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Report on the in-depth review of the third communication of the European Community

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I. INTRODUCTION AND NATIONAL CIRCUMSTANCES RELEVANT TO EMISSIONS AND REMOVALS OF GREENHOUSE GASES

A. Introduction

1. The secretariat of the United Nations Framework Convention on Climate Change (UNFCCC) received the third communication of the European Community (EC), hereinafter referred to as the NC3, on 27 December 2001. An in-depth review was carried out between February and December 2004, including a visit to Brussels from 29 March to 2 April 2004. The review team consisted of Mr. Xuedu Lu (China), Mr. Henryk Gaj (Poland), Mr. James Sullivan (United States of America), Mr. William Blyth (International Energy Agency), Mr. Javier Hanna (UNFCCC secretariat) and Mr. Harald Diaz-Bone (UNFCCC secretariat, coordinator).

2. The EC is the legal entity under which the member States of the European Union (EU) cooperate in the field of climate change. The EC is the only regional economic integration organization that is a Party to the Convention, as are all its member States separately. Each of their reports is also being reviewed, and the review of the EC's NC3 therefore focused on activities at the EU level. The review team had a number of meetings and discussions on all aspects of the EU climate policy as outlined in the NC3. During these meetings with officials from the European Commission, the European Environmental Agency (EEA), and representatives from European business and environmental non-governmental organizations (NGOs), the review team was given a wealth of additional materials and information that supported the information provided in the NC3.

B. National circumstances

3. ***Geography:*** At the time of the review visit, the EU had 15 member States (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom of Great Britain and Northern Ireland). Since May 2004, its membership has expanded to include 10 new member States (Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia) and may be enlarged even further in the coming years. This report focuses on the EU-15, covering a total land area of 3,234,548 km^2 located in northern, western and southern Europe.

4. The climate in most member States is influenced by the proximity of the Atlantic Ocean or the North Sea, which results in relatively low temperature variations from summer to winter and relatively high rainfall. From 1985 to 1999, there were on average 2,543 heating degree days annually in the EU, but this figure varies considerably between member States. On average, 42 per cent of the surface area is forest or wooded land, 39 per cent is agricultural land and 15 per cent is classified as other land areas.

5. ***Demography:*** The slight growth in population from 366.1 million in 1990 to 381.2 million in 2002 (an average annual growth rate of 0.34 per cent) comes mainly from constant immigration that more than compensates for the low and continuously decreasing birth rate in many EU member States. Compared to the majority of Parties to the UNFCCC, most member States have a relatively high population density. As well as having implications for settlement and building patterns, this facilitates economic integration among communities and regions.

6. ***Economy:*** Except for the biennium 1992–1993, the gross domestic product (GDP) grew constantly by 2–3 per cent annually, resulting in a total increase of 23.7 per cent from 1990 to 2000. Growth slowed to 1.7 per cent in 2001 and to 1.1 per cent in 2002. Agriculture and fisheries have maintained their share of GDP, although at a low value of less than 3 per cent. Industry and construction have grown in absolute terms but their share has slightly declined; together, they account for almost a

third of GDP. Two thirds is accounted for by the services sector, with financial services, renting and comparable activities having grown in the 1990s.

7. ***Energy:*** Between 1990 and 2002, the total primary energy supply (TPES) grew by 12.2 per cent, with a considerable shift from coal to natural gas. In 2001, the TPES consisted mainly of oil products (40.5 per cent), gas (23.2 per cent), nuclear energy (15.5 per cent) and coal (14.6 per cent). During the same period renewable energy sources (RES), mainly biomass and hydropower, grew by 38 per cent, and in 2001 they accounted for 6 per cent of TPES. Because of the highly uneven distribution of biomass and hydropower resources among EU member States, the relative contribution of these varies from less than 2 per cent in the United Kingdom to more than 28 per cent in Sweden.

8. In 2002, per capita emissions of carbon dioxide (CO_2) amounted to 8.9 Mg; total greenhouse gas (GHG) emissions per capita amounted to 10.8 Mg CO_2 equivalent. Mainly because of the growing shares of natural gas in TPES and of the service sector in GDP, the economy reduced its GHG emissions intensity considerably, by 22.2 per cent, between 1990 and 2000 (see table 1), and has continued to decline since then. Other reasons for this decrease include a continuous decoupling of industrial production growth and fossil fuel consumption.

Table 1. Main macroeconomic indicators and greenhouse gas emissions[a]

	1990	2000	2002	Change (%) 1990–2000	Change (%) 2000–2002
Population (millions)	366.1	379.2	381.2	+3.6	+0.5
Gross domestic product – GDP (billions USD of 1995)[b]	6877.1	8508.2	8752.2	+23.7	+2.9
Industrial production index (1995 = 100)	97.1	114.5	113.6	+17.9	–0.8
Total primary energy supply – TPES (Mtoe)	1327.3	1463.4	1489.4	+10.2	+1.8
Electricity consumption (TWh)	2048.3	2480.5	2561.4	+21.1	+3.3
Greenhouse gas (GHG) emissions[c] (Tg[d] CO_2 equivalent)	4231.4	4090.9	4123.6	–3.3	+0.8
GHG emissions per capita (Mg CO_2 equivalent)	11.6	10.8	10.8	–6.6	+0.3
GHG emissions per GDP unit (kg CO_2 equivalent per USD of 1995)	0.601	0.467	0.453	–22.2	–3.0

[a] Data for population, GDP, TPES, and electricity are from "Energy balances of OECD countries, 1999–2002", OECD/IEA, Paris, 2004. GHG data are from the EC's GHG inventory submission in 2004.
[b] Calculated using the method of purchasing power parities (PPP).
[c] Without accounting for land-use change and forestry (LUCF).
[d] One teragram (Tg) is equal to 1,000 gigagrams (Gg) or one million tonnes (Mt).

9. ***Political structure:*** The EU has a unique institutional system. Its member States delegate sovereignty for certain matters to independent institutions that represent the interests of the Union as a whole, its member countries and its citizens. Each national government is represented within the European Council, and the European Parliament is directly elected by citizens of member States.

10. The **European Commission** embodies and upholds the general interests of the Union. Its members are appointed by the member States, after approval by the European Parliament. The Commission has the right to initiate draft legislation and therefore presents legislative proposals to the European Parliament and the European Council. As the executive body of the EU, it is responsible for implementing the European legislation, budget and programmes. It acts as guardian of the European treaties and, together with the European Court of Justice, ensures that Community law is applied properly. Finally, it represents the EU on the international stage and negotiates international agreements, chiefly in the field of trade and cooperation.

C. Key developments in climate change policies

11. The EC ratified the UNFCCC in December 1993 and has submitted three national communications, in 1996, 1999 and 2001. During the visit to Brussels, the review team analysed the information provided in the NC3 together with data from the most recent inventory submission of the EC to the UNFCCC secretariat, which contained data on 1990–2001 emission trends. The results of this

analysis suggest that the EC contributed to achieving the aim of the Convention, as its total GHG emissions decreased by 3.3 per cent in the period from 1990 to 2000 (without CO_2 from LUCF), and by 3.8 per cent if CO_2 from LUCF is considered. Within the different economic sectors, the greatest emission reductions were achieved in waste management (–23 per cent) and industrial processes (–16 per cent), while CO_2 emissions from fuel combustion in transport grew by more than 18 per cent.

12. The EC signed the Kyoto Protocol in April 1998 and ratified it jointly with its 15 member States in May 2002. Its target under the Kyoto Protocol (the "Kyoto target") is to keep total GHG emissions during the first commitment period (2008–2012) below 92 per cent of the 1990 level.[1]

13. In 2001 the European Council at Gothenburg endorsed the European Union Strategy for Sustainable Development.[2] Under this strategy, the Commission proposed a new climate change objective: to limit global warming to less than 2 °C above pre-industrial levels in the long term; to set more ambitious environmental targets for energy taxation, such as automatically indexing taxes at least to the level of inflation; to phase out all subsidies for fossil fuel production and consumption by 2010; and that by 2010, alternative fuels, including biofuels, should account for at least 7 per cent of the fuel consumed by cars and trucks. In the same year, the Council adopted a strategy for the integration of sustainable development into sectoral policies. A set of indicators (including 12 core factors) for the implementation of this strategy is currently under consideration.

14. Several other important climate policies have been implemented or adopted. For example, in the period between the NC2 and the NC3, the adoption of the European Climate Change Programme (ECCP) and its monitoring mechanism was a major step in implementing the Convention. In 2004, the EU established one of the first mandatory CO_2 emissions trading systems (EU-ETS). A more detailed account of the EU policies and measures is given in section III.

15. The review and the additional information provided during the visit led the review team to conclude that the EC's NC3 is a comprehensive document, reflecting all important aspects of the EU's climate change policy at the time it was prepared and published. It covers the GHG inventory, policies and measures, overall and sectoral projections and all other issues required by the UNFCCC reporting guidelines.[3]

II. GREENHOUSE GAS INVENTORY INFORMATION

A. Inventory preparation and reporting

16. ***Institutional framework:*** Within the European Commission, the Directorate-General on Environment (DG ENV) is responsible for preparing and reporting the EC GHG emissions inventory. The EEA, supported by its European Topic Centre on Air Quality and Climate Change (ETC-ACC), and by the statistical office of the EU (Eurostat), compiles the data and prepares the report. The Commission submits the relevant reports (common reporting format (CRF) and national inventory report (NIR)) to the UNFCCC secretariat. The EEA regularly publishes reports on EU-wide GHG emission trends and their analysis.

17. ***Coverage:*** The NC3 provides data on the EC GHG emissions inventory by sources and removals by sinks for the period from 1990 to 1999, and follows the structure laid down in the UNFCCC

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[1] The EC and its member States, by a decision adopted on 25 April 2002, have agreed to fulfil their commitments under Article 3.1 jointly and in accordance with Article 4 of the Kyoto Protocol (see document FCCC/CP/2002/2).

[2] The full title of the document is: "A Sustainable Europe for a Better World: A European Union Strategy for Sustainable Development".

[3] 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.

guidelines. It includes emission data for CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6), as well as for nitrous oxides (NO_X), carbon monoxide (CO), non-methane volatile organic compounds (NMVOC) and sulphur dioxide (SO_2). The 2003 GHG inventory submission to the UNFCCC, containing data for 1990–2001 and covering all major source and sink categories, was provided to the team during the review. The base year for CO_2, CH_4 and N_2O is 1990; 1995 was chosen as the base year for fluorinated gases.

18. Estimates for GHG emissions and removals from LUCF are provided. Emissions of CO_2 from biomass burning and GHG emissions from international bunker fuels are reported. The EC calculates its total emissions from international bunkers as the sum of the international bunker emissions of the individual member States.

19. ***Methodology:*** The GHG inventory for the years 1990–1999 as reported in the NC3 and the 2003 inventory submission were both compiled according to Council Decision 99/296/EC for a monitoring mechanism of community CO_2 and other GHG emissions, and its guidelines. Reporting requirements for the content and format of the GHG inventory at the EU level are identical with those under the UNFCCC. In addition, member States applied the Revised 1996 IPCC[4] Guidelines, and in the case of the 2003 inventory submission, they also used the IPCC good practice guidance[5], where feasible. A key source analysis using tier 1 was performed at the EU level for the 2001 inventory, but at a higher level of aggregation than recommended, because the data were incomplete.

