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

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

A. Introduction

1. Germany ratified the United Nations Framework Convention on Climate Change (UNFCCC) on 9 December 1996. It signed the Kyoto Protocol to the UNFCCC on 29 April 1998 and ratified it, with the other members of the European Community (EC), on 31 May 2002. The UNFCCC secretariat received the first national communication of Germany (NC1) in 1994 and the second one (NC2) in 1997. This third national communication (NC3) was received on 18 October 2002.[1]

2. The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU[2]) coordinated the preparation of the NC3 with inputs from relevant ministries and agencies.[3] The NC3 was reviewed by the "CO_2 reduction" Interministerial Working Group (IWG) which is chaired by BMU and includes representatives of key federal ministries, such as the Federal Ministry of Economics and Labour (BMWA), Federal Ministry of Transport, Building and Housing (BMVBW), and Federal Ministry of Consumer Protection, Food and Agriculture (BMVEL).

3. Non-governmental organizations (NGOs) did not take part in the preparation and review of the NC3. However, NGOs actively participate in the discussions on German climate protection policy and are familiar with the key policy documents used in the preparation of the NC3.

4. The in-depth review of the NC3 was carried out from June to October 2003 and included a visit by the review team to Berlin from 21 to 25 July 2003. The team consisted of Mr. A.K. Chan (Malaysia), Mr. J. Magezi-Akiiki (Uganda),[4] Mr. M.H. Tsarukyan (Armenia), Mr. P. Tulkens (Belgium) and Mr. S. Kononov (UNFCCC secretariat, coordinator). During the visit, the team met officials from federal ministries and agencies, German experts involved in the preparation of the NC3, representatives of two German regions, a representative of local administrations (municipalities), and representatives of business, environmental and consumer NGOs.

B. National circumstances

5. ***Location and climate***: Germany is located in central Europe and has a temperate climate. In terms of territory, Germany is the fourth largest country in the EC (after France, Spain and Sweden). The average temperatures for the coldest month (January) are between +1.5 ºC and –1.5 ºC; the average temperatures for the warmest month (July) are between +17 ºC and +18 ºC. The climate is more oceanic in the northwest (where maritime air masses influence the weather considerably) and more continental in the southeast.

6. ***Land use***: Forests cover about 29 per cent of the territory; agricultural land occupies about 54 per cent, of which about two thirds are used for cultivation (1997 data). Agricultural land slightly decreased in the 1990s because of the expansion of settlements and transport infrastructure.

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[1] The submission date was 30 November 2001 (decision 11/CP.4).

[2] Here and hereafter in the text, the abbreviations of German organizations are from their German names.

[3] In addition to the BMU, the following organizations contributed to the NC3: the Federal Environmental Agency (UBA), the Federal Ministry of Economics and Labour (BMWA), the Federal Ministry of Transport, Building and Housing (BMVBW), the Federal Ministry of Consumer Protection, Food and Agriculture (BMVEL), the Federal Ministry for Economic Cooperation and Development (BMZ), the Federal Ministry for Education and Research (BMBF), the Federal Ministry for Finance (BMF), the German Weather Service (DWD), and the German Institute for Economic Research (DIW).

[4] Germany kindly provided funding for an additional expert from a developing country to take part in the review.

7. ***Institutional framework***: Germany is a parliamentary democracy and a federal state consisting of 16 regions ("Länder"). Five of these regions, located in East Germany, are often referred to as "new Länder", which means that they acceded to the Federal Republic of Germany in the process of German reunification in 1990. After reunification, the economy of the new Länder underwent deep restructuring, which resulted in a decrease in energy demand and, as a consequence, in GHG emissions.[5]

8. The federal authorities have exclusive power in foreign affairs and defence policy. The federal government also has a leading role in economic and energy policies. Federal authorities can enact environmental legislation in a number of key areas such as waste management, air quality control and nuclear energy. For some other areas, for example for water resources, federal authorities have the right to enact framework legislation; the Länder then have to adopt specific legal provisions. For the areas where federal jurisdiction is not defined, the Länder define and implement their own jurisdiction. The Länder are also responsible for the implementation of federal laws.

9. ***Population and economy***: With a population of 82.3 million (2001), Germany is the most populous country of the EC. The population grew by 3.7 per cent from 1990 to 2001 (table 1), mostly as a result of immigration. In terms of gross domestic product (GDP), the German economy ranks third in the world (after the United States of America and Japan).[6] The GDP per capita was about USD 33,000 in 2001. The main GDP components are services (67.6 per cent), industry (31.2 per cent) and agriculture (1.2 per cent).[7] Although GDP increased by about 20 per cent in the 1990s, GHG emissions decreased by almost 20 per cent (table 1), which seems to indicate a remarkable success in decoupling GHG emissions from economic growth.

Table 1. Main macro-economic indicators and GHG emissions for Germany

	1990	2001	Change 1990–2001 (%)
Population (millions)	79.4	82.3	3.7
Gross domestic product – GDP (billions USD of 1995)	2 221.6	2 703.3	21.7
Total primary energy supply – TPES (Mtoe[a])	356.3	348.8	–2.1
Electricity consumption (TWh)	459.2	486.9	6.0
GHG emissions[b] (Tg[c] CO_2 equivalent)	1 213.5	995.3	–18.0
GHG emissions per capita (Mg CO_2 equivalent)	15.3	12.1	–20.9
GHG emissions per GDP unit (kg CO_2 equivalent per USD of 1995)	0.546	0.368	–32.6

Sources: The data for population, TPES, and electricity are from: BMWA. 2002. *Energiedaten 2002: nationale und internationale Entwicklung* and from German energy balances (www.ag-energiebilanzen.de); GDP data are from the energy statistics database of the International Energy Agency (IEA); GHG emissions are from the German GHG inventory submitted in 2003.

[a] Millions of tonnes of oil equivalent.

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

[c] One teragram (Tg) is equal to 1,000 gigagrams (Gg) or one million tonnes.

10. ***Energy supply***: Table 2 shows that there were considerable changes in energy and electricity supply in Germany in the 1990s. The use of coal decreased, whereas the use of gas, nuclear energy and especially renewable energy sources (RES) increased. Some of these changes, for example the sharp decline in the use of lignite, resulted from or were accelerated by economic restructuring in the new Länder after Germany's reunification. The contribution of hard coal to energy and electricity supply remained much the same, but its origin changed: the share of imported hard coal in the total supply increased from about one quarter in 1990 to more than one half in 2001.[8]

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[5] This phenomenon is sometimes referred to as the "wall-fall effect".

[6] World Bank data for 2002 at <www.worldbank.org>.

[7] World Bank country data for 2000 at <www.worldbank.org>.

[8] Federal Ministry of Economics and Labour (BMWA). 2002. *Energiedaten 2002: nationale und internationale Entwicklung.*

11. The increasing use of gas was facilitated by liberalization of the energy sector, which is largely complete in Germany. Policy efforts to support the development of renewables resulted in a remarkable increase in the use of RES, especially wind energy. Further changes in energy supply are expected, in particular as a result of the phase-out of nuclear energy decided in 2000.

Table 2. Structure of primary energy and electricity supply in Germany (per cent)

	Energy supply		Electricity supply	
	1990	2001	1990	2001
Oil	34.9	38.2	2.0	0.8
Hard coal	15.4	13.2	23.7	23.2
Lignite	21.3	11.2	33.5	28.4
Gas	15.4	21.6	8.1	9.4
Nuclear energy	11.1	12.7	31.1	35.2
Combustible renewables and waste	1.34	2.35	0.34	0.88
Hydro energy	0.42	0.50	1.17	1.39
Non-combustible renewables	0.01	0.31	0.003	0.737
Other (electricity trade)	0.02	0.09	not applicable	not applicable

Source: The data are from German energy balances at www.ag-energiebilanzen, except for the data for hydro, renewables and electricity trade, which are taken from the energy statistics database of the IEA (the German energy balances are less detailed on these data items; however, IEA data are consistent with these balances).

12. Emissions of carbon dioxide (CO_2) from fuel combustion in Germany were 10.1 Mg CO_2 per capita and 0.31 kg CO_2 per United States dollar of GDP in 2000, which is lower than the average for the members of the Organisation for Economic Co-operation and Development (OECD): 11.1 t CO_2/capita and 0.45 kg CO_2/USD respectively.[9]

C. Relevant general, energy and environmental policies

13. Economic, energy and environmental policies in Germany are determined in coordination with the relevant policies of the European Community (EC). The key objectives of the national **energy policy** are security of supply, economic efficiency and environmental compatibility, including climate change mitigation. In accordance with the Constitution, federal authorities make key decisions and provide a framework for **environmental policy.** The National Strategy for Sustainable Development, adopted by the federal government in 2002, is an important framework document for environmental policy.

14. **Climate-related policies** in Germany are formulated under the auspices of the "CO_2 reduction" IWG established by the federal government in 1990 and chaired by the BMU. Studies and consultations in the framework of the IWG provided a basis for a new National Climate Protection Programme adopted by the federal government in October 2000.

15. Since 1990, Germany has had the national objective of reducing CO_2 emissions by 25 per cent by 2005 in comparison with the 1990 level. Within the EC burden-sharing agreement for the Kyoto Protocol, Germany committed itself to reducing its GHG emissions by 21 per cent, compared to the 1990 level, in the first commitment period from 2008 to 2012. At present, Germany concentrates on the achievement of its target under the Kyoto Protocol.

II. GREENHOUSE GAS INVENTORY INFORMATION

16. The NC3 inventory covers the period from 1990 to 2000 and includes CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6), oxide of nitrogen (NO_X), carbon monoxide (CO), non-methane volatile organic compounds (NMVOCs) and sulphur dioxide (SO_2). GHG emissions from international bunker fuels are not presented in the

[9] Organization for Economic Co-operation and Development (OECD)/International Energy Agency (IEA). 2002. *Key World Energy Statistics from the IEA*. 2002 edition. Paris.

NC3 but are available in the 2003 inventory submission. In general, the NC3 inventory is presented in accordance with the UNFCCC guidelines.[10] The review team noticed that although the NC3 contains references to an annex with emission tables in the common reporting format (CRF), there is no such annex in the NC3 (but CRF tables are available in the 2003 inventory submission).

A. Inventory preparation

17. ***Organizational arrangements***: The Federal Environmental Agency (UBA) is in charge of the preparation and support of the German GHG inventory. UBA collects information from various data sources nationwide: federal ministries and agencies, the Länder, industry, research institutes, and independent experts. UBA will establish the national inventory system under the Kyoto Protocol, in preparation for which a review of the information flows is being conducted.

