Topic report | 10/2001

European Community and Member States greenhouse gas emission trends 1990–99

August 2001

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Summary

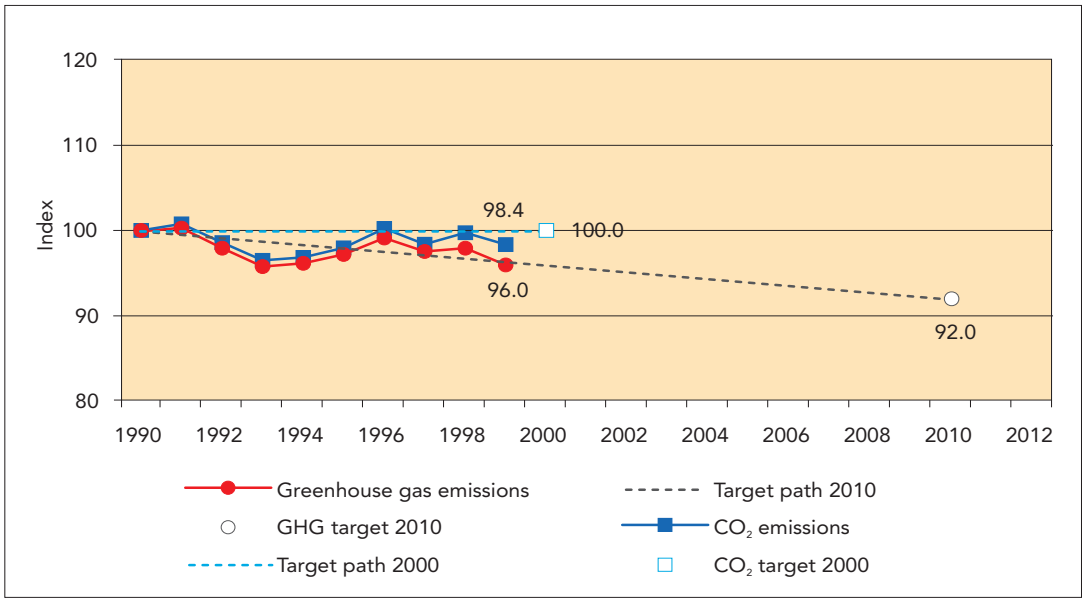
The purpose of this report is to identify progress of the European Community as a whole towards fulfilling its greenhouse gas emission commitments under the UNFCCC and the Kyoto Protocol and the contribution of each Member State to the EC targets (distance-to-target assessment). In addition, the main greenhouse gas sources (key source emission categories) and their underlying socioeconomic driving forces are identified at Community level (sectoral assessment). Finally, emission trends of the Member States are analysed and some main explanations for these trends are provided, either socioeconomic developments or policies and measures (policy-effectiveness assessment).

Distance-to-target assessment

The European Community achieved a reduction in greenhouse gas emissions in 1999 compared to 1998. In 1999, total EU-15 greenhouse gas emissions were 4 030 Tg (CO_2 equivalents), which was 2 % below 1998 and 4 % below 1990 levels. The most important reasons for reductions in 1999 compared to 1998 were the continuing fuel shift from coal to gas in electricity production, a relatively mild winter and therefore less need for heating, and one-off measures in the chemical industry.

In the Kyoto Protocol, the EC agreed to reduce its greenhouse gas emissions by 8 % by 2008–12, from 1990 levels. Assuming a linear target path from 1990 to 2010, total EC greenhouse gas emissions were 0.4 index points below this target path in 1999 (Figure A), i.e. the distance-to-target indicator (DTI) is minus 0.4.

EC greenhouse gas emissions compared with targets for 2000 and 2008–12 (excluding land-use change and forestry) Figure A



Source: Submissions by the EC Member States (CRF tables).

CO_2 is by far the most important greenhouse gas, accounting for 81 % of total EC emissions in 1999. In 1999, EC CO_2 emissions were 3 271 Tg, down 1.4 % from 1998 and 1.6 % below 1990 levels. In the UNFCCC, the EC agreed to stabilise its CO_2 emissions at 1990 levels by 2000. Assuming a linear target path from 1990 to 2000, EC CO_2 emissions were 1.6 index points below this target path in 1999 (Figure A).

The main driving forces

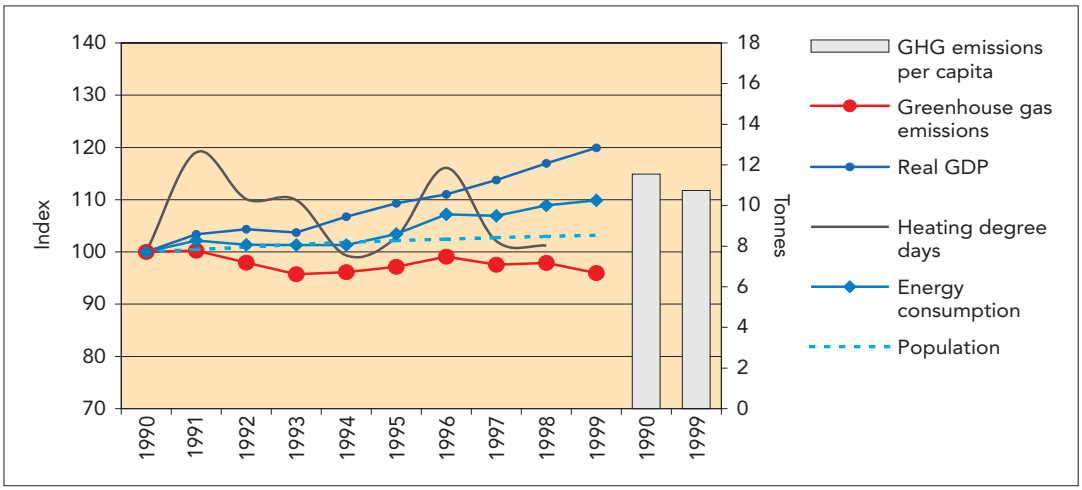
In 1999, real GDP grew by 2.5 % in the EU, energy use increased by 0.9 %, compared to 1998 (Figure B). This compares to decreases of greenhouse gas emissions by 2 % and of CO_2

emissions by 1.4 %. Therefore, in 1999, greenhouse gas emissions de-coupled from economic growth and also from energy use, compared to 1998. Also over the whole period from 1990 to 1999, total greenhouse gas emissions de-coupled from GDP growth by 24 index points, and from energy use by 14 index points. As the EU population grew by 3.2 % between 1990 and 1999, EC greenhouse gas emissions per capita decreased from 11.5 tonnes in 1990 to 10.7 tonnes in 1999.

Figure B

EC greenhouse gas emissions and main driving forces (real GDP, heating degree days (1), gross inland energy consumption, population) and greenhouse gas emissions per capita

Source: Eurostat for real GDP, energy consumption and population; EC (2000e) for heating degree days; EC Member States submissions (CRF tables) for greenhouse gas emissions



Contribution of Member States to the EC greenhouse gas targets

Table A shows large variations in greenhouse gas emission trends between Member States. Nine Member States reduced their emissions compared to 1998, but only five Member States were below base year levels in 1999 (six, if Danish greenhouse gas emissions are adjusted for electricity trade in 1990).

The overall EC greenhouse gas emission trend is dominated by contributions from the two largest emitters Germany and the UK, accounting for about 40 % of EC greenhouse gas emissions. These two Member States achieved total greenhouse gas emission reductions of 81 Tg of CO_2 equivalents (compared to 1998) and 330 Tg (compared to 1990).

The main reasons for the favourable trend in Germany are increasing efficiency in power and heating plants and the economic restructuring of the five new *Länder* after the German reunification. The reduction of GHG emissions in the UK was primarily the result of liberalising the energy market and the subsequent fuel switches from oil and coal to gas in electricity production and N_2O emission reduction measures in the chemical industry.

A study published recently quantifies the effects of the German unification and economic restructuring and the liberalisation of the electricity market for Germany and the UK respectively. According to this study, in both Member States these special circumstances account for about 50 % of the reduction of all six greenhouse gas emissions. This share increases to 60 % if only energy-related CO_2 emissions are considered.

(1) Heating degree days are a measure for the need for heating due to cold temperatures. They are the sum of temperature differences between a certain constant indoor temperature and the daily average of outdoor temperature. Therefore, high heating degree days indicate low average temperatures and increased need for heating.

Greenhouse gas emissions in CO2 equivalents (excluding land-use change and forestry) and Kyoto Protocol targets for 2008–12

Table A

MEMBER STATE	1990 (million tonnes)	1999 (million tonnes	Change 1998–1999 (%)	Change 1990–1999 (1) (%)	Targets 2008–2012 under Kyoto Protocol and EU 'burden sharing' (%)	Distance-to-target indicator (DTI) (index-points)	Evaluation of progress in 1999 (3)
Austria	76.9	79.2	0.0	2.6	- 13.0	8.5	☹
Belgium	136.7	140.4	- 3.4	2.8	- 7.5	6.1	☹
Denmark (2)	70.0	73.0	- 4.6	4.0 (- 4.6)	- 21.0	13.5 (4.9)	☹ (☹)
Finland	77.1	76.2	- 0.8	- 1.1	0.0	- 1.1	😐
France	545.7	544.5	- 2.2	-0.2	0.0	- 0.2	😐
Germany	1,206.6	982.4	- 3.7	- 18.7	- 21.0	- 9.3	☺
Greece	105.3	123.2	- 0.7	16.9	25.0	5.7	☹
Ireland	53.5	65.3	2.5	22.1	13.0	16.3	☹
Italy	518.3	541.1	0.9	4.4	- 6.5	7.3	☹
Luxembourg	10.8	6.1	4.6	- 43.3	- 28.0	- 30.7	☺
Netherlands	215.8	230.1	- 2.9	6.1	- 6.0	8.8	☹
Portugal	64.6	79.3	2.9	22.4	27.0	10.2	☹
Spain	305.8	380.2	6.1	23.2	15.0	16.5	☹
Sweden	69.5	70.7	- 2.6	1.5	4.0	- 0.3	😐
UK	741.9	637.9	-6.5	- 14.0	- 12.5	- 8.4	☺
EU-15	**4,198.7**	**4,029.6**	**- 2.0**	**- 4.0**	**- 8.0**	**- 0.4**	😐

Source: Submissions by the EC Member States (CRF tables).

(1) For the fluorinated gases most Member States have selected a base year other than 1990 (namely 1995), as allowed for under the protocol. However, for the analysis of EU emission trends in this report 1990 emissions data have been used as the base year for all gases, for consistency reasons.
(2) For Denmark, data that reflect adjustments for electricity trade (import and export) in 1990 are given in brackets. This methodology is used by Denmark to monitor progress towards its national target under the EC 'burden sharing' agreement. For the EU emissions, total non-adjusted Danish data have been used.
(3) The EEA evaluation of progress to 1999 awards 'smileys' according to the distance-to-target indicator in 1999. The following rating system is used:
☺ distance-to-target indicator below minus 2 index points (positive contribution to EC trend)
☹ distance-to-target indicator above plus 2 index points (negative contribution to EC trend)
😐 distance-to-target indicator in a ravtnge of plus/minus 2 index points (limited positive or negative contribution to EC trend)

Progress of the Member States

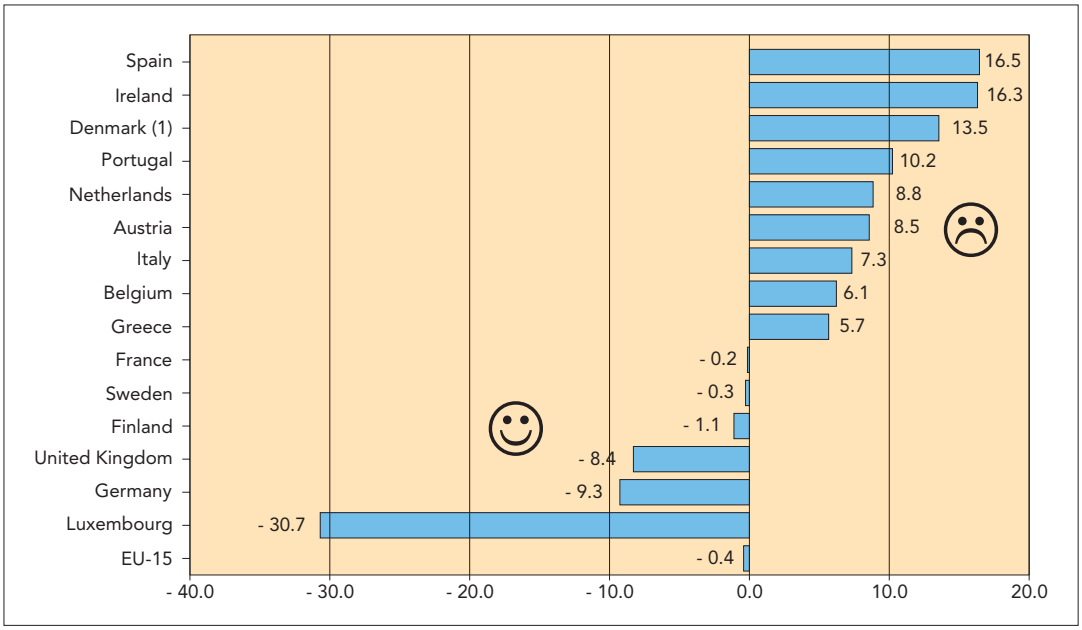
If greenhouse gas emissions of the Member States are compared with their linear target paths for 2000 and 2008–12, progress of Member States looks as follows (Figure C).

In 1999, Germany, Luxembourg and the United Kingdom were well below their Kyoto target paths. France, Finland and Sweden were near to their linear Kyoto target paths. All other Member States were well above their Kyoto target paths (Spain, Ireland and Portugal by 10 index points or more). The Danish distance-to-target indicator is 13.5 index points above the target path for non-adjusted data and 4.9 index points, if Danish greenhouse gas emissions are adjusted for electricity trade in 1990.

Figure C

Distance-to-target indicators (in index points) for the Kyoto Protocol and EC burden sharing targets of EC Member States

Source: Submissions by the EC Member States (CRF tables).



(1) The Danish DTI is 4.9 index points, if Danish greenhouse gas emissions are adjusted for electricity trade in 1990.

Sectoral assessment

In order to analyse the sectoral greenhouse gas trends in more detail, the most important greenhouse gas source categories (key sources) have been identified on the basis of the IPCC Tier 1 method. For the EC as a whole, 18 key source categories have been identified covering 96 % of total EC GHG emissions (Table B).

Table B

EC greenhouse gas source categories identified as key sources (emissions in Tg or million tonnes of CO2 equivalents)

Source: Submissions by the EC Member States (CRF tables).

Greenhouse Gas Source Categories	Gas	Sector	GHG emissions in 1990 (million tonnes)	GHG emissions in 1999 (million tonnes)	Cumulative total in 1999 (%)
1.A.1. Energy Industries	CO_2	Energy	1147	1044	25.9
1.A.3. Transport	CO_2	Energy	698	825	46.4
1.A.4. Other Sectors	CO_2	Energy	631	631	62.1
1.A.2. Manufacturing Industries	CO_2	Energy	638	582	76.5
4.D. Agricultural Soils	N_2O	Agriculture	194	188	81.2
4.A. Enteric Fermentation	CH_4	Agriculture	142	131	84.4
2.A. Mineral Products	CO_2	Ind. Processes	108	108	87.1
6.A. Solid Waste Disposal on Land	CH_4	Waste	136	106	89.7
2.B. Chemical Industry	N_2O	Ind. Processes	110	48	90.9
HFCs (total)	F-gases	Ind. Processes	26	43	91.9
4.B. Manure Management	CH_4	Agriculture	42	40	92.9
1.B.2. Fugitive Emissions from Oil and Gas	CH_4	Energy	34	32	93.7
4.B. Manure Management	N_2O	Agriculture	28	29	94.5
1.A.3. Transport	N_2O	Energy	12	25	95.1
1.B.1. Fugitive Emissions from Solid Fuels	CH_4	Energy	51	24	95.7
SF_6 (total)	F-gases	Ind. Processes	8	11	95.9
PFCs (total)	F-gases	Ind. Processes	14	8	96.2
1.A.5. Other	CO_2	Energy	20	7	96.3

The emission trends of the key source categories vary widely. Figure D shows the ranking of key source categories according to absolute changes between 1990 and 1999.

Sectors with increases in emissions: Emissions from transport have risen rapidly since 1990 (mainly CO_2, but also N_2O emissions). This is mainly due to growth in road transport in almost all Member States (but in particular in the cohesion States Ireland, Spain, Portugal and Greece). N_2O emission increases from transport are mainly due to the increased use of catalytic converters, which reduce emissions of air pollutants but produce N_2O as a by-product. The second key source category with substantially increasing emissions is HFC emissions from industrial processes. Some HFCs are used as substitutes for ozone depleting CFCs which have been gradually phased out in the 1990s. However one Member State (UK) showed large decreases in HFC emissions, due to reduction measures in the chemical industry (HCFC production).

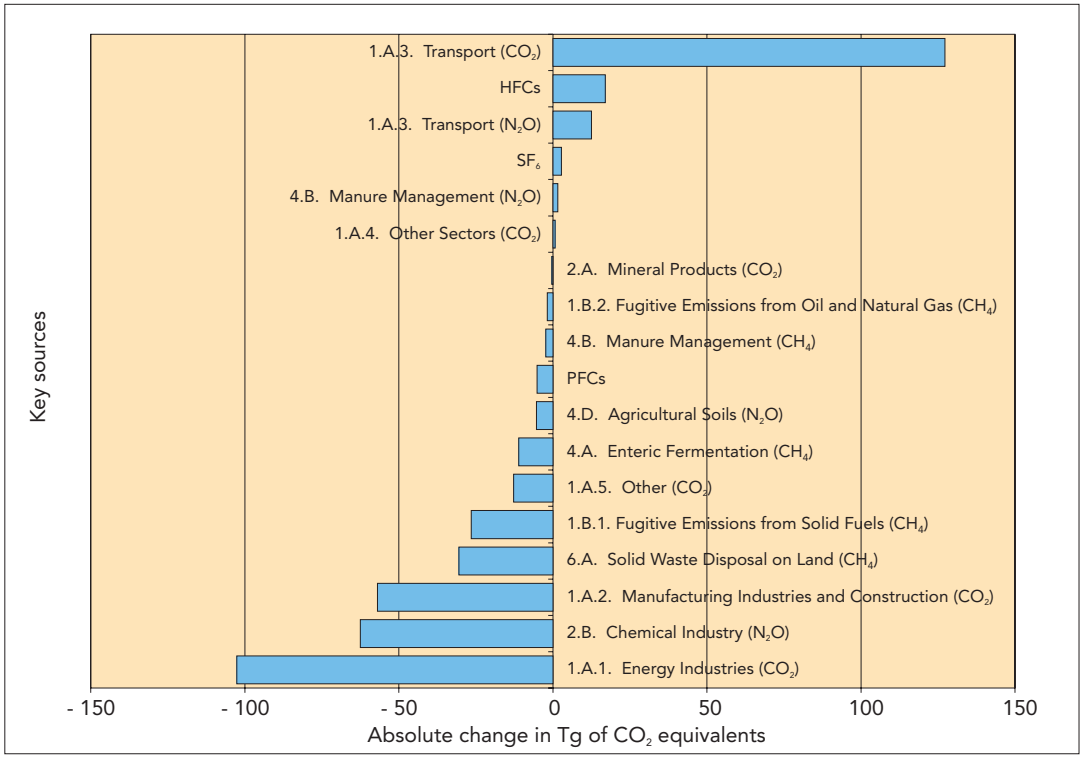
Sectors with reductions in emissions: The largest reductions in absolute terms were achieved in the energy sector (electricity and heat production) mainly due to fuel shifts from coal to gas in several Member States (above all in the UK) and efficiency improvements (above all in Germany).

Second largest were reductions of N_2O in the chemical industry in the UK, Germany and France mainly due to specific measures in the adipic acid production in these countries.

Third largest were reductions of CO_2 emissions from fossil fuel combustion in the manufacturing industries mainly due to economic restructuring and efficiency improvements in the German manufacturing industry after German unification. Voluntary agreements to improve energy efficiency probably had positive effects. Other Member States also introduced voluntary agreements or other programmes aimed at improving energy efficiency in industry.

Absolute GHG emission trends 1990–99 in the EC key source categories (Tg or million tonnes of CO_2 equivalents)

Figure D



Source: Submissions by the EC Member States (CRF tables).

Substantial CH_4 emission reductions were achieved by reductions in solid waste disposal on land (landfilling) and declining fugitive emissions from solid fuels. These reductions are mainly due to measures related to the implementation of the landfill directive and the decline of coal mining after cuts in coal subsidies mainly in the UK, Germany and France.

Member States' emission trends 1990–99 in the key sources mentioned above show large differences. There are several reasons for these differing trends (e.g. different starting points, socioeconomic developments and temperature variations), but trends are at least partly also due to the implementation of policies and measures, although some of these have not been primarily aimed at the reduction of greenhouse gas emissions. Examples for policies and measures, in addition to those mentioned above, that resulted in the reduction of CO_2 emissions in the Member States are summarised below.

CO_2 emissions from energy industries: One of the most important reasons for declining CO_2 emissions from energy industries is a fuel switch from coal to gas in thermal power production in several Member States, especially in the UK.

The liberalisation of the electricity market in the UK started in 1990 by the government in order to reduce the State-controlled share of the economy. One of the most significant changes since 1990 has been the change in the fuel mix, with a large shift from coal to gas. In 1990, coal accounted for 64 % of power generation, but fell to 34 % in 1998. In the same time, gas-fired power production went up from 1 to 32 %.

The switch from coal-fired to gas-fired technology for electricity generation has significantly reduced the CO_2 emissions. Between 1990 and 1999, carbon dioxide emissions from electricity supply industry fell by more than 20 %. The CO_2 emission reductions are partly due to the lower carbon content of natural gas and partly because of the overall higher energy efficiency of natural gas-fired power plants. A recent study suggests that about 50 % of total UK GHG reductions is the result of the liberalisation of the electricity market.

However, there is a drawback of the liberalisation of the UK electricity market for the environment as well. Lower consumer prices can lead to increased use of electricity and reduce incentives for energy efficiency improvements at the consumer level.

In several EC Member States programmes are in place for increase in the use of combined heat and power (CHP) generation. This policy, together with improvements in the efficiency of power generation, is another reason for CO_2 emission cuts from energy industries.

The power production from renewable energies is a third reason for CO_2 emission cuts from energy industries. In particular, wind power showed high growth rates in several Member States in the 1990s. The share of wind power production in total European electricity production was 0.5 % in 1998, with considerable differences among the EC Member States. In Denmark wind power accounted for almost 7 % of power production in 1998, up almost 5 percentage points from 1990. Spain is second with a share of 1.1 %. Germany, Luxembourg and Ireland have a share of 0.8 % in total electricity production. In absolute terms, Germany has become the largest wind power producer in the EU accounting for 38 % of total EU wind power production in 1998, followed by Denmark (23 %) and Spain (18 %).

The rapid expansion of Danish wind power is the result of a specific policy with the main aims of reducing greenhouse gas and other emissions, improving security of energy supplies and supporting technological development. The growth of wind power was triggered by an extensive subsidy scheme, reaching almost 0.1 % of GDP in 1998, and covering production subsidies, tax subsidies for cooperatively owned wind turbines, and guaranteed feed-in tariffs for wind power. In the future, the subsidy schemes will be phased out and a system of 'green certificates' is supposed to provide a more cost-effective way of meeting 20 % of the Danish electricity demand from renewable sources by 2003.

CO_2 emissions from transport: Finland, Sweden and the United Kingdom show the lowest CO_2 emission and road fuel growth rates in the EU. One reason for this might be high or rapidly growing fuel prices. Finland and Sweden had the highest prices of unleaded petrol and all three Member States mentioned were at the top of the diesel prices. In the UK, fuel prices were increased automatically in real terms each year between 1993 and 1999.

The fuel duty escalator in the UK was first introduced in 1993 with an annual increase on fuel duty of 3 % in real terms. It subsequently was increased to 5 % and from 1997 to 6 %. In 1999, it was decided to end the fuel duty escalator. The environmental impact of the road fuel duty escalator has been estimated with the help of models. Assuming an annual 6 % road fuel duty escalator between 1996 and 2002, it was forecast that the fuel price rises over this period would save between 2 and 5 million tonnes of carbon per year in 2010.

CO_2 emissions from small combustion (including households): In recent years, the instrument of an ecological tax reform has gained importance as a measure to stimulate emission reductions from small combustion. The Nordic countries started with such programmes in the early 1990s by shifting taxes from labour (personal income, social security contributions, etc.) to the use of the environment (energy taxes, CO_2 taxes but also taxes on water and waste, etc.). A number of EC Member States followed recently, or are about to implement such reforms.