20. The EC GHG inventory contains estimates for GHG emissions at aggregated sectoral level, but not at further disaggregated sub-source-category level. These estimates are equal to the arithmetical sum of the data of the 15 individual member State inventories, which are prepared using methods and activity data specific to each member State.[6] Most of the detailed inventory information is not reported, although it is contained in the individual submissions of the member States to the UNFCCC. The review team noted that underlying information on important differences between methodologies, activity data and emission factors at member State level, or on comparability and consistency among member State inventories, is not reported. The EC GHG inventory relies on the quality, completeness and timeliness of submissions from the member States. If data are incomplete at the member State level, the EEA applies a procedure to fill the gaps.

21. ***Comparison of inventory estimates:*** An estimate for CO_2 emissions from fossil fuels, based on a reference approach calculated using data from Eurostat energy balances and IPCC default values, is reported for the period 1990–2000. Differences in the estimates for CO_2 emissions from the reference approach of the individual member States and those calculated using data from Eurostat energy balances are discussed in the NIR.[7] Estimations of feedstocks and non-energy use of fuels are available for the years 1990–2000, and are also based on Eurostat data and IPCC default values both for the fraction of carbon stored and for carbon emission factors.

22. ***Consistency of timelines:*** The 2003 inventory submission contains recalculations of the time series 1990–2000 (table 2), which have been undertaken to take into account recalculations at the member State level. These recalculations reflect efforts by the member States to improve their individual consistency in the timelines of inventory data. The NIR of the 2003 submission provides a summary table of those recalculations, and some explanations of their rationale, which contributes to the

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[4] Intergovernmental Panel on Climate Change. *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories.*

[5] IPCC. *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories.*

[6] Except for the reference approach estimate of CO_2 from fossil fuels.

[7] The review team noted with interest that such differences will be smoothed out in the future as a result of the Eurostat project on energy data harmonization.

transparency of the inventory. The largest recalculations in absolute terms for 1990 and 2000 were made in three key sources: CH_4 from solid waste disposal on land, N_2O from agricultural soils and CH_4 from manure management. Large recalculations in absolute terms were made by France, Germany and Italy; in relative terms, the largest recalculations were made by Portugal. There have been recalculations in all sectors, but the overall impact on total emissions (excluding LUCF) is small (–0.38 per cent for 1990 and +0.18 per cent for 2000, for example). The inventory data as presented in the NC3 are therefore broadly consistent with the 2003 inventory submission.

Table 2. Estimates for emissions in 1990 and 1999: results of recalculations

	Gg CO_2 equivalent			Change (%)	
Totals[a]	**NC3**	**NIR 2002**	**NIR 2003**	**NC3 – NIR 2002**	**NIR 2002 – NIR 2003**
1990 total CO_2	3 325 370	3 341 803	3 329 139	0.49	–0.38
1999 total CO_2	3 270 520	3 308 494	3 308 900	1.16	0.01
1990 total CH_4	437 493	424 252	411 932	–3.03	–2.90
1999 total CH_4	364 140	348 507	341 002	–4.29	–2.15
1990 total N_2O	388 430	395 154	403 274	1.73	2.05
1999 total N_2O	332 940	334 147	345 405	0.36	3.37
1990 total GHG	4 198 705	4 207 624	4 191 729	0.21	–0.38
1999 total GHG	4 029 657	4 048 197	4 053 531	0.46	0.13

[a] Excluding emissions from land-use change and forestry (LUCF).

23. ***Comprehensiveness:*** The review team took note of the 2003 submission of the GHG inventory, including the complete time series of CRF tables and NIR. However, in the absence of disaggregated estimates below the source category level, the review team was unable to carry out a comprehensive review. Each figure at the source category level is the sum of the 15 national emission estimations, based on different methodologies, activity data and emission factors, and subject to different uncertainties.

24. ***Uncertainty estimates:*** The 2003 inventory submission provides only qualitative uncertainty assessments. Therefore, the review team was unable to fully assess the appropriateness of the methodological approaches and the quality of the resulting estimates.

25. ***Analysis of drivers:*** The NIR of the 2003 inventory submission does not provide substantive analysis of drivers behind emission trends, and the CRF tables do not contain any explanations through documentation boxes. During the visit to Brussels, the review team was provided with a detailed trend analysis of the main GHG sources identified at EU level and emission trends of the member States for the years 1990–2001.[8] The review team noted with appreciation that this information greatly improved the quality and transparency of the GHG inventory information (see section II.B).

26. ***Compliance with guidelines:*** The NC3 section on GHG inventory information broadly complied with the UNFCCC reporting guidelines. The review team noted that, compared to the NC2, the NC3 section on inventory marked a noticeable improvement and extension of reporting on the GHG inventory. Moreover, the 2003 inventory submission marked a further step in improving the quality of reporting. Still, the review team identified further potential for improvement, particularly in relation to cross-cutting issues in the GHG inventory: provision of quantified uncertainty estimates; development and reporting of a quality assurance/quality control (QA/QC) plan; provision of disaggregated data in the CRF at the subsector level, increasing the consistency and transparency of inventory reporting; and provision of underlying information on the main differences in methodologies, activity data and emission factors at member State level, together with an analysis of comparability and consistency among member State inventories.

27. ***Recent developments:*** The review team was informed that the Commission is aiming to improve the transparency and completeness of its inventory in 2004 and 2005, particularly with regard to the

[8] EEA (2004). *Analysis of greenhouse gas emission trends and projections in Europe 2003.*

provision of quantitative uncertainty estimates, development of specific QA/QC procedures and provision of data of GHG emissions at sub-category level. Since 2004, the legal basis for the compilation of the GHG inventory and the inventory system for the EC and its member States is Council Decision 280/2004/EC on the monitoring mechanism of community CO_2 and other GHG emissions and implementation of the Kyoto Protocol. This decision aims to bring the EC GHG inventory into full compliance with the requirements of the Kyoto Protocol and the Marrakesh Accords. Furthermore, the new European monitoring mechanism, in line with a number of other ongoing activities, is expected to improve completeness and transparency. The following analysis of the GHG emissions profile and trends is based on the data reported in the 2003 GHG inventory submission.

B. Emission profile and trends

28. The EU emissions profile shows the clear dominance of the energy sector, with CO_2 as the main GHG. Emissions of GHGs (without LUCF) totalled 4,108,256 Gg CO_2 equivalent in 2001, after having declined by 2 per cent during the period 1990–2001. This decline was a result of broadly constant (but slightly fluctuating) CO_2 emissions and declining trends in CH_4 and N_2O emissions. Table 3 shows the emissions trends by gas in this period.

Table 3. GHG emissions by gas, 1990–2001

	Gg CO_2 equivalent								Change
	1990	1995	1996	1997	1998	1999	2000	2001	%[a]
CO_2[b]	**3 329 139**	**3 262 960**	**3 339 599**	**3 279 607**	**3 329 936**	**3 308 900**	**3 329 314**	**3 383 556**	**1.6**
CH_4[b]	**411 932**	**368 418**	**364 253**	**355 124**	**348 292**	**341 002**	**332 710**	**327 423**	**20.5**
N_2O[b]	**403 277**	**383 790**	**390 625**	**388 611**	**366 310**	**345 405**	**343 672**	**338 831**	**–16.0**
Fluorinated gases	47 381	59 643	64 248	69 938	73 320	58 223	60 961	58 447	23.4
Net GHG[c]	4 007 668	3 891 053	3 966 262	3 900 775	3 934 928	3 861 919	3 894 272	3 912 604	–2.4
Total GHG[d]	**4 191 729**	**4 074 811**	**4 158 724**	**4 093 280**	**4 117 858**	**4 053 531**	**4 066 658**	**4 108 256**	**–2.0**

[a] Change between 1990 and 2001, expressed as a percentage of 1990 values.
[b] Emissions without LUCF.
[c] Total GHG (with net CO_2 emissions/removals from LUCF).
[d] Total GHG (without LUCF).

29. ***Overall GHG emissions:*** In 1990, CO_2 accounted for 79.4 per cent of the total GHG emissions (without LUCF), followed by CH_4 (9.8 per cent) and N_2O (9.6 per cent). A similar pattern is observed for 2001, when the proportion of CO_2 was 82.4 per cent, followed by N_2O (8.2 per cent) and CH_4 (8.0 per cent). In 1990, fluorinated gases (PFCs, HFCs and SF_6 taken together) made up 1.1 per cent of total GHG emissions (without LUCF); in 2001 they made up 1.4 per cent.

30. The 2004 progress report of the EU monitoring mechanism presents GHG emissions data by member States for the years 1990 and 2002. According to this breakdown, the four biggest member States (i.e. Germany, the United Kingdom, France and Italy), accounted for the lion's share (72 per cent in 1990, and 67 per cent in 2002) of total EU GHG emissions. Between 1990 and 2002, decreasing GHG emissions in six member States (Germany, United Kingdom, France, Sweden, Luxembourg and Denmark) totalled 364.4 Mt CO_2 equivalent; increases in emissions in the remaining nine member States totalled 242.6 Mt CO_2 equivalent. Germany (65 per cent) and the United Kingdom (31 per cent) contributed most to these reductions, while the bulk of increasing GHG emissions were reported by the cohesion States: Spain (47 per cent), Italy (19 per cent), Greece (12 per cent), Portugal (10 per cent) and Ireland (6 per cent). Individual member States' GHG emission trends varied between a decrease by 18.9 per cent in Germany and an increase by 41.0 per cent in Portugal during this period.

31. ***Carbon dioxide:*** Total emissions of CO_2 in the EU were 3,383,556 Gg in 2001. The major source categories were energy industries (33.1 per cent), followed by transport (24.6 per cent), other sectors (19.4 per cent), manufacturing industries and construction (17.3 per cent) and industrial processes (3.1 per cent). Removals of CO_2 by LUCF have increased by 6 per cent since 1990 and equalled

5 per cent of total GHG emissions (excluding LUCF) in 2001. They varied between 181 and 216 Tg CO_2 over the period 1990–2001, reflecting wide annual fluctuations, ranging from a decrease of 9.5 per cent to an increase of 12.8 per cent. In 2001, CO_2 emissions from international bunkers equalled 5.7 per cent of total GHG emissions (excluding LUCF), after having increased by 51.9 per cent since 1990.