18. ***Methodology***: For the energy part, the German GHG inventory is based on energy balances prepared by the Working Group on Energy Balances (AGEB).[11] Non-energy emissions are estimated from relevant activity data. The emission factors are mostly country-specific, derived from the information provided to the UBA and from research studies. Noticeable changes in the implied emission factors for CO_2 from fuel combustion occurred in the 1990s (table 3). German experts provided explanations for these changes; one of them is the changing share from different fuel types on overall consumption within the cluster groups for the implied emission factors (liquid, solid, gaseous fuels). For example, the energy consumption of lignite dropped from 974 PJ in 1990 to 80 PJ in 2000. The lower share of lignite in the solid fuel category leads to a smaller influence of its higher emission factor (compared to other solid fuel types) and therefore to a lower overall implied emission factor in the year 2000. In the category of liquid fuels, town gas, which had a considerable share in 1990, was fully replaced by the end of the 1990s. Another reason for the changes in the implied emission factors is the change of methodology in 1994–1995.[12]

Table 3. Implied emission factors for CO_2 from fuel combustion

	1990 value (t/TJ)	2000 value (t/TJ)	Difference (%)
Liquid fuels	85.57	73.42	–14.2
Solid fuels	107.13	99.63	–7.0
Gaseous fuels	64.08	56.00	–12.6

Source: The 2003 inventory submission of Germany to the UNFCCC.

19. Uncertainty estimates are not available for the German GHG inventory. The numbers provided at the in-depth review of the NC2 (1997) are considered as still valid: 3 per cent for CO_2, 13–15 per cent for CH_4 and N_2O. German experts recognize the absence of uncertainty analysis as a weak point of the inventory and are already addressing this problem.

20. ***Recalculations***: The NC3 does not mention emission recalculations but between the NC2 and the NC3 recalculations had been done, especially for CH_4 and N_2O (table 4). Further recalculations, in particularly for CH_4, HFCs, PFCs and SF_6, were made after the submission of the NC3; these changes are reflected in the latest (2003) inventory submission to the UNFCCC. A major reason for the changes is the switch to detailed emission calculation in the inventory submission of 2003; earlier submissions were calculated on a more aggregated level and therefore had higher uncertainties. Changes for HFCs, PFCs and SF_6 in the inventory submission of 2003 relate to new research and development (R&D) studies,

[10] Document FCCC/CP/1999/7.

[11] AGEB, which has prepared national energy balances since 1971, currently consists of six energy associations and three economic research institutes. The balances are publicly available at <www.ag-energiebilanzen.de>.

[12] Until 1994, different methods were used for the "old" and "new" Länder but since 1995 a single methodology has been used. German experts intend to report on the impact of such differences in 2004.

which better reflect production and consumption data. CH_4 emission changes mostly relate to more detailed calculation methods for agriculture used in the 2003 submission. These calculations are based on simple methods according to the EMEP/CORINAIR methodology and are consistent with the IPCC tier 1 approach; default IPCC values for Western Europe are used as emission factors. The NC3 inventory is therefore not fully consistent with the 2003 inventory submission, in particular for CH_4, HFCs, PFCs and SF_6. German experts are developing a management system for conducting and recording inventory recalculations.

21. In 2003, Germany submitted its first national inventory report (NIR) to the UNFCCC.[13] An in-country review of the German GHG inventory by a UNFCCC expert review team is scheduled for 2004. A centralized inventory review took place in Bonn, Germany in September 2003. These reviews provide opportunities for further improvement of inventories.

Table 4. Emission estimates in the NC2, the NC3 and the 2003 inventory (Inv-2003), by gas

	1990 emissions (Tg CO_2 equivalent)			Change in 1990 emissions (%)		2000 emissions (Tg CO_2 equivalent)		Change in 2000 emissions (%)
	NC2	NC3	Inv-2003	from NC2 to NC3	from NC3 to Inv-2003	NC3	Inv-2003	from NC3 to Inv-2003
CO_2	1 014.2	1 014.5	1 014.4	0.0	0.0	857.9	858.0	0.0
CH_4	119.3	110.7	101.1	–7.2	–8.7	60.6	54.5	–10.0
N_2O	70.1	88.6	87.9	26.5	–0.8	60.1	59.4	–1.2
HFCs	2.34	2.34	3.51	0.0	50.0	7.70	6.63	–13.9
PFCs	2.70	2.69	2.70	–0.2	0.1	1.71	0.79	–53.8
SF_6	3.90	3.90	3.90	0.0	0.0	3.44	4.02	16.7
GHG without LUCF	**1 212.5**	**1 222.8**	**1 213.5**	**0.8**	**–0.8**	**991.4**	**983.3**	**–0.8**

Note: The GHG total may slightly differ from the sum by gases because of rounding.

B. Overall emission trends[14]

22. From 1990 to 2001, GHG emissions in Germany (without LUCF) decreased by 18 per cent (table 5 and figure 1), or by about 218 Tg CO_2 equivalent. In terms of absolute amount, this is the largest GHG reduction in the EC. GHG reductions in Germany therefore contributed considerably to the overall reduction of GHG emissions in the 1990s by the EC[15] and by Annex I Parties to the UNFCCC.

Table 5. GHG emissions (without LUCF) in Germany, 1990–2001, by gas

	Tg of CO_2 equivalent												Change 1990–2001
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	(%)
CO_2	1 014.4	975.8	928.1	918.0	903.8	898.8	920.9	889.6	881.4	854.7	858.0	870.8	–14.2
CH_4	101.07	91.03	84.00	77.58	73.14	69.77	65.92	63.86	60.93	59.31	54.54	52.17	–48.4
N_2O	87.91	83.14	84.10	80.54	77.62	78.55	80.19	75.73	62.26	59.01	59.35	60.23	–31.5
HFCs	3.51	3.55	3.68	4.95	5.18	6.36	5.77	6.36	6.98	7.28	6.63	8.13	131.6
PFCs	2.70	2.36	2.14	2.01	1.63	1.76	1.72	1.38	1.48	1.25	0.79	0.72	–73.3
SF_6	3.90	4.35	4.88	5.40	5.81	6.63	6.36	6.27	6.04	4.41	4.02	3.33	–14.6
HFCs+PFCs+SF_6	10.10	10.25	10.69	12.36	12.61	14.75	13.85	14.01	14.50	12.94	11.44	12.18	20.6
GHG total	**1 213.5**	**1 160.2**	**1 106.9**	**1 088.5**	**1 067.2**	**1 061.8**	**1 080.8**	**1 043.2**	**1 019.1**	**986.0**	**983.3**	**995.3**	**–18.0**

Source: The 2003 inventory submission of Germany to the UNFCCC.

23. The reductions in emissions noticeably slowed down in the second part of the 1990s: from 1990 to 1995 the emissions decreased by about 13 per cent, but from 1995 to 2001 by only 6 per cent. This

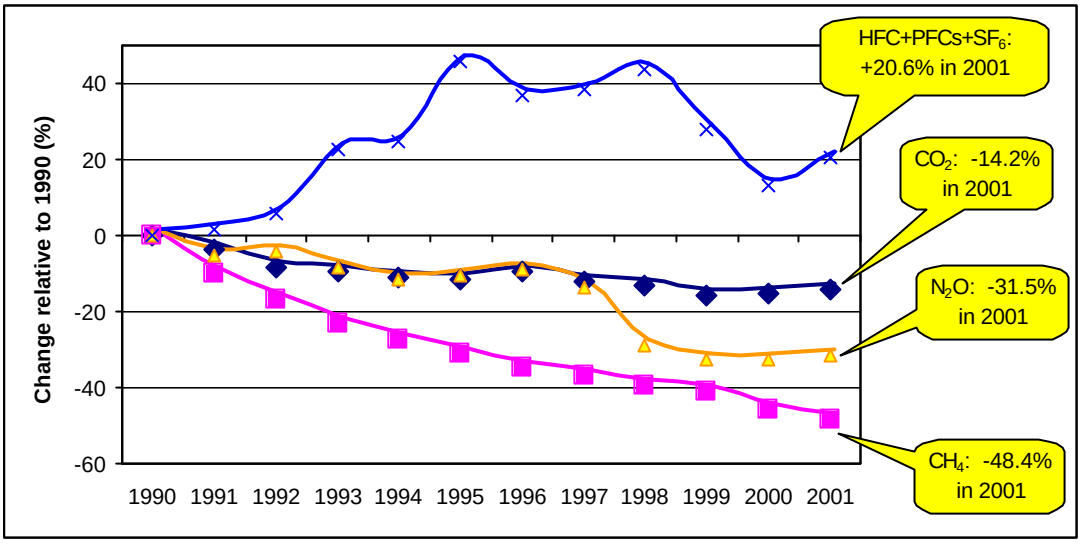
[13] The review team used some information from the NIR in the preparation of this report.

[14] Because of the latest inventory recalculations mentioned earlier, the analysis of the GHG inventory in this chapter is based on the 2003 inventory submission and not on the inventory data given in the NC3.

[15] For example, from 1990 to 2001 GHG emissions of the whole EC decreased from 4,192 to 4,108 Tg CO_2 equivalent (data from the 2003 EC submission to the UNFCCC).

reflects the so-called "wall-fall" effect after German reunification in 1990. German experts estimated that this effect accounted for about 50 per cent of GHG reductions in the 1990s, with the other 50 per cent being due to policy measures (for CO_2, the ratio is 60/40).[16] From 2000 to 2001, GHG emissions increased slightly.

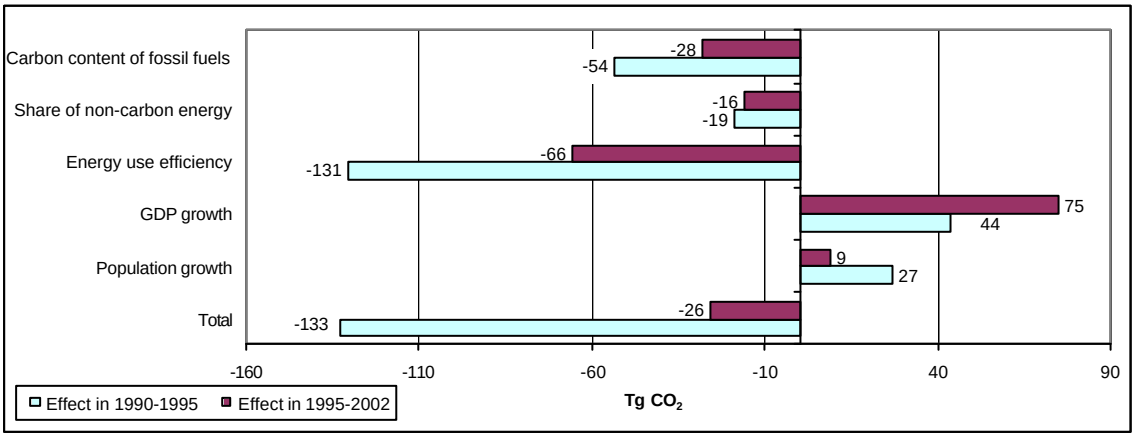
Figure 1. Relative changes in GHG emissions in Germany, 1990–2001



Note: The trend for total GHGs, not shown in this graph, is similar to the trend shown for CO_2.