In 1999, Germany introduced an ecological tax reform with five steps until 2003, including annual increases of electricity and road fuel taxes in exchange for reductions in social security contributions and promotion of renewable energies. The aim of the tax reform is to reduce energy consumption and related emissions and to stimulate the development of environmentally sound technologies. In addition, the reductions in social security contributions are intended to increase employment.

A first systematic and model-based analysis of the eco-tax reform in Germany indicates that energy consumption and CO_2 emissions are decreasing, employment is growing slightly and the influence on economic growth is very low. For CO_2 emissions, a 2–3 % decrease by 2005 compared to the base line scenario without tax reform is projected. Some 250 000 new jobs will be created by 2010, and economic growth reduction will be no more than 0.1 % per year.

1. Introduction

1.1. General

This report is an indicator-based assessment of European Community greenhouse gas emissions trends based on data from the EC Member States compiled by the European Topic Centre on Air and Climate Change (ETC/ACC) in the *Annual European Community greenhouse gas inventory 1990–99, submission to UNFCCC* (EEA, 2001a) and some additional data from Eurostat. In 2000, EEA published a first annual assessment of greenhouse gas emission trends (EEA, 2000c). This second annual report focuses more on non-CO_2 emissions and uses a new methodology for the sectoral analysis of the EC greenhouse gas emissions. In addition, more indicators based on data from Eurostat and also — for the first time — from the detailed Member States' inventories are presented.

The purpose of this report is:

- To identify and present progress of the EC as a whole towards fulfilling its greenhouse gas emission commitments under the UNFCCC and the Kyoto Protocol and the contribution of each Member State to the EC targets (distance-to-target assessment). For this purpose, for the EC and each Member State, distance-to-target indicators (DTI) are calculated as a measure of the deviation of actual emissions in 1999 from the linear target paths for 2000 and 2010.

- To present trends of greenhouse gas emissions in the EC and its Member States by gas and by key sources (sectoral assessment). Sectoral indicators, for socioeconomic driving forces behind greenhouse gas emissions, are identified and presented by using data from Eurostat or from Member States' detailed inventories.

- To identify decreasing or less increasing emission trends by comparing and analysing Member States' key source emissions (with special regard to non-CO_2 gases) and, to provide main explanations, either socioeconomic developments or policies and measures, for these trends in some Member States (policy-effectiveness assessment).

The legal basis of this report is Council Decision 1999/296/EC for a monitoring mechanism of Community CO_2 and other greenhouse gas emissions ([2]). This decision establishes a mechanism for: (1) monitoring, in the Member States, all anthropogenic greenhouse gas emissions not controlled by the Montreal Protocol (CO_2, carbon dioxide; CH_4, methane; N_2O, nitrous oxide; HFCs, PFCs and SF_6, industrial fluorinated gases), and (2) evaluating actual and projected progress towards meeting commitments in respect of these emissions.

According to Article 6 of Council Decision 1999/296/EC, the Commission shall assess annually whether the actual and projected progress of Member States is sufficient to ensure fulfilment of the EC commitments under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol and shall report to the European Parliament and the Council. The annual evaluation report of the Commission has to be forwarded to the European Parliament and the Council by October each year. The first annual Commission progress report under the decision was published in November 2000 (EC, 2000f).

This report, prepared by EEA and its European Topic Centre on Air and Climate Change (ETC/ACC), serves as an input to the annual evaluation report of the European Commission.

(2) OJ L 117, 5.5.1999, p. 35

The outline of this report: The report starts with a summary, providing the main conclusions on the indicator-based assessment of the EC emission trends and the progress of the EC and its Member States towards achieving the UNFCCC and Kyoto Protocol targets.

Chapter 1 (Introduction) briefly characterises the methodological approaches taken for the distance-to-target assessment and identification of key source indicators. In addition, greenhouse gas emission targets of the EC and its Member States and the primary data basis for this report are presented.

Chapter 2 uses indicators to evaluate progress of the Community as a whole towards fulfilling its greenhouse gas emission commitments and to analyse trends and driving forces of greenhouse gas emissions in the EU. In addition, individual contributions of the Member States to the EC greenhouse gas emission targets are evaluated.

Chapter 3 aims at analysing the sectoral performance of the EC as a whole and of its Member States. First, key source indicators are identified based on the IPCC Tier 1 approach for the EC inventory (IPCC, 2000). Then, the performance of the Member States in each of these key sources is compared and analysed, in order to identify decreasing or less increasing emission trends in the Member States. In addition, sectoral driving force indicators are presented based on data submitted by the Member States (FCCC Common Reporting Format or CRF tables) and additional data from Eurostat, in order to provide explanations, either socioeconomic developments or policies and measures, for these greenhouse gas emissions trends.

Annex 1 presents for each Member State indicators following the general outline of the analysis on EC greenhouse gas trend assessment. This includes distance-to-target indicators, main socioeconomic and other driving force indicators, and sectoral greenhouse gas indicators. For each Member State, a summary (four pages) is presented with the following uniform structure: page 1 contains a description of the main trends of the indicators, page 2 presents the two main graphs (total emissions compared with targets and main driving forces), pages 3 and 4 include the main indicators. In addition, the tables of EC greenhouse gas emission and driving force indicators are presented.

Annex 2 provides short summary tables of greenhouse gas emissions by gas (CO_2, CH_4, N_2O, HFCs, PFCs and SF_6) for the EC and its Member States. More detailed tables of CO_2, CH_4 and N_2O emissions and emission data on HFCs, PFCs and SF_6 for the EC and its Member States have been compiled by ETC/ACC and are available in the EEA technical report *Annual European Community greenhouse gas inventory 1990–99*, submission to UNFCCC (EEA, 2001a). These data are also available on the EEA web site (http://www.eea.eu.int/).

1.2. Methodological approach

The analysis in this report is provided in two steps:

1. Identification of distance-to-target indicators and analysis and description of overall trends of greenhouse gas emissions and driving forces.

2. Identification of sectoral key source indicators on the basis of the IPCC Tier 1 method.

The distance-to-target indicators (DTI)
This report aims at evaluating actual progress of the European Community towards fulfilling its greenhouse gas emission targets by comparing past (actual) performance with greenhouse gas emission target paths for 2000 and for 2008–12, while the annual Commission progress report under the Council decision assesses both actual and projected progress. The distance-to-target indicator (DTI) is a measure for the deviation of actual emissions in 1999 from two (hypothetical) linear paths: (1) the target path between 1990 and 2000, in order to evaluate the likelihood of meeting the UNFCCC 2000 stabilisation target for CO_2 emissions; (2) the target path between 1990 and 2010 (i.e. the mid-point of the Kyoto range 2008–12) for total greenhouse gas emissions, in order to give indications on progress towards the Kyoto and Member States' sharing targets (see Section 1.3).

The distance-to-target indicators are also presented for each Member State, in order to evaluate their contribution to the fulfilment of the targets by the European Community.

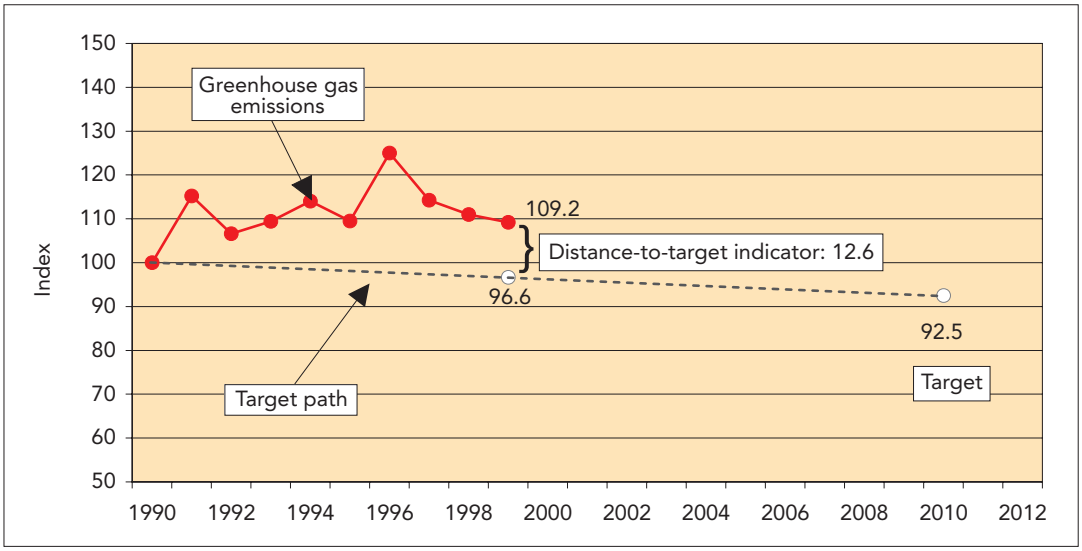
Note: This report does not aim at evaluating compliance of Member States with targets, and it does not analyse emission projections. EC and Member State projections (for 2010), taking into account adopted policies and measures, are analysed by the Commission in line with the requirements of the monitoring mechanism (Article 6). Instead, this report aims at evaluating the Member State contribution to the EC greenhouse gas emissions in 1999. This is done by comparing actual values in 1999 with hypothetical values for 1999 on the linear target paths. These linear paths are not set as such in any official document, but used in this report in order to perform a consistent and comparable assessment of the contribution of the Member States to the progress of the European Community as a whole towards the targets within the period 1990 to 1999.

The distance-to-target assessment consists of four steps (see Figure 1 for a theoretical example of a country's situation):

1. Plotting the index of actual performance (e.g. 1990–99 index of greenhouse gas emissions) against the index of the target path (hypothetical linear line between 1990 and the target (in case of Figure 1 the Kyoto/burden sharing target).
2. Calculating the hypothetical, interpolated, value on the target path index in 1999 (in Figure 1: 96.6).
3. Calculating the deviation of the emission index value in 1999 (in Figure 1: 109.2) from the value on the target path. In Figure 1, the deviation is 12.6 index points, i.e. the distance-to-target indicator (DTI) is 12.6 index points.
4. Awarding smileys according to the achievements with the following ratings:
   ☺ distance-to-target indicator below minus 2 index points (positive contribution to EC trend)
   ☹ distance-to-target indicator above plus 2 index points (negative contribution to EC trend)
   😐 distance-to-target indicator in a range of plus/minus 2 index points (limited positive or negative contribution to EC trend)

The performance of the example country in Figure 1 would be evaluated with Λ, since the trend is not in line with the Kyoto/burden sharing target.

Figure 1 **Index of greenhouse gas emissions (base 1990) and Kyoto/burden sharing target 2008–12 (theoretical example for an EC Member State)**



Sectoral indicators

The sectoral assessment is based on the identification of key source categories according to the Tier 1 method (quantitative approach) described in IPCC (2000). A key source category is defined as an emission source that has a significant influence on a country's GHG inventory in terms of the absolute level of emissions, the trend in emissions, or both.

Note: In this report, a key source analysis is performed for the EC total emissions merely for the purpose of obtaining indicators for the sectoral trend assessment. The basis of the analysis is IPCC (2000), but the source categories adopted are more aggregated than those suggested in IPCC (2000) because of lack of some data. In addition, the key source analysis does not identify key source categories for each EC Member State, as needed for their UNFCCC reporting. IPCC key source categories for national UNFCCC reporting have to be identified by the Member States.rce

In order to identify key source categories of the EC, the following procedure has been applied (based on IPCC, 2000):

1. Starting point for the key source identification for this report was the CRF Table *Summary 1.A.* of the EC greenhouse gas inventory. (A more detailed split e.g. by fuels as provided for by IPCC (2000) is not available at European level.) All source categories where greenhouse gas emissions occur were listed, at the most disaggregated level and split by gas (CO_2, CH_4, N_2O). For HFCs, PFCs and SF_6 no category splits were made, but emission totals were taken as one source category. This way, a list of 62 source categories was identified.
2. The source categories were ranked in descending order according to their share in total EC greenhouse gas emissions in 1999. Those source categories contributing together 95 % of total greenhouse emissions are defined as key source categories in the first stage (level assessment). For the EC, 14 key source categories were identified in this stage.
3. The source categories were ranked in descending order according to their contribution to the overall EC trend of greenhouse gas emissions 1990 to 1999 (deviation from average trend multiplied by share). Again, those source categories contributing 95 % to the trend of total EC greenhouse emissions are defined as key source categories in this stage (trend assessment). Apart from those categories already identified under the level assessment, four further categories were identified.
4. This procedure resulted in the identification of the following 18 key source categories for the EC for 1999 (ranked according to their share).

Key source categories for EC greenhouse gas emissions (in Tg or million tonnes of CO_2 equivalents) Table 1

Greenhouse Gas Source Categories	Gas	Sector	GHG emissions in 1990 (million tonnes)	GHG emissions in 1999 (million tonnes)	Cumulative total in 1999 (%)
1.A.1. Energy Industries	CO_2	Energy	1147	1044	25.9
1.A.3. Transport	CO_2	Energy	698	825	46.4
1.A.4. Other Sectors	CO_2	Energy	631	631	62.1
1.A.2. Manufacturing Industries	CO_2	Energy	638	582	76.5
4.D. Agricultural Soils	N_2O	Agriculture	194	188	81.2
4.A. Enteric Fermentation	CH_4	Agriculture	142	131	84.4
2.A. Mineral Products	CO_2	Ind. Processes	108	108	87.1
6.A. Solid Waste Disposal on Land	CH_4	Waste	136	106	89.7
2.B. Chemical Industry	N_2O	Ind. Processes	110	48	90.9
HFCs (total)	F-gases	Ind. Processes	26	43	91.9
4.B. Manure Management	CH_4	Agriculture	42	40	92.9
1.B.2. Fugitive Emissions from Oil and Gas	CH_4	Energy	34	32	93.7
4.B. Manure Management	N_2O	Agriculture	28	29	94.5
1.A.3. Transport	N_2O	Energy	12	25	95.1
1.B.1. Fugitive Emissions from Solid Fuels	CH_4	Energy	51	24	95.7
SF_6 (total)	F-gases	Ind. Processes	8	11	95.9
PFCs (total)	F-gases	Ind. Processes	14	8	96.2
1.A.5. Other	CO_2	Energy	20	7	96.3

1.3. European Community and Member States' greenhouse gas emission targets

European Community

The Kyoto greenhouse gas emission target: In the Kyoto Protocol (December 1997), the European Community agreed to reduce its greenhouse gas emissions by 8 % below 1990 levels by 2008–12. In the light of the intention of the EC and all Member States to notify the EC burden sharing agreement, the reduction targets of the Kyoto Protocol may be achieved jointly, and not all Member States will have to reduce their greenhouse gas emissions by 8 % as long as the EC as a whole meets the target.

The CO_2 stabilisation target: In 1990, the Council of Ministers (joint Energy/Environment) of 29 October agreed on the objective to stabilise EC CO_2 emissions by 2000 at 1990 levels. Additionally, Article 4 of the UNFCCC, establishes that Annex I parties to this convention (including all EC Member States and the European Community as parties) have to adopt policies and measures with the aim of returning their anthropogenic CO_2 and other greenhouse gas emissions, individually or jointly, by the year 2000 to 1990 levels. The Member States of the European Community aim to achieve the stabilisation target throughout the EC as a whole.

Member States

Greenhouse gas emission targets for 2008–12: According to the Kyoto Protocol, the average greenhouse gas emissions of the EC and its Member States have to be 8 % below 1990 levels during the five year commitment period 2008–12. In June 1998, the Council of Ministers agreed on different emission limitation and/or reduction targets for each Member State basically according to economic circumstances, called the 'burden sharing' agreement. Table 2 summarises all Member States targets. It shows that eight Member States agreed to reduction targets by 2008–12 (Austria, Belgium, Denmark, Germany, Italy, Luxembourg, the Netherlands, the United Kingdom). Two Member States (Finland, France) agreed to stabilise greenhouse gas emissions by 2008–12, whereas five Member States (Greece, Ireland, Portugal, Spain, Sweden) agreed to limit their increases by 2008–12.

CO_2 emission targets for 2000: The objective of stabilising CO_2 emissions at 1990 levels by 2000 was agreed for the European Union as a whole, but Member States contribute in different ways to achieve this target. Most, but not all, Member States have set national CO_2 limitation targets. Three Member States (Belgium, Denmark and the Netherlands) have set reduction targets (corrected for temperature variations). Five Member States aim at stabilising their CO_2 emissions by 2000 at 1990 levels (Austria, Italy, Luxembourg, Sweden the United Kingdom), whereas France has set a stabilisation target on basis of per capita fossil fuel use. Greece, Ireland and Spain aim at limiting the increase of CO_2 emissions by 2000 (see Table 2).

National greenhouse gas emission targets of EC Member States — Table 2

Member State	National CO_2 emission targets by 2000	National greenhouse gas emission targets (including removals) by 2008–12 under the EC burden sharing agreement (%)
Austria	Stabilisation at 1990 level	- 13
Belgium	5 % reduction compared to 1990 levels (corrected for temperature variations).	- 7.5
Denmark	5 % reduction compared to 1990 (corrected for temperature variations and calculated as if all electricity used in Denmark was produced in Denmark)	- 21[1]
Finland	Limitation of the increase of CO_2 emissions from energy production and consumption by the end of the 1990's	0
France	Stabilisation of fossil-fuel related CO_2 emissions at less than 2tC per capita per year by 2000	0
Germany	No 2000 target	- 21
Greece	Limitation of the increase in CO_2 emissions to 15 %, during the period 1990 to 2000	+ 25
Ireland	Limitation of the increase in CO_2 emissions to 20 % during the period 1990–2000 (or to 11 % if carbon sinks are also included in calculation)	+ 13
Italy	Stabilisation at 1990 level	- 6.5
Luxembourg	Stabilisation at 1990 level	- 28
Netherlands	3 % reduction compared to 1990 levels (corrected for temperature variations)	- 6
Portugal	No 2000 target	+ 27
Spain	Limitation of the increase in CO_2 emissions to 11 to 13 % during the period 1990–2000	+ 15
Sweden	Stabilisation at 1990 level	+ 4
United Kingdom	Stabilisation at 1990 level	- 12.5

(1) In connection with the agreement Denmark made the following statement: 'Denmark is able to reduce its emissions by 17 % in the first commitment period compared to its 1990 level of about 80 million tonnes corrected CO_2-equivalents through domestic policies and measures and present measures adopted by the Community. In making its legal commitment to a 21 % reduction as set out in the agreement, Denmark has assumed the further elaboration and adoption of common and coordinated policies and measures (CCPMs) prior to the ratification of the Kyoto Protocol.'

1.4. Data sources and definitions

The two main data sources of this report are data supplied by the EC Member States under the monitoring mechanism (for greenhouse gas data and sectoral background data) and data from Eurostat's New Cronos database (for main driving force and sectoral background data). The data availability (time series) for each MS and the EU as a whole can be seen in Annex 1.

Greenhouse gas emissions

For the preparation of this report, EC greenhouse gas inventories as compiled under the EC monitoring mechanism (by EEA-ETC/ACC) and submitted by the European Commission to the UNFCCC (April 2001) have been used. The data are presented in the EEA technical report *Annual European Community greenhouse gas inventory 1990–99*, submission to UNFCCC (EEA, 2001a). They are also available on the EEA web site (http://www.eea.eu.int/) and are annexed in a highly aggregated form at the end of this report (Annex 2). The EC inventory contains data submitted by the Member States to the European Commission by 1 April 2001. For those Member States that did not submit data before this deadline (Belgium,

Luxembourg), a data gap filling procedure was applied in accordance with the guidelines of the monitoring mechanism (Luxembourg: 1991–93, 1999; Belgium: 1999) ([3]).

Greenhouse gas data restrictions: Greenhouse gas emission data, as referred to in this report, do not include emissions and removals from land use change and forestry (LUCF) (CRF Category 5) for two reasons: (1) inconsistent calculation methods of Member States; (2) it is only very recently (at COP 6, part 2, in Bonn, July 2001) that a political agreement has been achieved on outstanding methodological decisions on CO_2 sinks under the Kyoto Protocol (which has to be formally confirmed at COP 7 in Marrakech). Data on carbon sinks in line with these decisions were not available for this report.

In addition, no adjustments for temperature variations or electricity trade are made for the EC as a whole. However, for two Member States (Denmark, the Netherlands) additional emission data adjusted for temperature variations or electricity trade are presented separately (when targets refer to adjusted data and data were submitted).

Main and sectoral driving force data

There are two main data sources for sectoral background data:

1. The data as supplied by the Member States under the monitoring mechanism in the common reporting format (CRF tables) by April 2001. For 11 Member States, sectoral background data was available. Eight Member States provided time series from 1990 to 1999.
2. Data downloaded from Eurostat's New Cronos database; this database was also used to derive the main driving force data.

For energy related data, Eurostat (2000) has been used in a few cases. Data on cement production has been taken from Cembureau published in EC (2001a). All other data is referenced in the text.

The geographical coverage of emission statistics and other statistics is not fully consistent (i.e. inclusion of overseas territories in emission data). However, this is not expected to distort overall trends and main conclusions.

Some important definitions of Eurostat driving force indicators referred to in the annex are given below:

Energy consumption refers to gross inland energy consumption.

Industrial production refers to the evolution of value added at factor cost at constant prices in the industrial sector.

Volume passenger transport refers to the annual volume of passenger-kilometres travelled in cars.

Volume freight transport refers to the annual number of tonne-kilometres transported on road.

Final energy consumption in households refers to the final energy consumption including electricity but excluding transport.

Transformation input to refineries refers to quantities of crude oil and intermediary products treated in the refineries, including the quantities of oil products re-treated in the refineries (recycling).

(3) The data gap filling procedure was to take the emissions reported for the most recent previous year as the first estimates. However, for CO_2 emissions from fossil fuel combustion, the method used the latest estimates reported by the Member States in combination with trend information for more recent years from latest calculations of CO_2 emissions from fossil fuels by Eurostat. After the deadline for data submission in April, Luxembourg submitted data that suggest that Luxembourg's greenhouse gas emissions in 1999 as compiled within the EU inventory are slightly overestimated. In June 2001, Belgium submitted data for 1998 and 1999, which suggest that the Belgian greenhouse gas emissions in 1998 and 1999 as compiled within the EU inventory are underestimated to some extent. In accordance with the monitoring mechanism guidelines (agreed in September 2000) the latest data from Belgium and Luxembourg will be included in the next annual EU greenhouse gas inventory, to be finalised 15 April 2002.

2. Distance-to-target assessment

This chapter aims at identifying and presenting indicators to evaluate the progress of the European Community as a whole towards fulfilling its greenhouse gas emission targets. The first section evaluates actual progress of the EC by presenting distance-to-target indicators (DTI). The DTI is based on a comparison of 1999 greenhouse gas emission data with the target paths in 1999 for CO_2 emissions (2000) and total greenhouse gas emissions (2008–12). Section 2 presents overall greenhouse gas emission trends and the development of main driving forces. Section 3 evaluates the contribution of the Member States to the fulfilment of the EC greenhouse gas targets.

2.1. Distance-to-target indicator (DTI)

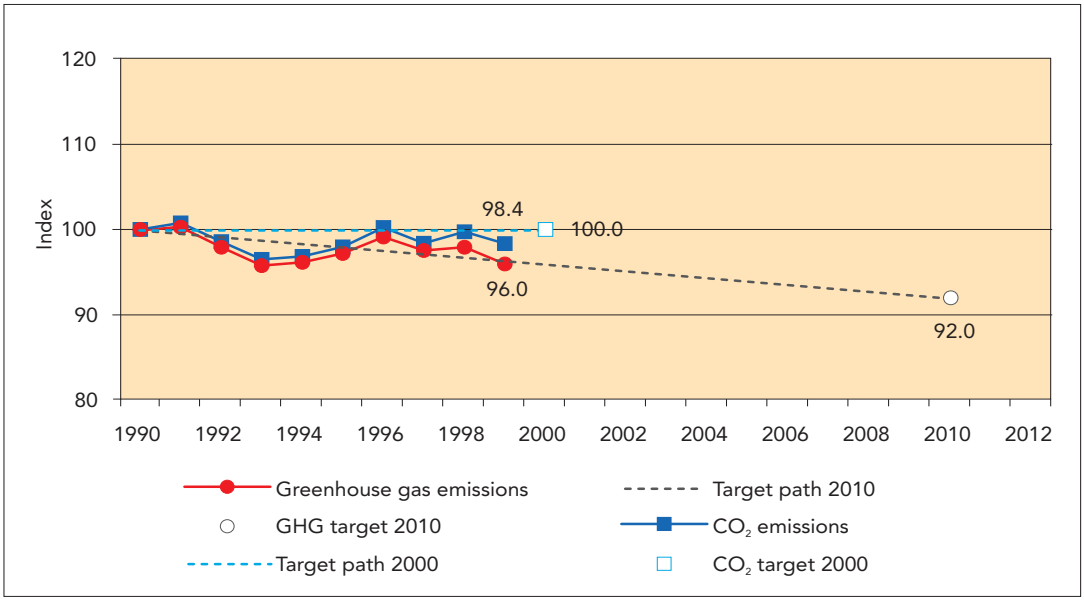
The European Community achieved a reduction in greenhouse gas emissions in 1999 compared to 1998. In 1999, total EC greenhouse gas emissions were 4 030 Tg (CO_2 equivalents), which was 2 % below 1998 and 4 % below 1990 levels. The most important reasons for reductions in 1999 compared to 1998 were the continuing fuel shift from coal to gas in electricity production, a relatively mild winter and therefore less need for heating, and one-off measures in the chemical industry.