Table 4. Carbon dioxide emissions by source, 1990–2001

GHG gas source and sink categories	Gg CO_2								Change %[a]
	1990	1995	1996	1997	1998	1999	2000	2001	
Energy	3 163 488	3 105 865	3 186 993	3 123 922	3 174 812	3 151 565	3 169 623	3 225 913	**2.0**
Energy industries	*1 144 434*	*1 079 944*	*1 093 426*	*1 058 364*	*1 088 645*	*1 070 061*	*1 102 660*	*1 119 301*	***–2.2***
Manufacturing industries and construction	*642 348*	*604 249*	*591 759*	*602 615*	*598 874*	*590 241*	*590 851*	*585 160*	***–8.9***
Transport	*695 003*	*752 889*	*769 248*	*778 309*	*802 558*	*822 186*	*823 606*	*833 925*	***20.0***
Other sectors and Other[b]	*655 172*	*645 775*	*708 947*	*660 783*	*660 555*	*644 982*	*628 862*	*663 069*	***1.2***
Fugitives	*26 530*	*23 008*	*23 612*	*23 851*	*24 180*	*24 096*	*23 643*	*24 458.*	***–7.8***
Industrial processes	147 931	142 034	136 961	140 288	140 678	142 317	144 708	143 040	**–3.3**
Solvent and other product use	6 067	5 338	5 341	5 404	5 448	5 435	5 565	5 389	**–11.2**
Agriculture	3 208	1 718	1 818	2 055	2 024	2 007	2 023	1 946	**–39.3**
Land-use change and forestry	–191 943	–191 554	–200 274	–200 325	–191 082	–199 413	–180 560	–203 481	**6.0**
Waste	7 804	7 304	7 786	7 380	6 254	6 825	6 664	6 577	**–15.7**
Other	641	700	699	558	721	751	730	690	**7.8**
Total CO_2 emissions/ removals with LUCF	3 137 195	3 071 406	3 139 324	3 079 282	3 138 854	3 109 487	3 148 754	3 180 074	**1.4**
Total CO_2 emissions without LUCF	**3 329 139**	**3 262 960**	**3 339 599**	**3 279 607**	**3 329 936**	**3 308 900**	**3 329 314**	**3 383 556**	**1.6**
International bunkers[c]	155 521	172 906	184 914	200 621	212 060	211 856	222 536	236 171	**51.9**

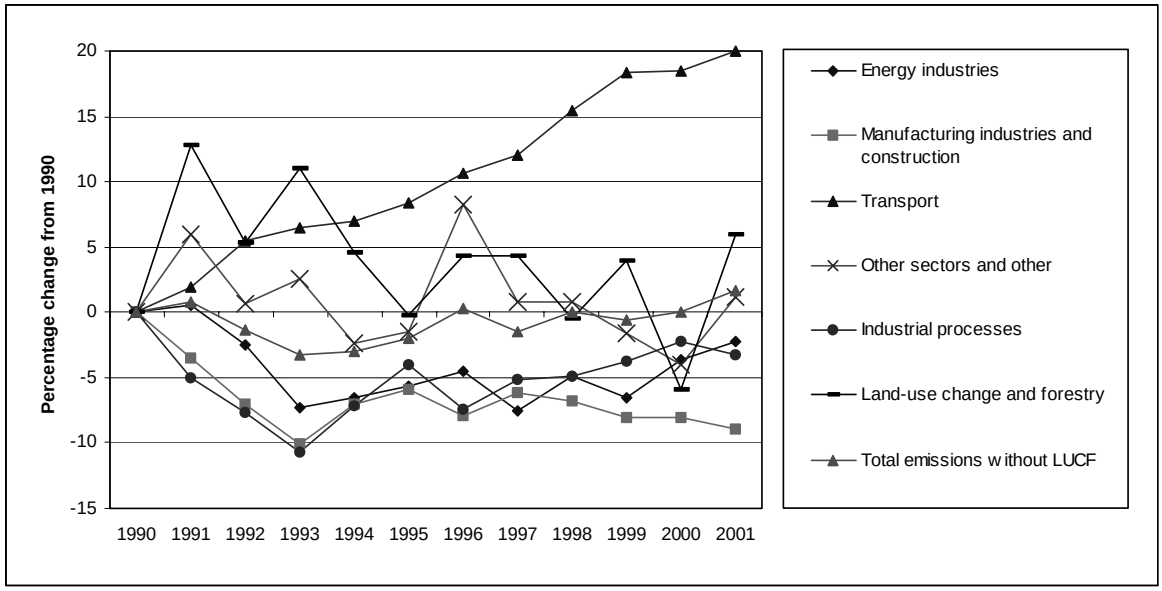
[a] Change between 1990 and 2001, expressed as a percentage of 1990 values.
[b] Emissions from IPCC categories 1.A.4 (Energy use in other sectors) and 1.A.5 (Other) were added.
[c] Emissions from international bunkers were not included in the totals.

32. As shown in table 4 and figure 1, CO_2 emissions fluctuated between 1990 and 2001 with peak levels in 1991, 1996, 1998 and 2001. Emissions of CO_2 from energy industries fell by 2.2 per cent between 1990 and 2001 and showed some fluctuations (with the same peak levels as total CO_2 emissions) and a general decreasing trend, mainly due to fuel switching in electricity production from coal to natural gas, and increased shares of RES and nuclear power in electricity generation, as well as energy efficiency improvements. At the same time, final electricity consumption increased in all member States (by 23 per cent between 1990 and 2001), showing a decoupling from CO_2 emissions.

33. Notably, CO_2 emissions from transport in 2001 showed an increase of 20 per cent compared to the 1990 level, due to a steady increase in transport activity (mainly road transport, both passenger and freight). Emissions of CO_2 from other sectors (mainly residential and commercial sectors) increased by 1.2 per cent during this period, showing small fluctuations peaking in years with more intensive heating periods. Households account for two thirds of CO_2 emissions in this source category, and the number of dwellings increased by 12 per cent during the period 1990–2000. This decoupling may be an indication of improvements in energy efficiency of space heating; however, the high performance of some countries could also be influenced by a shift from household heating boilers to district heating (which slightly increases emissions from energy industries).

34. Emissions of CO_2 from manufacturing industries and construction declined by 8.9 per cent between 1990 and 2001. The reductions were mainly due to efficiency improvements and structural change in Germany after reunification. Finally, CO_2 emissions from industrial processes decreased by 3.3 per cent between 1990 and 2001, showing a general decreasing trend in all source categories (mineral products, chemical industry, metal and other production). These emissions declined mainly in the early 1990s, and increased again in recent years.

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



35. ***Methane:*** Emissions of CH_4 amounted to 327,423 Gg CO_2 equivalent in 2001. Enteric fermentation accounted for the largest share (40.2 per cent), followed by solid waste disposal on land (24.5 per cent), manure management (13.8 per cent) and fugitive emissions from fuels (13.3 per cent).

36. As shown in table 5, CH_4 emissions decreased steadily by 20.5 per cent between 1990 and 2001. This reduction is largely attributed to the decline in emissions from enteric fermentation (8.6 per cent), mainly due to a 10 per cent decrease in the number of cattle as a result of the reform of the common agricultural policy (CAP). It is also attributed to a decrease in CH_4 emissions from landfills (27.7 per cent) due to the implementation of the Landfill Directive and other legislation in the field of waste management, by reducing the amount of untreated biodegradable waste disposed of in landfills and installing landfill gas recovery systems at all new sites. Further reasons for the reduction in CH_4 emissions include a 46.5 per cent reduction in fugitive emissions (mainly from solid fuels), resulting from a decline of coal-mining activities after cuts in coal subsidies mainly in France, Germany and the United Kingdom.

37. ***Nitrous oxide:*** Emissions of N_2O reached 338,831 Gg CO_2 equivalent in 2001. Major sources were emissions from agricultural soils (58.1 per cent), chemical industry (14.5 per cent), transport (7.8 per cent), manure management (6.4 per cent) and energy industries (4.7 per cent).

38. Table 6 shows that total N_2O emissions decreased by 16 per cent between 1990 and 2001, following the trend of industrial processes and agricultural N_2O emissions. There were large reductions in emissions of N_2O from chemical industry (53.7 per cent), both in absolute and relative terms, primarily as a result of measures to reduce emissions from adipic acid production, particularly in the United Kingdom, Germany and France: between 1997 and 1999 these emissions fell by 47.7 per cent. Emissions of N_2O from agricultural soils decreased by 8.2 per cent between 1990 and 2001, mainly as a result of a decrease in the use of nitrogen fertilizer, as a consequence of the CAP reform and the implementation of the Nitrate Directive. Emissions of N_2O from transport currently account for only a small portion of total GHG emissions, but increased sharply by 126.1 per cent from 1990 to 2001 because of an increase in the number of vehicles equipped with three-way catalytic converters. Between 1990 and 2001, increases in N_2O emissions from fuel combustion in energy industries (9.8 per cent) occurred mainly because of increased burning of biomass.

Table 5. Methane emissions by source,[a] 1990–2001

GHG gas source and sink categories	Gg CO_2 equivalent								Change (%)[b]
	1990	1995	1996	1997	1998	1999	2000	2001	
Energy	99 036	78 666	75 831	71 946	68 565	65 457	60 690	57 624	**–41.8**
Fugitive emissions	*81 480*	*64 218*	*60 858*	*57 708*	*54 432*	*51 240*	*47 124*	*43 617*	***–46.5***
Agriculture	192 129	183 708	184 317	182 826	182 322	181 440	179 970	179 529	**–6.6**
Enteric fermentation	*144 081*	*136 689*	*137 235*	*135 471*	*134 673*	*134 106*	*132 237*	*131 628*	***–8.6***
Manure management	*45 171*	*44 310*	*44 226*	*44 520*	*44 940*	*44 709*	*45 066*	*45 276*	***0.2***
Waste	120 183	105 491	103 476	99 795	96 909	93 610	91 572	89 818	**–25.3**
Solid waste disposal on land	*110 985*	*96 560*	*94 374*	*90 387*	*87 315*	*83 902*	*81 929*	*80 295*	***–27.7***
Total emissions	**411 932**	**368 418**	**364 253**	**355 124**	**348 292**	**341 002**	**332 710**	**327 423**	**–20.5**

[a] Emissions without LUCF.
[b] Change between 1990 and 2000, expressed as a percentage of 1990 values.

Table 6. Nitrous oxide emissions by source,[a] 1990–2001

GHG gas source and sink categories	Gg CO_2 equivalent								Change (%)[b]
	1990	1995	1996	1997	1998	1999	2000	2001	
Energy	47 016	52 045	53 106	53 942	56 135	57 533	58 204	60 159	**28.0**
Energy industries	*14 606*	*14 534*	*14 895*	*14 628*	*15 227*	*15 117*	*15 297*	*16 040*	***9.8***
Transport	*11 660*	*18 334*	*19 746*	*20 964*	*22 577*	*23 999*	*24 873*	*26 361*	***126.1***
Industrial processes	106 145	97 540	100 739	96 526	73 298	50 502	49 836	49 252	**–53.6**
Chemical industry	*106 096*	*97 486*	*100 684*	*96 468*	*73 243*	*50 435*	*49 777*	*49 167*	***–53.7***
Agriculture	238 428	223 570	226 124	227 472	226 159	226 644	224 818	218 748	**–8.3**
Agricultural soils	*214 489*	*201 510*	*203 973*	*205 198*	*203 993*	*204 504*	*203 101*	*196 818*	***–8.2***
Manure management	*23 495*	*21 710*	*21 781*	*21 888*	*21 826*	*21 816*	*21 349*	*21 562*	***–8.2***
Total emissions	**403 277**	**383 790**	**390 625**	**388 611**	**366 310**	**345 405**	**343 672**	**338 831**	**–16.0**

[a] Emissions without LUCF.
[b] Change between 1990 and 2001, expressed as a percentage of 1990 values.

39. ***Fluorinated gases:*** Emissions of fluorinated gases increased by 23.4 per cent between 1990 and 2001; however, taken together, they still accounted for only 1.4 per cent of total GHG emissions (without LUCF). In table 7, considerable differences can be observed between the different groups of gases. Emissions of HFCs increased notably between 1990 and 2001 (by 69.0 per cent), mainly because of their increased use in refrigeration and air conditioning, as aerosol propellants and blowing agents for the production of thermal insulation foams, and as substitutes for the ozone-depleting substances phased out under the Montreal Protocol. The trend of these emissions shows some fluctuations and a notable decrease of 23.3 per cent from 1998 to 1999. A fall of 58.8 per cent in PFC emissions between 1990 and 2001 is the result of their decreased output from aluminium production, while the 14.7 per cent increase in SF_6 emissions originates from its increased use in electrical equipment insulation. In addition, SF_6 emissions show a downward trend from 1997 to 2001, including a notable decrease of 18.8 per cent from 1998 to 1999.

