energy saving and waste recycling is funded by the Ministry of Petroleum and Energy.

IX. CONCLUSIONS

126. The review of the information detailed in the NC3 of Norway and in supplementary information provided to the review team during the visit, together with the outcome of the discussions during the visit, allowed the review team to conclude that the NC3 provides a comprehensive and consistent overview of the national climate policy and covers all major sectors and gases. Key climate change policies and measures, the GHG inventory, projections and other issues addressed in the NC3 are presented in a concise and objective manner. The review team also concluded that the presentation of the information broadly conforms with the UNFCCC guidelines and did not identify any major gaps.

127. The presentation of information in the NC3 could benefit from more analysis of the underlying drivers behind the historical and future emission trends. Such analysis could usefully be presented in the national circumstances chapter, where more explicit links could be made between the national profile, profiles by sector and underlying drivers behind emission trends. The existing analysis in the chapter on the GHG inventory could be further strengthened to provide more explanation of the past emission trend. The presentation of information could also benefit from more rigorous and systematic assessment of the effects of policies and measures, despite the inherent methodological difficulties associated with such assessment. Such an assessment, together with a more systematic monitoring of the effects of policies and measures, could help to identify any underperformance of the existing measures and to strengthen them or introduce new ones, if necessary. The review team encouraged Norway to enhance transparency in reporting its projections and to improve its reporting in accordance with the comments in this report.

128. Analysis of the past emission trends contained in the NC3, together with data from the most recent inventory of Norway containing data on the 1990–2000 emission trend, provide evidence that Norway exceeded 1990 overall emission levels in 2000 by 6.3 per cent, without CO₂ removals from LUCF. If removals from LUCF were to be subtracted from the total emissions, the net total emissions in 2000 would be around 14 per cent below the 1990 level. As to its future commitments under the Kyoto Protocol, the Norwegian Government has decided not to make use of LULUCF activities under Article 3.4. Possible reasons for emissions being higher in 2000 than in 1990 include relatively high and stable economic growth throughout the decade resulting mainly from a significant growth of the oil and gas sector, rapid growth in transport and the contribution of policies and measures being insufficient to moderate emission growth. In particular, in 1991 Norway was among the first countries to introduce a CO₂ tax as a central instrument in its climate policy, with high levels of taxation compared to other countries with a similar tax. However, the effect of the tax is modified by the way it is implemented, e.g. the tax applies to only around 65 per cent of CO₂ emissions and around 50 per cent of all GHG emissions, and the highest rates apply to sectors with low elasticity for fuel price changes. Still, the effect of the tax is considerable. Estimates suggest that for 1999 and 2000 the CO₂ tax reduced total national GHG emissions by around 6 per cent.

129. Under the Kyoto Protocol, Norway is committed to limiting emission growth in the first commitment period (2008–2012) to 1 per cent over the 1990 level. With the policies and measures currently implemented, total emissions are projected to rise to 63,200 Gg CO₂ equivalent, which represents around 20 per cent increase over the target level of 52,500 Gg CO₂ equivalent. The “with additional measures” scenario, including new measures, most of which are presented in the 2001 and 2002 White Papers, suggests that the emissions growth could be slowed down and emissions could reach 57,900 Gg CO₂ equivalent. This represents around half of the difference between the target level of emissions and the reference scenario and corresponds to the pledge made by the government to obtain a significant part of the needed emission reductions in Norway and not to use sink credits under Article 3.4. The rest of this difference could be covered by the Kyoto flexible mechanism tools. Norway has already gained valuable experience with some of these tools, e.g. joint implementation, and is actively participating in activities leading to the operationalization of the CDM.

130. In the context of new measures, a gradual shift from the existing climate regime with the CO₂ tax as the central instrument, to a new regime in the pre-Kyoto period with the CO₂ tax in place together with emissions trading on sources not covered by a tax, constitutes the main policy thrust in preparing for the first commitment period under the Kyoto Protocol. Voluntary agreements with industry and domestic joint implementation are expected to complement the effect of emissions trading and the CO₂ tax in a carefully designed set of domestic policies and measures. The importance of starting with mandatory emissions trading for certain sources at an early stage was underpinned by the need to gain experience with this innovative policy instrument and to have sufficient time to address problematic issues.

131. At the sectoral level, Norway provides a good illustration of the complicated situation for countries where low-cost measures are not available, but reductions still have to be made. This highlights the transport sector, where emissions are growing in almost all countries. Norway too seems to have a need for innovative measures in this sector. At an institutional level, the new government agency, Enova, set up in 2002 to promote energy saving, non-traditional renewables and environmentally friendly natural gas solutions, could make a significant contribution to achieving the goals of Norwegian climate policy.

132. The review team formed the impression that there is a broad-based consensus among people and politicians in Norway on the significant threat that climate change poses to humanity and to ecosystems, and the need to combat it. This consensus underpins Norway’s commitment to contribute significantly to attaining climate change goals and the targets set for the country under the Kyoto Protocol. It also underpins Norway’s determination to be among the leading countries in the fight against climate change in the international context and to provide significant support to developing countries in addressing climate change.