In the Kyoto Protocol, the EC agreed to reduce its greenhouse gas emissions by 8 % by 2008–12, from 1990 levels. Assuming a linear target path from 1990 to 2010, total EC greenhouse gas emissions were 0.4 index points below this target path in 1999 (Figure 2), i.e. the DTI is minus 0.4. Note that the trend changes slightly, if the EC selects a base year other than 1990 for fluorinated gases, as allowed for under the Kyoto Protocol.

CO_2 is by far the most important greenhouse gas, accounting for 81 % of total EC emissions in 1999. In 1999, EC CO_2 emissions were 3 271 Tg, down 1.4 % from 1998 and 1.6 % below 1990 levels. In the UNFCCC, the EC agreed to stabilise its CO_2 emissions at 1990 levels by 2000. Assuming a linear target path from 1990 to 2000, EC CO_2 emissions were 1.6 index points below this target path in 1999 (Figure 2).

Figure 2 **EC greenhouse gas emissions compared with targets for 2000 and 2008–12 (excluding LUCF)**

Source: Submissions by the EC Member States (CRF tables).



Note 1: The linear target path is not intended as an approximation of past and future emission trends. Therefore, it does not deliver a measure of (possible) compliance of the EC with its greenhouse gas targets in 2008–12, but aims at evaluating overall EC greenhouse gas emissions in 1999.

Note 2: Greenhouse gas emission data for the EC as a whole do not include emissions and removals from LUCF. In addition, no adjustments for temperature variations or electricity trade are considered. See Section 1.4 for details.

Note 3: For the fluorinated gases most Member States have selected a base year other than 1990 (namely 1995), as allowed for under the Kyoto Protocol. However, for the analysis of EC emissions trends in this report 1990 emissions data have been used for the base year for all gases, for consistency reasons.

2.2. EC greenhouse gas emission trends and main driving forces

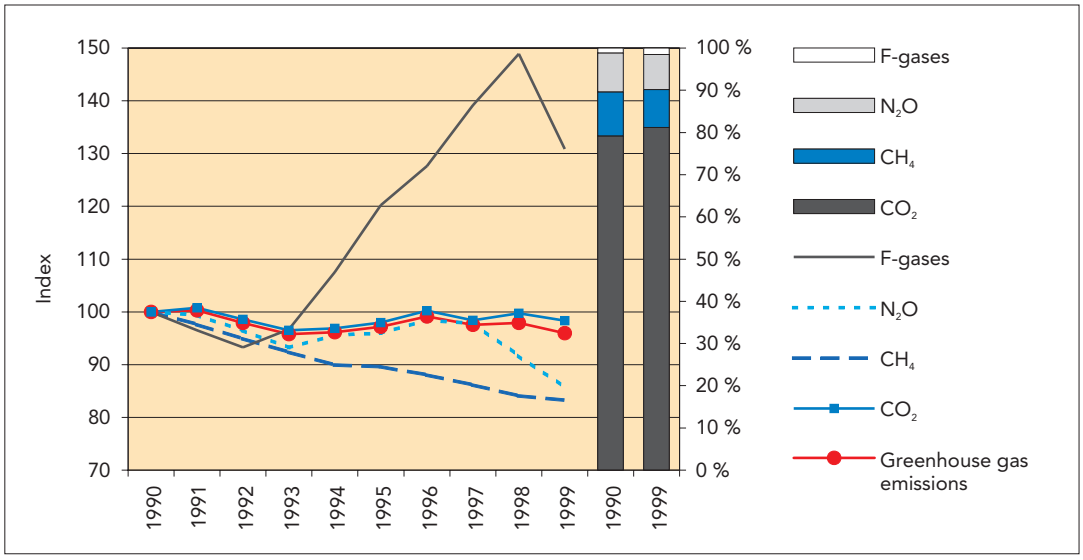
Greenhouse gas emission trends: Total greenhouse gas emissions decreased by 4 % between 1990 and 1999, but trends of the different gases varied considerably. Figure 3 shows the importance of CO_2 emissions, which account for 81 % of total GHG emissions and reduced slightly since 1990 (– 1.6 %).

CH_4 emissions account for 9 % of total EC greenhouse gas emissions and decreased by 17 % between 1990 and 1999. The main reasons for declining CH_4 emissions were reductions in solid waste disposal on land, the decline of coal mining and falling cattle numbers.

N_2O emissions are responsible for 8 % of total greenhouse gas emissions and decreased by 14 %. The main reason for N_2O emission cuts were reduction measures in the chemical industry (adipic acid production) in recent years.

Fluorinated gas emissions (F-gases) show opposing trends: HFC and SF_6 emissions increased sharply between 1990 and 1999 (+ 66 % and + 34 % respectively), whereas PFC emissions reduced by 38 %. Despite the sharp increase of F-gas emissions since 1992 (+ 31 %), they account for only 2 % of total greenhouse gas emissions. The main reason for rapidly growing fluorinated-gas emissions in the EU is the phase out of ozone depleting substances like chlorofluorocarbons under the Montreal Protocol and the replacement of these substances with HFCs (mainly in refrigeration, air conditioning, foam production and as aerosol propellants). The decline of F-gas emissions in 1999 compared to 1998 is due to large HFC emission reductions in the UK.

EC greenhouse gas emissions by gas (excluding LUCF) Figure 3

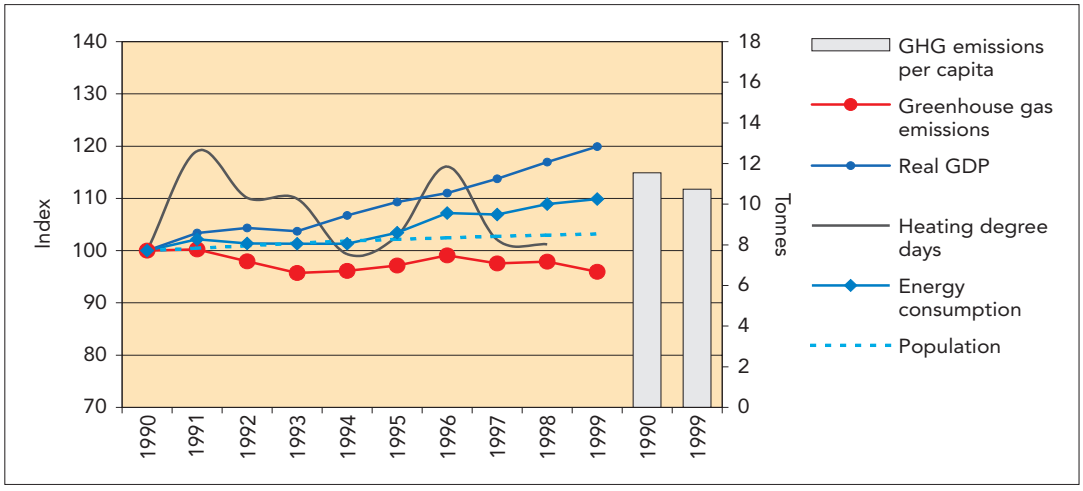


Source: Submissions by the EC Member States (CRF tables).

The main driving forces: In 1999, real GDP grew by 2.5 % in the EU, energy use increased by 0.9 %, compared to 1998 (Figure 4). This compares to decreases of greenhouse gas emissions by 2 % and of CO_2 emissions by 1.4 %. Therefore, in 1999, greenhouse gas emissions de-coupled from economic growth and from energy use, compared to 1998. Also over the whole period from 1990 to 1999, total greenhouse gas emissions de-coupled from GDP growth by 24 index points, and from energy use by 14 index points. As the EU population grew by 3.2 % between 1990 and 1999, EU greenhouse gas emissions per capita decreased from 11.5 tonnes in 1990 to 10.7 tonnes in 1999.

Figure 5 shows the development of GHG emissions per capita by Member States between 1990 and 1999. The reduction of the GHG emissions per capita for the EU is again largely due to decreases in Germany (– 21 %) and the UK (– 17 %). There have also been decreases in Austria, Finland, France, Luxembourg and Sweden. In seven Member States, the per capita emissions have increased between 1990 and 1999, with Portugal and Spain showing percentage increases of more than 20 %. The highest per capita emissions in 1999 were in Ireland (17.4 tonnes) and the lowest in Portugal (7.9 tonnes) and Sweden (8 tonnes).

EC greenhouse gas emissions and main driving forces (real GDP, heating degree days (4), gross inland energy consumption, population) and greenhouse gas emissions per capita Figure 4

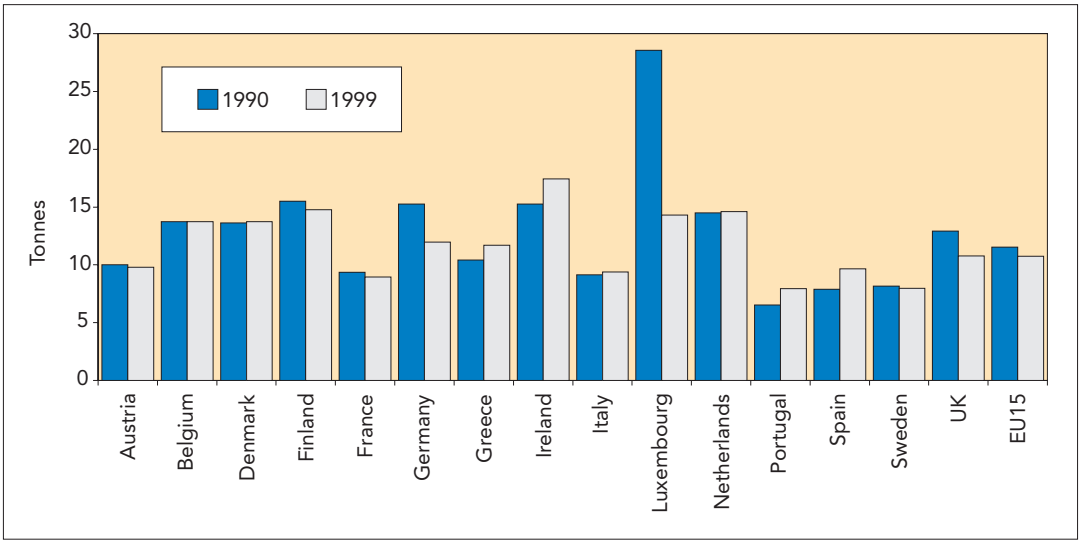


Source: Eurostat for real GDP, energy consumption and population; EC (2000e) for heating degree days; EC Member States submissions (CRF tables) for greenhouse gas emissions.

(4) Heating degree days are a measure for the need for heating due to cold temperatures. They are the sum of temperature differences between a certain constant indoor temperature and the daily average of outdoor temperature. Therefore, high heating degree days indicate low average temperatures and increased need for heating.

Figure 5 **GHG emissions per capita by Member State and for the EC 1990–99**

Source: EC Member States submissions (CRF tables) for greenhouse gas emissions and Eurostat for population



2.3. Contribution of Member States to the EC greenhouse gas targets

Table 3 shows large variations in greenhouse gas emission trends between Member States. Nine Member States reduced their emissions compared to 1998, but only five Member States were below base year levels in 1999 (six, if Danish greenhouse gas emissions are adjusted for electricity trade in 1990).

Table 3 **Greenhouse gas emissions in CO_2 equivalents (excluding LUCF)**

Source: Submissions by the EC Member States (CRF tables).

MEMBER STATE	1990 (million tonnes)	1999 (million tonnes	Change 1998–1999 (%)	Change 1990–1999 (1) (%)	Targets 2008–2012 under Kyoto Protocol and EU 'burden sharing' (%)	Distance-to-target indicator (DTI) (index-points)	Evaluation of progress in 1999 (3)
Austria	76.9	79.2	0.0	2.6	- 13.0	8.5	☹
Belgium	136.7	140.4	- 3.4	2.8	- 7.5	6.1	☹
Denmark (2)	70.0	73.0	- 4.6	4.0 (- 4.6)	- 21.0	13.5 (4.9)	☹ (☹)
Finland	77.1	76.2	- 0.8	- 1.1	0.0	- 1.1	😐
France	545.7	544.5	- 2.2	-0.2	0.0	- 0.2	😐
Germany	1,206.6	982.4	- 3.7	- 18.7	- 21.0	- 9.3	☺
Greece	105.3	123.2	- 0.7	16.9	25.0	5.7	☹
Ireland	53.5	65.3	2.5	22.1	13.0	16.3	☹
Italy	518.3	541.1	0.9	4.4	- 6.5	7.3	☹
Luxembourg	10.8	6.1	4.6	- 43.3	- 28.0	- 30.7	☺
Netherlands	215.8	230.1	- 2.9	6.1	- 6.0	8.8	☹
Portugal	64.6	79.3	2.9	22.4	27.0	10.2	☹
Spain	305.8	380.2	6.1	23.2	15.0	16.5	☹
Sweden	69.5	70.7	- 2.6	1.5	4.0	- 0.3	😐
UK	741.9	637.9	-6.5	- 14.0	- 12.5	- 8.4	☺
EU-15	**4,198.7**	**4,029.6**	**- 2.0**	**- 4.0**	**- 8.0**	**- 0.4**	😐

(1) For the fluorinated gases most Member States have selected a base year other than 1990 (namely 1995), as allowed for under the protocol. However, for the analysis of EU emission trends in this report 1990 emissions data have been used as the base year for all gases, for consistency reasons.
(2) For Denmark, data that reflect adjustments for electricity trade (import and export) in 1990 are given in brackets. This methodology is used by Denmark to monitor progress towards its national target under the EC 'burden sharing' agreement. For the EU emissions, total non-adjusted Danish data have been used.
(3) The EEA evaluation of progress to 1999 awards 'smileys' according to the distance-to-target indicator in 1999. The following rating system is used:
☺ distance-to-target indicator below minus 2 index points (positive contribution to EC trend)
☹ distance-to-target indicator above plus 2 index points (negative contribution to EC trend)
😐 distance-to-target indicator in a ravtnge of plus/minus 2 index points (limited positive or negative contribution to EC trend)

The overall EC greenhouse gas emission trend is dominated by contributions from the two largest emitters Germany and the UK, accounting for about 40 % of EC greenhouse gas emissions. These two Member States achieved total greenhouse gas emission reductions of 81 Tg of CO_2 equivalents (compared to 1998) and 330 Tg (compared to 1990).

The main reasons for the favourable trend in Germany are increasing efficiency in power and heating plants and the economic restructuring of the five new *Länder* after the German unification. The reduction of GHG emissions in the UK was primarily the result of liberalising the energy market and the subsequent fuel switches from oil and coal to gas in electricity production and N_2O emission reduction measures in the chemical industry.

A study published recently quantifies the effects of the reunification and the liberalisation of the electricity market for Germany and the UK respectively. According to this study, in both Member States these special circumstances account for about 50 % of the reduction of all six greenhouse gas emissions. This share increases to 60 % if only energy-related CO_2 emissions are considered. A diverse set of policies affecting energy-related CO_2 emissions and policies directed towards non-CO_2 emissions (in particular waste management and the reduction of N_2O from adipic acid production) accounts for the remaining 50 % of the greenhouse gas emission reductions in both countries (Eichhammer et al., 2001).

The third and fourth largest emitters, France (14 %) and Italy (13 %), show opposing trends. Whereas France cut its GHG emissions in 1999 compared to 1998 (- 2.2 %) and was slightly below 1990 levels in 1999, Italy's GHG emissions were above 1998 and 1990 levels in 1999. In France, large reductions were achieved in N_2O emissions from the chemical industry, but CO_2 emissions from transport increased considerably. Italian GHG emissions increased between 1990 and 1999 primarily in the transport sector and in electricity production.

Spain, as the fifth largest emitter in the EU accounts for 9 % of total EC GHG emissions and increased emissions by more than 20 % between 1990 and 1999. The main sources contributing to the increase are the same as in Italy, i.e. transport and electricity production (see Chapter 3 for a sectoral assessment).

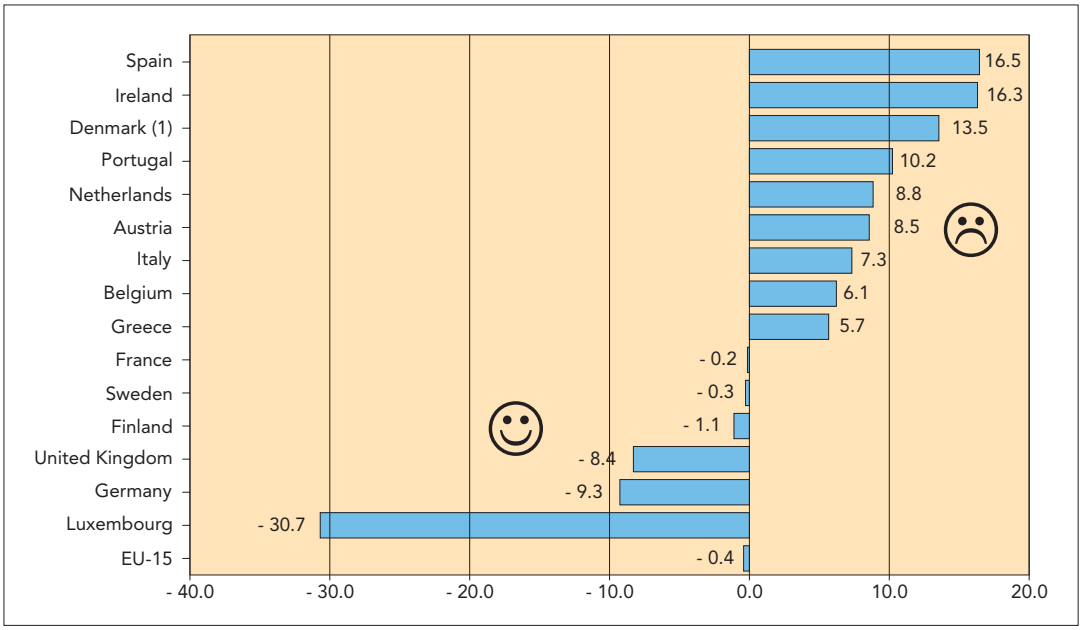
Progress of the Member States: If greenhouse gas emissions of the Member States are compared with their linear target paths for 2000 and 2008–12, progress of Member States looks as follows:

Kyoto target for 2008–12 (Figure 6): In 1999, Germany, Luxembourg and the United Kingdom were well below their Kyoto target paths. France, Finland and Sweden were near to their linear Kyoto target paths. All other Member States were well above their Kyoto target paths (Spain, Ireland and Portugal by 10 index points or more). The Danish distance-to-target indicator is 13.5 index points above the target path for non-adjusted data and 4.9 index points, if Danish greenhouse gas emissions are adjusted for electricity trade in 1990.

A more detailed analysis of the progress of each Member State is given in Annex 1.

Figure 6 **Distance-to-target indicators (in index points) for the Kyoto Protocol and EC burden sharing targets of EC Member States**

Source: Submissions by the EC Member States (CRF tables).



(1) The Danish DTI is 4.9 index points, if Danish greenhouse gas emissions are adjusted for electricity trade in 1990.

CO_2 target for 2000: The UK and Luxembourg were well below their CO_2 targets for 2000 (Table 4). Denmark was near the CO_2 emission target path for 2000 (taking into account adjustments for electricity trade for Denmark). All other Member States were well above their CO_2 target path for 2000 (Ireland, Spain and the Netherlands by 10 index points or more). Four Member States do not have targets for CO_2 for 2000.

Table 4 **CO_2 emissions (excluding LUCF) and targets for 2000**

Source: Submissions by the EC Member States (CRF tables).

MEMBER STATE	1990 (million tonnes)	1999 (million tonnes)	Change 1998–99 (%)	Change 1990–99 (%)	UNFCCC and national targets for 2000 (%)	Distance-to-target indicator (DTI) (index points)	Evaluation of progress in 1999 (1)
Austria	62.1	65.8	0.4	5.9	0.0	5.9	?
Belgium	114.0	117.0	- 4.1	2.6	- 5.0	7.1	?
Denmark (2)	53.0	57.0	- 5.4	7.4 (- 4.0)	- 5.0	11.9 (0.5)	☹ (😐)
Finland	62.5	64.2	- 0.6	2.8	No target	No target	No target
France	385.5	404.7	- 1.5	5.0	No target	No target	No target
Germany	1,014.5	858.5	- 3.3	- 15.4	No target	No target	No target
Greece	84.3	98.5	- 0.9	16.7	15.0	3.2	?
Ireland	31.6	41.9	4.7	32.7	20.0	14.7	?
Italy	437.7	456.5	0.5	4.3	0.0	4.3	?
Luxembourg	10.2	5.4	5.2	- 46.3	0.0	- 46.3	?
Netherlands (3)	161.2	174.1	- 3.8	8.0 (7.1)	- 3.0	10.7 (9.8)	☹ (😐)
Portugal	44.1	57.9	3.8	31.2	No target	No target	No target
Spain	226.1	281.1	4.7	24.3	12.0	13.5	?
Sweden	55.1	56.5	- 2.9	2.5	0.0	2.5	?
UK	583.5	531.5	- 2.2	- 8.9	0.0	- 8.9	?
EU-15	3,325.4	3,270.5	- 1.4	- 1.6	0.0	- 1.6	?

(1) See Note 3 in Table 3.
(2) See Note 2 in Table 3.
(3) For the Netherlands, data that reflect adjustments for temperature variations in 1990–99 are given in brackets. The Dutch national target takes these adjustments into account.

3. Sectoral assessment

This chapter analyses the performance of the EC and the Member States at sectoral level. It presents key sources as identified by using the IPCC Tier 1 approach for the EC inventory. By comparing the performance of the Member States in each of theses key source categories, decreasing or less increasing trends in the Member States are identified. In addition, sectoral driving force data is presented (either from the CRF tables submitted by the Member States or from Eurostat) in order to provide explanations, either socioeconomic developments or policies and measures, for these greenhouse gas emissions trends.

1.1.Key source indicators

In order to analyse the sectoral greenhouse gas trends in more detail and to focus on the most important sources, key source indicators are identified on the basis of the IPCC Tier 1 method (see Section 1.2). The aim of the key source analysis is to identify source categories that cover 95 % of GHG and/or show substantial changes in emissions between 1990 and 1999. The result of the key source analysis for the EC on basis of CRF Table *Summary 1.A.* is given in Table 5: In the first step (level assessment) 14 key source categories have been identified covering 95 % of EC GHG emissions. In a second step, four categories have been added because of their remarkable trend performance (the last four categories in Table 5). Therefore, in our analysis 18 key source categories have been identified for the EU covering 96 % of total EC GHG emissions in 1999.

EC greenhouse gas source categories identified as key sources (emissions in Tg or million tonnes of CO_2 equivalents)

Table 5

Greenhouse Gas Source Categories	Gas	Sector	GHG emissions in 1990 (million tonnes)	GHG emissions in 1999 (million tonnes)	Cumulative total in 1999 (%)
1.A.1. Energy Industries	CO_2	Energy	1147	1044	25.9
1.A.3. Transport	CO_2	Energy	698	825	46.4
1.A.4. Other Sectors	CO_2	Energy	631	631	62.1
1.A.2. Manufacturing Industries	CO_2	Energy	638	582	76.5
4.D. Agricultural Soils	N_2O	Agriculture	194	188	81.2
4.A. Enteric Fermentation	CH_4	Agriculture	142	131	84.4
2.A. Mineral Products	CO_2	Ind. Processes	108	108	87.1
6.A. Solid Waste Disposal on Land	CH_4	Waste	136	106	89.7
2.B. Chemical Industry	N_2O	Ind. Processes	110	48	90.9
HFCs (total)	F-gases	Ind. Processes	26	43	91.9
4.B. Manure Management	CH_4	Agriculture	42	40	92.9
1.B.2. Fugitive Emissions from Oil and Gas	CH_4	Energy	34	32	93.7
4.B. Manure Management	N_2O	Agriculture	28	29	94.5
1.A.3. Transport	N_2O	Energy	12	25	95.1
1.B.1. Fugitive Emissions from Solid Fuels	CH_4	Energy	51	24	95.7
SF_6 (total)	F-gases	Ind. Processes	8	11	95.9
PFCs (total)	F-gases	Ind. Processes	14	8	96.2
1.A.5. Other	CO_2	Energy	20	7	96.3

Source: Submissions by the EC Member States (CRF tables).