Table 7. Fluorinated gases emissions, 1990–2001

GHG	Gg CO_2 equivalent								Change (%)[a]
	1990	1995	1996	1997	1998	1999	2000	2001	
HFCs	25 668	39 255	43 692	49 753	54 070	41 449	45 033	43 383	**69.0**
PFCs	13 403	7 679	7 717	7 358	7 063	6 885	6 163	5 527	**–58.8**
SF_6	8 311	12 709	12 839	12 827	12 187	9 890	9 765	9 537	**14.7**
Total	**47 381**	**59 643**	**64 248**	**69 938**	**73 320**	**58 223**	**60 961**	**58 447**	**23.4**

[a] Change between 1990 and 2000, expressed as a percentage of 1990 values.

III. POLICIES AND MEASURES

A. Overview

40. ***Institutional arrangements:*** Within the European Commission, DG ENV is responsible for the overall coordination of the EU's climate change policy. The EEA, supported by the ETC-ACC and

Eurostat, is the implementing agency for monitoring and evaluation of EU-wide activities aimed at meeting the commitments under the UNFCCC and the Kyoto Protocol. The Directorate-General on Transport and Energy (DG TREN) is responsible for the integration of EU climate policy in the energy and transport sector. Other important Directorates-General dealing with climate change aspects include those on research (DG RESEARCH), agriculture (DG AGRI), as well as business and industry (DG ENTERPRISES). Implementation of EU laws is the responsibility of the member States. The review team noted that these special institutional arrangements make it more difficult to monitor and assess EU-wide climate policy effects than is the case for other Annex I Parties.

41. ***Coverage:*** The NC3 outlines the general context of climate policy in the EU. It focuses on the common and coordinated policies and measures at the EU level, as the policies and measures of individual member States are described in their own communications. The review team noted that the NC3 provides a much clearer picture than the NC2 of the overall EU policy-making process and the relationship of the common and coordinated climate policies to the larger EU policy context, including social and other environmental objectives.

42. ***Compliance with UNFCCC guidelines:*** The section on policies and measures broadly conforms with the provisions of the UNFCCC reporting guidelines; most mandatory reporting elements are included, except for the sub-sections on policies no longer in place.[9] However, the review team noted that many optional elements were not included, which it felt would enhance the completeness and transparency of reporting. The review team recognizes that, because of its policy-making structure and as a supranational Party to the Convention, the EC faces many challenges: for example, in reporting on effectiveness and cost-effectiveness of policies and measures, as well as on their implementation status. Also, the team noted that information on ancillary benefits of climate policies on other policy objectives (e.g. employment) and on potentially counterproductive policies and measures (e.g. the cohesion policy)[10] would help the reader to better understand the policy choices made and to assess the individual effects of EU-wide policies.

43. During the visit to Brussels, the review team was provided with supplemental information that included estimated effects of key member State policies and measures.[11] The review team encourages the EC to provide further information on important activities of member States in future communications, and was informed during the visit to Brussels that the new monitoring mechanism would probably enable this type of reporting.

44. ***EU monitoring mechanism:*** Council Decision 93/389/EEC established a mechanism for monitoring emissions of GHGs and evaluating progress towards meeting commitments in respect of those emissions. The monitoring mechanism has recently been strengthened through a new Council Decision 280/2004/EC. The decision is accompanied by more detailed implementing provisions (laid down in Commission Decision 2005/166/EC) that define reporting requirements for member States.

45. One of the key outputs of the monitoring mechanism (see paragraph 27) is the EC GHG inventory which forms the basis for the annual submission to the UNFCCC, as well as being a key input to the progress evaluation report prepared by the Commission for the European Parliament each year. This report assesses whether actual and projected progress of member States is sufficient to ensure fulfilment of the EC's commitments under the UNFCCC and the Kyoto Protocol.

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[9] See paragraph 5 of the UNFCCC reporting guidelines and item IV.C of its annex.

[10] See Article 4.2(e) (ii) of the Convention and paragraph 16 of the UNFCCC reporting guidelines.

[11] EEA (2003). *GHG Emissions Trends & Projections in Europe.*

46. ***Overview of policy development:*** The Sixth Environmental Action Programme (6^{th} EAP)[12] sets the environmental objectives and priorities that will be an integral part of the EU's strategy for sustainable development. Adopted in 2001, the 6^{th} EAP continues and enhances policy initiatives of its predecessor. The programme establishes environmental objectives for the next 10 years and beyond, and includes in its scope the environmental aspects of the enlargement of the EU.

47. The issue of climate change is given a high priority in the 6^{th} EAP. The programme identifies the need to reduce global GHG emissions by 20–40 per cent by 2020, in order to achieve the longer-term reduction target of 70 per cent that is seen to be in line with the ultimate objective of the UNFCCC. In the short term, the target is to achieve an 8 per cent reduction in GHG emissions during the first commitment period of the Kyoto Protocol. The programme calls for a re-shaping of the economy with the aim of decoupling emissions and economic growth. The review team noted that, although there have been promising trends in some sectors, including waste management and industrial processes, an overall decoupling of emissions from economic growth is not yet proven.

48. In parallel with the mitigation of climate change, the increasing need to adapt to the effects of climate change is acknowledged. In addition, the 6^{th} EAP identifies a leadership role for the EU in international action against climate change, which includes ratification of the Kyoto Protocol. Along with the "first-mover advantage" that comes with such a leadership role there is also the "first-mover risk" of undertaking actions without the assurance that others will take commensurate action. The EU is therefore also undertaking international policy initiatives aimed to encourage further countries to adopt quantitative reduction targets.

49. The European Climate Change Programme (ECCP) is the result of a multi-stakeholder initiative launched by the European Commission in June 2000. Its objective is to develop the main elements of the EU strategy to meet its domestic target of an 8 per cent reduction in GHG emissions from 1990 levels by 2008–2012. The ECCP identifies a range of cost-effective policies and measures with a total reduction potential of 578–696 Mt CO_2 equivalent in 2010, which is twice the amount needed to reach the Kyoto target. A key finding is that the EU's total compliance costs could be as low as EUR 3.7 billion annually, or 0.06 per cent of EU GDP in 2010.

B. Cross-cutting measures

50. ***EU emissions trading scheme:*** The EU has adopted Directive 2003/87/EC setting out a framework for member States to allocate tradable CO_2 emissions allowances to combustion installations with a rated thermal input of more than 20 MW (except hazardous or municipal waste installations), mineral oil refineries, coke ovens, as well as installations in the steel, minerals and paper industries exceeding certain size thresholds. Covering an estimated 45–50 per cent of total CO_2 emissions, the trading scheme has created the world's largest mandatory GHG emissions trading scheme. Because of its high cost-effectiveness, it is expected to play a central role in the EU's overall climate policy. The EU-ETS started in the 25 EU member States on 1 January 2005.

51. The EU-ETS allows companies to use credits from project-based mechanisms under the Kyoto Protocol (joint implementation (JI) and clean development mechanism (CDM)), to help them comply with their obligations under the scheme. Furthermore, it is open to linking with compatible emissions trading schemes of other Annex I Parties that are also Parties to the Kyoto Protocol. The review team noted that this linking of mechanisms and schemes is a strength of the EU-ETS, since it provides a cost-effective means for EU-based industries to reduce their GHG emissions, improves liquidity of the trading market, encourages international cooperation and transfer of technology, and could therefore fulfil an important role in the international climate change process.

[12] EC document COM (2001) 31 final.

52. The allocation process is an important step in determining how successful the EU-ETS will be in contributing to the EU's climate change goals. A suitable level of allocation helps to set the allowance price at a level that will stimulate the technological changes necessary to bring about emission reductions from the energy sector. Although the Commission has issued allocation guidelines, under the principle of subsidiarity member States have considerable flexibility in determining the details of their allocation plans, including how the allocation conforms with progress towards meeting their national Kyoto targets. Because of this important role of the member States in the implementation phase, the Commission has not yet been able to estimate the emissions reduction potential of the scheme.

53. The review team noted that the EU-ETS introduces a complex set of investment conditions for the sectors covered. A direct effect should be to provide a price signal that encourages use of lower-emitting technology in all these sectors. In addition, in the medium term, if electricity prices increase in response to raised carbon prices, this could lead to a more favourable investment climate for the European power sector, and could potentially accelerate investment in lower-emitting technology in that sector. On the other hand, as may be the case with any climate change regulation, there could be an important effect of uncertainty (both at the international and at the EU level) which creates an incentive to delay investment and wait for new information on the level of emission reductions required.

54. Monitoring and reporting guidelines under the EU-ETS have been introduced which allow a tiered approach representing different levels of accuracy. The most accurate tier is to incorporate installation-level data (on activity data and emission factors, for example) which could deviate from national or IPCC default values. The review team noted that this process could lead to new emissions data becoming available for the sectors covered by the scheme, which could feed into revisions of national inventory data.

55. The EU-ETS will be reviewed around mid-2006 to allow fine-tuning in the light of experience gained and to consider whether it should be extended to other sectors, such as chemicals, aluminium, and transport, and to GHGs other than CO_2. The review team noted the importance of this review process in ensuring the ability of the scheme to deliver the necessary emission reductions in the scheme's second phase 2008-2012, particularly as this coincides with the Kyoto Protocol first commitment period. It further noted with appreciation that the EU will want to share with all interested parties and stakeholders the invaluable information on experience gained during the setting up of the scheme.

56. ***Interaction with other policies:*** For those installations covered by the emissions trading scheme, member States are allowed to waive requirements under the Integrated Pollution Prevention and Control (IPPC) Directive to apply guidance on best available techniques relating to energy efficiency and emissions of GHGs covered. The team noted that the overall requirements for emission reduction under the EU-ETS would need to be at least as stringent as the requirements under the IPPC, in order to lead to a net reduction of GHG emissions compared to previous existing policies.

57. The review team recognizes the potential strengths of the EU-ETS, and the bold move by the EU to put this new market-based mechanism at the centre of its climate policy. But, in view of the potential weaknesses of the scheme, the review team encourages the EU to monitor the effectiveness of the policy, and to take action if necessary to strengthen the emission reduction requirements either by modifying the trading scheme policy itself, or by integrating it within a broader policy package, to ensure that it contributes to the delivery of the EU's overall policy goals for the mitigation of climate change.

58. ***Fiscal measures:*** In 2003, the EU adopted the Directive on the Taxation of Energy Products, which introduces a framework of rules to restructure and harmonize national systems of taxation relating to heating and usage of motor fuels. It updates the 1992 Directive on Mineral Oil Taxes, in order to raise minimum tax rates in line with inflation, and expands coverage of the minimum rates to include coal, lignite, natural gas and electricity. The tax on electricity is an output tax, but includes the option for

member States to impose additional taxes on certain input fuels to reflect environmental impacts. The directive also makes provision for tax reductions on RES, combined heat and power (CHP) and biofuels. It also allows reduced tax rates for energy-intensive industries, which must meet criteria relating to competitiveness and be linked to a voluntary agreement or emissions trading scheme that is comparable to the tax scheme. It exempts aviation fuel. The review team was not informed of the extent to which the new minimum tax rates will lead to a real increase in taxes over and above the rates that are already in force at the member State level, except for diesel where the new rates will lead to real increases in taxation in 6 out of the 15 member States, with further increases due in 2010.

C. Energy

1. Energy supply

59. The energy supply sector is the largest single source of GHG emissions in the EU, accounting for 29.3 per cent of total emissions (excluding LUCF) in 2001. Almost all (93 per cent) of the GHG emissions are of CO_2. The largest contributor to these CO_2 emissions is the supply of public electricity and heat (85 per cent) and petroleum refining (11 per cent). In 1990, fugitive emissions from fuels accounted for 2.6 per cent of total EU emissions (excluding LUCF), the largest contributor being emissions of CH_4 from solid fuels and natural gas supply.