24. CO_2, CH_4 and N_2O emissions decreased from 1990 to 2001, decreases in CH_4 being the largest. HFC emissions increased considerably, as HFCs replaced ozone-depleting substances. The increase in HFC emissions was partially offset by a decrease in (much smaller) PFC emissions, mostly due to technical progress in aluminium production. SF_6 emissions increased until 1995 but then returned to their 1990 level as a result of a combination of increases in the emissions from automobile tyres and decreases in the emissions from windows (due to the tightened regulation on thermal insulation).

Figure 2. Impact of key drivers on CO_2 emissions in 1990–2002



Source: Hans-Joachim Ziesing "CO_2 emissions in 2002 – only a slight reduction". April 2003. *Economic Bulletin of the German Institute for Economic Research* 40(4)4: 121-130. Berlin.

25. CO_2 is the main GHG in Germany – about 88 per cent of GHG total in 2001 (CH_4 accounted for 5.5 per cent and N_2O for 6.0 per cent). Figure 2 illustrates the impact of key drivers on CO_2 emissions in

[16] J. Schleich, W. Eichhammer, U. Boede, F. Gagelmann, E. Jochem, B. Schlomann, H.-J. Ziesing. 2001. Greenhouse gas reductions in Germany – lucky strike or hard work? *Climate Policy* 1, 363–380.

1990–2002. Improvement in energy use efficiency (largely obtained in the new Länder in 1990–1995) was the main contributor to emission reductions. The next important component was the carbon content of fossil fuels (the replacement of hard coal and lignite by natural gas, see table 2). An increase in the use of non-carbon energy (RES and nuclear energy) was also a factor.[17]

C. Key emission sources and sectoral trends

26. Table 6 shows that GHG emissions decreased in all sectors and subsectors, transport being the only (but important) exception. The largest relative reductions were in waste management (66 per cent). By absolute amount, reductions in energy industries and in manufacturing industries and construction were by far the largest: respectively 68.3 and 65.0 Tg CO_2 equivalent from 1990 to 2001.

27. Table 6 also shows that most GHG emissions (87.9 per cent in 2001) come from the energy sector (6.6 per cent from agriculture, 4.3 per cent from industrial processes and 1.1 per cent from waste management). According to the key source analysis in the 2003 NIR, five CO_2 sources accounted for more than 80 per cent of the total GHG emissions: gas combustion (19.3 per cent in 2000), mobile (road vehicle) combustion (17.9 per cent), hard coal combustion (17.5 per cent), lignite combustion (17.5 per cent), and oil combustion (11.2 per cent). GHG removals through LUCF offset 2.4 per cent of the total GHG emissions in 2001.

Table 6. GHG emissions by sector and subsector in Germany, 1990–2001

	Tg CO_2 equivalent												Change 1990–2001
	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**(%)**
1. Energy	1036.0	998.0	949.1	937.0	918.3	911.4	933.9	900.9	890.6	862.6	862.0	874.4	–15.6
Energy industries	*417.6*	*403.5*	*380.6*	*370.2*	*366.8*	*355.8*	*361.5*	*343.3*	*345.1*	*331.6*	*343.9*	*349.2*	*–16.4*
Manufacturing industries and construction	*198.5*	*174.7*	*161.3*	*149.2*	*150.8*	*151.2*	*145.3*	*145.2*	*139.6*	*136.7*	*137.2*	*133.5*	*–32.7*
Transport	*166.7*	*170.8*	*177.0*	*182.3*	*178.6*	*182.6*	*182.8*	*183.4*	*186.8*	*192.6*	*189.2*	*185.1*	*11.0*
Other combustion	*219.8*	*217.2*	*198.6*	*206.0*	*195.3*	*195.5*	*219.6*	*205.3*	*196.8*	*180.4*	*174.2*	*191.5*	*–12.9*
Fugitive emissions	*33.5*	*31.8*	*31.6*	*29.3*	*26.6*	*26.3*	*24.7*	*23.7*	*22.3*	*21.2*	*17.5*	*15.1*	*–54.9*
2. Industrial processes	63.26	60.65	64.54	63.48	64.22	66.58	65.37	62.13	49.42	44.11	42.67	43.23	–31.7
3. Solvents	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92	0.0
4. Agriculture	81.68	72.98	70.00	68.16	66.35	67.48	67.29	66.43	65.95	66.57	66.17	65.23	–20.1
5. LUCF	–33.7	–33.7	–33.7	–33.7	–33.7	–33.4	–33.4	–33.4	–33.4	–33.4	–23.7	–23.7	–29.7
6. Waste	30.66	26.66	21.31	17.86	16.39	14.41	12.32	11.79	11.15	10.79	10.55	10.56	–65.6
GHG (with LUCF)	**1179.8**	**1126.5**	**1073.2**	**1054.8**	**1033.5**	**1028.4**	**1047.4**	**1009.8**	**985.7**	**952.6**	**959.6**	**971.6**	**–17.6**

28. The German NC3 presents the main emission trends well, but the review team felt that more attention could be paid to the analysis of key emission drivers. During the country visit, German experts presented such analyses to the review team. The team was impressed by the high quality of these analyses and used them in the discussion of sectoral emission trends that follows.

29. ***Emissions from energy industries***: The large decrease in GHG (mostly CO_2) emissions from energy industries was primarily due to a sharp decrease in lignite-based, and to a lesser extent, coal-based energy supply (see table 2 and figure 2). The use of lignite in East Germany fell (some lignite-fuelled power plants were closed), but the use of hard coal in both West and East Germany declined, too. A decrease in coal subsidies played a role in this process.

[17] These estimates were obtained with a decomposition method based on a linear function $\boldsymbol{C = Pye(1 - a)c_f}$, where $\boldsymbol{C}$ is the total CO_2 emissions, $\boldsymbol{P}$ is population, $\boldsymbol{y}$ is the GDP per capita, $\boldsymbol{e}$ is primary energy supply per GDP unit, $\boldsymbol{a}$ is the share of fossil fuels in primary energy supply, and $\boldsymbol{c_f}$ is the average CO_2 emission factor for the fossil part of primary energy supply. For details, see the publication referenced in figure 2.

30. ***Emissions from manufacturing industries and construction***: The reasons for the large decrease in these emissions are similar to those for energy industries. Economic restructuring in the new Länder and the overall improvements in energy use efficiency (see figure 2) were also important.

31. ***Emissions from the residential and commercial sectors***: The emissions from the commercial sector decreased notably in the 1990s (table 7). In 2001, CO_2 emissions from the residential sector amounted to 130.9 Tg (compared to 128.4 Tg CO_2 in 1990) without taking into account the change in average annual temperature. This can be explained by the fact that 2001 was a comparatively cold year, which resulted in an increase of CO_2 emissions, mainly due to fuel combustion for heating.

Table 7. CO_2 emissions from the residential and commercial sectors (Tg CO_2)

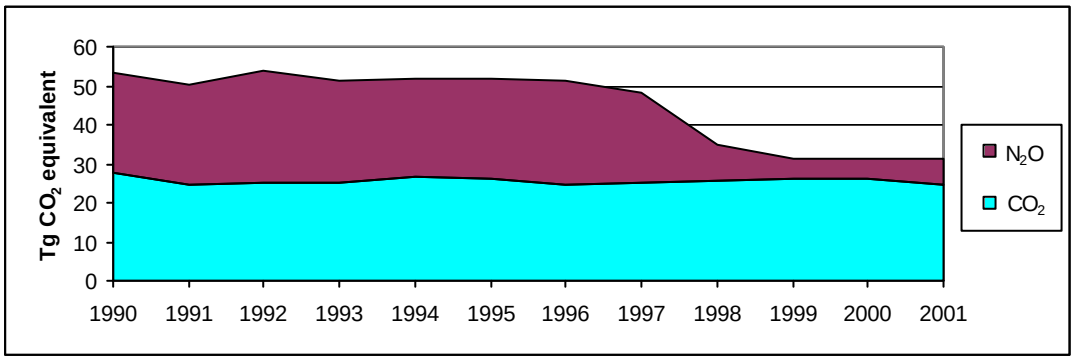
	1990	2001	2002	Change 1990–2002 (%)
Commercial / Institutional	61.7	49.6	47.4	–23.1
Residential	128.4	130.9	120.0	–6.5

Source: Umweltbundesamt, AG Energiebilanzen, DIW Berlin: Wochenbericht 39/03.

32. ***Fugitive emissions***: Fugitive emissions (predominantly CH_4) from solid fuels consistently decreased from 1990 to 2001 (from 25.8 to 7.7 Tg CO_2 equivalent), mostly because of the decrease in mining of coal and lignite. Fugitive emissions from gas supply and processing remained at the 1990 level (7.74 and 7.42 Tg CO_2 equivalent in 1990 and 2001 respectively), although much more gas was transported (2,300 PJ in 1990 compared to 3,000 PJ in 2000). Reduction in CH_4 leakages from gas pipelines, in the new Länder in particular, made it possible to contain the growth of these emissions.

33. ***Emissions from industrial processes***: These emissions decreased by about one third in the 1990s (figure 3), mostly because a voluntary commitment by German industry led to a remarkable decrease in N_2O emissions from adipic acid production (a decrease of 18.9 Tg CO_2 equivalent from 1990 to 2001). CO_2 emissions, mostly from cement and lime production, fluctuated slightly during the 1990s.

Figure 3. Industrial GHG emissions in Germany, 1990–2001



Source: The 2003 inventory submission of Germany to the UNFCCC.

34. ***Emissions from transport***: The emissions from transport (mostly CO_2) increased up to 1999 but declined from 1999 to 2001 (table 8). Figure 4 indicates that freight transport (in tonne-km) grew much faster than GDP. This is observed for both domestic and international transport (road transport to/from/through Germany). For domestic transport, increased movement between East Germany and West Germany after reunification has been one of the reasons. The process of sub-urbanization led to increasing mileages per drive and more transport needs. Growth in the international part of freight transport has been due to increased heavy duty transport within the EC domestic market, especially to/from central and eastern Europe. Another reason for increasing freight transport is the "lean production" and "just-in-time" policy of the business sector. The share of freight transport in the total CO_2

emissions from transport is about one third (34 per cent in 1999); therefore, freight transport contributed considerably to emission increases in the 1990s, especially as freight transport by rail declined during this period (figure 4).[18]