The emission trends of the key source categories vary widely. Figure 7 shows the ranking of key source categories according to absolute changes between 1990 and 1999.

Sectors with increase in emissions: Emissions from transport have risen rapidly since 1990 (mainly CO_2, but also N_2O emissions). This is mainly due to growth in road transport in almost all Member States (but in particular in the cohesion States Ireland, Spain, Portugal and Greece). N_2O emission increases from transport are mainly due to the increased use of catalytic converters, which reduce emissions of air pollutants, but produce N_2O as a by-product.

The second key source category with substantially increasing emissions is HFC emissions from industrial processes. Some HFCs are used as substitutes for ozone depleting CFCs which have been gradually phased out in the 1990s. However one Member State (UK) showed large decreases in HFC emissions, due to reduction measures in the chemical industry (HCFC production).

Sectors with reductions in emissions: The largest reductions in absolute terms were achieved in the energy sector (electricity and heat production) mainly due to fuel shifts from coal to gas in several Member States (above all in the UK) and efficiency improvements (above all in Germany).

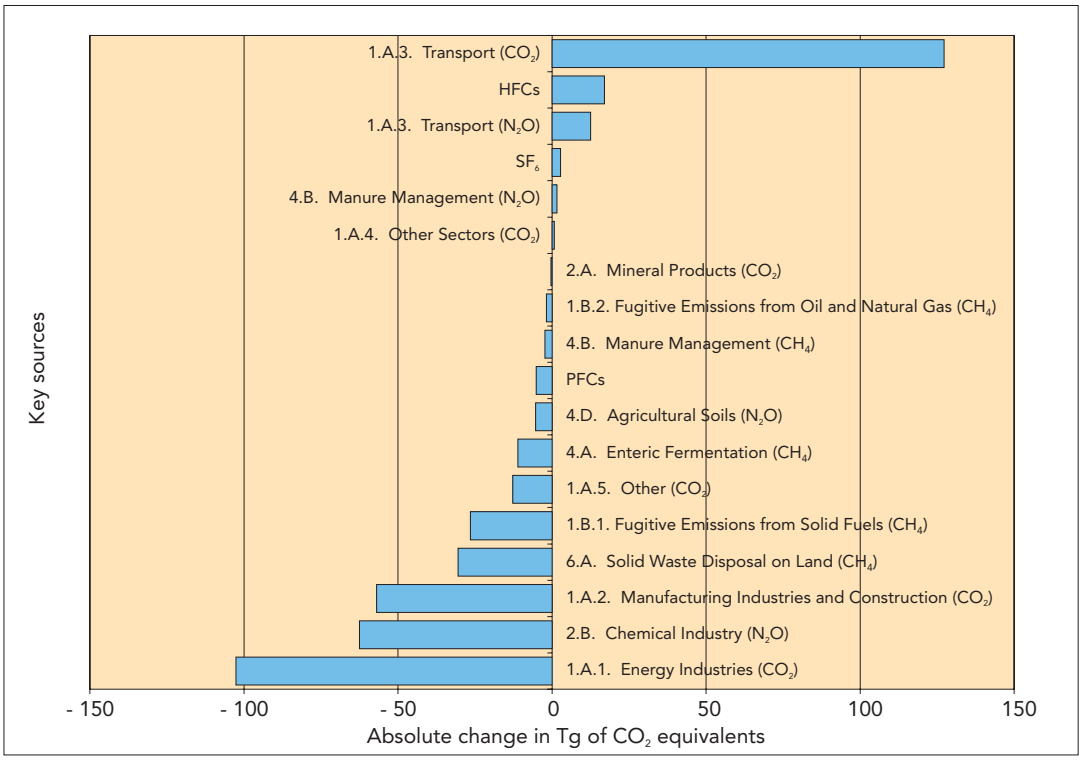
Second largest were reductions of N_2O in the chemical industry in the UK, Germany and France mainly due to specific measures in the adipic acid production in these countries.

Third largest were reductions of CO_2 emissions from fossil fuel combustion in the manufacturing industries mainly due to economic restructuring and efficiency improvements in the German manufacturing industry after German unification. Voluntary agreements to improve energy efficiency probably had positive effects. Other Member States also introduced voluntary agreements or other programmes aimed at improving energy efficiency in industry.

Substantial CH_4 emission reductions were achieved from solid waste disposal on land (landfilling) and fugitive emissions from solid fuels. These reductions are mainly due to measures related to the implementation of the landfill directive and the decline of coal mining after cuts in coal subsidies mainly in the UK, Germany and France.

Figure 7 **Absolute GHG emission trends 1990–99 in the EC key source categories (Tg or million tonnes of CO_2 equivalents)**

Source: Submissions by the EC Member States (CRF tables).



3.2. Key source indicator trends

This chapter analyses the sectoral performance in the EU by comparing the Member States performance in the key sources identified above. It concentrates on those key sources that contributed more than 1 % to total EC greenhouse gas emissions in 1999. In addition, underlying sectoral driving force trends are presented.

Note that these comparisons of key source indicators refer to the trend 1990–99 in the Member States. The different circumstances in the Member States are not taken into account. This might give a misleading picture for Member States that already implemented emission reduction measures or fuel shifts before 1990. Also for Member States with lower-than-EC-average economic welfare in 1990, but which had a higher-than-EC-average economic growth, emission reductions or limited growth may have been difficult to achieve.

3.2.1. Energy industries (CO_2)

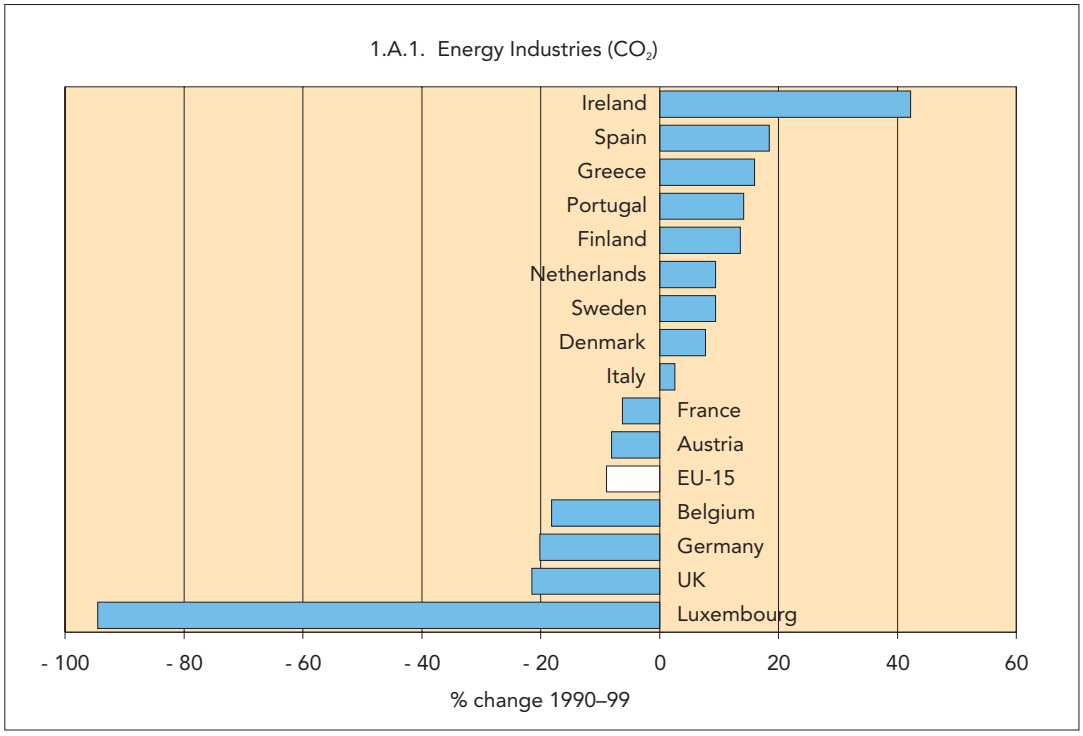
Energy industries include fossil fuel combustion in public electricity and heat production, petroleum refining, and the manufacture of solid fuels and other energy industries. CO_2 emissions from energy industries are the largest single source of greenhouse gas emissions in the EU accounting for 25.9 % of total greenhouse gas emissions in 1999. However, the trend of CO_2 emissions from energy industries is favourable: emissions declined from 1990 to 1999 by 9 % or 103 Tg in the EU.

The largest emitter of CO_2 from energy industries is Germany accounting for 32 % of total EC CO_2 emissions from energy industries, followed by the UK (17 %) and Italy (14 %).

Figure 8 shows that the trends at Member States level vary considerably. Whereas Belgium, Germany, the United Kingdom and Luxembourg reduced emissions by approximately 20 % or more, Ireland had an increase of more than 40 %. The main reasons for the 95 % decrease of Luxembourg's CO_2 emissions from energy industries were reductions in thermal power production and increases in hydro-power and electricity imports.

In absolute terms, Germany reduced CO_2 emissions from energy combustion by 83 Tg and the UK by 49 Tg, whereas Spain increased emissions by 14 Tg.

Percentage change of CO_2 emissions from energy industries in EC Member States 1990–99 Figure 8

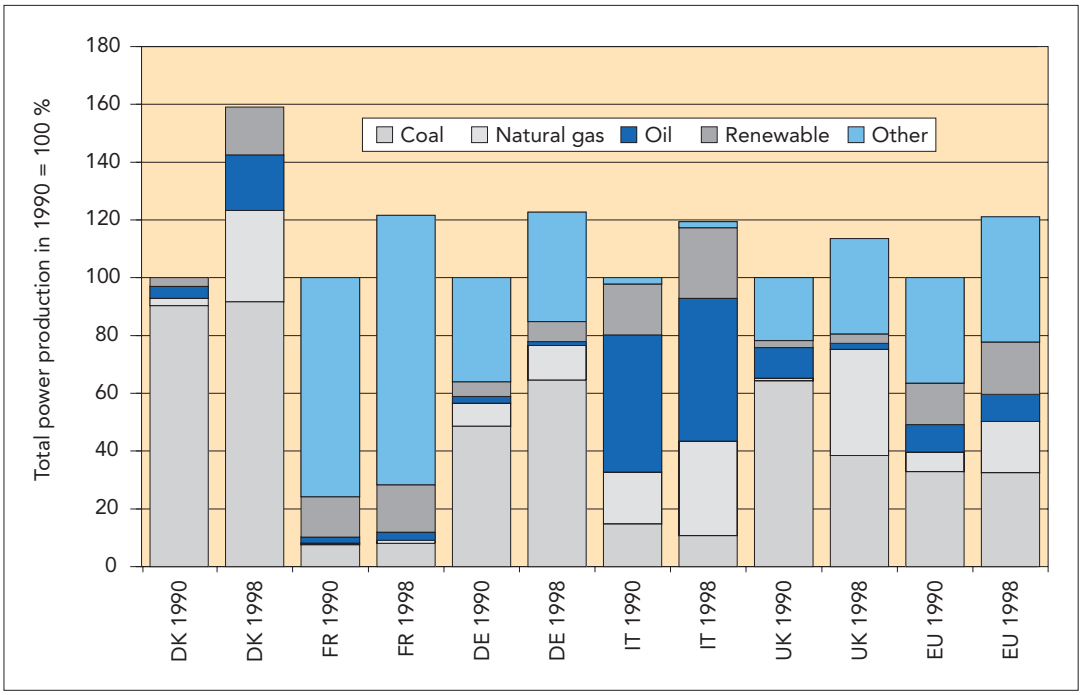


Source: Submissions by the EC Member States (CRF tables).

The main driving forces of CO_2 emissions from energy industries are public electricity and heat production in thermal power plants. In the EU as a whole, electricity production grew by 21 % between 1990 and 1998 (see Figure 9). This substantial increase contrasts with the 9 % CO_2 emission reduction mentioned above. The main reasons for de-coupling electricity production from CO_2 emissions were fuel shifts from coal to natural gas, renewable energy sources and nuclear power, and efficiency improvements.

Figure 9 **Gross electricity production by energy sources in selected EC Member States 1990 and 1998 (1990 is 100 %)**

Source: Eurostat.



Germany, France, the UK and Italy are the largest power producers in the EU. Denmark had EU wide the largest increase in total power production between 1990 and 1998 and the highest growth rate of renewable electricity generation. Driving forces for power production trends in these Member States are summarised below. Additional information on policy relevant details on wind power in Denmark and on the UK electricity market liberalisation is given in two separate boxes further down:

- **Denmark:** As a swing producer for Scandinavian hydro-power, Denmark's electricity production fluctuates heavily according to the needs in the Nordic electricity market. This was a main reason why Danish power production was 60 % above 1990 levels in 1998. In addition, Danish power production is characterised by a rapid growth of renewable power production. The share of renewables in total power production rose from 3 % in 1990 to 10 % in 1998. Denmark has the highest share of wind power production in the EU (see Figure 11 and Box 1).
- **France** is the largest exporter of electricity in the EU and has the highest share of nuclear power (76 % in 1998). Renewable energies account for 13 % of total power production, coal for 7 %. Total power production increased by 22 % between 1990 and 1998, with fuel shifts from coal to nuclear power and natural gas.
- **Germany:** German CO_2 emissions from energy industries reduced by 20 % between 1990 and 1999, but gross electricity production grew by 23 % between 1990 and 1998. The most important reason for de-coupling CO_2 emissions from electricity production were energy efficiency improvements in coal-fired power plants: whereas electricity production from coal-fired power stations increased by 33 % between 1990 and 1998, coal input to power stations reduced by 12 %. Also increased power production from gas and renewable sources contributed to CO_2 reductions from energy industries. Wind power experienced a take-off in recent years. Due to favourable feed-in tariffs, Germany became the largest wind power producer in the EU accounting for 38 % total EU wind power production in 1998.

- **Italy** is the largest importer of electricity and has the highest share of oil-fired power production (41 %). The share of gas in power production increased from 18 % in 1990 to 27 % in 1998, whereas coal declined from 15 % to 9 %. Renewable energies (hydro-power and geothermal energy) accounted for 20 % of Italian power production in 1998, up two percentage points from 1990.
- **United Kingdom:** The share of electricity production from natural gas in total gross electricity production increased from 1 to 32 % between 1990 and 1998, whereas the share of coal-fired electricity production declined from 64 to 34 %. Figure 10 below shows that solid fuel use in British electricity and heat production decreased by 51 % between 1990 and 1999, but the use of gas increased by a factor of 3 200. In 1999, for the first time more gas than coal was used in British power stations. The most important reason for this fuel shift from coal to gas was the energy market liberalisation in the United Kingdom (see Box 2).

Box 1: Wind power production in Denmark

Danish wind power production more than quadrupled between 1990 and 1998 and accounted for 7 % of total electricity production in 1998. According to O'Brien and Hoj (2001), the rapid expansion of Danish wind power is the result of a specific policy with the main aims of reducing greenhouse gas and other emissions, improving security of energy supplies, and supporting technological development.
The growth of wind power was triggered by an extensive subsidy scheme, reaching almost 0.1 % of GDP in 1998, and covering production subsidies, tax subsidies for cooperatively owned wind turbines, and guaranteed feed-in tariffs for wind power. In the future, the subsidy schemes will be phased out and a system of 'green certificates' is supposed to provide a more cost-effective way of meeting 20 % of the Danish electricity demand from renewable sources by 2003.
Technology has made rapid progress over the past decade, and average production costs for newly installed wind turbines (in a prime location) have fallen by around half. Danish wind turbine producers have benefited from the rapid growth of their domestic market, and are thought to supply around 60 % of the world export market.

Box 2: Electricity liberalisation in the UK

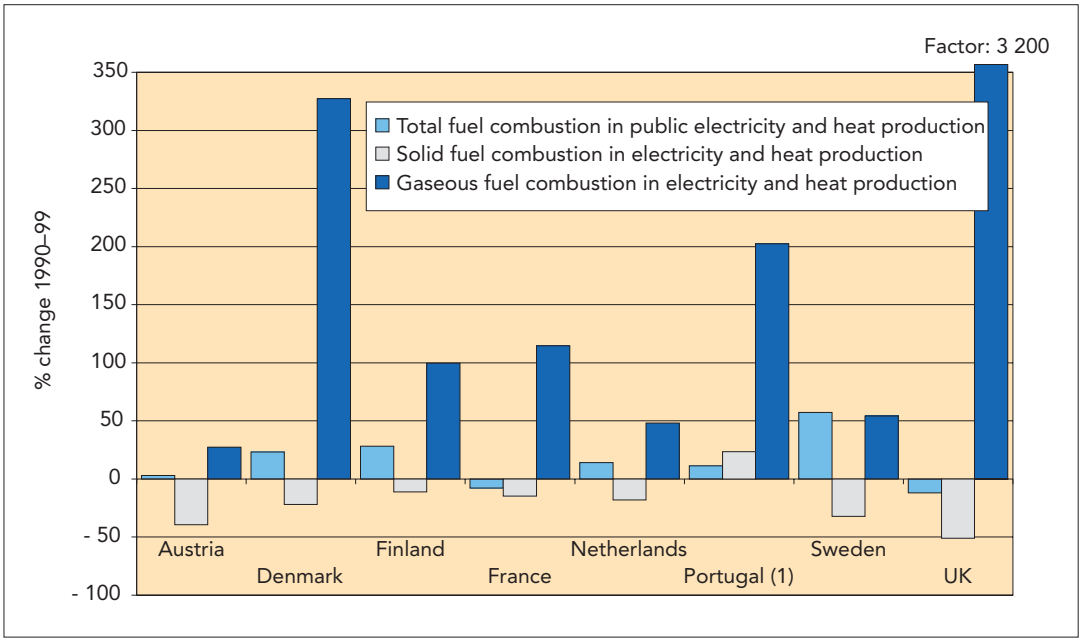
The liberalisation of the electricity market in the UK was started in 1990 by the government in order to reduce the State-controlled share of the economy. The liberalisation has resulted in greater competition and price reductions. The number of major generators has increased from one pre-privatisation, the Central Electricity Generating Board (CEGB), to 30 at the end of 1998. And the market share of the two largest generators, National Power and PowerGen, has fallen from 78 % in 1990 to 39 % in 1997/98. Between 1990 and 1997, industrial electricity prices fell by 21 % in real terms and domestic prices (including VAT) fell by 9 % in the same period.
One of the most significant changes since 1990 has been the change in the fuel mix, with a large shift from coal to gas generation. In 1990, coal accounted for 64 % of power generation, but fell to 34 % in 1998. In the same time, the gas-fired power production went up from 1 to 32 % (Eurostat data). According to the latest FCCC (CRF) greenhouse gas inventory submission of the UK, 1999 was the first year where more gas than coal was used in British power stations.
A major beneficiary of this change has been the environment. The switch from coal-fired to gas-fired technology for electricity generation has significantly reduced the CO_2 emissions. Between 1990 and 1999, carbon dioxide emissions from electricity supply industry fell by more than 20 %. The CO_2 emission reductions are partly due to the lower carbon content of natural gas and partly because of the overall higher energy efficiency of natural gas-fired power plants. There have also been similar reductions in emissions of sulphur and nitrogen oxides and of smoke and dust.
However, there is a drawback of the liberalisation of the UK electricity market for the environment as well. Lower consumer prices can lead to increased use of electricity and reduce incentives for energy efficiency improvements at the consumer level.

Source: Source: G8 Environmental Futures Forum on 'Domestic best practices addressing climate change', http://www.eic.or.jp.

As mentioned above, one of the main reasons for declining CO_2 emissions from energy industries is the fuel shift from solid fuels to natural gas which is illustrated in Figure 10. It shows that seven out of the eight Member States reduced solid fuel input to public power plants and all of them increased the use of natural gas. Two Member States decreased total fuel combustion in power plants with higher efficiency of gas-fired power production, compared to coal-fired power production, being the most likely reason.

Figure 10 **Percentage change of fuel use in public electricity and heat production for selected Member States 1990–99 (2) (UK: change by a factor 3 200)**

Source: Submissions by the EC Member States (CRF tables).



(1) For Portugal the base year for gaseous fuels is 1997; before this year, no gas was used in Portuguese power production.
(2) UK: gaseous fuel combustion changed (increased) by a factor of 3 200

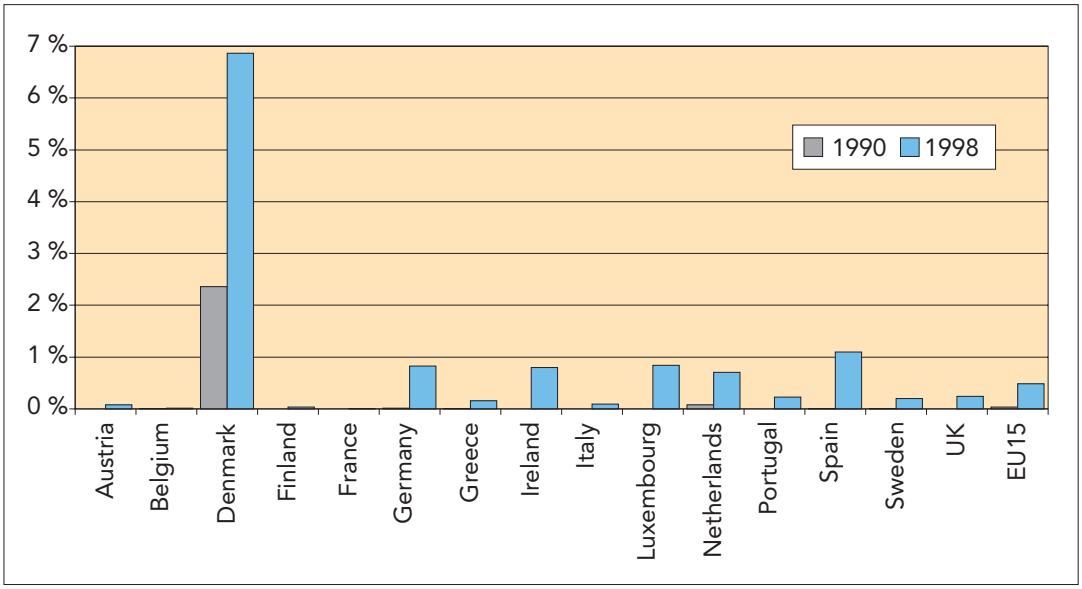
Renewable energies: Power production from renewable energy sources is another reason for CO_2 emission cuts from energy industries. In the EU, power production from renewable sources grew by 27 % between 1990 and 1998. However, this increased the share of renewables in total power production only slightly from 14 % in 1990 to 15 % in 1998.

Wind power showed high growth rates in several Member States in the 1990s. The share of wind power production in total European electricity production was 0.5 % in 1998, with considerable differences among the EC Member States. Figure 11 shows that in Denmark wind power accounted for almost 7 % of power production in 1998. Spain is second with a share of 1.1 %. Germany, Luxembourg and Ireland have a share of 0.8 % in total electricity production.

In absolute terms, Germany has become the largest wind power producer in the EU accounting for 38 % of total EU wind power production in 1998, followed by Denmark (23 %) and Spain (18 %).

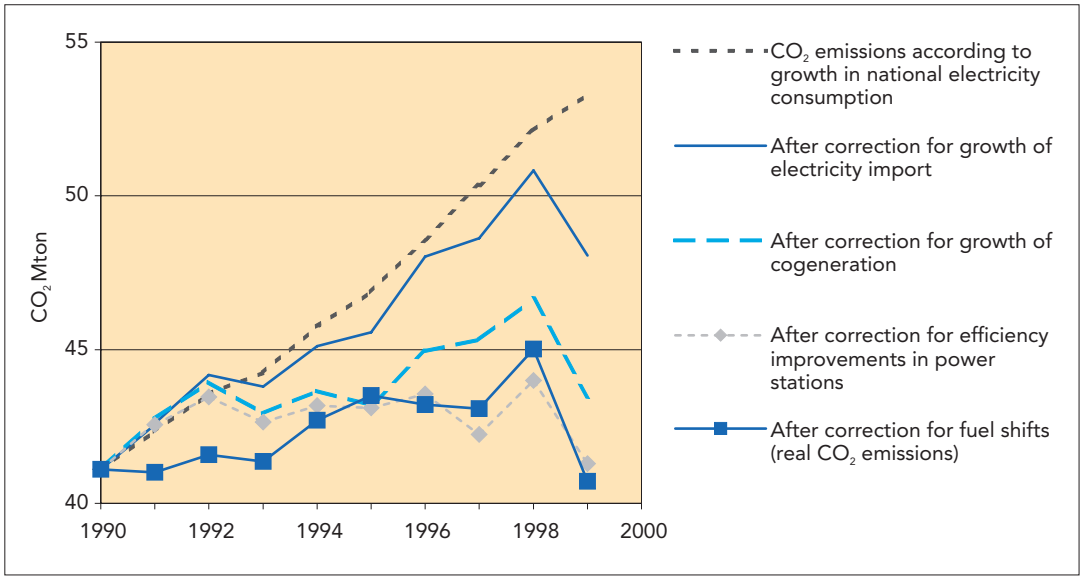
Figure 11 **Share of wind power in total electricity production in 1990 and 1998**

Source: Eurostat.