60. Emissions of GHGs from energy industries declined by 4.9 per cent between 1990 and 2001. Significant reductions in fugitive emissions (–37 per cent) contributed to this decline, while CO_2 emissions declined by 2 per cent over the same period, with emissions remaining slightly below 1990 levels throughout the period. This drop in CO_2 emissions was achieved despite an increase of 23 per cent in the level of electricity consumption over the same period. This decoupling of emissions from activity levels was mainly the result of a shift in the energy mix for electricity generation, from coal to natural gas. This shift both lowered the average emission factor for electricity generation (responsible for 45 per cent of the decoupling) and increased the average efficiency of electricity generation (responsible for 48 per cent of the decoupling). The remaining 7 per cent was achieved as a result of a shift towards greater generation from carbon-free sources (nuclear and RES).

61. A key pillar of energy policy at the EU level has been the liberalization of energy markets, with directives covering the electricity and gas markets. For the electricity sector, liberalization was one of the drivers for the shift towards gas-fired generation in the United Kingdom – an important contributor to the overall EU trend in the sector – and so far it has had a positive environmental benefit. The NC3 gives an ex-ante estimate of the mitigation impact of liberalization of 88 Mt CO_2 equivalent beyond 2010. However, the review team noted that, as a result of electricity market liberalization, the generation mix is increasingly driven by market prices of input fuels, with a consequent increase in the level of uncertainty over future emissions levels. Projections of emissions reflect this uncertainty, ranging from a 7 per cent decline in emissions between 1990 and 2010 in DG TREN's baseline ("with measures") projections, and a 2 per cent increase in emissions over the same period projected by the member States in the "with measures" scenario. The longer-term outlook provided by DG TREN's baseline ("with measures") projections shows an increasing emissions trend after 2010 as fuel prices evolve towards favouring coal. The review team noted that historical reductions and apparent decoupling of emissions may therefore be reversed in future in response to market forces, and concluded that additional policies and measures would be needed to address these trends.

62. Sustainability provisions may be built into the energy markets through inclusion of public service obligations on energy suppliers, and the EU Directive on Energy Services will also seek to incorporate energy demand measures into the market, although the review team was not informed of the expected efficacy of these provisions.

63. Power stations and refineries having combustion plant with a rated input of greater than 50 MW are subject to the IPPC Directive (see paragraph 82), which covers much of the electricity and the refineries sector, although climate change mitigation is not a major focus of this directive.

64. One of the strategy documents guiding policy in the energy sector is the Green Paper on Security of Energy Supply. In this document, it is recognized that the EU's external energy dependence is projected to reach 70 per cent by 2030 under current policies, and that 98 per cent of the transport market is currently dependent on oil. The Green Paper identifies priority areas for action: controlling the growth of demand through greater energy efficiency and improved energy market competition, as well as managing supply dependence through strengthening both internal and external supply options.

65. ***Renewable energy:*** A response to both climate change and energy security concerns has been the promotion of electricity generation from RES. The NC3 describes several of the programmes that have been used to support RES at the EU level. Key policy initiatives included a White Paper[13] in 1997, and the 2001 Directive on the Promotion of Electricity from Renewable Energy Sources. This directive sets a framework for renewable electricity to increase its share of consumption from current (2000) levels of 14.7 per cent, to a level of 22.1 per cent in 2010. The emission reduction potential is estimated *ex-ante* at 100–125 Mt CO_2 equivalent in 2010. The directive sets indicative targets for the proportion of RES for each member State, although the review team noted that effectiveness of the directive will depend largely on the details of its implementation. Member States have to transpose the directive into national law, and will be responsible for bringing forward concrete measures (e.g. green certificate schemes, feed-in tariffs, and other forms of subsidy) that will help promote RES to meet the target. In practice, a variety of measures is likely to be used by different member States, and the directive itself does not impose any such measures.

66. Although renewable electricity generation increased at a rate of 3.3 per cent per year between 1990 and 2000, the increase in electricity consumption over this period means that its share of consumption increased by a more modest 0.9 per cent per year. DG TREN's baseline ("with measures") scenario projects that the share of RES in the generating mix will increase at a rate of 1.7 per cent per year between 2000 and 2010. However, the review team noted that the share would need to increase at a much higher rate of over 4 per cent per year from 2000 levels in order to meet the target specified in the directive for 2010, suggesting the need for additional policies and measures. Progress is due to be reviewed in 2005.

67. ***Cogeneration:*** The Commission's cogeneration strategy sets an overall indicative target of doubling the share of electricity production from CHP in total EU electricity production from 9 per cent in 1994 to 18 per cent by 2010.[14] The review team noted that meeting this target will be challenging, given that the share of CHP generation in 2000 was 10.3 per cent, having declined slightly since 1998 because of unfavourable market conditions. A CHP directive, currently under decision, aims to contribute towards meeting this target by setting common definitions for CHP, and requiring member States to assess their national potential. The directive is estimated to have an emissions reduction potential of 65 Mt CO_2 equivalent by 2010. Member States' own projections estimate a reduction potential for CHP "with existing measures" of 28 Mt CO_2 equivalent, and a further 6 Mt CO_2 equivalent in the "with additional measures" scenario, which could include a range of measures from reducing market barriers (e.g. in relation to access to public electricity grids for CHP plants) to more direct subsidies and fiscal incentive schemes. Again, the directive itself does not impose any particular concrete measures on member States.

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13 EC document COM (1997) 599 final.

14 EC document COM (97) 514 final.

2. Energy demand

68. Emissions from energy use (excluding the transport sector) account for 31 per cent of total GHG emissions (excluding LUCF). They decreased by 4.1 per cent from 1990 to 2001.

69. The NC3 does not include energy demand data, which makes it difficult to evaluate the sectoral coverage of policies and measures. During the review team's visit, additional energy demand data were provided in the updated baseline energy projections.[15] In 2000, the domestic sector (of which two thirds was residential) accounted for 40 per cent of the total energy demand, transport for 32 per cent and industry for 28 per cent. Excluding transport, final energy demand increased by 6.7 per cent from 1990 to 2000 and is projected to increase by 11.3 per cent from 2000 to 2010.

70. Improving energy efficiency in industry and buildings has a large potential for reducing GHG emissions (214–259 Mt CO_2 equivalent). The Directive on the Energy Performance of Buildings (Directive 2002/91/EC) introduces a common methodology for calculating the energy performance of large buildings (more than 1,000 m^2); minimum standards for energy performance (applicable to new buildings and major renovations); a system of building certification; and an inspection programme on energy efficiency and GHG emissions for boilers and air conditioning systems. The review team noted that the overall effectiveness of this directive will largely depend on the methodology chosen to evaluate the energy performance of buildings, and that the directive does not cover large sources of potential savings, including existing floor space and smaller buildings.

71. The Directive on Energy Labelling (Directive 92/75/EC) and subsequent implementation measures stipulate minimum efficiency standards for many categories of consumer appliance. Envisaged revisions to the directive (to include refrigerators, freezers and dishwashers) have the potential to reduce emissions by 10 Mt CO_2 equivalent, and planned new labels for water heaters have a potential of 23 Mt CO_2 equivalent. These market-push measures are designed to work in tandem with voluntary market-pull measures such as Energy Star to promote a continual increase in product efficiency over time.

72. Realization of these demand-side reduction potentials will require close monitoring of the effectiveness of implementation, and periodic review of the policy design. The review team noted that legislative delays, methodologies applied and actual implementation at the member State level could substantially reduce the effectiveness of these policies and measures. For example, the review team was informed that the Directive on Energy Services would not achieve its potential reductions in 2010 as a result of legislative delays in the European Parliament.

73. The review team found that, despite the large potential reduction in GHG emissions reported for policies and measures addressing energy demand (see table 8), the NC3 and presentations during the visit to Brussels focused much less on this sector than on many others with considerably less reduction potential. Additional information and detailed descriptions of the policies and measures in this area would be beneficial in future communications, especially a breakdown of different strategies used to address the distinct informational needs of energy users in the residential and commercial sectors.

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[15] European Commission (2003). *European Energy and Transport Trends to 2030.*

Table 8: ECCP emission reduction potentials for policies and measures on energy demand in 2010

Policy/measure	Reduction potential in 2010 (Mt CO_2 equivalent)	Policy/measure	Reduction potential in 2010 (Mt CO_2 equivalent)
Buildings Directive	35–45	Directive on Energy Services	40–55
Labelling Directive	54	Motor challenge	30
Voluntary agreements	30–35	Public procurement	25–40

Source: ECCP.

D. Transport

74. Emissions from transport, mainly road transport, contributed 21.0 per cent of total GHG emissions (excluding LUCF) in 2001. Emissions increased strongly, by 21.3 per cent, between 1990 and 2001. Transport statistics for 1990–2001 show an unbroken growth trend in transport activity and a modal shift from rail and maritime transport towards road transport and aviation. In particular, road freight transport (+43 per cent) and aviation (+82 per cent) grew faster than GDP, while road passenger transport grew by 20 per cent. Projections under the "with existing measures" scenario indicate a continued rise in sectoral emissions of 34 per cent by 2010, compared to 1990, again propelled by strong growth in road transport and aviation.

75. The review team was unable to analyse the drivers and key factors behind these trends because of incomplete information. During the visit to Brussels, a representative from Eurostat provided the review team with an overview on the System of Community Transport Statistics (SCTS), and its shortcomings in statistical coverage. The review team noted that due to a lack in EU-wide regulation for road passenger transport statistics, data on this most important mode of transport is not systematically included. It was informed that a EUR 35 million project proposal to consolidate SCTS was under consideration in 2004.

76. The most important climate policy in this sector consists of three voluntary agreements with the European, Japanese and Korean car manufacturers (ACEA/JAMA/KAMA). These agreements aim at reducing average specific CO_2 emissions from newly registered passenger cars to 140 g/km by 2008/09. The mitigation effect is estimated at 75–80 Mt CO_2 equivalent in 2010. The agreement is monitored through yearly reports. Results of the 2004 monitoring report suggest that additional efforts need to be made in order to achieve the target by 2010 at the latest.

77. Various measures were investigated by the ECCP, and a Directive on the Promotion of Biofuels for Transport was adopted by the European Commission in October 2001. This legislation requires that an increasing proportion of all diesel and petrol sold in the member States be biofuels, starting with 2 per cent in 2005 and progressively increasing to reach a minimum of 5.75 per cent of fuels sold in 2010. It is estimated to reduce GHG emissions by 35–40 Mt CO_2 equivalent in 2010. At the same time, a policy for shifting the balance between modes of transport, in particular towards rail transport, was put in place. A proposal on infrastructure charging (40–60 Mt CO_2 savings potential) has been under discussion in the legislative process since 2000.

78. Further to the fiscal measures described in paragraph 58, the Commission is also considering a number of other proposals to further harmonize taxation in the transport sector. In 2002 a proposal on the taxation of fuel used by road hauliers was introduced, which would move towards a unified rate for heavy trucks across the EU by 2010. The proposal is currently under negotiation. A further communication from the Commission in 2002 suggested ways in which vehicle taxation could be restructured by member States to reflect CO_2 emissions, and the Commission is to consider introducing a new directive on this. The review team was not informed of the expected mitigation impacts of these implemented and proposed fiscal measures.