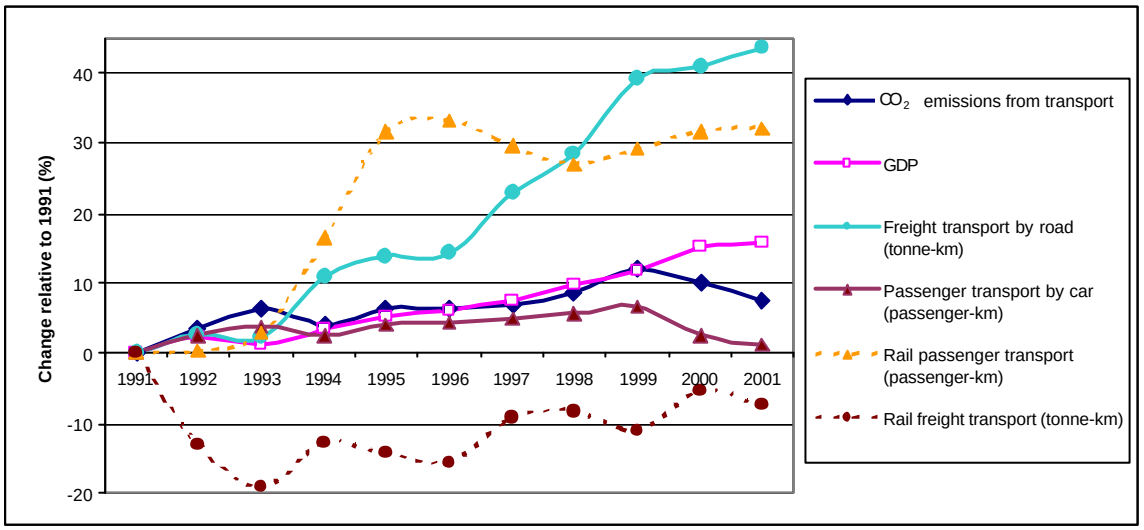
Table 8. Components of CO_2 emissions from transport

	Tg CO_2				Change from 1990 (%)	
	1990	**1999**	**2000**	**2001**	**1999**	**2001**
Civil aviation	2.90	4.16	4.40	4.29	43.4	47.9
Road	150.2	174.9	171.5	167.7	16.4	11.6
Railways	2.88	1.91	1.80	1.77	–33.7	–38.5
Navigation	2.05	0.95	0.88	0.85	–53.7	–58.5
Other	4.27	4.17	4.12	3.75	–2.3	–12.2
Total	**162.3**	**186.1**	**182.7**	**178.3**	**14.7**	**9.9**

Source: The 2003 inventory submission of Germany to the UNFCCC.

35. Passenger transport grew in line with GDP – even slower for 1999–2001 – which helped to decrease CO_2 emissions in 1999–2001. The reasons for a decrease in passenger-km are not yet fully clear, but the ecological tax (eco-tax) reform in 1999 is one important reason. Passenger transport by rail increased until 1996 and remained stable thereafter (figure 4).[19]

Figure 4. Changes in key drivers for CO_2 emissions from transport



Sources: Bundesministerium für Verkehr, Bau- und Wohnungswesen. 2002. "Verkehr in Zahlen 2002/2003", H. Rieke, Fahrleistungen und Kraftstoffverbrauch im Strassenverkehr, *Wochenbericht des Deutschen Instituts für Wirtschaftsforschung (DIW)*, No. 51–52, pp. 881–889. Berlin.

36. Technical progress in the automobile industry and a shift from gasoline to diesel fuel also contributed to emission decreases. From 1991 to 2001, the average fuel consumption of gasoline passenger cars in Germany decreased by 7.4 per cent, from 9.5 to 8.8 litre/100 km. In the same period, the fuel consumption of new gasoline passenger cars decreased by 6.2 per cent, from 8.1 to 7.6 litre/100 km.[20] There was a similar trend for trucks used in freight transport. The share of diesel-fuelled vehicles in the total vehicle fleet increased from 12 to 15 per cent for passenger cars and from 74 to 89 per cent for freight vehicles.[21]

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[18] The share of rail in total freight transport was about 14.6 per cent in 2001 (20.2 per cent in 1991).

[19] The share of rail in total passenger transport was about 8 per cent in 2001 (7 per cent in 1991).

[20] H. Rieke. 2002. Fahrleistungen und Kraftstoffverbrauch im Strassenverkehr, *Wochenbericht des Deutschen Instituts für Wirtschaftsforschung* (DIW), No. 51–52, pp. 881-889. Berlin. Note that the numbers in litre/km for existing and new cars are not quite comparable because of the different methods used.

[21] Bundesministerium für Verkehr, Bau- und Wohnungswesen. 2002. *Verkehr in Zahlen 2002/2003*.

37. ***Agricultural emissions***: GHG emissions from agriculture decreased by about 20 per cent from 1990 to 2001. Both CH_4 and N_2O emissions decreased: CH_4 from 33.7 to 25.4 and N_2O from 48.0 to 39.8 Tg CO_2 equivalent. The key factor for N_2O was a decrease in the use of nitrogen fertilizers due to strengthened environmental regulations and a decline in agricultural production. CH_4 emissions (mostly from enteric fermentation) followed a decline in numbers of cattle.

38. ***Emissions from waste management***: The emissions from waste management, which are almost exclusively CH_4 emissions from solid waste disposal on land,[22] fell sharply from 1990 to 2001 – by about 66 per cent (see table 6). Improvement in the management of landfill sites played the key role in this process, which was facilitated by a strengthened regulation introduced in 1993.

39. ***GHG removals through LUCF***: GHG[23] removals by LUCF dropped from about 34 Tg CO_2 in 1990–1999 to 24 Tg in 2000–2001 as a result of the damage caused by the 1999 storms. The removals appeared to change in a stepwise manner because they were estimated as 5-year averages.[24] German experts indicated that the lack of data for changes in land use remains a source of uncertainty in LUCF calculations.

III. POLICIES AND MEASURES

A. Reporting issues

40. The NC3 complied with most UNFCCC reporting requirements on policies and measures but the review team noted the following deviations from the guidelines.

41. ***Evaluation of the efficiency of mitigation measures***: Quantitative estimates of the impacts of individual policies and measures could be reported more comprehensively, especially as such information is available in Germany.[25] It is not always clear in the NC3 whether the reported impact on emissions means a reduction in comparison with the 1990 level, a reduction in comparison with a "with measures" scenario, or a reduction in comparison with a "without measures" scenario. For the measures already in place, it is often not clear whether the reported effect has already been realized (before 2002) or will only be realized by 2005 (or by 2010).

42. ***Consistency with the GHG inventory***: The NC3 estimates of emission reductions come from studies conducted in 1997–1999. As the inventory changed noticeably in 2001–2003, the NC3 estimates are not fully consistent with the inventory, particularly for CH_4 and N_2O emissions.

43. ***Definition of the status of policies and measures***: The NC3 does not follow the classification of measures suggested by UNFCCC guidelines (implemented, adopted, planned).

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[22] German experts indicated that information on emissions from wastewater treatment plants was not complete but a research project to collect such information was ongoing.

[23] In fact, these are only CO_2 removals, because the CH_4 and N_2O components are not estimated in Germany.

[24] Although they considered this approach to be possible, the review team expressed the opinion that the CO_2 removals could also be estimated for every year separately and the averages could be calculated using these individual annual estimates. Such an approach, although it is more difficult, could provide greater transparency for changes in CO_2 removals.

[25] See, for example, G. Stein, B. Strobel. 1998. Policy Scenarios for Climate Protection, Volume 4: Methodological Guideline for Assessing the Impact of Measures for Emission Mitigation, *Schriften des Forschungszentrums Jülich*, Reihe Umwelt/Environment. Jülich.

44. ***Information on practices leading to increased emissions***: Germany did not report on practices leading to increased GHG emissions (paragraph 16 of UNFCCC guidelines). In this respect, a review of tax rebates for the use of company cars by employees and for commuting to work could be relevant.

45. ***Costs, cost-efficiency and benefits of mitigation measures***: The NC3 gives little information on (a) the costs of policies and measures,[26] (b) non-GHG mitigation benefits of the measures, (c) how the mitigation measures interact with other policies and measures (paragraph 24 of the UNFCCC guidelines). Such information is not mandatory but it could help understand the impacts of climate-related measures on the economy and social development.

B. Policy framework and objectives

46. The German climate protection policy was initiated in 1987–1994 by a parliamentary commission (Enquete-Kommission). In 1990, the government established the "CO_2 reduction" IWG chaired by BMU. The IWG includes six working parties chaired by the responsible federal ministries: energy supply (chaired by BMWA), transport (BMVBW), buildings and structures (BMVBW), new technologies (BMWA), agriculture and forestry (BMVEL), and emissions inventory (BMU). IWG coordinates the national climate protection policy and periodically reports to the federal government. Five such reports have been submitted: in 1990, 1991, 1994, 1997 and 2000. The next report is due in 2003.

47. Germany formulated its first target for emission reductions in 1990: the reduction of CO_2 emissions[27] by 25 per cent by 2005 in comparison with the 1990 level. The attainment of this target is considered to be an indicator of the "demonstrable progress" stipulated in the Kyoto Protocol. Within the EC burden-sharing agreement for the Kyoto Protocol, Germany committed itself to reducing its GHG emissions in the first commitment period (2008–2012) by 21 per cent compared to the 1990 level.[28] This is one of the largest reduction targets among Annex II Parties to the UNFCCC. In October 2002, Germany proposed a joint EC reduction target of 30 per cent by 2020 of GHG emissions. Under this condition Germany indicated its willingness to make a commitment to a 40 per cent reduction of GHG emissions by 2020. This manifests the commitment of Germany to the long-term objective of the UNFCCC.

48. The fifth IWG report in 2000 formulated a new, strengthened National Climate Protection Programme (NCPP).[29] The reason for strengthening the policy was the gap between the CO_2 reduction objective and the actual trends in CO_2 emissions. This gap was estimated as 50–70 Tg CO_2. The NCPP identified additional measures to close the gap and defined sectoral reduction targets.

49. The sixth IWG report, due in 2003, will evaluate progress towards the CO_2 reduction target. According to German experts, ongoing studies may revise the estimates of emission reductions given in the NC3 and identify those mitigation measures that had not had the expected effect (possibly measures relating to cogeneration and energy use efficiency in buildings). Therefore, the NC3 estimates of emission reductions, quoted in this report, should be considered with some caution.

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[26] Some estimates on the costs of CO_2 reduction and on the cost efficiency of CO_2 mitigation measures are available in G. Stein, B. Strobel. 1999. Politikszenarien für den Klimaschutz, Band 5: Szenarien und Massnahmen zur Minderung von CO_2-Emissionen in Deutschland bis 2020, *Schriften des Forschungszentrums Jülich*, Reihe Umwelt/Environment, Band 20. Jülich.

[27] Defined as the sum of CO_2 emissions from energy production and from industrial processing. Initially, the target was for West Germany but it was reaffirmed (in 1995) for the whole of Germany after reunification.

[28] More exactly, the reduction is relative to a base year level, defined as the 1990 level for CO_2, CH_4 and N_2O and the 1995 level for HFCs, PFCs and SF_6.

[29] BMU. 2000. Nationales Klimaschutzprogramme: Beschluss der Bundesregierung vom 18. Oktober 2000, *Fünfter Bericht der Interministeriellen Arbeitsgruppe "CO_2-Reduktion"*. Berlin. BMU. 2000. Germany's National Climate Protection Programme: Summary. Berlin.