The impact of structural changes (fuel shifts, efficiency improvements, share of cogeneration as well as export/import of electricity) on CO_2 emissions can be illustrated by the case of the Netherlands. Figure 12 shows that the growth of CO_2 emissions due to electricity production was much lower than what may be expected on the basis of growing electricity use. Whereas national electricity consumption increased by 30 % between 1990 and 1999, CO_2 emissions from electricity production were almost at 1990 levels in 1999.

CO_2 emissions from electricity production in the Netherlands, including cogeneration, 1990–99 Figure 12



Source: National Institute of Public Health and the Environment (RIVM, The Netherlands).

Figure 12 also shows that in 1999, the most important reason for de-coupling CO_2 emissions from growing power consumption was a large increase in electricity imports. However, during the whole period 1990–99, increased power production from cogeneration and efficiency improvements in public power stations had a large impact on CO_2 emissions from electricity production. Also fuel shifts had an impact on CO_2 emissions from Dutch electricity production (especially in the early 1990s).

3.2.2. Transport (CO_2)

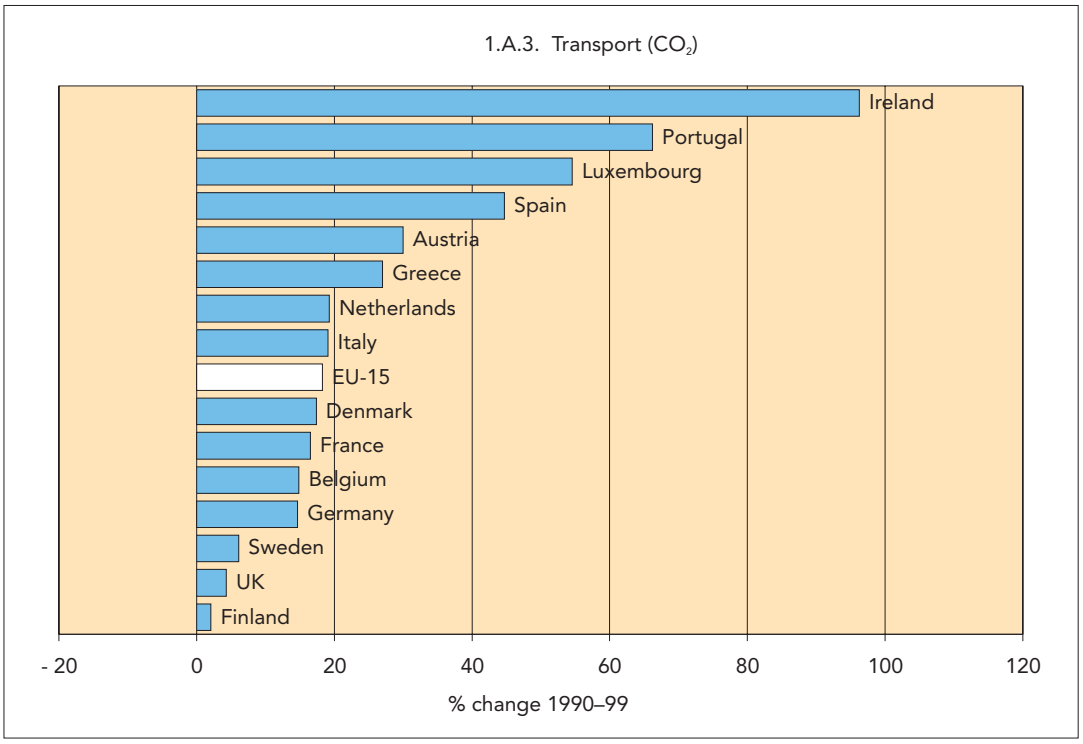
CO_2 emissions from transport are the second largest single source of greenhouse gas emissions in the EU accounting for 20.5 % of total greenhouse gas emissions in 1999. And CO_2 emissions from transport are rising rapidly: between 1990 and 1999 emissions increased by 18 % or 127 Tg in EU-15. Transport includes emissions from fossil fuel combustion in road transportation, national civil aviation, railways, national navigation, and other transportation. (Note that, in accordance with UNFCCC guidelines, these emissions do not include CO_2 emissions from international aviation and navigation, which were 224 Tg in 1999 or 6 % of total EC greenhouse gas emissions. Total EC CO_2 emissions from international aviation and navigation grew by 60 Tg or 37 % between 1990 and 1999.)

The largest emitter of CO_2 from transport in the EU is Germany accounting for 23 % of total EC CO_2 emissions from transport, followed by France (17 %), and the UK and Italy (15 % each).

Figure 13 shows that, although all Member States had CO_2 emission increases from transport between 1990 and 1999, there are significant differences in the Member States performance. In Finland, the United Kingdom and Sweden emissions grew by less than 10 % from 1990 to 1999, whereas Ireland almost doubled its CO_2 emissions from transport. In general, it is the cohesion States, which show sustained growth rates due to their economic catch-up process. In absolute terms, the largest increases were in Spain (26 Tg), Germany (24 Tg), France (20 Tg), and Italy (19 Tg).

Figure 13 **Percentage change in CO_2 emissions from transport in EC Member States 1990–99**

Source: Submissions by the EC Member States (CRF tables).



Note: Excludes emissions from international aviation and navigation (in accordance with UNFCCC guidelines).

The main reason for the strong growth of CO_2 emissions from transport is the increase in road transport volumes and — associated with this — rising road fuel consumption. Figure 14 shows that in the EU passenger car and road freight transport increased by 15 and 29 % respectively between 1990 and 1997. All Member States with the exception of Finland (freight) and Sweden (passenger) had increases in both types of transport; in most Member States freight transport increased more rapidly than passenger transport.

Figure 14 **Growth rates of passenger car transport (passenger-kilometres) and road freight transport (tonne-kilometres) 1990–97**

Source: Eurostat.

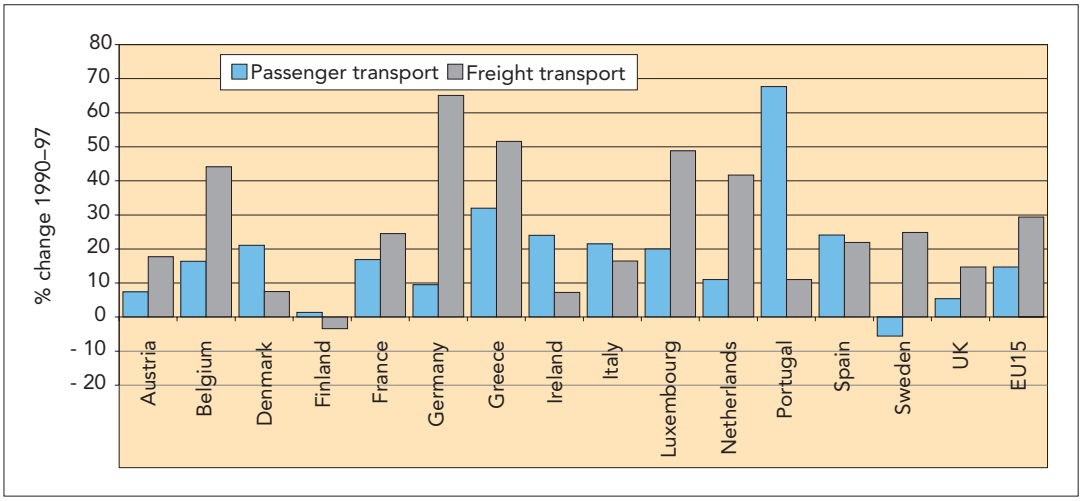
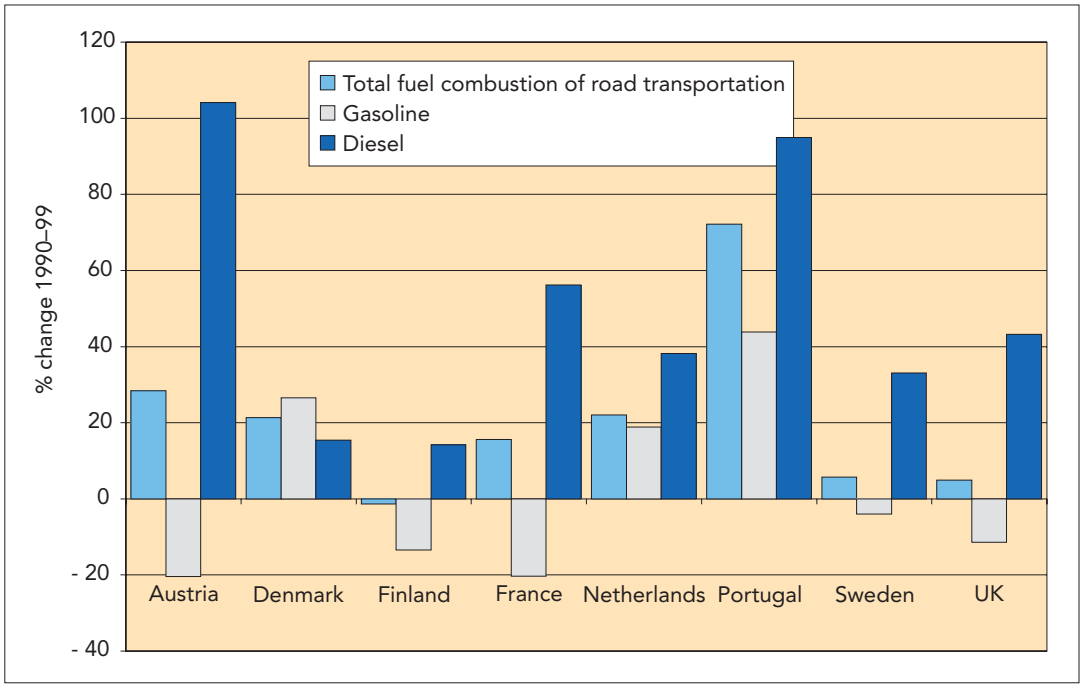


Figure 15 shows that, except for Finland, all Member States (that were reporting background data in the CRF tables) had rising road fuel consumption in the 1990s. In addition, a fuel shift from gasoline to diesel can be observed: all Member States increased diesel consumption, but five out of eight Member States reduced gasoline consumption. The increase in diesel consumption is the result of rapidly growing freight transport, but also of a shift in passenger

cars from gasoline to diesel. One reason for the fuel shift in passenger cars might be a substantial price gap between diesel and gasoline in all Member States.

Percentage change of road fuel combustion in EC Member States 1990–99 Figure 15



Source: Submissions by the EC Member States (CRF tables).

Note: Includes fuel used in passenger and freight transport.

Finland, Sweden and the United Kingdom show the lowest CO_2 emission and road fuel growth rates in the EU. One reason for this might be high or rapidly growing fuel prices. Figures 16 and 17 illustrate that in 1999 Finland and Sweden had the highest prices of unleaded petrol (in constant 1990 euro) and all three Member States mentioned were at the top of the diesel prices ([4]). In the UK, fuel prices were increased automatically in real terms each year between 1993 and 1999 (see Box 3).

On the other hand, Greece, Portugal, Spain, Luxembourg and Austria show low prices of road fuels. Ireland has rather low prices for petrol, but above-average diesel prices. However, for the cohesion States, low transport levels (e.g. low car-ownership ratios) and a certain economic catch-up process might have had more influence on transport growth rates than fuel prices. Also Luxembourg had high economic growth rates in the 1990s.

(4) In addition, in Finland overall prices of private car use increased almost parallel with real disposable income in the 1990s. Therefore, in Finland used car prices did not decline in relative terms, as in other Member States (EEA, 2000a).

Figure 16 **Prices of unleaded petrol in constant 1990 euro per 1 000 litre**

Source: Eurostat.

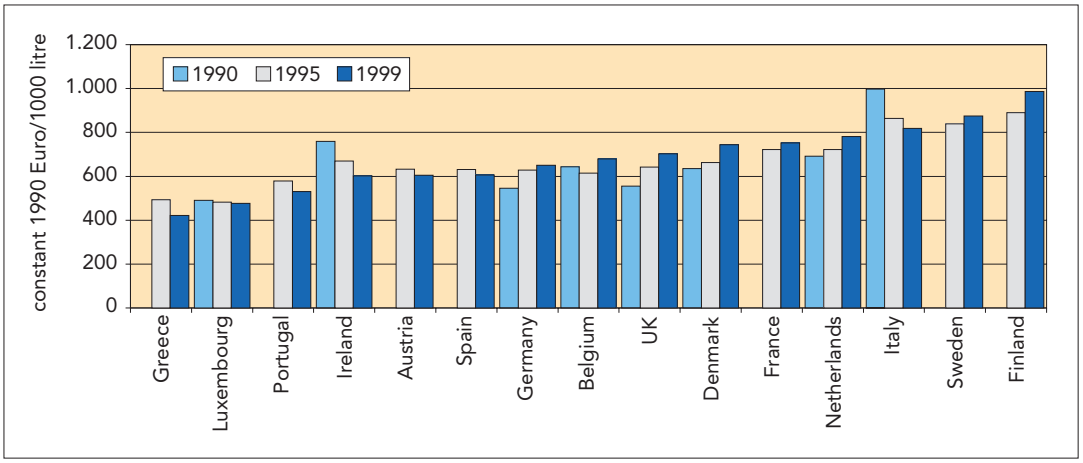
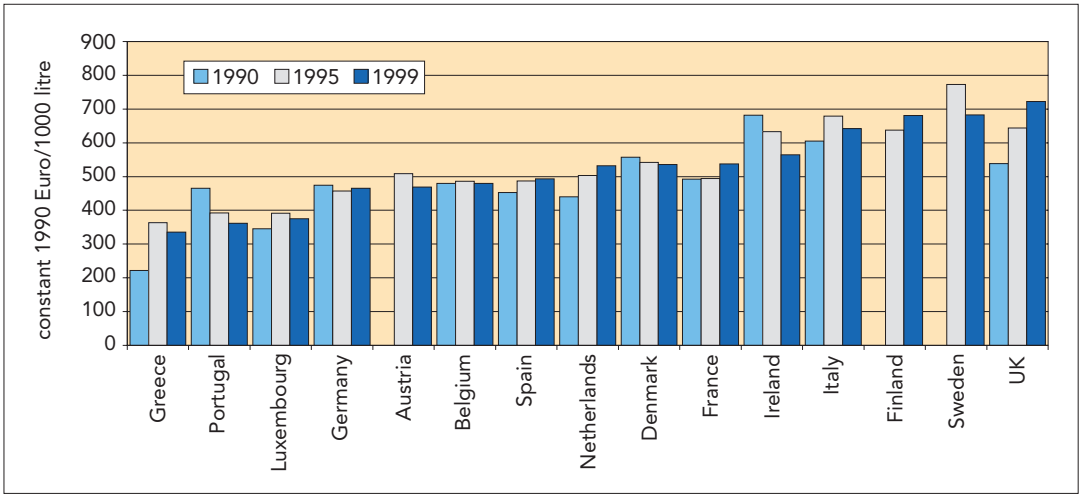


Figure 17 **Prices of diesel oil in constant 1990 euro per 1 000 litre**

Source: Eurostat.



Actual energy efficiency of passenger transport (and consequently the specific CO_2 emissions) has improved only slightly in the 1990s, following technological improvements. Freight transport shows no improvement at all in energy efficiency, amongst others because of inefficient loading trends. The discrepancy between improvements in technology and actual energy efficiency is amongst others the result of the use of heavier and more powerful vehicles and lower occupancy rates and load factors (EEA, 2001b).

The EU aims at improving the fuel economy of passenger cars and reducing the average CO_2 emissions for new passenger cars to 120 g CO_2/km by 2005, and 2010 at the latest. One of the instruments for reaching this are self-commitments of the automobile industry on fuel economy improvements, aiming at achieving an average CO_2 emission figure for new passenger cars of 140 g CO_2/km by 2008/2009.

According to the first annual report on the effectiveness of the strategy to reduce CO_2 emissions from cars, the average specific CO_2 emissions of new passenger cars reduced by 5.6 % from 186 g CO_2/km in 1995 to 176 g CO_2/km in 1999. One of the reasons for the specific emission reductions was the technological development in diesel cars and a shift in fleet composition from petrol to diesel passenger cars (EC, 2000a).

Box 3: The road fuel duty escalator in the UK

The fuel duty escalator was first introduced in 1993 with an annual increase on fuel duty of 3 % in real terms. It subsequently was increased to 5 % and from 1997 to 6 %. In 1999, it was decided to end the fuel duty escalator.
The fuel duty escalator was introduced as a long-term measure for two reasons. Firstly, it was intended to encourage vehicle users to reduce their fuel consumption, and thus CO_2 emissions, either through the vehicle they drive (by selecting a more fuel efficient model) or the way they use their vehicle (by selecting a more fuel efficient driving style, making fewer journeys or switching to alternative modes of transport). In addition, the escalator acts as a signal to car manufacturers about likely demand for more fuel efficient vehicles. Secondly, the effects of the escalator are expected to be apparent for a long time after policy itself is discontinued, because of the long-term increase in fuel prices.
The environmental impact of the road fuel duty escalator has been estimated with the help of models. Assuming an annual 6 % road fuel duty escalator between 1996 and 2002, it was forecast that the fuel price rises over this period would save between 2 and 5 million tonnes of carbon per year in 2010, compared to a scenario without real fuel duty increases beyond 1996.
Also actual performance appears to underline the effectiveness of the road fuel duty escalator, but it is stressed that the measure is intended as a long-term measure. According to surveys of road goods transport there is some evidence that there has been marked improvement in the average fuel consumption efficiency of lorries since the escalator was introduced in 1993. Average miles per gallon for articulated lorries over 33 tonnes increased by 13 % between 1993 and 1998.
Source: Response to the Environmental Audit Committee request for a memorandum addressing the environmental appraisal of the fuel duty escalator. In G8 Environmental Futures Forum on 'Domestic best practices addressing climate change', http://www.eic.or.jp

3.2.3. Other sectors (CO_2) (Small combustion including households)

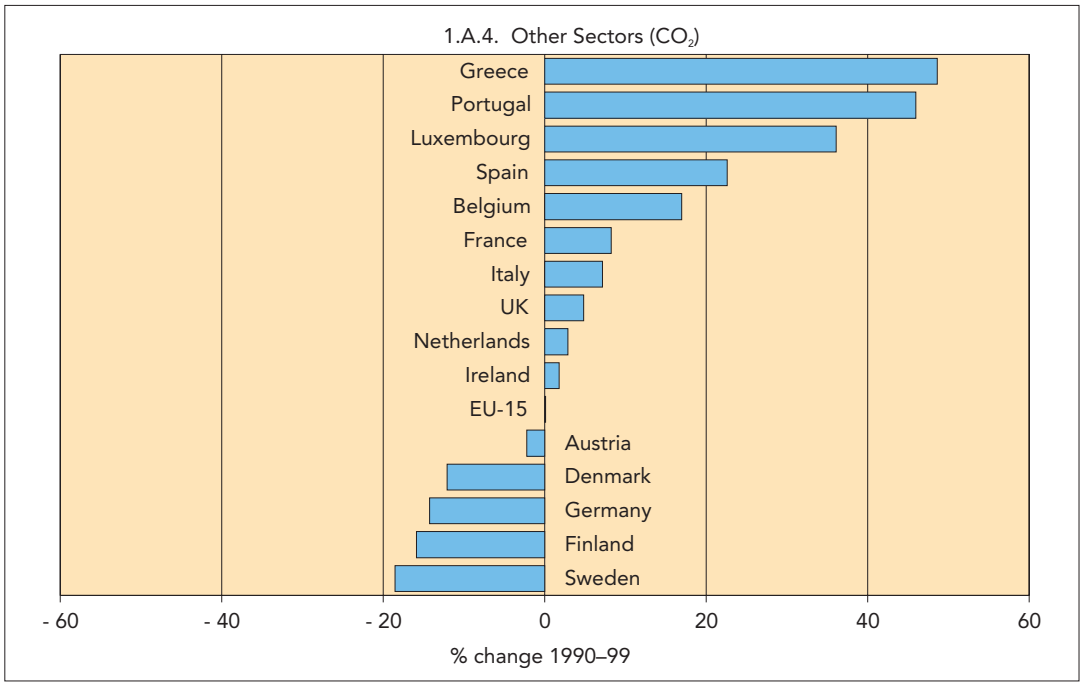
CO_2 emissions from small combustion is the third largest source of greenhouse gas emissions in the EU and accounts for 15.7 % of total greenhouse gas emissions in 1999. Small combustion includes fossil fuel combustion from small commercial businesses (as opposed to industry), public institutions, households and agricultural businesses, with households being by far the largest sub-group in this category.

The largest emitter of CO_2 emissions from small combustion is Germany accounting for 28 % of total EC CO_2 emissions from small combustion, followed by the UK (19 %) and France (16 %).

Between 1990 and 1999, CO_2 emissions from small combustion were stable at EU level, but trends of the Member States varied considerably (Figure 18). Whereas Germany and the Nordic countries achieved substantial CO_2 cuts, Greece, Portugal, Luxembourg and Spain increased their emissions by more than 20 %. In absolute terms, Germany reduced CO_2 emissions from small combustion by 29 Tg, whereas the UK, Italy and Spain (+ 5 Tg each), and France (+ 8 Tg) had large emission increases.

Percentage change of CO_2 emissions from small combustion (including households) in EC Member States 1990–99

Figure 18



Source: Submissions by the EC Member States (CRF tables).

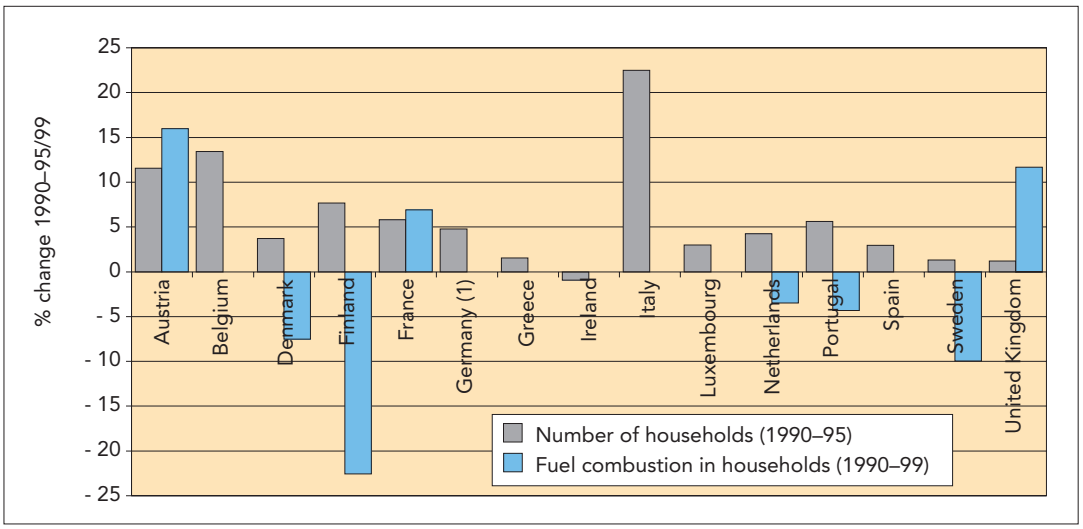
Fossil fuel consumption of households is the main driver of CO_2 emissions from small combustion. The main factors influencing on energy consumption of households are:

- Number and size of dwellings: as economic welfare increases the number and the average size of dwellings increases, thus putting pressure on energy consumption in households.
- Building codes: higher insulation standards and efficiency improvements in heating and warm water equipment mainly refer to newly built houses.
- Age distribution of the existing building stock: as the turnover rate of buildings is very low, the refurbishment of the existing building stock with low insulation standards is very important to increase efficient use of energy.
- Climate: the need for heating (and also for cooling) depends on the climate (and weather). Therefore, the heating degree days (a measure for the heating needs due to low temperature) show a close connection with CO_2 emissions from residential sources for several Member States.

Figure 19 shows that in all Member States the number of households increased between 1990 and 1995 (except for Ireland), but fuel consumption trends of households vary: some Member States reduced fuel combustion considerably (e.g. Sweden, Finland and Denmark), but others increased fuel use in this sector.

Figure 19 **Percentage change of number of households (1990–95) and fuel combustion in households (1990–99)**

Source: Euromonitor (1997) for number of households; submissions by the EC Member States (CRF tables) for fuel combustion in households.



(1) For Germany the percentage change of household numbers refers to 1991–95.

One additional factor influencing fuel combustion in households is district heating. As district heating replaces heating boilers in households, an increased share of district heating reduces CO_2 emissions from households (and increases emissions from energy industries). For Finland, Sweden and Denmark, increased production of district heating seems to play a role in declining fuel combustion in households. In Germany, efficiency improvements in Eastern German households might have been one reason for emission reductions.