79. In contrast to the overall trend, emissions from transport in the United Kingdom and Germany have been declining recently – and Finland returned to its 1990 emission levels in 2000. The review

team noted that a combination of improved fuel efficiency, higher fuel prices and broader transport policies in these member States might have contributed to this effect. The team also noted that achieving sustainable transport was taken up as one of the priority areas in the Commission's future cohesion policy, in reaction to the concern that new member States might repeat the experience of Greece, Ireland, Portugal and Spain: high economic growth accompanied by strong growth in GHG emissions from transport.

E. Industry

80. Energy-related GHG emissions from manufacturing industries and construction contributed 14.5 per cent of total GHG emissions (excluding LUCF) in 2001. Emissions decreased by 9 per cent between 1990 and 2001. Most of this reduction was already achieved by 1993, and was largely due to efficiency improvements and structural change in Germany following reunification, together with overall low levels of economic activity during this period. Emissions have remained stable since 1993, but activity levels as measured by gross value added (GVA) increased by 13 per cent relative to 1990. Emissions of CO_2 per unit of output have declined in most of the major emitting sectors, including iron and steel, minerals, chemicals and food industries.

81. Under the DG TREN baseline scenario, emissions are projected to decline by a further 10 per cent between 2000 and 2010, while output as measured by GVA is projected to increase by 26 per cent over the same period. The review team noted that the industrial sector was one of the few where the decoupling of emissions from activity looked set to continue.

82. The sector is subject to several of the cross-cutting policies described in previous sections. In addition, many industrial subsectors are covered by the IPPC Directive. This includes a mandatory permitting procedure to be enforced by member States, requiring installations covered by the directive to report on emissions of a range of pollutants and also requiring them to follow best available techniques for environmental protection. Although climate change mitigation is not its primary focus, the IPPC Directive includes the promotion of energy efficiency and control of certain GHGs.

83. Emissions from industrial processes contributed 6.1 per cent of total GHG emissions (excluding LUCF) in 2001. Key non-energy emissions in 2001 included emissions of CO_2 from cement (3 per cent of total emissions), N_2O from chemicals (1.2 per cent of total emissions), and fluorinated gases (1.4 per cent of total emissions).

84. Emissions from industrial processes declined by 16.8 per cent between 1990 and 2001, mostly as a result of measures to reduce the emission of N_2O from the manufacture of adipic acid, which saved 57 Mt CO_2 equivalent between 1990 and 2001. There was also a reduction in the emission of HFCs as a result of technical improvements in the manufacture of halocarbons, saving 20 Mt CO_2 equivalent between 1990 and 2001.

85. The review team noted that these reductions have been offset to some extent by an increase in the emissions of HFC associated with increasing consumption of HFCs as a replacement for ozone-depleting substances (see paragraph 39). The "with measures" projections of member States indicate an overall decline in emissions from industrial processes of 2 per cent between the base year and 2010, although, within this, they project an increase of 98 per cent for fluorinated gases over the same period.

86. A response to this trend was the introduction in 2003 of proposals for a regulation on the emission of fluorinated gases, which aims to introduce measures on containment and recovery of gases, requirements on data reporting, and restrictions on the marketing and use of fluorinated gases. The regulation is estimated to have an emissions reduction potential of 23 Mt CO_2 equivalent.

F. Agriculture

87. Since 1990, agriculture and fisheries have maintained their share in GVA, although at a low value of less than 3 per cent. Nevertheless, around 40 per cent of the total EU budget is spent on this sector. Emissions of GHGs from agriculture contributed 9.7 per cent of total GHG emissions (excluding LUCF) in 2001. Emissions decreased by 7.7 per cent between 1990 and 2001. The main GHG sources in agriculture are N_2O from soils, CH_4 from enteric fermentation, and CH_4 and N_2O from manure management. Agricultural land use and the use of fertilizers is continuously decreasing in the EU, and the composition of livestock is shifting from cattle to pigs and poultry.

88. Several policies and measures in the agricultural sector could directly or indirectly affect GHG emissions or removals. The Common Agricultural Policy (CAP), adopted in 1992, and reforms in agricultural policy under Agenda 2000, are the main policies and measures in this sector. The reduction in GHGs caused by the CAP market policies is estimated to be 28 Mt CO_2 equivalent in 2010. The CAP has already considerably reduced the GHG emissions from this sector, mainly as a result of an increase in livestock productivity, a decrease in livestock population, changes in livestock types, and changes in agricultural practices. The new CAP, adopted in 1999, includes a number of relevant measures, including support schemes for sustainable rural development, investment in agricultural holdings and training for farmers.

89. In 2003, common rules for direct support schemes under the CAP and establishing certain support schemes for farmers (carbon credit for energy crops) and a support scheme for rural development through the European Agricultural Guidance and Guarantee Fund (EAGGF) were adopted. The related mitigation effect has not been reported. The agricultural working group under the ECCP has identified further reduction potential for agricultural activities of 12 Mt CO_2 equivalent.

G. Forestry

90. Net removals of CO_2 by LUCF have increased by 6 per cent since 1990; in 2001 they amounted to 141,219 Gg CO_2 or 5 per cent of total GHG emissions (excluding LUCF). The review team noted that reported aggregate estimates of the member States from activities under Articles 3.3 and 3.4 of the Kyoto Protocol would represent a net sequestration of about 31 Mt CO_2 per year. This amount is composed of about 26 Mt CO_2 equivalent emissions per year for afforestation, reforestation and deforestation and about 5 Mt for forest management. These activities could substantially help some member States, including Ireland, Spain, and Portugal, to meet their Kyoto commitments.

91. Several policies and measures in the forestry sector directly or indirectly affect GHG emissions or removals. The EU Forestry Strategy aims at the protection and sustainable management and development of forests. Other relevant policies include the prevention of forest fires, protection of forests against atmospheric pollution, the Integrated Sink Enhancement Assessment (INSEA) Programme, and agricultural and forest research. The related mitigation effect has not been reported.

92. The working group on renewable raw materials under the ECCP identified a sequestration potential of 33 Mt CO_2 equivalent in forestry-related soils and 60–70 Mt CO_2 equivalent in agricultural soils in 2010.

H. Waste management

93. GHG emissions from waste management contributed 2.5 per cent of total GHG emissions (excluding LUCF) in 2001. Emissions decreased by 24.1 per cent between 1990 and 2001, and a continued decrease by 51 per cent is projected in the "with measures" scenario for the period 1990–2010.

94. Important sectoral policies and measures include the 1999 Landfill Directive, with an estimated reduction effect of 41 Mt CO_2 equivalent in 2010, and the Directive on Packaging and Packaging Waste.

Further directives to be implemented by the member States include those on end-of-life vehicles and on waste electrical and electronic equipment, and the thematic strategy on waste prevention and recycling. The related mitigation effect has not been reported.

IV. PROJECTIONS AND THE TOTAL EFFECT OF POLICIES AND MEASURES

A. Preparation of projections

95. ***Institutional framework:*** DG ENV is responsible for coordinating the preparation of projections for the NC3. The NC3 projections were based on a two-year background study[16] compiled by three European research institutions, including ECOFYS Energy and Environment (the Netherlands), AEA Technology Environment (United Kingdom), and the National Technical University of Athens (Greece). The study resulted in both a bottom-up (with the GENESIS database) and a top-down (with the PRIMES model) analysis of the allocation of objectives for different sectors and GHGs that would enable the EU to meet its Kyoto target at least cost. Baseline projection for CO_2 emissions were based on the top-down analysis of the 1999 study "European Union Energy Outlook 2020".[17]

96. During the visit to Brussels, the review team was provided with a new set of projections prepared by EEA in 2003, hereinafter called the "2003 projections". Projections are updated and improved on an annual cycle for all sectors, in the context of the monitoring mechanism (paragraph 45).

97. ***Coverage:*** The NC3 projections cover the period to 2010. Broadly, information was reported on a gas-by-gas basis for all sectors according to the IPCC categorization, except for LUCF. All GHGs, including CO_2, CH_4, N_2O and fluorinated gases, were reported. Also, a list of those common and coordinated policies and measures that were included in the NC3 projections was presented.

98. ***Compliance with the guidelines:*** The reporting of projections conformed to some extent with the UNFCCC guidelines. Aggregated emissions expressed in CO_2 equivalent using the global warning potential (GWP) were presented for the base year and for 2010 by gas and by sector. Longer-term trends until 2020 were not reported.[18] The emission figures in the tables seemed complete, and one graphical presentation of energy-related CO_2 emission trends was included. The review team noted that projections of emissions from LUCF[19] and the estimated and expected total effect of policies and measures were not reported.[20] Emissions from international aviation and marine transport were not reported separately from domestic transport. A sensitivity analysis was not performed. Because of the incomplete reporting on projections, the review team was unable to assess the total effect of EU-wide common and coordinated policies and measures. It encouraged the Party to follow the relevant provisions of the UNFCCC reporting guidelines more closely.

B. Scenarios, models and assumptions underlying future emission trends

99. ***Scenarios:*** A "with measures" scenario, which included adopted and implemented measures, was reported in the NC3. No "without measures" scenario or "with additional measures" scenario was reported. However, total reduction potentials for additional EU-wide common and coordinated policies and measures were reported at an aggregate level by gas. The 2003 projections included a "with measures" and a "with additional measures" scenario.

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16 ECOFYS et al. (2001). *Economic Evaluation of Sectoral Emission Reduction Objectives for Climate Change.*

17 <http://europa.eu.int/comm/energy/en/etf_2_en.html>.

18 See paragraphs 37 and 48 of the UNFCCC reporting guidelines.

19 See paragraphs 34 and 35 of the UNFCCC reporting guidelines.

20 See paragraphs 39 and 40 of the UNFCCC reporting guidelines and item V.B of its annex.

100. ***Methodology:*** The background study combined a top-down and a bottom-up methodological approach (see paragraph 95). The approaches complement each other, helping to increase the understanding of different cost-effective mitigation options.

101. The top-down approach of the PRIMES model analysed all energy-related mitigation options simultaneously, making it difficult to separate distinct policy options. Technology development was modelled in lesser detail than in the bottom-up approach. However, the advantage of the top-down approach was a consistent treatment of all countries by one methodology. The PRIMES models was retained for the 2003 projections, but with a slightly revised set of assumptions (see table 9).

Table 9. Key assumptions for the NC3 and 2003 projections

	NC3 projections	2003 projections
Annual population growth (%)	0.2 (during 1995-2010)	"slight increase"
World crude oil prices (USD of 1990 per barrel) in 2010	16.9	~ 20
Gas import prices (USD of 1990 per barrel oil equivalent)	15.2	~ 17
GDP growth during 2000–2010	2.3–2.5	2.4
Annual growth in passenger travel (%) 1995–2010	1.6	"higher growth than NC3"

102. The bottom-up approach identified different technological options for the reduction of GHG emissions, their investment and operation costs, and their specific costs per tonne of CO_2 equivalent. The advantage of this approach was a high degree of transparency in the options for reducing GHG emissions. However, it did not provide for a dynamic analysis of simultaneous or behavioural changes in energy demand and supply, as was the case with the PRIMES model.

103. ***Comparison with the NC2 projections:*** The emission projections in the NC3 differ in scope and methodology from those presented in the NC2. The NC2 projections were limited to CO_2 and were basically a compilation of member States' "with measures" projections. The review team noted that the methodology used for the NC3 projections marks a clear step forward, since the application of the PRIMES model enabled EU-wide, cross-country modelling. However, the complete lack of information on projected trends at the member State level, as was provided by the NC2, was seen as a backward step, because the review team was not able to review the consistency of the aggregated figures presented in the NC3 with the projections of individual member States.