C. Cross-sectoral measures

50. The two key cross-sectoral measures are the implemented ecological tax reform and the planned promotion of the "finance and operate" concept[30] for energy users. The eco-tax was introduced in five annual steps from 1999 to 2003, each step meaning a tax increase of EUR 0.0307 per litre for gasoline and diesel fuel and EUR 0.0026 per kWh for electricity. By January 2003, the standard eco-tax rates were EUR 0.0205 per kWh for electricity, EUR 0.153 per litre for gasoline and diesel fuel, and EUR 19.03 per tonne of oil equivalent (toe) for gas. There are many exemptions: for example, lower tax rates apply to manufacturing industries, to energy-intensive industries and to some gas-fired plants (with efficiency above 57.5 per cent); coal and lignite are exempted. The eco-tax revenues are used to lower labour costs and companies' contribution rates to the state pension fund. According to the NC3, the ecological tax reform should reduce CO_2 emissions by 10 Tg CO_2 by 2005 and by 20 Tg CO_2 by 2008-2012, mostly in transport. The review team noted that the exemptions might decrease the impact of the eco-tax on CO_2 emissions.

51. The recently (2000) created German Energy Agency (DENA) supports projects in energy efficiency, RES and climate protection, both sectorally and cross-sectorally. DENA cooperates with relevant authorities in the Länder and plays an important role in increasing public awareness of energy and environmental issues.

D. Energy-supply industries

52. Support of RES is the cornerstone of GHG mitigation in this sector. Earlier promotional measures (described in the NC1 and the NC2) were strengthened by the Renewable Energy Act of 29 March 2000. The Act guarantees acceptance of electricity from solar, wind, geothermal, and biomass energy by grid operators and a feed-in tariff at a level that makes renewables commercially attractive. The remarkable expansion of wind-based generation in the 1990s confirms the success of this policy.[31] Further development of wind-based generation is expected, with a possible shift to offshore siting. The NC3 estimated the total effect of the Act as GHG reductions of about 25 Tg CO_2 equivalent by 2005 and 50 Tg CO_2 equivalent by 2008–2012. The Renewable Energy Act is complemented by additional promotional programmes, both federally and in the Länder.

53. The latest measures to facilitate the development of cogeneration include an agreement between the federal government and German industry on the promotion of cogeneration and the Act on Cogeneration. This should result in CO_2 reductions of 10 Tg by 2005 and 23 Tg by 2008–2012. Construction of new combined-cycle gas-fired power plants (CCGT) and combined heat and power (CHP) plants can also provide considerable reductions, especially by 2008–2012, when older plants are likely to be replaced.

54. While recognizing the success of Germany in the promotion of renewables, the review team noted that, according to the NC3 projections, CO_2 emissions from energy supply should decrease from 413 Tg CO_2 in 1990 to 276 Tg CO_2 by 2005. But, according to the 2003 GHG inventory, the actual emissions in 2001 were about 345 Tg CO_2. The review team noted that reaching the level of 276 Tg CO_2 by 2005 represented a considerable challenge (see also the section on projections later in this report).[32]

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[30] The meaning of the concept is that a third party invests into and supports energy use equipment.

[31] It is striking that wind/solar-based power generation in Germany (some 10.9 TWh in 2001, according to IEA data) represents about 27 per cent of the total wind/solar-based power generation in the world (40.7 TWh).

[32] It is, however, important to note that current research projects are revising both GHG emissions of past years and GHG projections for Germany.

55. With respect to cogeneration, the team noticed that, according to German energy statistics, heat production by CHP plants in Germany has declined from 343.8. PJ in 1990 to 315.5 PJ in 2000.[33]

56. The liberalization of the German electricity market led to a price decrease for the industrial sector and for private consumers.[34] But the price levels have been increasing since 2001. In private households the prices are as high now as they were before liberalization. This development is due to a number of reasons: the increase in wholesale prices, the effects of the eco-tax, and also the arrangement for a guaranteed feed-in tariff for electricity production from renewables and the effect of the Act on Cogeneration. This tendency has been limited so far and even went unnoticed by electricity consumers because of the overall price decrease after liberalization and because the overall amount of electricity produced by renewables is still small (see table 2). In the future, an increasing share of electricity production by renewables may require innovative approaches to compensate for potential price increases.

57. About 35 per cent of German GHG emissions come from the combustion of hard coal and lignite (see section II.C above). Germany is implementing a programme to reduce subsidies for domestic hard coal production, according to which these subsidies will decrease from EUR 4.5 billion per year in 1997 to EUR 2.8 billion in 2005. Correspondingly, hard coal production in Germany declined from about 70 million tonnes in 1990 to 27 million tonnes in 2001.[35] However, this decrease did not affect CO_2 emissions significantly because there was an increase in the amount of imported coal.

58. In June 2000, Germany decided to phase out nuclear power. This decision may lead to increased CO_2 emissions, as estimated in the NC3. However, these estimates were not included in the set of GHG projections provided in the NC3.

E. Residential and commercial sectors

59. The key measure for new buildings is the Ordinance on Energy Saving, which came into force in 2002. The Ordinance is also valid for certain activities, such as insulation for ceilings and walls during the process of renovation with respect to the building asset. The Ordinance reflects the requirements of a new EC directive on energy performance of buildings (2002/91/EC). The average energy requirements for new buildings in Germany will therefore decrease from 100 to 70 kWh/m^2/year; the estimated effect on emissions is a CO_2 reduction of 10 Tg.

60. For existing buildings (about 80 per cent of all buildings were built before 1983), emphasis is placed on economic incentives (in addition to regulations for heating and loans for old buildings). In 2001, the federal government launched a building modernization programme, implemented through the Kreditanstalt für Wiederaufbau (KfW), a promotional bank. Low-interest, long-term loans of EUR 5 billion are to be allocated under the programme; the federal government provides EUR 1 billion. Together with other programmes the KfW-programme should reduce the CO_2 level by 5 to 7 Tg.

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[33] Federal Ministry of Economics and Labour (BMWA). 2002. *Energiedaten 2002: nationale und internationale Entwicklung*.

[34] German experts estimated the impact of power market liberalization on GHG emissions, see J. Schleich, W. Eichhammer, U. Boede, F. Gagelmann, E. Jochem, B. Schlomann, H.-J. Ziesing. 2001. Greenhouse gas reductions in Germany – lucky strike or hard work?" *Climate Policy* 1, 363–380. The estimated effect is a reduction by 6 Tg CO_2, apparently because the electricity price decrease induced by liberalization made a large number of smaller and less efficient CHPs, including those using coal, uneconomic, and they were closed. But, simultaneously, this had a negative impact on the promotion of cogeneration.

[35] Federal Ministry of Economics and Labour (BMWA). 2002. *Energiedaten 2002: nationale und internationale Entwicklung*.

61. The review team commented that it might be useful to evaluate the actual efficiency of these measures, especially for those that have estimates of reduction effects for 2005. This is particularly topical for the residential sector where, unlike the commercial sector, CO_2 emissions did not change much in the 1990s (see table 7).

F. Industry

62. Both energy-related and process-related emissions from industry declined considerably in the 1990s (see table 6). Reductions in N_2O emissions from adipic acid production were particularly substantial: these emissions decreased from 20.9 Tg CO_2 equivalent in 1990 to 3.0 Tg CO_2 equivalent in 2001. CO_2 emissions also decreased considerably (see table 9).

Table 9. GHG and CO_2 emissions from industry (both energy- and process-related)

	Tg CO_2 equivalent							Change 1990–2001
	1990	1996	1997	1998	1999	2000	2001	(%)
GHG emissions	261.7	210.7	207.4	189.0	180.8	179.8	176.7	–32.5
CO_2 emissions	224.1	168.7	169.3	164.2	161.7	162.3	156.9	–30.0

63. Voluntary commitments are the key part of the policy package. In 1996, German industry made a commitment to decrease its CO_2 emissions by 20 per cent by 2005 compared to the 1990 levels. This commitment was largely fulfilled by 2000, so in November 2000 a new agreement between the federal government and industry was concluded that aims to reduce specific CO_2 emissions by 28 per cent by 2005 and specific GHG emissions by 35 per cent by 2012 from the 1990 levels. The estimated effect is an additional CO_2 saving of 10 Tg by 2005 and a further reduction of 10 Tg CO_2 equivalent by 2012 (compared to 1998).

64. A monitoring mechanism for voluntary agreements, involving annual reporting and an independent assessment by a selected research institute,[36] was established for the agreement of 1996 and will be used for the 2000 agreement. However, the NC3 does not provide enough information demonstrating to what extent these agreements lead to greater reductions than a "business-as-usual" evolution; no information is given on the cost, economic and social impacts of voluntary agreements.[37]

65. Germany is preparing to implement the EC directive on emissions trading. The national allocation plan (NAP), due for March 2004, is being discussed by the federal authorities and industry. The federal government intends to convert the targets adopted in the voluntary agreements into NAP, taking into account the current national progress towards the Kyoto Protocol target. According to German experts, being ready in time for EC emissions trading could be a challenging task.

G. Transport

66. On average during the 1990s, the improved energy efficiency of road vehicles was outweighed by the increase in the number of vehicles and in the distances travelled. However, slight emission decreases were observed in 2000 and 2001 – by 1.8 and 2.2 per cent (see the inventory section of this report), largely as a result of a decline in CO_2 emissions from passenger transport (figure 4).

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[36] H.G. Buttermann, B. Hillebrand. 2002. Die Klimaschutzerklärung der deutschen Industrie vom März 1996 – eine abschliessende Bilanz: Monitoring Bericht 2000, *Untersuchungen des Rheinisch-Westfälischen Instituts für Wirtschaftsforschung*, Heft 40. Essen.

[37] Some information is available in the monitoring reports, such as the one referenced in footnote 36.

67. Voluntary agreements with car manufacturers are expected to provide large emission reductions in transport. However, the estimate given in the NC3 (4–7 Tg CO_2 by 2005, 10 Tg CO_2 by 2008–2012) relates only to the agreement made by the federal government with German industry in 1995. The impact of the EC agreements with European, Japanese and Korean car manufacturers is neither mentioned nor quantified in the NC3. This impact may be considerable in Germany, because the turnover of the car fleet seems to be relatively high.[38]

68. For freight transport, a distance-dependent highway toll for trucks was to come into operation in 2003. According to the NC3, this was to provide a CO_2 reduction of 5 Tg CO_2 by 2005.

69. The federal authorities, and especially the Länder, support the development of public transport. Integrated transport planning will be strengthened. The planned railway reform aims to expand the railway network and to promote combined rail-road transportation of goods. For passenger transport, expanded railway networks may divert passengers from using short-distance air travel. Such measures are important because the modal split of transport in Germany did not change much between 1991 and 2001, except for a distinct increase in the share of domestic air transport (from 3 to 5 per cent for passenger transport and from 52 to 59 per cent for freight transport).[39]

70. Recent estimates, provided by German experts to the review team, indicate that emissions from freight transport are likely to continue to grow, unless additional policy action is taken. Given the trend of the 1990s (see table 8), further growth in CO_2 emissions from air transport is also likely.[40]

H. Agriculture

71. The share of agriculture in the total GHG emissions is small (6.6 per cent in 2001) but agriculture accounts for 66.1 per cent of N_2O emissions and 48.7 per cent of CH_4 emissions (2001 data). N_2O emissions from agricultural soils are a key emission source in Germany.