Box 4: The German eco-tax reform

In recent years, the instrument of an ecological tax reform has gained importance as a measure to stimulate emission reductions from small combustion. The Nordic countries started with such programmes in the early 1990s by shifting taxes from labour (personal income, social security contributions, etc.) to the use of the environment (energy taxes, CO_2 taxes but also taxes on water and waste, etc.). A number of EC Member States followed recently, or are about to implement such reforms (Speck and Ekins, 2000).
In 1999, Germany introduced an ecological tax reform with five steps until 2003, including annual increases of electricity and road fuel taxes in exchange for reductions in social security contributions and promotion of renewable energies. The aim of the tax reform is to reduce energy consumption and related emissions and to stimulate the development of environmentally sound technologies. In addition, the reductions in social security contributions are intended to increase employment.
A first systematic and model-based analysis of the eco-tax reform in Germany indicates that energy consumption and CO_2 emissions are decreasing, employment is growing slightly and the influence on economic growth is very low. For CO_2 emissions, a 2–3 % decrease by 2005 compared to the base line scenario without tax reform is projected. 250 000 new jobs will be created by 2010, and economic growth reduction will be no more than 0.1 % per year. The sectoral development shows no universal pattern for a structural change from energy intensive to labour intensive industries. The distributional effects are moderate.

Source: DIW (2001).

3.2.4. Manufacturing industries and construction (CO_2)

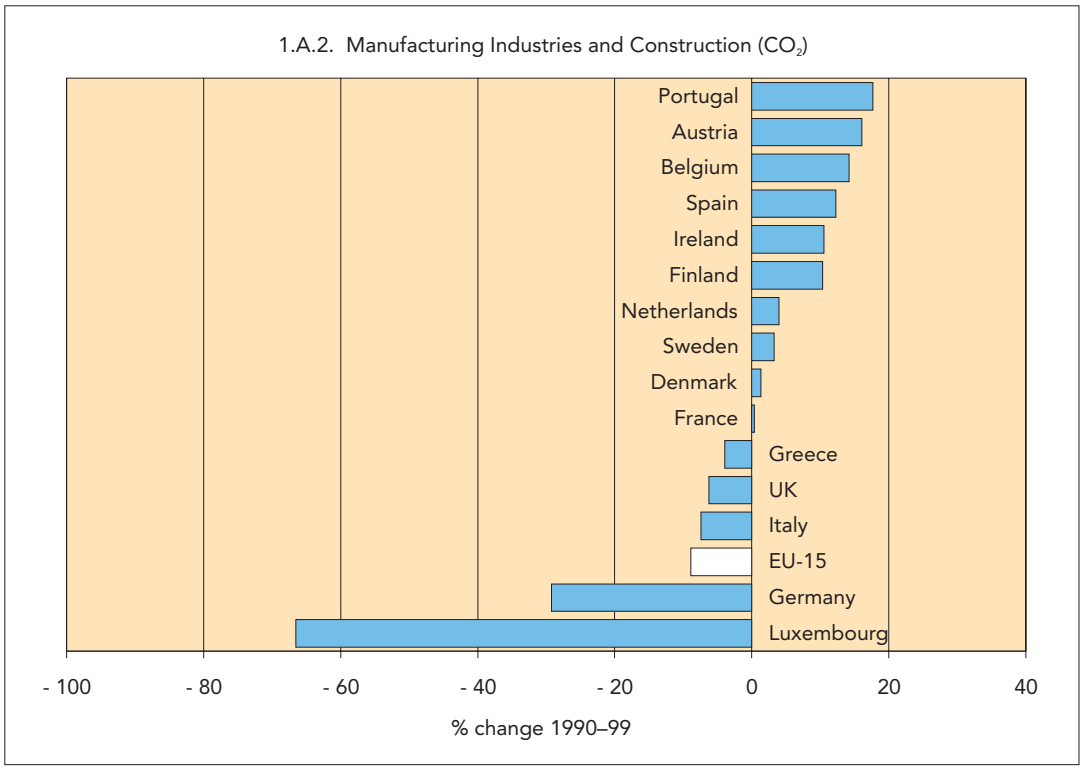
CO_2 emissions from fossil fuel combustion in manufacturing industries is the fourth largest source of greenhouse gas emissions in the EU and accounted for 14.4 % of total greenhouse gas emissions in 1999. The trend of CO_2 emissions from manufacturing industries is favourable: between 1990 and 1999 emissions decreased by 9 % or 57 Tg in EU-15.

Germany is the largest emitter of CO_2 from manufacturing industries accounting for about 24 % of EU emissions, followed by the UK (15 %) and Italy (14 %). All three large emitters reduced emissions between 1990 and 1999, whereas many other Member States increased CO_2 emissions from manufacturing industries (Figure 20).

Germany decreased CO_2 emissions by 29 % or 57 Tg. The main reason for this was the restructuring of German industry and efficiency improvements after German reunification. The 67 % decrease of Luxembourg's CO_2 emissions from manufacturing industries were mainly due to a sharp decrease in coke consumption after the conversion of the steel industry to electric arc furnaces.

Percentage change of CO_2 emissions from manufacturing industries and construction in EC Member States 1990–99

Figure 20



Source: Submissions by the EC Member States (CRF tables).

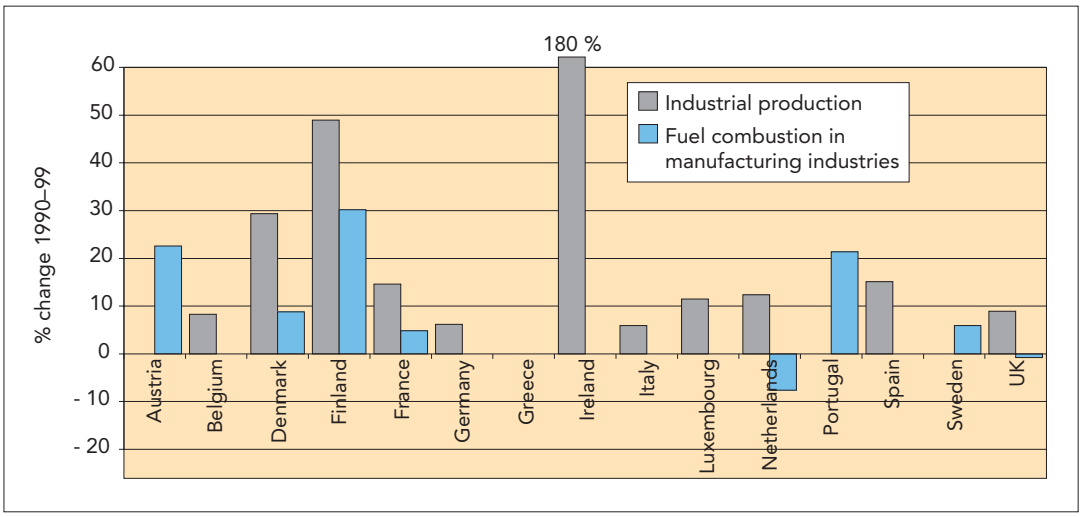
The main driving force of CO_2 emissions from manufacturing industries is production output and related fossil fuel use in manufacturing industries. Fossil fuels are used for combustion in the manufacturing industries or as a feedstock in the chemical industry ([5]). Figure 21 shows that in all Member States, for which data is available, industrial production (in terms of value added) increased in the 1990s. The most striking increase was achieved by Ireland (+ 180 %), but also Finnish and Danish industry grew rapidly.

Fuel combustion in manufacturing industries as reported by the Member States (in the CRF tables) increased in six Member States, two reported decreases. In those Member States, for which data on industrial output and on fuel consumption are available, fuel combustion grew at a slower pace than industrial output, thus illustrating some efficiency improvements.

However, these results should be interpreted with care as different criteria are used by Member States to decide whether particular emissions are allocated to fossil fuel combustion or to the relevant industrial process (e.g. steel production).

Figure 21 **Industrial production (in terms of value added) and fuel combustion in manufacturing industries in the EC Member States (1990–99)**

Source: Eurostat for industrial production; submissions by the EC Member States (CRF tables) for fuel combustion in manufacturing industries.



3.2.5. Agricultural soils (N_2O)

N_2O emissions from agricultural soils is the single largest source category of N_2O emissions and accounts for 4.7 % of total EC greenhouse gas emissions in 1999. N_2O emissions from agricultural soils slightly decreased (– 3 % or – 5 Tg) between 1990 and 1999 in EU-15. N_2O emissions from agricultural soils occur from the application of mineral nitrogen fertilisers and organic nitrogen from animal manure.

The largest emitter of N_2O from agricultural soils is France accounting for 27 % of total EU emissions. Second and third are the UK and Germany with shares of 15 and 13 % in total EU N_2O emissions respectively.

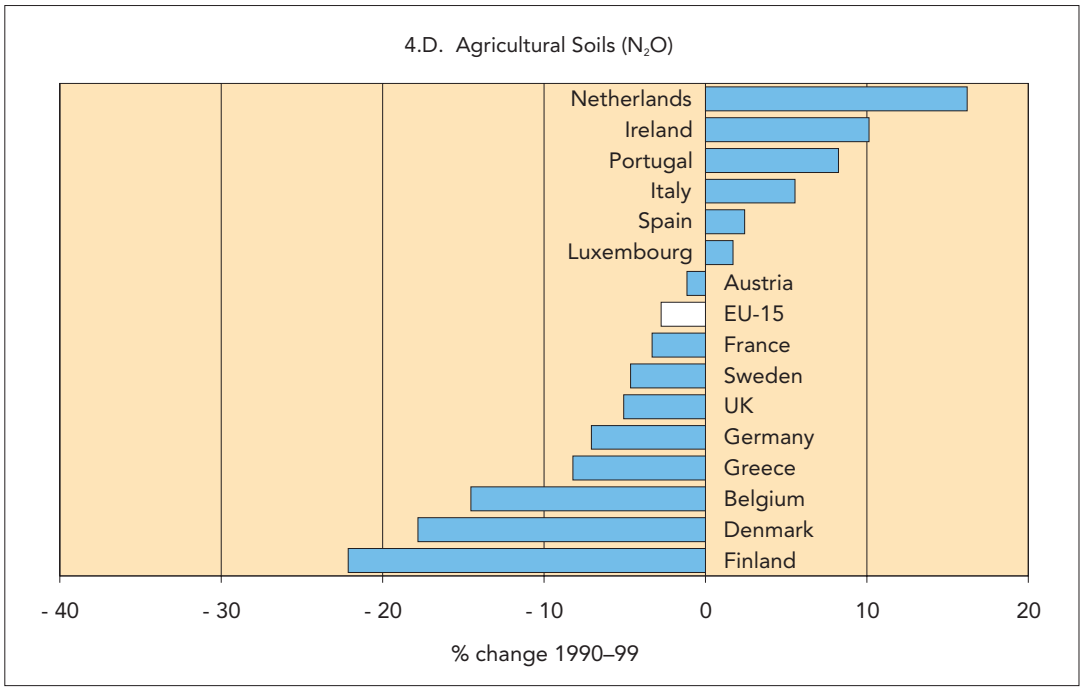
Trends in the Member States vary considerably: the largest reductions in absolute terms occurred in Germany, France, Denmark and the UK (reductions by more than 1 Tg of CO_2 equivalents), whereas Italy and the Netherlands accounted for the largest increases (more than 1 Tg of CO_2 equivalents). In relative terms, Finland, Denmark and Belgium reduced emissions by more than 10 % between 1990 and 1999, whereas the Netherlands and Ireland had increases by more than 10 % (Figure 22).

The increase in the Netherlands is due to the phase-out of manure spreading on the land and the incorporation of manure into the soil, which is a measure to reduce ammonia emissions from manure, but which increases N_2O emissions as a negative side-effect.

(5) All fossil fuels are used as feedstocks for non-energy purposes to some degree (e.g. natural gas is used for ammonia production). CO_2 emissions from feedstocks may be a substantial fraction of total CO_2 emissions from manufacturing industries, e.g. in the Netherlands they account for about 25 % of total industry emissions.

Trends should be interpreted with care, as methodological problems with estimating N_2O emissions from agricultural soils exist in a number of Member States.

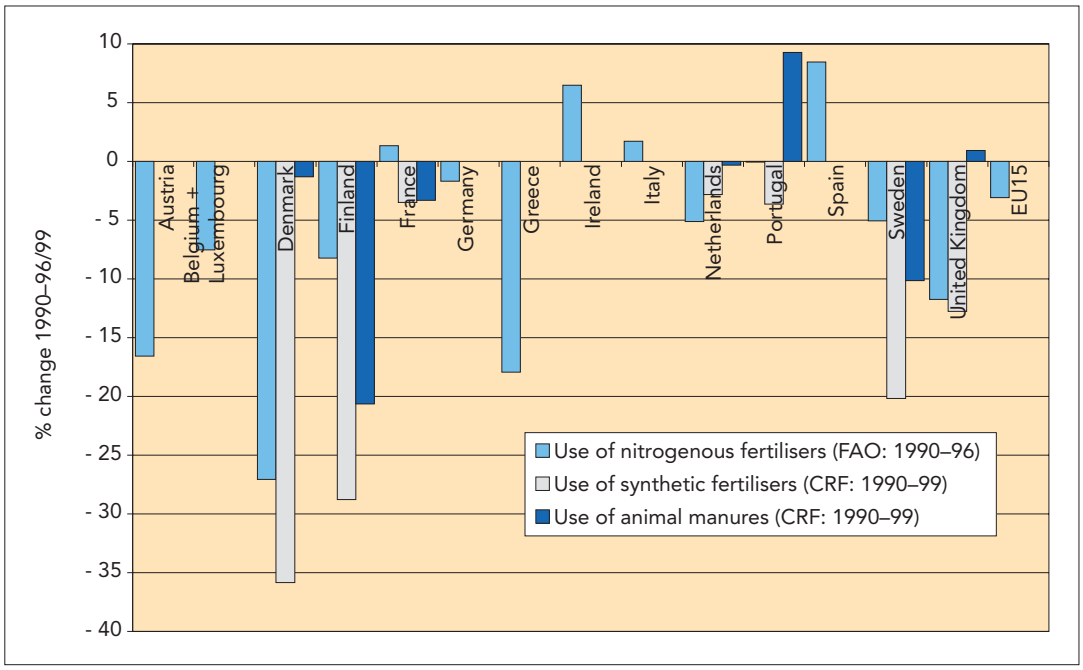
Percentage change of N_2O emissions from agricultural soils in EC Member States 1990–99 Figure 22



Source: Submissions by the EC Member States (CRF tables).

N_2O emissions from agricultural land can be decreased by overall efficiency improvements of nitrogen uptake by crops, which should lead to lower fertiliser consumption on agricultural land. Figure 23 shows that in most Member States the use of fertiliser and organic manure went down in the 1990s. The largest reductions occurred in Denmark, Finland and Sweden. Ireland, Portugal, Italy and Spain increased the use of fertiliser or organic manure, which is consistent with N_2O emission trends from agricultural soils.

Use of fertilisers and organic manure in the EC Member States 1990–96/1999 Figure 23

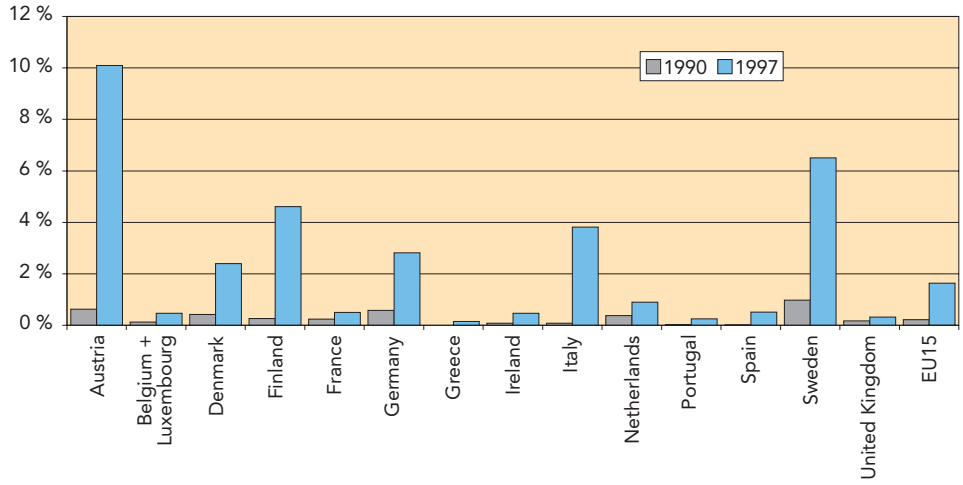


Source: FAO for use of nitrogenous fertilisers; submissions by the EC Member States (CRF tables) for use of synthetic fertilisers and animal manners.

Box 5: Organic farming in Europe

In recent years, organic farming has become an alternative to conventional farming practices in some Member States. At EU level the reforms of the agricultural policy in the 1990s have resulted in agricultural support shifting progressively away from market support to direct income support and the integration of environmental aspects into agriculture. Regulation (EEC) No 2078/92 introduced agri-environment measures and the Agenda 2000 reforms (Regulation (EC) No 1257/1999 on rural development) created a direct link between income support and environmental protection. This should also lead to increased support for organic farming in the EU.
Organic farming is thought to offer potentials to reduce emissions of agricultural greenhouse gases, mainly because of not using inorganic N fertiliser, lower livestock densities and the greater use of solid rather than liquid manure systems (see www.soilassociation.org).
The area under organic farming in the EU increased by a factor of seven between 1990 and 1997. However, the total area of agricultural land under organic farming schemes remains small in the EU (2 %). Figure 24 shows that there are significant differences among Member States, with Austria (10 %) and Sweden (6.5 %) having the highest shares in 1997.

Figure 24 **Share of organically farmed agricultural land area in the EU 1990 and 1997**



Source: EEA (2000b).

The main reasons for the increase in organic farming in Austria in the 1990s were (Vogl and Hess. 1996):
- Between 1989 and 1992 a number of regional and federal subsidy schemes were introduced.
- As many farmers are grassland farmers and grassland farming being not as intensive as other types of farming, many farmers had to adopt only small changes.
- The introduction of more attractive subsidy schemes after EC accession in 1995 and the insecurity of many farmers concerning increased competition from abroad has made organic farming a more attractive option for many farmers in the mid-1990s.
- New marketing structures for organic farmers (e.g. direct farm selling, organic food markets, home delivery), and especially the entry of the large retailing companies gave a boost to the organic food market.
- The image of organic farming has changed. Organic farming is not considered anymore 'old fashioned and resisting modern agricultural developments', but it is increasingly seen as being at the forefront of modern agricultural practices.

3.2.6. Enteric fermentation (CH_4)

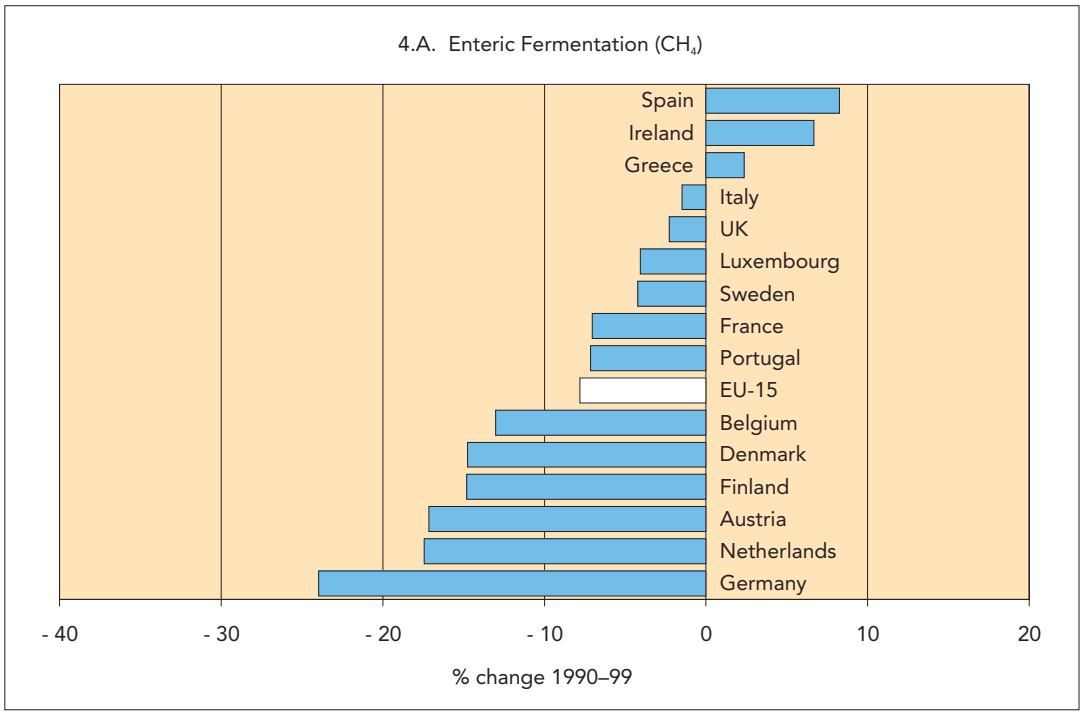
Enteric fermentation is the largest single source of CH_4 emissions in the EU and accounts for 3.2 % of total greenhouse gas emissions in 1999. The trend of CH_4 emissions from enteric fermentation is favourable: between 1990 and 1999 emissions decreased by 8 % or 11 Tg of CO_2 equivalents in EU-15.

CH_4 emissions from enteric fermentation result from anaerobic fermentation of polysaccharides and other components of animal feeds in the stomach of ruminant animals by micro-organisms. Therefore, the number of ruminant animals (e.g. cattle, sheep) is the most important driving force of CH_4 emissions from enteric fermentation.

France is the largest emitter of CH_4 from enteric fermentation accounting for 21 % of EU emissions, followed by Germany (15 %) and the UK (14 %). These Member States also account for more than 50 % of the EU cattle population. The UK and Spain have the largest sheep populations in the EU.

Figure 25 shows that most Member States reduced CH_4 emissions from enteric fermentation. In relative terms, the largest reductions occurred in Germany (– 24 %), the Netherlands and Austria (– 17 % each); in absolute terms, Germany (– 6 Tg of CO_2 equivalents), France (– 2 Tg) and the Netherlands (– 1 Tg) showed the largest decreases.

Percentage change of CH_4 emissions from enteric fermentation in EC Member States 1990–99 Figure 25



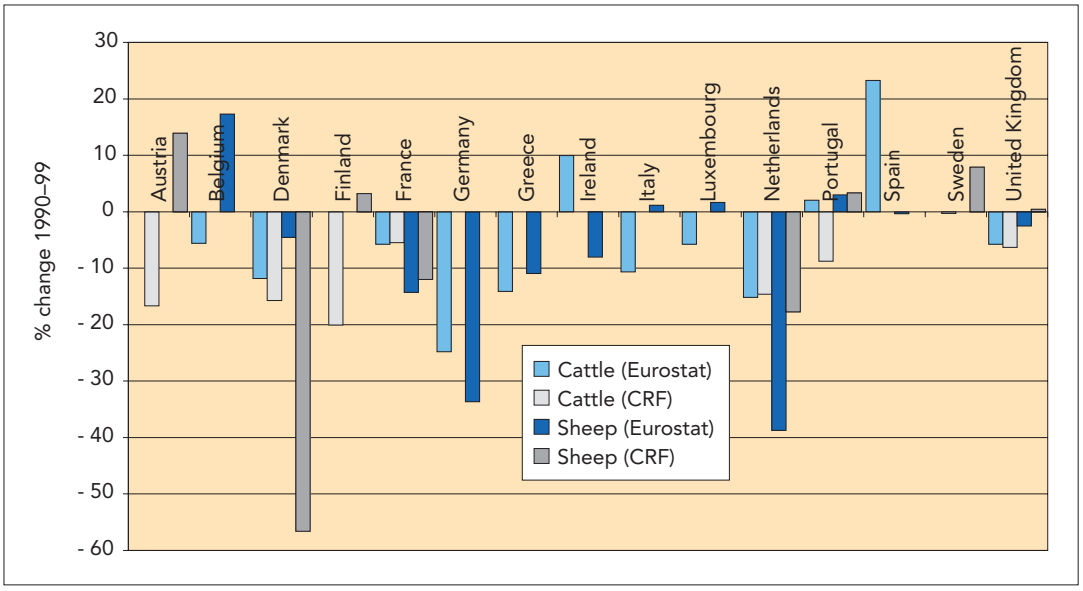
Source: Submissions by the EC Member States (CRF tables).

Figure 26 gives the percentage change of cattle and sheep populations in the EC Member States, as provided by Eurostat and as reported by Member States in the CRF tables. For some Member States, a considerable difference between the two figures can be observed. Further work is needed to identify the causes of these differences.