104. ***Assumptions underlying future emission trends:*** Table 9 summarizes key assumptions for the NC3 and 2003 projections relating to energy prices and growth in GDP, population and transport activity. The NC3 did not elaborate on the assumptions on technological progress in the projections, except for the ACEA agreement (see paragraph 76) which was assumed to be successfully achieved in 2008. Policy assumptions were reported and include progress in energy market liberalization, restructuring in the power sector towards higher energy efficiency and lower carbon fuels (natural gas), and continued promotion of RES. The different policies of member States on nuclear energy were also taken into account. Overall, there was an upward revision of energy prices in the 2003 projections compared to the NC3 projections.

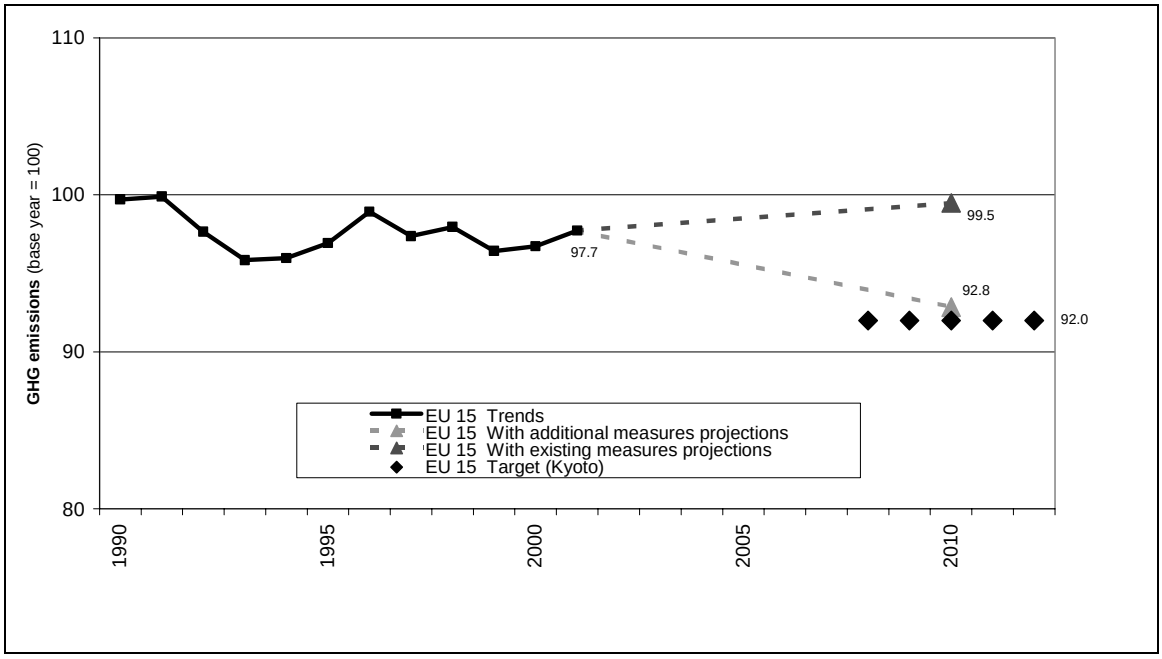
105. The review team noted that despite the evident progress made in reporting on GHG emission projections, transparency and completeness could be further improved in some areas, including underlying input assumptions, methodologies used, and the link between individual and total effects of policies and measures (both at the member State and the EU level) and the projected scenarios.

C. Results of projections

106. ***Results:*** On a "with measures" basis, total annual GHG emissions are estimated in the 2003 projections to decline by 0.5 per cent, from 4,123.3 Mt CO_2 equivalent in the base year to 4,102.3 Mt CO_2 equivalent in 2010. On a "with additional measures" basis, they are estimated to decline by 7.2 per cent, to 3,828.3 Mt CO_2 equivalent in 2010. The Kyoto target implied by the EU burden-sharing

agreement (see paragraph 12) was reported as 3,773.8 Mt CO_2 equivalent in 2010. The resulting reduction gaps for 2010 were reported as 328.5 Mt CO_2 equivalent in the "with measures" scenario, and 54.5 Mt CO_2 equivalent in the "with additional measures" scenario (see figure 2 and table 10).

Figure 2: Projections of total GHG emissions and EU-15's Kyoto target (aggregated projections of EU member States)



Source: EEA 2003

Table 10. Emissions in 2010 as estimated in the NC3 and 2003 projections (Mt CO_2 equivalent)

	NC3 WM projections	NC3 "Potential for additional measures"	2003 WM projections	2003 WAM projections
Base year emissions[a]	4 138	4 138	4 123.3	4 123.3
Emissions in 2010	4 190	3 950	4 102.3	3 828.3
Kyoto target	3 807	3 807	3 773.8	3 773.8
Gap	383	143	328.5	54.5
Base line growth 1990–2010	NA	NA	NA	NA
Total effect of policies and measures	NA	NA	NA	NA

[a] Base year emissions differ from 1990 total GHG emissions (see table 2), because 1995 was chosen as the base year for fluorinated gases.
NA = not available.

107. The estimated gap is considerably smaller (by 14.2 per cent) in the 2003 projections than in the NC3 projections. On a "with measures" basis, total annual GHG emissions were estimated in the NC3 projections to rise by 1.3 per cent, from 4,138 Mt CO_2 equivalent in the base year to 4,190 Mt CO_2 equivalent in 2010. The resulting reduction gaps for the NC3 projections can be calculated as 383 Mt CO_2 equivalent. Additional measures were estimated to have the potential to reduce this gap to 143 Mt CO_2 equivalent. Because of incomplete information on the total effect of policies and measures and on drivers and key factors behind the emission trends, the review team was unable to analyse these differences.

108. ***Technical mitigation potential of policies and measures:*** Updated estimates of the technical potential of new policies and measures were also provided during the review team's visit (see table 11). The total reduction potential for EU policies and measures "currently in implementation" is estimated at 350–430 Mt CO_2 equivalent in 2010.

109. As noted in the second review of the ECCP, the ex ante ECCP evaluation of the potential of a certain measure does not necessarily coincide with its actual realization in the field. In addition, the estimated potentials are based on reaching certain indicative targets, which might not materialize in practice. Thus, the effectiveness of policies and measures needs to be monitored closely, so that they can be reviewed if appropriate. The review team was informed during the visit that an evaluation of policies and measures "as implemented" is expected in 2005 based on information provided by member States under the new monitoring mechanism, and encourages this type of reporting in future communications.

Table 11: Emission reduction potentials for new policies and measures in 2010

Sector	Reduction potential in 2010 (Mt CO_2 equivalent)	Sector	Reduction potential in 2010 (Mt CO_2 equivalent)
Cross-cutting	NA	Waste	41
Energy supply	236–278	Agriculture	12
Energy demand	214–259	Sinks (forest-related)	33
Transport (incl. voluntary)	152–185	Sinks (agriculture-related)	60–70
Industry	23		

Source: ECCP 2004.
NA = not available.

110. ***Discussion of EC projections:*** The review team noted that the EC, as a supra-national body, faces a number of special difficulties in developing its emission projections and estimating expected effects of policies and measures. Additional dimensions, not experienced by individual country Parties, interfere in the analysis and in reporting. These difficulties are related to the climate policy-making process in the EU, where both individual and common and coordinated policies and measures are planned, adopted and implemented at various political levels. Also, EU directives are often implemented differently in the member States, leading to differences in the size and timing of expected mitigation effects. Furthermore, the need to differentiate between the two categories of policies and measures undoubtedly creates methodological difficulties, as both are interrelated and overlapping to some extent. The review team acknowledges these problems, but nevertheless encourages the EC to continue its efforts to create more consistent, transparent, comparable, accurate and complete information on the EU-wide GHG emissions trends, and on the contribution of member State and EU-wide policy initiatives to the overall mitigation effect achieved.

111. The review team noted that in the context of the new EU monitoring mechanism (see paragraph 44), institutional arrangements with regard to the development and reporting of projections are currently being improved, and that future communications might benefit, especially in the field of qualitative and quantitative assessments of policies and measures and the resulting projected emissions trends. In the implementation process of the monitoring mechanism, special emphasis will be given to harmonization of projections methodologies in all member States and unification of the reporting format.

V. VULNERABILITY ASSESSMENT, CLIMATE CHANGE IMPACTS AND ADAPTATION MEASURES

112. ***Reporting:*** The NC3 includes information on the expected impacts of climate change in Europe, and a summary vulnerability assessment for 12 sectors, including water resources, soil and land resources, ecosystems, coastal zones, mountain regions, forestry, agriculture, fisheries, insurance, transport, energy and other industries, tourism and recreation, and human health. It also reports briefly on adaptation options in these sectors.

113. This section of the NC3 is based on the European ACACIA Project Report, published in 2000 by the European Commission. This report was funded by the Environment Programme of DG RESEARCH and also provided the basis for the chapter on the effects of climate change in Europe in the 2001 Third Assessment Report of the IPCC. It was compiled by a group of 27 European scientific

experts, many of whom are authors of the IPCC working group II. During the visit to Brussels, the review team was provided with an updated EEA report on impact assessments.[21]

114. ***Impact assessment:*** Patterns from recent climate modelling indicate a continued increase in temperature, with temperatures in Europe rising by 0.1–0.4 °C every decade; most warming is expected to occur in southern and north-eastern Europe. Annual precipitation in northern Europe is expected to increase over the coming decades, while slight decreases are expected in southern Europe. Sea levels are projected to rise by 13–68 cm by the 2050s.

115. ***Vulnerability assessment:*** Negative impacts on all sectors were identified, including water shortage or floods, storm damage, soil erosion, disappearance of glaciers and permafrost, and fire risk for forestry. Infrastructures are expected to suffer from the impacts of climate change because of floods and landslides.

116. ***Adaptation options:*** The identified options related to impacts and adaptation, as reported in the NC3, focus on increasing the understanding of impacts and vulnerability through intensive research. Concrete steps towards implementing adaptation policies were not reported. The review team noted that only a few member States have examined the need to reduce vulnerability and to increase their resilience to the effects of climate change.

117. ***Financial support for adaptation:*** During the visit to Brussels, the review team was provided with new information on the financial support for developing countries to study the impacts of climate change, and their vulnerability and adaptation to it. One example is the "Asia Pro Eco" Programme, which will promote adoption of environmentally sound practices and integration of environmental concerns, including climate change, into urban and related rural and coastal activities, and will encourage long-term sustainable investments and trade between the EU and Asia. Furthermore, the team was informed about plans to adopt an action plan on climate change and development in the near future.

118. ***Research needs:*** Representatives of the Commission underlined the need for further research on the quantitative assessment of climate change impacts, vulnerability and adaptation, and indicated some priority for this research in the future ECCP.

VI. FINANCIAL RESOURCES AND TRANSFER OF TECHNOLOGY

119. ***Institutional framework:*** The NC3 describes the institutional arrangements relating to financial assistance and technology transfer in detail, and describes actions taken by the EC in providing financial assistance and facilitating technology transfer relating to climate change through multilateral development institutions and bilateral cooperation with developing countries.

120. ***Regional assistance:*** The EC provided financial resources for major cooperation programmes with central and eastern European States (PHARE programme), and with developing countries through different channels. These programmes cover a broad range of topics, including energy efficiency and clean energy technologies, RES, and other activities with mitigation effects in the fields of environment, agriculture and forestry. The EC also provided co-finance for Global Environment Fund (GEF) projects. The review team noted that financial support for activities relating to climate change has been increasing in the reporting period. The EC budget for activities related to climate change was EUR 1,227 million on average during 1986–1998, EUR 1,065 million in 1997, and EUR 1,936 million in 1998, indicating a significant increase.