72. The Ordinance on Fertilizers, implemented in line with the EC Common Agricultural Policy, reduces the amount of nitrogen applied to soil. The estimated impact is about 2.1 Tg CO_2 equivalent by 2005. The same ordinance has an impact on CH_4 emissions by promoting the use of biogas from the management of liquid manure and, as biogas can replace fossil fuels, an impact on CO_2 emissions.

73. The promotion of organic farming is expected to reduce CO_2, CH_4 and N_2O emissions. The area occupied by organic farms grew from about 270,000 ha in 1994 to almost 700,000 ha in 2002, but their proportion of the total agricultural land was only 4.2 per cent in 2002. The NC3 does not provide estimates for the possible impact of organic farming on GHG emissions.

I. Waste management

74. The emissions from waste management decreased by 66 per cent from 1990 to 2001 (table 6). The decrease was policy-driven – two new regulations introduced in 1991 and 1993 led to a reduction in the number of landfills and in the amount of landfilled waste.[41] In the new Länder the number of landfills dropped from about 8,000 in 1990 to 137 in 1999 (in the old Länder from 290 to 239). Waste management in East Germany was local and small-scale until 1990. Since Germany's reunification, small landfill sites were closed whereas central landfills were established. Emission calculation from waste management

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[38] This process is facilitated by the preferential taxing on low-emission vehicles (not estimated in the NC3).

[39] Bundesministerium für Verkehr, Bau- und Wohnungswesen. 2002. *Verkehr in Zahlen 2002/2003*.

[40] The review team noted in this respect that there are tax exemptions for aviation fuel in Germany.

[41] The 2003 NIR indicates that the amount of landfilled waste decreased almost three times from 1990 to 2001.

also includes the small closed landfills. From 1 June 2005 waste may be landfilled only if it does not have a negative impact on GHG emissions.

J. Forestry

75. The federal government and the Länder promote investments in forestry and in the use of wood products through the programme entitled "Joint task for the improvement of agricultural structures and coastal protection". Since the 1990s, the annual funding for this programme has been about EUR 60 million. Regional authorities provide supplementary funding for forest development. Additionally, about EUR 100 million were allocated for restoration after the 1999 storms (together by the federal government and the Länder).

K. Regional policies

76. The Länder participate actively in the development and implementation of GHG mitigation measures. For some programmes, for example supporting the development and use of renewables, funding from the Länder is comparable with federal funding or even greater. German experts recently estimated[42] that regional policies brought about CO_2 reductions of about 6.8 Tg CO_2 for the year 2000, distributed as 1.1 Tg for industry, 3.3 Tg in commerce and services, and 2.4 Tg in private households.

IV. PROJECTIONS AND THE TOTAL EFFECT OF POLICIES AND MEASURES

A. Reporting issues

77. The NC3 contains projections for CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 prepared for 2005 and 2010. One scenario is presented.[43] CO_2 projections are based on a 1999 report "Policy scenarios for climate protection II"; CH_4 and N_2O projections are based on a 1997 report "Policy scenarios for climate protection"; projections for HFCs, PFCs and SF_6 come from a 1999 report "HFCs, PFCs and SF_6 emissions in Germany and potential reductions".

78. In the presentation of the projections, the NC3 deviates considerably from the requirements set out in the UNFCCC reporting guidelines. In the opinion of the review team, the major deviations are:

- The projections are not consistent with the latest available GHG inventory (requirement of paragraph 32 of the UNFCCC guidelines). Considerable differences are observed for CH_4, N_2O, HFCs, PFCs and SF_6.[44] These differences are not mentioned and not explained in the NC3.
- Projections of GHG emissions from international bunker fuels are not provided (paragraph 36).
- Projections for 2015 and 2020 are not available (paragraph 37).
- The NC3 does not provide an estimate of the total effect of policies and measures compared to the situation without such policies (paragraph 40).
- The information reported is not sufficient for a reader to obtain a basic understanding of the approach used (paragraph 42). In particular, the following are missing (paragraphs 43, 45–48): a description of the models used, a summary of the major strengths and weaknesses of the models, a comparison with

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[42] W. Eichhammer, U. Boede, F. Gagelmann, E. Jochem, N. Kling, J. Schleich, B. Schlomann, J. Chesshire, H.-J. Ziesing. 2001. *Greenhouse gas reductions in Germany and the UK – coincidence or policy induced? (an analysis for international climate policy)*. Research report 201 41 133. UBA-FB 000193. Umweltbundesamt. Berlin.

[43] For HFCs, PFCs and SF_6 there are also estimates for a "with additional measures" scenario.

[44] For example, for the 1999 emissions the differences between the NC3 projections and the 2003 inventory are (in per cent): 15.9 for CH_4, –25.9 for N_2O, –41.2 for HFCs, 36.8 for PFCs and 24.0 for SF_6.

the previous set of projections, information about key assumptions, a discussion of the sensitivity of the projections, and an explanation of the behaviour of key variables.[45]

79. During the visit to Berlin, the review team obtained preliminary data on new projections of German GHG emissions. These projections are being prepared in the framework of a study, "Policy scenarios for climate protection III", commissioned by the BMU to a number of research institutes.[46] The study is to be completed by the end of 2003. As these projections are much newer, the review team decided to use them in this report. In what follows, they are referred to as the "2003 projections".

B. Methodology

80. CO_2 projections in the NC3 projections are based on the study "Policy scenarios for climate protection II" (1999). Options for reducing CO_2 emissions were identified from the policy viewpoint and from the technical viewpoint. The set of technical options was studied with an optimization model,[47] which contained a baseline ("Model Basis Szenario") and a reference ("with measures") scenario, the latter estimated by experts outside the model. Optimization within the model was used to find a combination of measures leading to full compliance with the CO_2 reduction target at lowest cost. The modelling results underwent an expert analysis and several scenarios were formulated: "without measures", "with measures", "30%-Reduktion (2010)", "40%-Reduktion (2010) and "40%-Reduktion mit Kernenergieausstieg (2010)".[48] Non-CO_2 emissions were estimated from assumed changes in activity levels.[49]

C. Scenario definitions and key assumptions

81. Although the 1999 study calculated three scenarios, the NC3 contains only one scenario and does not specify its type. As the NC3 projection refer to the current set of policies and measures, the review team interpreted it as a "with measures" scenario. From discussions with German experts, the review team understood that this projection was based on the "with additional measures" projections from "Policy scenarios for climate protection II". The rationale for such use was that the measures considered as "additional" in 1999 had mostly been "implemented" by 2003. It implies that the "with measures" projection of the NC3 contains a 25 per cent reduction of CO_2 emissions by 2005 as an input variable.

82. The new, 2003 projections are structured into three scenarios: "without measures", "with measures" (or a reference scenario) and "with additional measures".[50] Table 10 compares key assumptions and principal variables for the NC3 projections, the actual data of 1999–2001 and the 2003 projections.

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[45] For this point, the deficiencies in NC3 reporting were compensated by the information provided by German experts to the review team during and after the visit to Berlin.

[46] Deutsches Institut für Wirtschaftsforschung (DIW), Berlin; Forschungszentrum Jülich (FZJ_STE), Jülich; Fraunhofer Institut für Systemtechnik und Innovationsforschung (FhG-ISI), Karlruhe; Öko-Institut, Berlin.

[47] The IKARUS model was used. See Laue, H.-J. *et al*. 1997. IKARUS-Datenbank: Ein Informationssystem zur technischen, wirtschaftlichen und umweltrelevanten Bewertung von Energietechniken, *Schriften des Forschungszentrums Jülich*, Reihe Umwelt, Vol.4. Jülich.

[48] The last three scenarios assume CO_2 reductions by 30–40 per cent; the last scenario combines a 40 per cent reduction with the phase-out of nuclear energy. These scenarios contain additional GHG mitigation measures.

[49] The 2003 projections were calculated by a similar procedure.

[50] More exactly, "Model Basis Szenario" and "Referenzszenario" are scenarios "with measures", and "Reduktionsszenario I, II" are scenarios "with additional measures". Within the "with additional measures" scenario, there are two cases: (a) CO_2 reductions of 30 per cent by 2020 and 40 per cent by 2030; and (b) CO_2 reductions of 40 per cent by 2020 and 50 per cent by 2030. However, as detailed information on these scenarios was not available and as these reductions are target values assuming new GHG mitigation measures, only the reference, "with measures" scenario ("Referenzszenario") is discussed in this report.

83. Table 10 indicates that the total primary energy supply (TPES) was considerably underestimated in the NC3 projections, maybe because the impact of energy-saving measures on energy demand was overestimated. Another notable difference is that the NC3 projections assumed more profound changes in the structure of energy supply than were actually observed in 1999–2001: the use of coal declined less than assumed and, accordingly, the use of natural gas did not increase as much as expected. On the other hand, the use of renewables increased faster than projected but, as their share in the energy balance is still minor, this could not influence CO_2 emissions much. The differences between the assumed and actual parameters for transport are also remarkable, for example the higher-than-expected growth in freight air transport.

Table 10. Key assumptions and principal variables in German projections

	NC3 projections (from "Policy Scenarios II", case of 40 per cent reduction without nuclear phase-out)			**Actual values**			**2003 projections** (the reference scenario from "Policy Scenarios III")
Key variables	**1995**	**2005**	**2010**	**1999**	**2000**	**2001**	**2010**
Population (millions)	81.7	83.8	82.9	82.1	82.2	82.3	81.5
GDP growth (%/year)	2.0	1.8	1.8	2.0	2.9	0.6	1.9
Energy supply:							
TPES (PJ)	13 859	12 496	12 031	14 324	14 356	14 602	14 427
Share of hard coal (%)	15.2	8.9	8.0	13.7	14.0	13.2	12
Share of lignite (%)	12.3	10.7	9.8	10.3	10.8	11.2	11
Share of gas (%)	19.5	27.4	29.3	21.2	21.1	21.6	23
Share of renewables (%)	1.6	2.0	2.5	2.7	3.1	3.2	6
Passenger transport (billion passenger-km):							
Road transport	763.0	874.0	902.0	761.6	731.2	722.5	n.a.
Air transport	5.0	9.0	10.0	4.2	4.6	4.6	n.a.
Freight transport (billion tonne-km):							
Road transport	266.0	327.0	369.0	341.7	346.3	353.0	n.a.
Air transport	n.a.	n.a.	n.a.	0.696	0.763	0.736	n.a.

Note: n.a. means "not available".

Sources: (a) For the NC3 projections: G. Stein, B. Strobel. 1999. Politikszenarien für den Klimaschutz, Band 5: Szenarien und Massnahmen zur Minderung von CO_2-Emissionen in Deutschland bis 2020, *Schriften des Forschungszentrums Jülich*, Reihe Umwelt/Environment, Band 20. Jülich.

(b) For the actual variables: Verkehr in Zahlen 2002/2003. Bundesministerium für Verkehr, Bau- und Wohnungswesen. 2002. German energy balances at <www.ag-energiebilanzen.de>.