In general, in several Member States both cattle and sheep populations declined between 1990 and 1999. Germany and the Netherlands experienced substantial reductions in cattle and sheep numbers between 1990 and 1999, which is consistent with substantial CH_4 emission reductions from enteric fermentation. Spain, Ireland and Greece are the only Member States that increased CH_4 emissions from enteric fermentation. In Spain and Ireland this might be due to substantial increases in cattle populations. In the case of Greece, however, Eurostat data indicates decreases in cattle and sheep numbers, but emissions from enteric fermentation grew.

Figure 26 **Percentage change of cattle and sheep population in EC Member States 1990–99**

Source: Eurostat and submissions by the Member States (CRF tables).



In addition to falling livestock numbers, livestock may have shifted towards lower emissions per animal, e.g. larger fractions of relatively low emitting young animals, as in the case of cattle in the Netherlands.

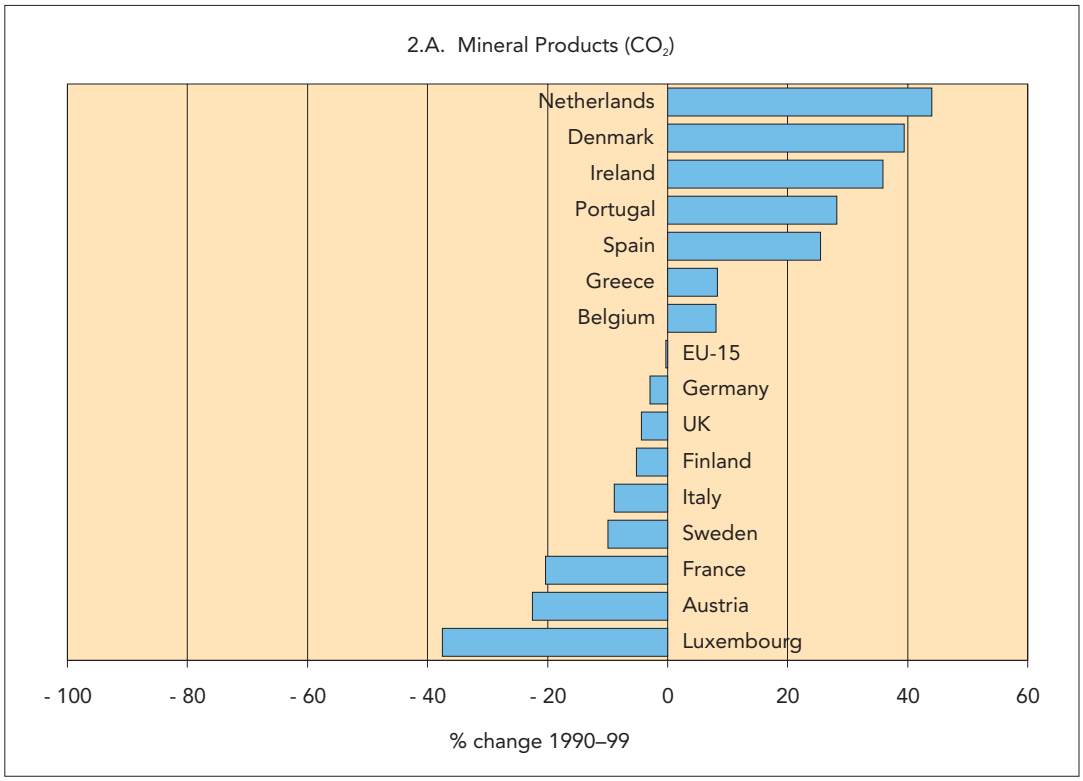
3.2.7. Mineral products (CO_2)

CO_2 emissions from industrial processes of mineral products were 108 Tg and accounted for 2.7 % of total EC greenhouse gas emissions. In 1999, they were at the level of 1990. The main sectors in this category are cement production, lime production, limestone and dolomite use, soda ash production and use, asphalt roofing, and road paving with asphalt, with cement production being by far the largest single source of CO_2 emissions.

Germany is the largest emitter of CO_2 from mineral products accounting for 22 % of EU emissions, followed by Italy (18 %) and Spain (17 %). The largest reductions in absolute terms occurred in France (– 3 Tg) and Italy (– 2 Tg), whereas Spanish CO_2 emissions from mineral products increased by 4 Tg between 1990 and 1999. In relative terms, Luxembourg, Austria and France reduced by more than 20 %, whereas Ireland, Denmark and the Netherlands increased emissions by more than 30 % (Figure 27).

However, these results should be interpreted with care as different criteria are used by Member States to decide whether particular emissions are allocated to fossil fuel combustion or to the relevant industrial process (e.g. cement production).

Percentage change of CO_2 emissions from mineral products in EC Member States 1990–99 Figure 27

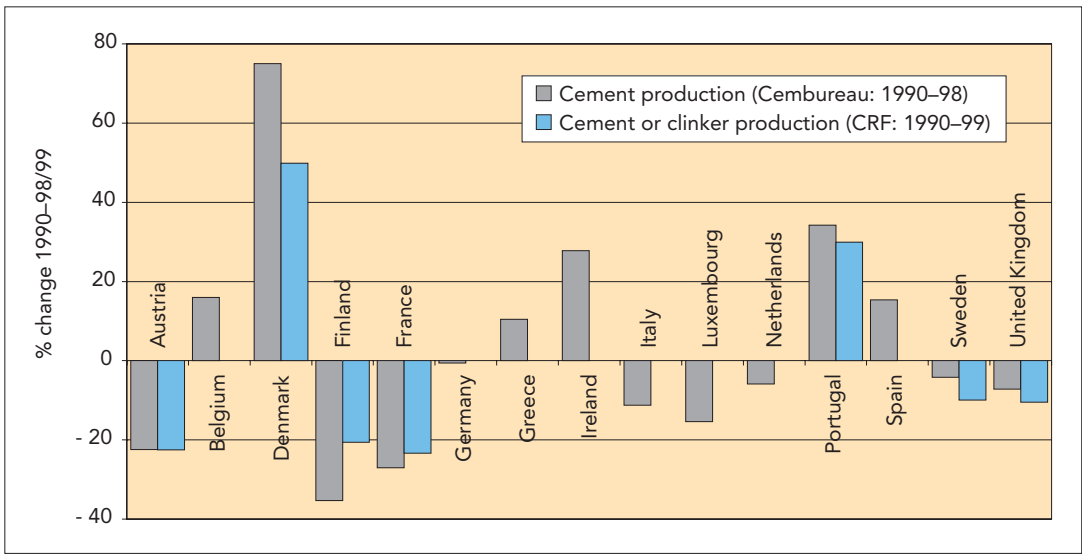


Source: Submissions by the EC Member States (CRF tables).

Cement production is a main driver of process related CO_2 emissions from the mineral industry. According to data of Cembureau published in EC (2001a), Italy is the largest cement producer in the EU, closely followed by Germany and Spain. According to this data source, 9 Member States reduced cement production between 1990 and 1998, six Member States increased.

Figure 28 presents cement production data of Cembureau for 1990–98 and of the CRF tables for 1990–99. Both data sets are broadly consistent. In addition, there seems to be considerable correlation between emissions (Figure 27) and cement production in the EC Member States.

Percentage change of cement production in EC Member States 1990–98/1999 Figure 28



Source: Cembureau published in EC (2001a) and submissions by the EC Member States (CRF tables).

3.2.8. Solid waste disposal on land (CH_4)

CH_4 emissions from solid waste disposal on land account for 2.6 % of total EC greenhouse gas emissions. They were 106 Tg of CO_2 equivalents in 1999 and reduced by 22 % (31 Tg of CO_2 equivalents) between 1990 and 1999. CH_4 emissions occur in landfills due to the breakdown of biodegradable carbon compounds by anaerobic methanogenic bacteria. The resulting landfill gas does not only contain methane but also CO_2, since aerobic processes occur in landfills as well.

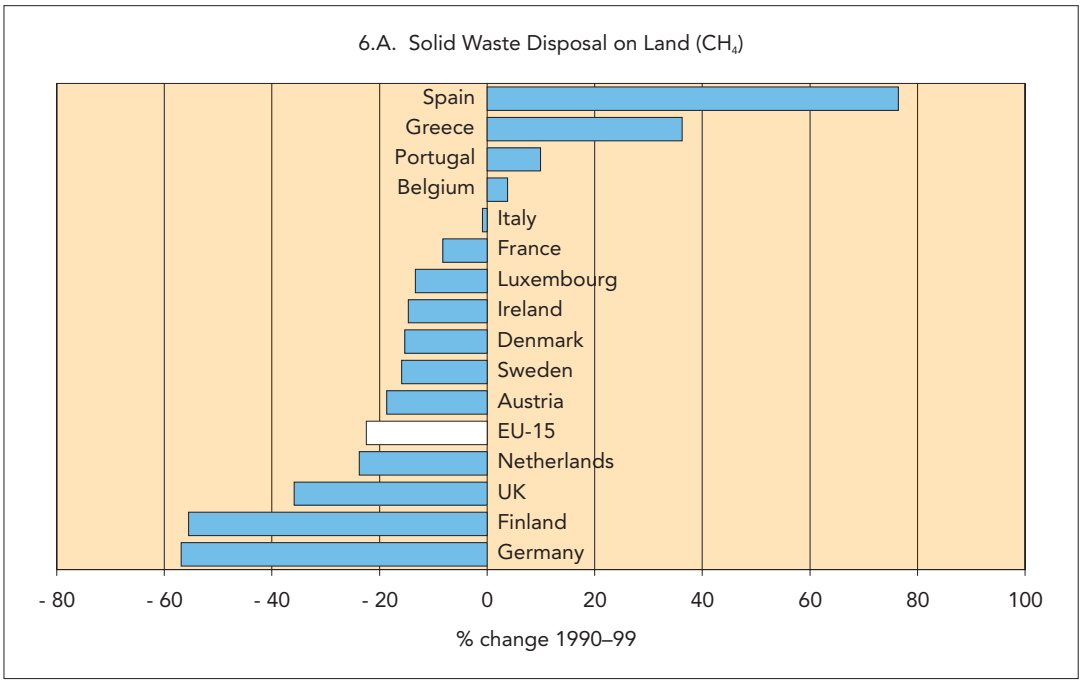
The largest emitters are Germany and France accounting for 16 % of total EU CH_4 emissions from landfills each, followed by Spain and the UK (14 % each). Most Member States reduced CH_4 emissions from solid waste disposal between 1990 and 1999 (Figure 29). Four Member States achieved reductions of more than 20 % (Germany, Finland, the UK and the Netherlands), whereas in two Member States emissions increased by more than 20 % (Spain, Greece). In absolute terms, Germany reduced by 22 Tg and the UK by 8 Tg of CO_2 equivalents, whereas Spanish emissions increased by 7 Tg.

Several Member States (of those that were reporting time series on sectoral background data for waste) reduced total waste disposal on land between 1990 and 1999 (Figure 30). They include Austria (– 12 %), Denmark (– 54 %), Finland (– 39 %), France (– 16 %), the Netherlands (– 64 %) and Sweden (– 45 %). In Portugal, total waste disposal on land was 29 % higher in 1999, compared to 1990. The UK reported increases until 1995 (+ 11 %), since then waste disposal went down and was 5 % above 1990 level in 1999. One reason for declining volumes of waste disposed at UK landfills might have been the introduction of the landfill tax in 1996.

In addition, a number of countries such as the Netherlands and the UK show a growing fraction of methane recovered from landfills (and combusted or flared).

Figure 29 **Percentage change of CH_4 emissions from solid waste disposal on land in EC Member States 1990–99**

Source: Submissions by the EC Member States (CRF tables).



Box 6: The landfill directive and related legislation

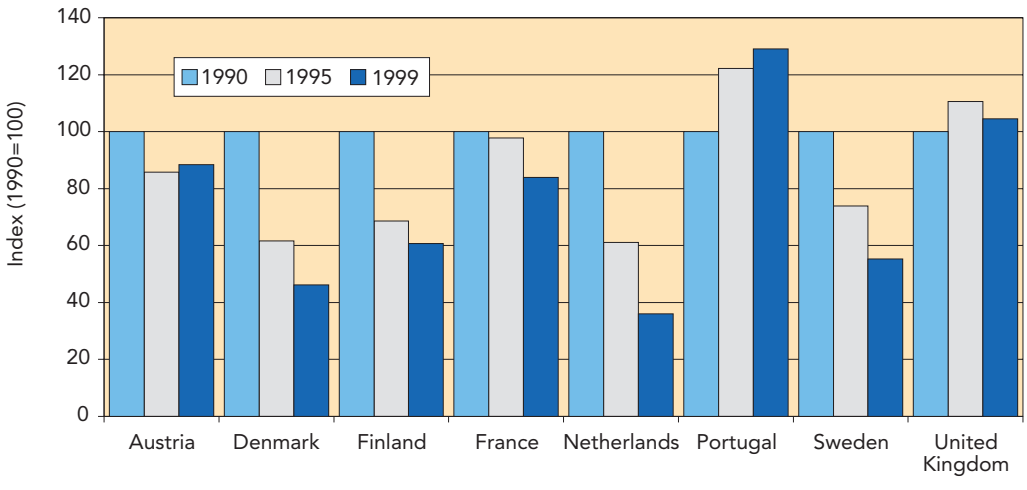
In 1999, Council Directive 1999/31/EC on the landfill of waste was adopted and has to be incorporated by the Member States into national legislation by July 2001. The objective of the landfill directive is to prevent or reduce as far as possible negative effects on the environment from the landfilling of waste, by introducing stringent technical requirements for waste and landfills. For greenhouse gas emissions it is relevant that the landfill directive will require both the installation of gas recovery at all new sites in the future and diversion of biodegradable municipal solid waste from landfills in the future.
In addition to this, several Member States have more stringent targets on landfilling of biodegradable waste:

National legislation relating to landfilling — **Table 6**

Member State	Legislation on organic waste to landfill
Austria	no carbon-containing waste after 2004
Belgium	only pre-treated waste after July 2000 (Flanders only)
Denmark	only pre-treated waste after 1997
Finland	only pre-treated waste after 2005
France	only 'final' waste after 2002
Germany	only pre-treated 'final' waste from 1999; no carbon containing wastes from 2005
Greece	no restrictions
Ireland	no restrictions
Italy	inert and residual wastes only from 2002
Netherlands	no combustible wastes to be landfilled after 2001
Portugal	no restrictions
Spain	no restrictions
Sweden	no organic material after 2005
UK	no restrictions

Source: EC (2000c).

Waste disposal on land in some EC Member States 1990–99 — Figure 30



Source: Submissions by the EC Member States (CRF tables).

3.2.9. Chemical industry (N_2O)

N_2O emissions from the chemical industry account for 1.2 % of total EC greenhouse gas emissions. They were 48 Tg of CO_2 equivalents in 1999 and reduced by 57 % (62 Tg of CO_2 equivalents) between 1990 and 1999. This was the second largest reduction of all EC greenhouse gas key source emissions in absolute terms.

Most N_2O emissions from chemical industries occur in the adipic and nitric acid production. Adipic acid is a raw material used mainly in the manufacture of 6.6 nylon, which is used in industrial carpets; some adipic acid is also used in the manufacture of engineering plastics and low temperature lubricants. Nitric acid is a raw material mainly used as a feedstock in

fertiliser production, but also in the production of adipic acid and explosives. Within the EU about 80 % of nitric acid production is used for fertiliser production (EC, 2001a).

In the EU, adipic acid is produced only in four countries (Germany, France, Italy and the UK), whereas nitric acid is produced widely in the EU, with 13 countries having reported emissions from this process in 1990 (Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden and the United Kingdom) (EC, 2001a).

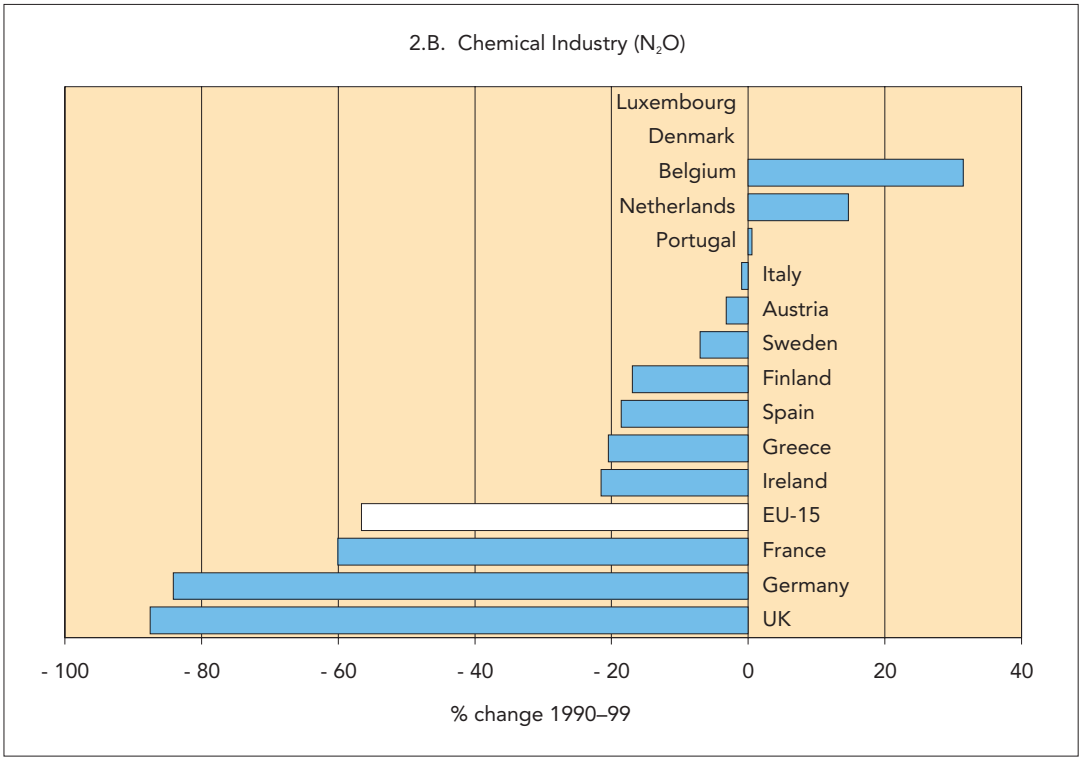
In 1999, the largest emitters of N_2O emissions from chemical industries were the Netherlands and France with 23 % of total N_2O emissions from chemical industries each, followed by Italy (14 %) and Belgium (10 %). In 1990, the UK and Germany were second and third but they achieved substantial reductions since then.

The UK, Germany and France achieved large reductions, both in relative and absolute terms between 1990 and 1999. The UK reduced emissions by 26 Tg of CO_2 equivalents (– 88 %), Germany reduced by 21 Tg (– 84 %) and France by 17 Tg (– 60 %). In contrast to this, Belgium (+ 1 Tg or + 31 %) and the Netherlands (+ 1 Tg or + 15 %) increased N_2O emissions from chemical industries (Figure 31).

The large reductions in Germany, the UK and France were achieved in the adipic acid production mainly due to emission reduction measures, not due to lower production volumes. According to Eurostat data, German adipic acid production increased by 34 % between 1995 and 1999, but in the same period N_2O emissions from chemical industries reduced by 84 %. Similarly, France increased adipic acid production by 7 % between 1990 and 1999, but decreased N_2O emissions from chemical industries by 60 %. Only in the UK can a decrease of adipic acid production (– 46 %) also be observed.

Figure 31 **Percentage change of N_2O emissions from chemical industry in EC Member States 1990–99**

Source: Submissions by the EC Member States (CRF tables).



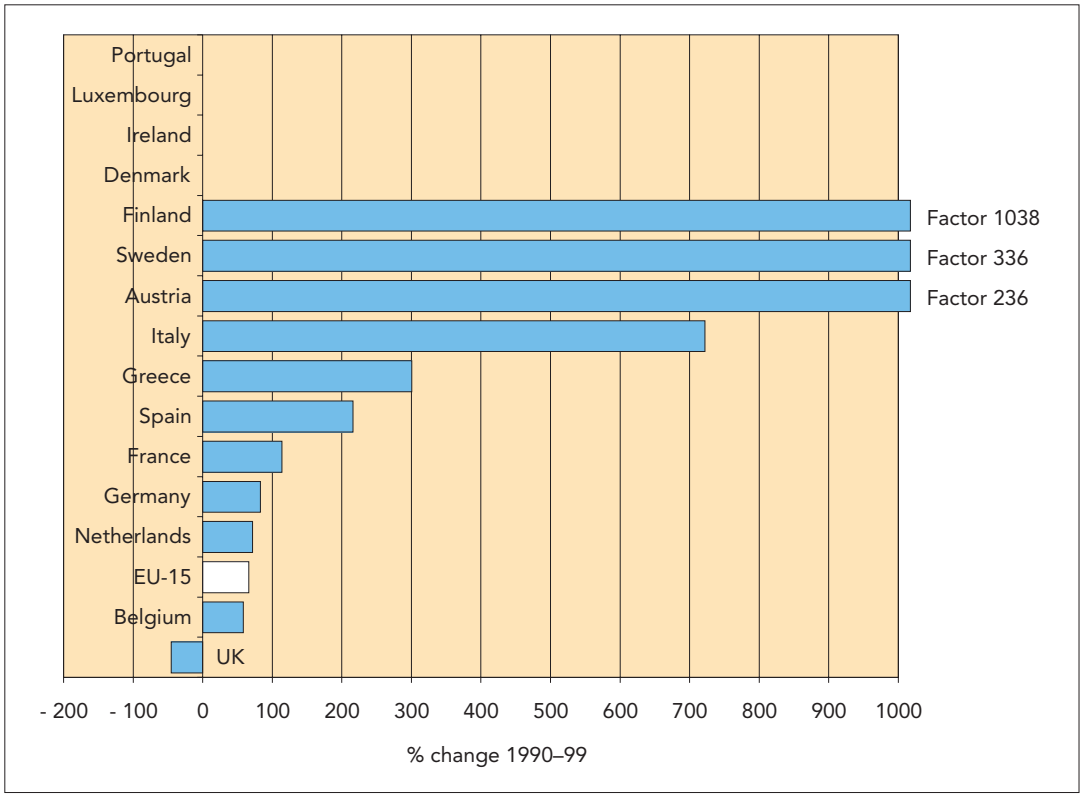
3.2.10. HFCs

HFC emissions account for 1.1 % of total EC greenhouse gas emissions. They were 43 Tg of CO_2 equivalents in 1999 and increased by 66 % (17 Tg of CO_2 equivalents) between 1990 and 1999. This was the second largest increase of all EC key source emissions in relative and in absolute terms.

The main reason for rapidly growing HFC emissions is the phase out of ozone depleting substances like chlorofluorocarbons under the Montreal Protocol and the replacement of these substances with HFCs. The main application fields of HFCs are refrigeration, air conditioning, blowing agents for the production of thermal insulation foams and aerosol propellants. In addition, large HFC emissions occur as by-products of the production of HCFC-22 through over-fluorination. (EC, 2000b).

The largest emitters of HFCs are Spain and the Netherlands accounting for 21 % of total EU HFC emissions each, followed by the UK (15 %). All Member States but one (UK) increased HFC emissions between 1990 and 1999 (Figure 32). Two Member States did not report HFC emissions (Luxembourg and Ireland). Denmark had no HFC emissions in 1990, therefore no percentage change could be calculated. Portugal has no HFC emissions. Finland, Sweden and Austria started from a very low level in 1990, therefore their growth rates are very high.

Percentage change of HFC emissions in EC Member States 1990–99 (1) Figure 32



Source: Submissions by the EC Member States (CRF tables).

(1) Finland, Sweden and Austria started from a very low emission level in 1990 therefore their growth rates are very high and shown as changes by factors in stead of percentage (more than 1 000 %).

The high share of the Netherlands is mainly caused by the production of HCFC-22, of which HFC-23 is emitted as a by-product. The reductions in the UK were achieved by emission reduction measures in the HCFC production.

In absolute terms, Spain (6 Tg of CO_2 equivalents), the Netherlands (4 Tg) and Greece (3 Tg) increased HFC emissions most, whereas the UK reduced emissions by 5 Tg of CO_2 equivalents.

3.2.11. Manure management (CH_4)

CH_4 emissions from manure management account for 1 % of total EC greenhouse gas emissions. They were 40 Tg of CO_2 equivalents in 1999 and reduced by 5 % (2 Tg of CO_2 equivalents) between 1990 and 1999.

Animal manures contain relatively complex organic compounds such as carbohydrates and proteins which are broken down by bacteria. In the presence of oxygen, the action of aerobic

bacteria results in the carbon being converted to CO_2 and, in the absence of oxygen, anaerobic bacteria transform the carbon to CH_4. Whereas the CO_2 that is evolved is part of the natural cycling of carbon in the environment and results in no overall increase in atmospheric CO_2, the carbon released as methane, has a higher global warming potential (EC, 2000d).