121. ***Assistance through bilateral and multilateral channels:*** Additional financial resources were provided to central and eastern European States and developing countries, through bilateral and

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[21] EEA Report No 2/2004. *Impacts of Europe's changing climate.*

multilateral channels and on a grant or commercial basis, for a broad range of topics, including energy efficiency and clean energy technologies, RES, and other projects with mitigation effects in the fields of environment, agriculture and forestry.

122. ***Bilateral and multilateral partnerships:*** The review team was informed that financial support to developing countries for addressing climate change will continue to increase in the near future. One example is the "Asia Pro Eco" Programme, in which 17 Asian countries and all member States are eligible to participate. The EC will provide a total contribution of EUR 31.5 million during the five-year implementation period (2002–2006).

123. ***EC strategy on development cooperation:*** The Commission has laid down strategic thoughts with respect to the role of cooperation with other countries in the context of global climate change. The emphasis of Community development cooperation is to reduce poverty through fostering sustainable development. Current activities directly supporting the objectives of the UNFCCC funded by the EC concentrate on capacity-building. The EC economic and development cooperation and other financing instruments support actions in many other sectors (e.g. energy, transport, waste management, agriculture, forestry) that would have a direct bearing on the objectives of the UNFCCC. The EC will therefore consider further integrating climate change objectives into its cooperation policies. The review team was informed that identifying country-specific needs and increased dialogue on climate change are seen as the most important challenges in the EC's cooperation with developing countries.

124. ***Compliance with the UNFCCC reporting guidelines:*** The review team noted that the mitigation and adaptation components of funded projects and activities have not been quantified.[22] The team also noted that the NC3 does not specify what part of the resources was "new and additional".[23] Therefore, the review team was unable to draw a clear conclusion of the financial resources contributed by the Community to developing countries for the activities specified under Article 4.3, 4.4 and 4.5 of the Kyoto Protocol. The team further noted that the NC3 does not provide information, in textual format, on steps taken by the EC to promote, facilitate and finance the transfer of technology, or to support development and enhancement of endogenous capacities and technologies of developing countries, as required by the guidelines.[24] However, five examples of technology transfer projects were reported in tabular format, covering electricity generation, energy efficiency, bio-energy and solar energy in Asia, Latin America and Africa, from 1989 to 2002. Impacts on GHG emissions or sinks of these five examples were not reported.

VII. RESEARCH AND SYSTEMATIC OBSERVATION

125. ***Reporting:*** The NC3 section on research and systematic observation provides an overview of the institutional arrangements for funding of EU-wide activities on research and systematic observation. Some research highlights are presented in the fields of climate process and climate system studies, climate modelling and scenario analysis, socio-economic research, and mitigation and adaptation technologies. Future priorities for research, as indicated by the working group on research under the ECCP, are listed. Furthermore, activities in the field of systematic observation are presented for meteorological and atmospheric observation, oceanographic observation, terrestrial observation and space-based observation programmes.

126. ***Research and technology development (RTD):*** The EU has provided EUR 800 million of funding for research and development of non-nuclear sustainable energy through the 6th Framework Programme for Research, which puts more emphasis on sustainability goals than the previous 5th Framework Programme. Of this amount, approximately half is reserved for demonstration projects,

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22 See paragraph 52 and table 5 of the UNFCCC reporting guidelines.
23 See paragraph 51 of the UNFCCC reporting guidelines and item VII.A of its annexes.
24 See paragraph 56 of the UNFCCC reporting guidelines.

administered by DG TREN. The other half is administered by DG RESEARCH, and comprises approximately EUR 200 million for research and development of new renewable electricity generation technologies, and EUR 200 million for hydrogen, carbon capture and storage, and fuel cell technologies. The review team noted that RTD expenditure on technologies for demand-side applications, including transport, is relatively limited in comparison with supply-side technology research. DG RESEARCH has also developed policy support tools and models which have been used in the development of climate-related policy.

127. ***Systematic observation:*** The review team noted that there is currently no overall EU approach to climate observation systems, although various elements of the 6th Framework Programme contribute to global observation systems. A major expansion programme is planned in a joint initiative with the European Space Agency, to provide a capacity for global monitoring of environment and security (GMES). The first phase of GMES is to be completed by 2008, with further major investment planned over the next two decades. GMES is planned to develop around three strands of action: the supply of information relevant to policy-makers and users, improved efficiency of information delivery, and the development of networks of monitoring infrastructures. The EU provides input to meteorological and atmospheric observation through its Global Atmosphere Watch regional network. There are currently no direct contributions to the GCOS Surface Network, or the GCOS Upper Air Network. The EU does, however, participate in a number of other international observation initiatives covering oceanographic, terrestrial and space-based programmes.

VIII. EDUCATION, TRAINING AND PUBLIC AWARENESS

128. ***Public information and awareness:*** The European Commission is committed to the principles of open government and provides large amount of information to the public in a number of forms. Activities in these areas are focused on public awareness, while most activities in education and training are developed at member State level. The EU has developed a community information policy (CIP) in relation to the environment and climate change, which has the objectives of promoting the results of Community policies, informing about proposals and actions, ensuring transparency and encouraging debate and partnership. The EU uses the following channels and tools under the CIP to provide coverage of climate change issues and respond to them: an information centre, an Internet site, a publication programme including special magazines (for example the 2002 “EU Focus on Climate Change”), relationships and cooperation with the press and audiovisual sectors, cooperation with business, NGOs and networks to disseminate information and other activities, as well as grants to awareness-raising projects and conferences (for example “The Future of the Kyoto Protocol beyond 2012”, during the Green Week in 2004).

129. ***Education and training:*** In 1999 the Commission reviewed its activities in environmental education and training (EET) and produced a number of conclusions and policy recommendations, referring to future activities and including management of networks, stimulation of innovations and professional development, external integration of EET in new areas, establishing minimum standards and guidelines. Key policy recommendations included integrating and clarifying the role of EET in the next Environmental Action Plan and formulating a special programme to assist accession countries and the public in these countries.

130. ***Public participation:*** Public participation in addressing climate change takes place through a number of environmental and business NGOs. The review team noted that consultation processes could be improved, for example by regular participation of NGO representatives in the process of preparing the EC national communications.

IX. CONCLUSIONS

131. The review of the third communication of the European Community and the additional information provided during the visit to Brussels led the review team to conclude that the EC's NC3 is a comprehensive document, reflecting all important aspects of the EU's climate change policy at the time it was prepared and published. It focuses on EU-wide common and coordinated policies and measures, as the activities of individual member States are described in their own communications. The review team noted that there are no major gaps and that the document conformed with the UNFCCC reporting guidelines. It acknowledged the enhanced comprehensiveness and transparency in the information reported in the NC3 compared to the previous communication.

132. Reporting on the progress made in implementing the Convention and its Kyoto Protocol benefits greatly from the monitoring mechanism of the ECCP. It triggers a number of background documents and regular progress reports on important aspects of EU climate policy, including the analysis of GHG emission trends and projections in the EU. Based on this information, each year the Commission prepares a progress evaluation report for the European Parliament which assesses whether the actual and projected progress of member States is sufficient to ensure fulfilment of the EC's commitments under the UNFCCC and the Kyoto Protocol. The review team noted with appreciation this recent increased attention to monitoring and evaluation. Still, the review team identified some potential for improvement of reporting, for example in relation to cross-cutting issues in the GHG inventory (see paragraph 26), longer-term effects of policies and measures (see paragraph 42), estimates of uncertainty in GHG emission projections and total effect of policies and measures (see paragraph 98), and the mitigation and adaptation components of financial support projects and activities (see paragraph 124).

133. In the context of the Convention's aim of returning the GHG emissions of Annex I Parties to their 1990 levels, the review team noted that the EC contributed to achieving this aim, as its total GHG emissions decreased by 3.3 per cent in the period from 1990 to 2000 (without CO_2 from LUCF), and by 3.8 per cent if CO_2 from LUCF is considered. The main reasons for these reductions in GHG emissions were a fuel switch from coal to natural gas in the energy mix for electricity generation and a restructuring of industry in eastern Germany. The review team noted that, although there have been promising trends in some sectors, including waste management and industrial processes, an overall decoupling of emissions from economic growth is not yet proven. The strong growth in emissions from fuel combustion in transport was of particular concern. The review team was unable to ascertain to what extent EU-wide common and coordinated policies and measures helped to reduce the overall GHG emissions. However, it noted the large reduction potential of 578–696 Mt CO_2 equivalent in 2010 that was estimated for a set of cost-effective policy options identified in the context of the ECCP (see paragraph 49).

134. The EC signed the Kyoto Protocol in April 1998 and ratified it jointly with its 15 member States in May 2002. Its target under the Kyoto Protocol is to keep total GHG emissions during the first commitment period (2008–2012) below 92 per cent of the 1990 level. Results of most recent projections suggest that this target can be achieved only if additional policies and measures are implemented. Also, a number of EU member States will need to make use of the flexibility mechanisms of the Kyoto Protocol (JI and CDM) in order to meet their target under the EU burden-sharing agreement.

135. Important new policy developments occurred between the NC2 and NC3, and also after the publication of the NC3. A number of EU directives were adopted, including those on the taxation of energy products, on integrated pollution prevention and control (IPPC), on the promotion of biofuels and electricity generation from renewable energy sources, on the promotion of co-generation, and on land-filling. Also, the Green Paper on Security of Energy Supply, new rules under the Common Agricultural Policy, and the voluntary agreements with car manufacturers are expected to have a

noticeable impact on EU-wide emission trends. Further regulations are planned or proposed, including those on fluorinated gases, and on further harmonization of taxation in the transport sector.

136. Some of the policy approaches of the EU have been innovative, such as the recent implementation of the EU emissions trading system. The review team recognized the potential strengths of the EU-ETS, and the bold move by the EU to put this new market-based mechanism at the centre of its climate policy. The EU-ETS allows companies to use credits from project-based mechanisms under the Kyoto Protocol (JI and CDM), to help them comply with their obligations under the scheme. Furthermore, it is open to linking with compatible emissions trading schemes of other Annex I Parties that are also Parties to the Kyoto Protocol. The review team noted that this linking of mechanisms and schemes is a strength of the EU-ETS, since it provides a cost-effective means for EU-based industries to reduce their GHG emissions, improves liquidity of the trading market, encourages international cooperation and transfer of technology, and could therefore fulfil an important role in the international climate change process. The review team noted with appreciation that the EU will want to share with all interested parties and stakeholders the invaluable information on experience gained during the setting up of the scheme.

137. Beyond climate policy-making, the EU is among the main actors in advancing the scientific understanding of climate change, its implications and the spectrum of response options, through a broad set of research and development activities. Patterns from recent climate modelling indicate a continued increase in temperature, with temperatures in Europe rising by 0.1–0.4 °C every decade. Most of the knowledge and experience gained are made publicly available, in order to support and accelerate the achievement of the long-term objective of the Convention. The EU Strategy for Sustainable Development translates and clarifies this objective as: limit global warming to less than 2 °C above pre-industrial levels in the long term.

138. The emphasis of EU development cooperation is to reduce poverty through fostering sustainable development. Current activities directly supporting the objectives of the UNFCCC funded by the EC concentrate on capacity-building. The review team acknowledged the EU's contribution to international cooperation on climate change by providing developing countries in all parts of the world with technical and financial support.

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