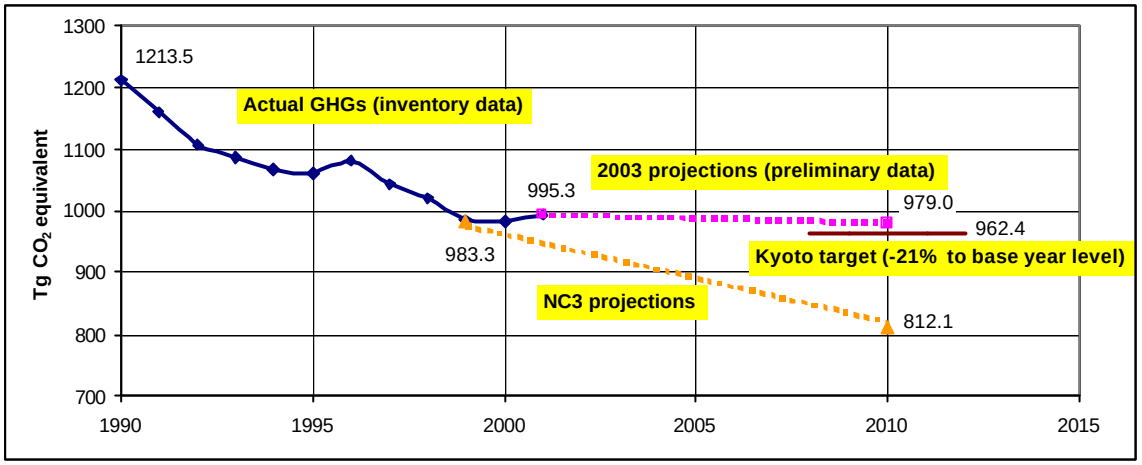
(c) For the 2003 projections: presentations of German experts during the review team's visit to Berlin.

D. Projected emission trends

84. Figure 5 and table 11 show that although the emission levels are notably higher in the new, 2003 projections than in the NC3, Germany is still on track with respect to its GHG reduction target under the Kyoto Protocol. The 2003 projection shown for 2010 indicates a 19.6 per cent reduction (from the base year level of 1218.2 to 979.0 Tg CO_2 equivalent). The remaining 1.4 per cent reduction to the 21 per cent target may well be achieved with the additional measures that are currently under discussion.

85. Table 11 shows that CO_2 emissions for two subsectors were significantly reconsidered in the 2003 projections: for energy industries and for "other" combustion, which is mostly fuel combustion in the residential and commercial sectors. It means that CO_2 mitigation measures in these subsectors possibly did not bring about those emission reductions that were projected by the 1999 study "Policy scenarios for climate protection II" (see also the section on policies and measures in this report).

Figure 5. Actual and projected GHG emissions in Germany



86. Table 11 also indicates that Germany may face serious difficulties in meeting its domestic CO_2 reduction target (a 25 per cent reduction by 2005). According to the 2003 reference projection, CO_2 emissions in 2005 would be only about 14 per cent below the 1990 level. Possible additional measures may help reduce CO_2 emissions further, but, given the short time before 2005, the review team felt that such measures may not reduce CO_2 emissions to the required level by then.[51]

Table 11. Projected and actual GHG emissions by gas and sector

	NC3 projections				Actual (2003 inventory)				2003 projections	
	1990	1999	2010	Change[a]	1990	1999	2000	2001	2010	Change[a]
	Tg CO_2 equivalent			%	Tg CO_2 equivalent				Tg CO_2 equivalent	%
CO_2 emissions:										
Energy industries	412.9	329.8	247.0	–40.2	412.9	327.9	340.0	345.3	353.0	–14.5
Manufacturing industries and construction	196.5	139.0	111.0	–43.5	196.5	135.7	136.2	132.5	111.0	–43.5
Transport	162.3	186.1	187.0	15.2	162.3	186.1	182.7	178.3	185.0	14.0
Other	215.2	177.1	124.0	–42.4	215.2	179.1	172.9	190.2	195.0	–9.4
Renewable bonus[b]									–7.0	–
Non-energy CO_2	27.7	26.5	25.0	–9.7	27.6	26.0	26.1	24.4	26.0	–5.8
CO_2 total	1 014.5	858.5	694.0	–31.6	1 014.4	854.7	858.0	870.8	863.0	–14.2
non-CO_2 emissions:										
CH_4	117.0	68.7	45.5	–61.1	101.1	59.3	54.5	52.2	n.a.	n.a.
N_2O	66.2	43.7	45.2	–31.7	87.9	59.0	59.4	60.2	n.a.	n.a.
HFCs+PFCs+SF_6	8.9	11.5	27.4	207.9	10.1	12.9	11.4	12.2	n.a.	n.a.
non-CO_2 total	192.1	123.9	118.1	–38.5	199.1	131.3	125.3	124.6	116	–41.7
GHG total	**1 206.6**	**982.4**	**812.1**	**–32.7**	**1 213.5**	**986.0**	**983.3**	**995.3**	**979.0**	**–19.3**

Note: n.a. means "not available".

[a] The change is from 1990 to 2010.

[b] Cross-sectoral CO_2 reductions from use of renewable energy.

[51] For example, in 2001 CO_2 emissions were 14.2 per cent below the 1990 level. Reaching a –25 per cent level by 2005 would require a reduction of about 112 Tg CO_2 between 2001 and 2005. This is almost the same reduction as the reduction achieved from 1990 to 1995 (115 Tg CO_2), during the time when economic restructuring and efficiency improvements in the new Länder contributed considerably to emission reductions.

E. General comments on projections

87. During the country visit, the review team was able to see that German experts have state-of-the-art knowledge of how to develop consistent and credible GHG projections. This was confirmed by the most recent projections provided to the review team at the time of the visit. During the visit, the review team discussed with German experts a number of possible improvements for future national communications.

88. ***Presentation of methodology***: The review team thought that more information about the modelling approaches used could help readers understand how the projections were prepared.

89. ***Consistency with the GHG inventory***: The review team pointed out the importance of ensuring, as suggested by the UNFCCC guidelines, consistency of projections with the latest available version of Germany's GHG inventory.

90. ***Approach to scenario formulation***: The NC3 "with measures" projection is based on the "with additional measures" projection prepared in 1999. This 1999 projection was calculated using an optimization procedure, with the CO_2 reduction target (a 25 per cent reduction by 2005) being one of the optimization constraints in the model. As a result, CO_2 emissions in 2005 under the 1999 "with additional measures" projection, and consequently also under the NC3 "with measures" projection, correspond exactly to the CO_2 reduction target. The review team felt that such an approach might make it impossible to identify, as part of the projection exercise, possible differences between the expected (in 1999) effects of policies and measures and their actual impacts on emissions (by 2002).

91. ***Modelling of the effects of policies and measures***: Progress in the implementation of existing GHG mitigation measures could be also be made more visible by creating and presenting a consistent "without measures" scenario, which could help to show how efficient the past measures were, both by sector and in total, and thus contribute to the monitoring of policies and measures.

92. ***Completeness of policies and measures***: The review team suggested that policy measures such as the planned nuclear phase-out and the EC agreements with car manufacturers on fuel efficiency of new passenger cars be taken into account in the next communication. The team understood that the 2003 projections already incorporate these measures.

93. ***Modelling of GHG emissions from transport***. An additional analytical effort might be required for the modelling of GHG emissions from transport. For this sector, optimization models may lack flexibility because there are several important factors that do not relate directly to cost efficiency, such as consumer preference for sports utility vehicles or for second household cars, and the rate of renewal of the vehicle fleet. Combination with specialized transport models may be required to reflect such factors.

94. ***Analysis of macro-economic impacts***: Future projections could include estimates of the macro-economic effects of alternative options for climate protection policies. Such analyses could identify the situations of a "double dividend" from emission reductions (a combination of GHG reductions and increases in GDP and employment). From discussions with German experts, the review team understood that such research studies exist in Germany.

95. ***Comparison with earlier projections (from the NC2)***: The NC3 did not compare the projections in the NC3 with those in the NC2 although the UNFCCC guidelines require it (paragraph 45). The comparison made by the review team showed that the "with measures" projection from the NC2 indicated higher emission levels than the NC3 projection. This is consistent with the fact that the NC3

projection was based on a "with additional measures" scenario from a 1999 study. The review team was of the opinion that such comparisons might be useful for improving the quality of the projections.

V. VULNERABILITY ASSESSMENT, CLIMATE CHANGE IMPACTS AND ADAPTATION MEASURES

96. The information on vulnerability and adaptation in the NC3 complies with UNFCCC guidelines. The following sectors/systems have been assessed as most vulnerable to **climate change impacts:** agriculture, forests, natural ecosystems, water resources, infrastructures, human health and coastal regions. The vulnerability is estimated in terms of expected changes in physical parameters; economic impacts are not mentioned, although during the visit to Berlin some estimates of the damage from the recent storms and floods were provided to the review team.[52]

97. Possible climate change impacts are higher temperatures and lower precipitation for southern and eastern Germany, and milder, wetter winters and drier, warmer summers for northern and western Germany. The impact of extreme events on transport infrastructure and tourism may be important.[53] Expansion of disease-carrying vectors (for example, ticks) is possible. Heat waves may also have an impact on mortality, as a recent German study showed. [54] Hotter summers may also lead to an increase in electricity demand for air conditioning.

98. Until recently, **adaptation** had not received much attention in Germany because the national focus was (and still is) on mitigation. However, after a number of natural disasters (storms, floods, heat waves) in recent years with sweeping economic and social consequences more attention is being given to adaptation, both at the federal level and in the Länder. A new three-year study was initiated in 2002 to estimate climate change impacts by economic sectors and by regions.

99. The review team noted that the NC2 and the NC3 differed in the approach to vulnerability and adaptation. The NC2 contained an entire section on adaptation measures whereas the NC3 gives very little information on it. Furthermore, in the NC2 the negative impacts of climate change were highlighted for most sectors whereas the NC3 focuses on the uncertainties in climate change impacts. The approach to impact assessment in the NC3 is not consistent across all sectors. Though the focus on uncertainty was the usual approach, the method used for water resources was different. A definite feature in a future climate scenario, a shift in the precipitation pattern, was used to assess the impact of climate change. The review team suggested that the approach to impact assessment should be made more consistent and, if a different approach is taken for particular sectors, explanations should be given.

VI. FINANCIAL RESOURCES AND TRANSFER OF TECHNOLOGY

100. This chapter of the NC3 is written in accordance with UNFCCC guidelines, except for the absence of table 4 of the guidelines ("contribution to multilateral institutions"). However, German experts provided this information to the review team after the country visit. The NC3 provides a list of thirteen projects in the format suggested by table 6 of the UNFCCC guidelines but only five of these projects had information on the impact on GHGs or sinks. German experts explained that the current reporting on projects does not make it possible to quantify the impact on emissions in a credible manner.

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[52] Münchener Rück. 2000. The total damage from the 1999 storms in Germany is estimated as EUR 1.8 million; the insured part of the damage was only EUR 0.75 million, *Winterstürme in Europa (II): Schadenanalyse 1999 – Schadenpotentiale*. Münchener Rück. 2002. The damage from the floods of 2002 is estimated as EUR 9.2 million; the insured part was about EUR 1.8 million, *Überschwemmungen Mittel-/Osteuropa: August 2002*.

[53] Since the extreme disasters of 1999 and 2002, insurance companies have become particularly concerned about the potential climate change impacts on their business; see footnote 52.

[54] G. Laschewski, G. Jendritzky. 2002. Effects of the thermal environment on human health: an investigation of 30 years of daily mortality data from south-west Germany, *Climate Research* 21, 91–103.

101. Germany's development assistance policy is determined by the BMZ and is based on the principle of sustainable development. KfW is responsible for financial cooperation; a state-owned company, the Gesellschaft für Technische Zusammenarbeit (GTZ), manages the technical aspects of cooperation.

102. The **Official Development Assistance** (ODA) of Germany in 2000 was EUR 5.458 billion. The ratio of ODA to GDP decreased from 0.41 per cent in 1990 to 0.26 per cent in 1998, but then increased to 0.27 per cent in 2000. The share of climate-related assistance in the total ODA was about 14.3 per cent in 1998–2000;[55] estimates for other years are not available. Germany strongly supports the **Global Environment Facility** (GEF) and considers contributions to it as "new and additional" funding. At the third GEF replenishment, Germany added a voluntary contribution of USD 30 million to its agreed basic share of 11 per cent. Thus, the German contribution increased from USD 220 million for the second GEF replenishment to USD 293 million.

103. About one third of the total bilateral financial support goes towards environmental projects, many of them involving climate-protection measures. From 1993 to 2002, about EUR 10.5 million were allocated to the German **Climate Protection Programme for Developing Countries** (CaPP). This funding was used for about 30 projects in more than 20 developing countries. Such projects supported, for example, the preparation of GHG inventories in China, Colombia, Namibia, Pakistan, Viet Nam and Zambia. In the future, CaPP will focus on three areas: reduction and avoidance of GHG emissions, preparation for the **clean development mechanism** (CDM), and adaptation to climate change.

104. The sectoral distribution of development aid fluctuates from year to year, depending on the type of aid requested by developing countries. Funding for renewable energies and tropical forests is considered particularly important and will be maintained at a high level. Through the BMZ, GTZ and KfW Germany is represented in the Vulnerability and Adaptation Resource Group, a network of agencies aiming to promote adaptation to climate change in developing countries. Technology transfer is promoted by the German Appropriate Technology Exchange Programme (GATE) supported by the GTZ.

105. Germany attaches special importance to the CDM and is also interested in **joint implementation** (JI). A checklist has been developed to help interested enterprises determine whether a project idea could be developed into a CDM or JI project. Guidelines are being developed to help prepare project design documents. There is work in progress on the Memoranda of Understanding relating to CDM and JI with Brazil, Costa Rica, the Czech Republic, Honduras, India, Romania, Russia, and the Ukraine. In 2003 Germany signed an agreement within the Baltic Sea region energy cooperation (BASREC) to establish a testing ground for the flexibility mechanisms under the Kyoto Protocol.

VII. RESEARCH AND SYSTEMATIC OBSERVATION

106. The information given on this topic complies with UNFCCC reporting guidelines. In comparison with the NC2, the amount of reported information increased considerably. The high quality and level of detail of the reported information reflect the availability of the first German report on the Global Climate Observing System (GCOS) which is part of the NC3. The review team noted, however, that although the information given was useful and good, it could be better organized to avoid duplication. For example, in Section 5 atmospheric, oceanographic and terrestrial observations are described under national programmes, and then these observations are presented again in section 6.

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[55] Organization for Economic Co-operation and Development (OECD). 2002. *Aid Targeting the Rio Conventions 1998–2000*, DCD/DAC/STAT(2002)7. Paris.

107. Most of the funding for **climate-related research** is provided by the Federal Ministry of Education and Research (BMBF) and the German Research Foundation (DFG). Individual projects are often funded by other federal ministries and by Länder. Climate research is integrated into a general framework of research to support sustainable development, "global change" being one of the key research areas. Since 1997, emphasis has been placed on integrated approaches that are better suited to addressing the extreme complexity of the problem of global change and climate change in particular. The review team noted the efforts taken in Germany to integrate data gathered by different agencies. Such efforts are valuable and they could be reported in more detail in the future.

108. The "German climate research programme" (DEKLIM) started in 2001 and will continue until 2007 with an annual funding of about EUR 10 million. It builds on previous climate research and focuses on better understanding of the global climate system, improvement of the reliability of climate models, and identification of mitigation and adaptation options.

109. Germany supports **research on energy technologies** within the framework of developing a sustainable energy supply system without nuclear energy. The federal funding of the BMWA and BMU for research on energy technologies (including research and development, investment grants, the Future Investment Programme, security research on nuclear technology) in 2002 was about EUR 0.2 billion. This does not include some sources of funding such as the institutional funding of the BMBF, and project funding of the BMVEL and BMBF. The research concentrates on the reduction of energy demand, increase in the efficiency of energy conversion, and improvement in the economics of renewable energy sources. Research in nuclear safety and radioactive waste disposal is supported; some support is provided for nuclear fusion (as part of the international ITER project). A new "Mobility and transport" research programme studies all major options for reducing emissions from transport.

110. Germany actively participates in the **Global Climate Observing System** (GCOS). Systems and national programmes for atmospheric, oceanographic and terrestrial climate observation are in place. German climate research is integrated into international research through German involvement into the work of IPCC and various European and international research programmes.

111. The NC3 provided little information on the support of climate research in developing countries but such support does exist. An example is the German-Indonesian project to study the El Niño Southern Oscillation. The German Weather Service supports climate research in developing countries through contributions to the World Meteorological Organization and its Technical Cooperation Programme.

112. When discussing the UNFCCC reporting guidelines on climate research and observation, German experts noted that, in their opinion, supplementary guidelines should be used for reporting on climate observation systems in order to provide complete global coverage of such systems. The review team expressed the view that this might be appropriate for specific reporting under GCOS.

VIII. EDUCATION, TRAINING AND PUBLIC AWARENESS

113. The NC3 of Germany does not contain a chapter on activities in education, training, and public awareness, although the UNFCCC guidelines require it. During the country visit the review team obtained information on the status of such activities, but the team still felt that this information, although valuable and useful, could not replace a systematic and comprehensive coverage of these issues in a national communication in accordance with the guidelines.

114. At the **federal level**, there are three units in the BMU that jointly promote climate awareness programmes: the unit responsible for education, public awareness and contact with stakeholders, the

climate protection unit and the unit for public relations. Other ministries and agencies, such as the BMVBW, BMBF and DENA, also initiate projects and activities relating to awareness on climate change.

115. At the **regional (Länder) level**, climate change is often introduced in schools through so-called "project weeks" during which students work on climate-related projects. Some schools participate in the "greening of schools programme" which encourages schools to save energy. The review team noted difficulties with introducing sustainability and climate change into the current school curricula, because the curricula are prepared separately by each of the Länder.

116. At the **community level**, environmental discussion groups and excursions are regularly held. In 1992–1997, only 14 per cent of all cities had local Agenda-21 programmes compared to about 80 per cent at present.

117. **Non-governmental organizations** (NGOs) play an important role in raising public awareness on climate change. An example is a programme called "Public Understanding of Science and Humanity (PUSH)" that has a climate-change component. Friends of the Earth produce awareness materials that are then passed on to schools, and organize lectures in schools and other institutions. NGOs are also spearheading a campaign for energy labelling of houses and cars to enable consumers to make climate-friendly decisions. Some NGOs use e-mail to disseminate information on climate change, in particular to members of parliament and federal and regional policy-makers.

118. In general, environmental NGOs support the climate protection policy led by the federal government. However, they often question governmental positions and decisions on specific issues, as well as the actual progress made in comparison with policy targets.

IX. CONCLUSIONS

119. The German NC3 complied with most of the UNFCCC reporting guidelines but the review team noted considerable deviations from the guidelines in the chapter on projections and, to a lesser extent, in the chapter on policies and measures. The NC3 did not contain the required chapter on activities in education, training, and public awareness.

120. From 1990 to 2001, the total GHG emissions in Germany (without LUCF) decreased by 18 per cent. This is one of the largest reductions among Annex II Parties to the UNFCCC. The fact that GDP increased by about 20 per cent in the same period indicates a remarkable success in decoupling GHG emissions from economic growth. The UNFCCC objective of GHG stabilization at the 1990 level by the year 2000 was well attained in Germany. Moreover, the large emission reductions in Germany contributed considerably to the attainment of the stabilization objective by Annex I Parties in total.

121. The review team was impressed by the following strong points of the German climate protection policy: a firm political commitment to GHG mitigation with emphasis on domestic measures; achievement of tangible results from determined policy efforts; use of quantitative targets for emission reductions; and the existence of a monitoring process. At the same time, the review team felt that sustaining the successes of the 1990s would be a considerable challenge. More recently, the emission reductions have slowed down noticeably while the deadlines come closer: 2005 for the national CO_2 reduction target and 2008–2012 for the first commitment period of the Kyoto Protocol. The planned nuclear phase-out may lead to increases in GHG emissions, as estimated in the NC3.

122. The available GHG projections confirm that the targets are challenging. Preliminary results from new, 2003 projections show emission levels higher than those presented in the NC3. Nevertheless, the new projections indicate that Germany is still on track for the GHG reduction target under the Kyoto Protocol, although without a large margin suggested by the NC3 projections. But German experts

acknowledged that Germany would need to do more to meet its domestic target, a 25 per cent reduction of CO_2 emissions by 2005. CO_2 emissions in 2001 were only 14.2 per cent lower than in 1990.

123. The German authorities are aware of the recent emission trends and of the need to strengthen their climate protection policy. At present, work is in progress to analyse the implementation of the current Climate Protection Programme of October 2000, because some measures (for example, cogeneration) do not seem to have produced the expected effect. The ongoing preparation for the implementation of the EC directive on emissions trading may also lead to a revision of the programme.

124. Most vulnerable to climate change impacts are agriculture, forests, natural ecosystems, water resources, infrastructures, human health and coastal regions. After the recent storms, floods and heat waves more attention is being given to adaptation studies, both federally and in the regions.

125. The ODA of Germany decreased from 0.41 per cent of GDP in 1990 to 0.27 per cent in 2000. The share of climate-related assistance in the total ODA was about 14.3 per cent in 1998–2000. Germany strongly supports the GEF and has increased contributions to it since 1991. From 1993 to 2002, about 30 projects in more than 20 developing countries were funded under the CaPP. In the future, the CaPP will focus on the reduction and avoidance of GHG emissions, preparation for the CDM, and adaptation to climate change.

126. Germany supports climate and technology research within the general framework of promoting sustainable development. German scientists actively participate in the work of GCOS and IPCC, and in international climate research programmes.

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