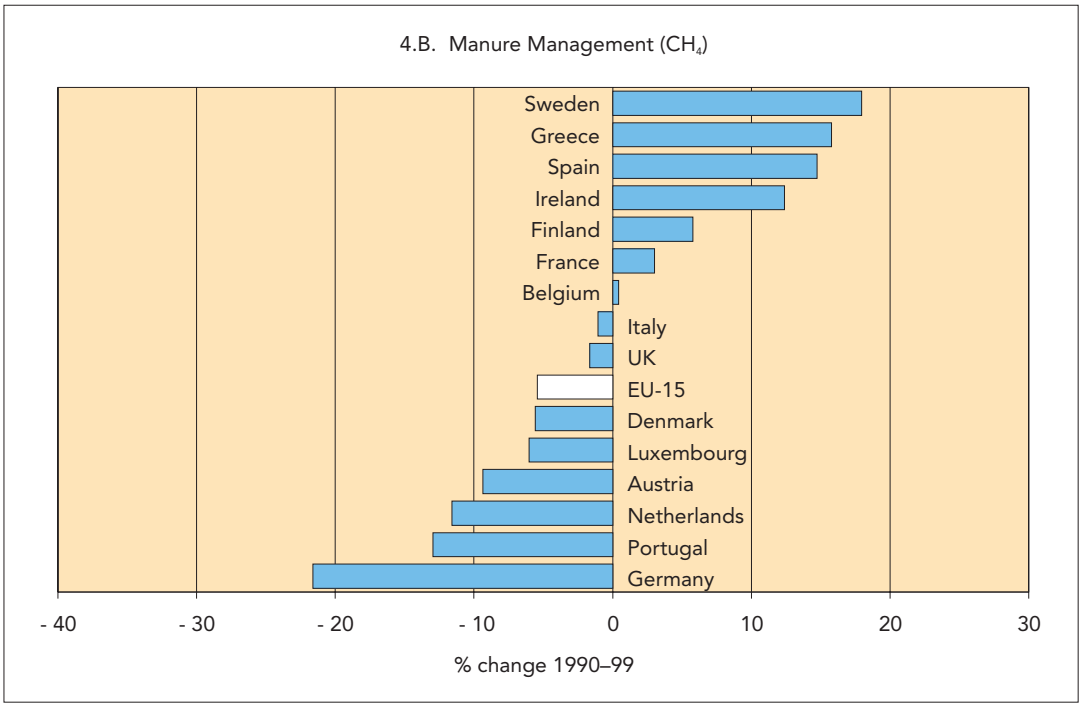
When livestock are in fields and their manure ends up being spread thinly on the ground, aerobic decomposition usually predominates. However, with modern intensive livestock practices, where animals are often housed or kept in confined spaces for at least part of the year, manure concentrations will be higher and manure will often be stored in tanks or lagoons where anaerobic conditions generally predominate and methane will be evolved (EC, 2000d).

In 1999, the largest emitters of CH_4 emissions from manure management were Germany and Spain accounting for 26 and 20 % of EU emissions respectively. In eight Member States emissions reduced between 1990 and 1999, in seven Member States emissions increased.

In Germany, Portugal and the Netherlands emissions reduced by more than 10 %, whereas Sweden, Greece, Spain and Ireland increased emissions between 1990 and 1999 (Figure 33). In absolute terms, Germany reduced by 3 Tg of CO_2 equivalents, whereas Spain increased by 1 Tg.

Figure 33 **Percentage change of CH_4 emissions from manure management in EC Member States 1990–99**

Source: Submissions by the EC Member States (CRF tables).



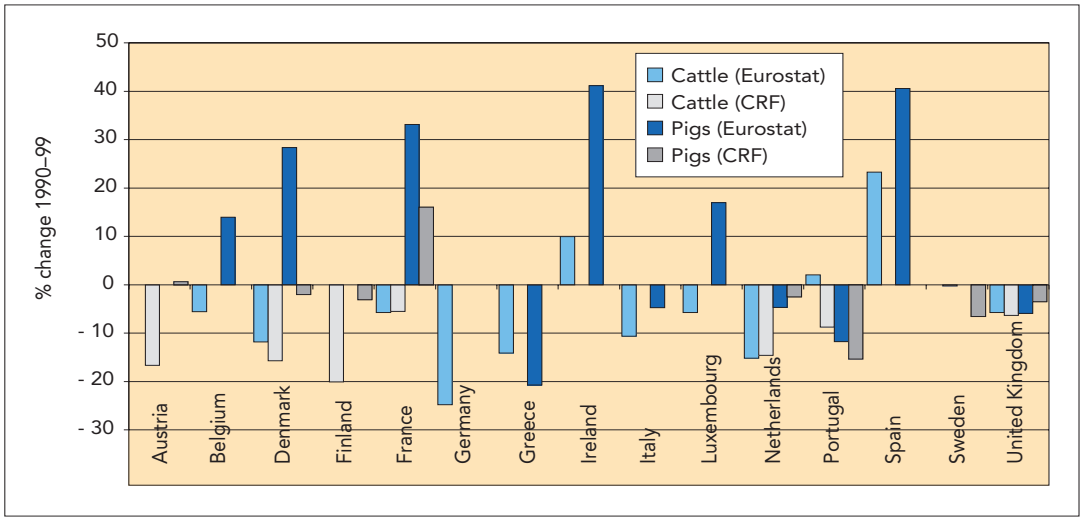
An important driving force of CH_4 emissions from manure management is the population size of cattle and pigs. Whereas the number of cattle decreased in most Member States between 1990 and 1999, the population size of pigs increased in several Member States (Figure 34).

For German CH_4 reductions from manure management, the significant fall in cattle population might be one reason. This might also be true for Portugal, the Netherlands and Austria (for Portugal, there is a difference in cattle numbers between Eurostat and the CRF data). In addition, in the case of the Netherlands, changes in agricultural practices have reduced the amount of manure produced per swine by 9 % in recent years.

For Sweden and Greece, the substantial increases in CH_4 emissions cannot be explained by increasing cattle and pig populations. In Spain and Ireland, both populations increased substantially between 1990 and 1999, which is consistent with the emission trends.

However, it should be noted that not only animal numbers influence on CH_4 emissions from manure management but also feed intake and digestibility, climatic conditions and manure management systems (EC, 2000d).

Cattle and pig population changes 1990–99 in EC Member States Figure 34



Source: Eurostat and submissions by the Member States (CRF tables).

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Units and abbreviations

t	1 tonne (metric) = 1 megagram (Mg) = 10^6 g
Mg	1 megagram =10^6 g = 1 tonne (t)
Gg	1 gigagram =10^9 g = 1 kilotonne (kt)
Tg	1 teragram = 10^{12} g = 1 megatonne (Mt)
ECU	European currency unit

CH_4	methane
CHP	combined heat and power
CO_2	carbon dioxide
COP	Conference of the Parties
CRF	common reporting format
DTI	distance-to-target indicator
EEA	European Environment Agency
ETC/ACC	European Topic Centre on Air and Climate Change
FAO	Food and Agriculture Organisation of the United Nations
GDP	gross domestic production
GHG	greenhouse gas
HFCs	hydrofluorocarbons
IEA	International Energy Agency
F-gases	fluorinated gases (HFCs, PFCs, SF_6)
IPCC	Intergovernmental Panel on Climate Change
LUCF	land use change and forestry
N_2O	nitrous oxide
PFCs	perfluorocarbons
SF_6	sulphur hexafluoride
UNFCCC	United Nations Framework Convention on Climate Change

Annex 1: Greenhouse gas emission indicators for the EC Member States and the EU

This annex presents indicators for each Member State following the general outline of the analysis on EC greenhouse gas trend assessment including: distance-to-target indicators, main driving force indicators, sectoral greenhouse gas indicators, and sectoral driving force indicators.

For each Member State, four pages are presented with the following uniform structure: page 1 describes the main trends of the indicators, page 2 presents the two main figures (total emissions compared with targets; main driving forces), pages 3 and 4 include the main indicators.

The sectoral analysis refers to the trends of MS emissions in selected EC key source categories. For each MS, those key sources have been selected that had the largest absolute change between 1990 and 1999.

Finally, indicators for the EU as a whole referred to in Chapters 2 and 3 are presented including distance-to-target indicators, main driving force indicators, sectoral greenhouse gas indicators, and sectoral driving force indicators.

Austria

Distance-to-target indicator (DTI): Austria's greenhouse gas emissions were almost stable in 1999 compared to 1998, but higher than in the base year (1995 for F-gases). In 1999, total greenhouse gas emissions were 79 Tg (CO_2 equivalents), which was 2.6 % above the base year level. In the burden sharing agreement to the Kyoto Protocol, Austria agreed to reduce its greenhouse gas emissions by 13 % by 2008–12, from 1990 levels. Assuming a linear target path from 1990 to 2010, Austrian greenhouse gas emissions were 8.5 index points above this target path in 1999 (Figure 35).

For CO_2, Austria set a stabilisation target by 2000. Figure 35 shows that Austria's CO_2 emissions are not in line with this target. In 1999, Austrian CO_2 emissions were 66 Tg, which was 83 % of total greenhouse gas emissions and 5.9 % above 1990 levels. Therefore, CO_2 emissions were 5.9 index points above the target path.

Main driving force indicators: In 1999, real GDP grew by 2.8 %, energy use increased by 1.2 % (Figure 36), compared to 1998. This compares to stable greenhouse gas emissions and a 0.4 % increase in CO_2 emissions. This means that, in 1999, greenhouse gas emissions de-coupled from economic growth and from energy use. Over the whole period from 1990 to 1999, greenhouse gas emissions and GDP de-coupled by 18 index points, and from energy consumption by 12 index points. From 1990 to 1999, Austrian greenhouse gas emissions per capita decreased slightly to 9.8 tonnes (compared to 10.7 tonnes of EU-15).

Sectoral analysis for selected EC key sources: The main feature of Austrian greenhouse gas emissions is the substantial increase in CO_2 emissions from transport (+ 30 % from 1990 compared to + 18 % of EU-15). Road fuel combustion increased by 28 %, but a substantial fuel shift from petrol to diesel can be observed: petrol use went down by 20 % between 1990 and 1999, whereas diesel use more than doubled. Factors contributing to this shift and also to the large growth of CO_2 emissions from transport might be a considerable gap between diesel and petrol prices and relatively low fuel prices in general (see Figures 16 and 17).

N_2O emissions from transport increased by 80 %. However, this increase was below the EU average (+ 103 %), because in 1990 already about one third of Austrian cars were fitted with catalytic converters (compared to about 12 % in EU-15). Austria (together with Germany and the Netherlands) was amongst the first European countries to introduce catalytic converters in petrol-engined cars.

Also CO_2 emissions from Austrian manufacturing industry increased substantially between 1990 and 1999 (+ 16 % compared to – 9 % at European level). Fuel combustion in manufacturing industries increased by 23 %. One reason for this might be sustained growth of industrial production (+ 24 % since 1995).

Fugitive CH_4 emissions from oil and natural gas increased by 32 % (EU-15: – 5 %) mainly due to growing oil refining (+ 14 %).

CO_2 emissions from energy industries reduced by 8 % mainly due to a fuel shift from coal to gas. Fuel combustion in Austrian power plants increased slightly by 3 %, but coal use went down by 39 %, whereas gas consumption increased by 27 %. Similarly, coal-fired power production decreased by 43 % between 1990 and 1998, whereas gas-fired power generation increased by 20 %. In general, Austrian electricity production is characterised by a large share of renewable power production (about 70 %).

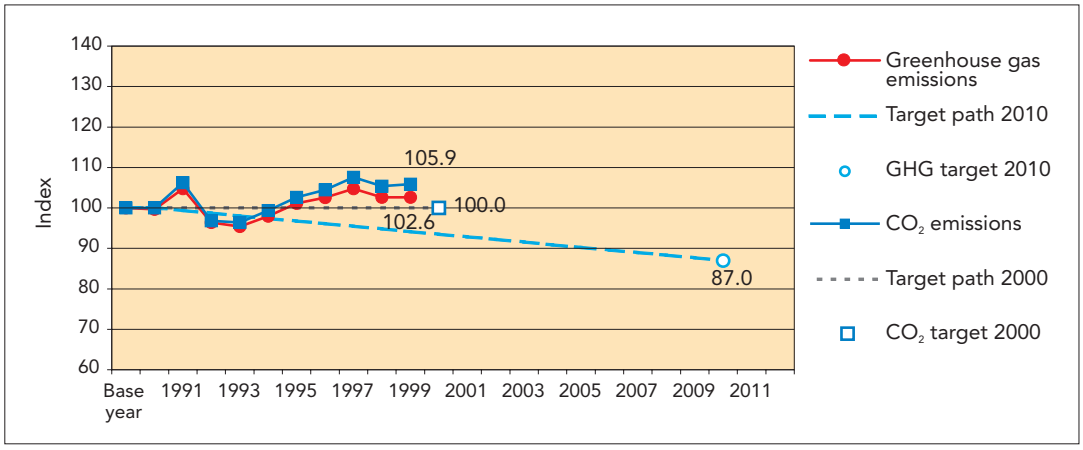
CH_4 emissions from enteric fermentation decreased by 17 % mainly due to reductions in cattle population (down 17 %). CH_4 emissions from solid waste disposal on land reduced by 19 % mainly due to reductions of waste disposed in landfills
(– 12 %).

CO_2 emissions from mineral products decreased by 22 % mainly due to cuts in cement production (– 23 %).

CO_2 emissions from small combustion reduced by 2 % between 1990 and 1999, but emissions and fuel combustion in households increased by 21 and 16 %. A positive trend can be observed in solar energy production. Austria is after Greece and Germany the third producer of solar energy, quadrupling production since 1990 and accounting for 15 % of EU total production in 1998. One reason for this was the establishment of subsidy schemes at national and local level.

N_2O emissions from agricultural soils reduced by 1 % between 1990 and 1999. Austria has the highest share of organically farmed land within the EU (10 %) (see Box 5), but due to the lack of reliable emission factors the Austrian greenhouse gas inventory does not yet account for the large increase of organic farming in the 1990s.

Austrian greenhouse gas emissions compared with targets for 2000 and 2008–12 (excluding LUCF) Figure 35



Austrian greenhouse gas emissions and driving forces (real GDP growth, heating degree days, gross inland energy consumption) and greenhouse gas emissions per capita in relation to EU-15 average Figure 36

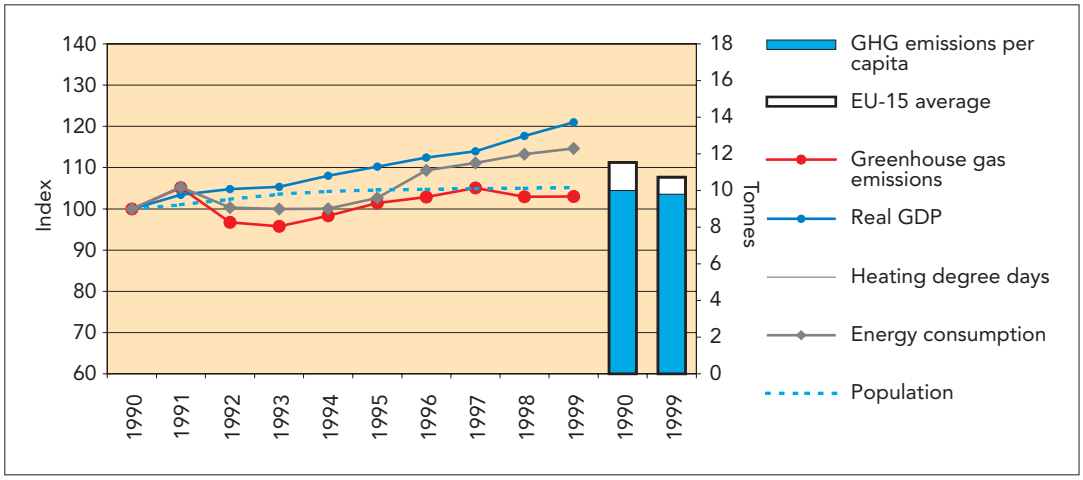


Table 7 **Distance-to-target indicators for Austria**

Source: Member State submission (CRF tables).

	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Greenhouse gas emissions (without LUCF)	100.0	99.7	104.8	96.4	95.4	98.0	101.1	102.5	104.7	102.6	102.6
DTI 2010	0.0	- 0.3	5.4	- 2.3	- 2.6	0.6	4.4	6.4	9.3	7.8	8.5
CO_2 (without LUCF)	100.0	100.0	106.3	96.8	96.4	99.4	102.6	104.4	107.6	105.4	105.9
DTI 2000	0.0	0.0	6.3	- 3.2	- 3.6	- 0.6	2.6	4.4	7.6	5.4	5.9

Table 8 **Main driving force indicators for Austria**

Source: Eurostat.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real GDP	100	103	105	105	108	110	112	114	118	121
Heating degree days	:	:	:	:	:	:	:	:	:	:
Population	100	101	102	104	104	105	105	105	105	105
Energy consumption	100	105	100	100	100	103	109	111	113	115

Note: The index of energy consumption in 1999 was calculated on basis of monthly data.

Table 9 **Sectoral emission indicators (key sources) for Austria**

Source: Member State submission (CRF tables).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1.A.1. Energy Industries (CO_2)	100	108	79	74	76	88	92	96	88	92
1.A.2. Manufacturing Industries and Construction (CO_2)	100	92	93	92	90	101	118	121	130	116
1.A.3. Transport (CO_2)	100	111	111	111	119	114	113	117	124	130
1.A.4. Other Sectors (CO_2) [Small combustion]	100	119	108	111	111	112	109	107	97	98
1.A.5. Other (CO_2)	0	0	0	0	0	0	0	0	0	0
2.A. Mineral Products (CO_2)	100	97	98	94	98	81	81	83	80	78
1.B.1. Fugitive Emissions from Solid Fuels (CH_4)	100	85	71	69	56	53	45	46	47	46
1.B.2. Fugitive Emissions from Oil and Natural Gas (CH_4)	100	106	104	109	113	123	131	126	130	132
4.A. Enteric Fermentation (CH_4)	100	98	93	92	91	88	86	85	85	83
4.B. Manure Management (CH_4)	100	99	96	99	98	96	94	94	96	91
6.A. Solid Waste Disposal on Land (CH_4)	100	98	97	94	92	90	88	85	81	81
1.A.3. Transport (N_2O)	100	124	140	153	172	176	174	173	181	180
2.B. Chemical Industry (N_2O)	100	101	92	97	95	91	94	92	95	97
4.B. Manure Management (N_2O)	0	0	0	0	0	0	0	0	0	0
4.D. Agricultural Soils (N_22O)	100	100	101	101	100	99	99	99	99	99
HFCs	100	158	232	329	458	14,798	16,932	19,458	22,102	23,589
PFCs	100	101	60	5	6	2	2	2	2	3
SF_6	100	132	140	159	199	227	241	222	184	141

Note: The list of key sources in this table is the one identified for the EC (see Section 1.2) and differs from the one defined by the Member States for their UNFCCC reporting.

Sectoral background activity indicators for Austria Table 10

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Fuel combustion in public electricity and heat production	100	107	84	80	84	95	101	103	99	103
Solid fuel combustion in electricity production	100	108	67	52	54	73	74	79	58	61
Gaseous fuel combustion in electricity production	100	100	93	95	103	115	126	116	123	127
Fuel combustion in manufacturing industries	100	96	95	93	97	105	122	128	129	123
Fuel combustion in iron and steel industries	100	104	69	70	78	90	88	97	83	92
Fuel combustion of road transportation	100	111	111	111	116	114	113	116	123	128
Gasoline combustion of road transportation	100	109	105	100	97	93	86	82	83	80
Diesel combustion of road transportation	100	114	121	129	146	146	154	168	184	204
Fuel combustion in households	100	113	106	120	118	125	130	121	117	116
Coal mining and handling	100	85	71	69	56	53	45	46	47	46
Oil refined	100	106	111	108	112	109	114	121	121	114
Cement production	100	103	103	104	102	82	81	84	81	77
Nitric acid production	100	101	92	97	95	91	94	92	95	97
Adipic acid production	0	0	0	0	0	0	0	0	0	0
Iron and Steel production/pig iron	100	99	92	95	101	115	103	120	120	121
Cattle population	100	98	93	90	90	90	88	85	84	83
Sheep population	100	105	101	108	111	118	123	124	117	114
Pig population	100	99	101	110	108	108	106	107	111	101
Use of synthetic fertilisers	0	0	0	0	0	0	0	0	0	0
Use of animal manures	0	0	0	0	0	0	0	0	0	0
Managed Waste Disposal on Land	100	97	95	91	87	86	87	87	88	88

Source: Member State submission (CRF tables).

Sectoral driving force and policy indicators for Austria Table 11

	1990	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Total gross electricity production	100	104	104	105	106	110	107	111	112	:
Gross electricity production from coal	100	111	73	47	49	68	72	76	57	:
Gross electricity production from natural gas	100	100	92	94	111	117	128	117	120	:
Gross electricity production from renewables	100	101	111	116	113	118	110	116	120	:
Industrial production	:	:	:	:	:	100	101	108	118	124
Steel production	100	98	92	97	103	117	104	121	123	121
Final energy consumption in industry	100	98	94	94	97	102	105	122	121	:
Volume passenger transport	100	113	111	109	109	109	105	107	:	:
Volume freight transport	100	102	103	106	110	112	116	118	:	:
Petrol price	:	:	:	:	:	100	104	106	101	96
Diesel price	:	:	:	:	:	100	102	107	101	92
Number of households	100	103	107	108	110	112	:	:	:	:
Final energy consumption in households	100	108	103	106	99	104	113	93	71	:
Cattle population	:	:	:	100	100	100	97	94	93	92
Sheep population	:	100	96	102	105	112	117	118	111	108
Pig population	:	:	:	:	100	99	98	99	102	92
Use of nitrogenous fertilisers	100	98	92	92	92	95	83	:	:	:
Transformation input to refineries	100	105	108	108	110	104	108	115	113	:
Primary production of solid fuels	100	85	72	68	53	47	40	41	42	:
Share of petrol-engined cars with catalytic converters (%)	35	37	40	48	56	63	71	76	:	:

Source: Eurostat, except for 'Number of households' (Euromonitor, 1997) and 'Use of nitrogenous fertilisers' (FAO).

Belgium

Distance-to-target indicator (DTI): Belgium's greenhouse gas emissions reduced by 3.4 % in 1999 compared to 1998, but still were above the base year level (1995 for F-gases). In 1999, total greenhouse gas emissions were 140 Tg (CO_2 equivalents), which was 2.8 % above the level of the base year. In the burden sharing agreement to the Kyoto Protocol, Belgium agreed to reduce its greenhouse gas emissions by 7.5 % by 2008–12, from 1990 levels. Assuming a linear target path from 1990 to 2010, Belgian greenhouse gas emissions were 6.1 index points above this target path in 1999 (Figure 37).

Belgian CO_2 emissions were 117 Tg in 1999, which was 2.6 % above 1990 levels 1999 and 83 % of total greenhouse gas emissions. Figure 37 shows that Belgian CO_2 emissions were well above the 5 % reduction target by 2000 (but approaching in recent years); the distance-to-target indicator was 7.1 in 1999.

Main driving force indicators: In 1999, real GDP grew by 2.7 %, but energy use decreased by 1.1 %. One reason for this might be the reduced need for heating, as the heating degree days went down by 3.6 % due to a mild winter (Figure 38). As greenhouse gas emissions and CO_2 emissions went down (3.4 % and 4.1 % respectively), emissions de-coupled from economic growth and energy use. Over the whole period from 1990 to 1999, greenhouse gas emissions de-coupled from GDP and from energy use by 15 index points each. In 1999, Belgian greenhouse gas emissions per capita were at 1990 levels, i.e. 13.7 tonnes (compared to 10.7 tonnes of EU-15).

Sectoral analysis for selected EC key sources: A main feature of Belgian greenhouse gas emissions is the substantial increase in CO_2 emissions from small combustion (+ 17 % from 1990 compared to a stabilisation at EU level). One reason for this might be a large increase in household numbers (+ 15 % between 1990 and 1996). Final energy consumption in households rose by 19 % between 1990 and 1998.

Also CO_2 emissions from Belgian manufacturing industry increased substantially between 1990 and 1999 (+ 14 % compared to – 9 % at European level). This compares to a growth rate of industrial production of 8 % and a final energy consumption in industry of + 10 % between 1990 and 1998. Steel production was 5 % below 1990 level in 1999.

The third sector that increased substantially is CO_2 emissions from transport (+ 15 %). Passenger transport increased by 16 % between 1990 and 1997, freight transport by 44 %.

A striking feature of Belgian greenhouse gas emissions is a 31 % (EU average: – 57 %) increase of N_2O emissions from chemical industries (more than 1 Tg of CO_2 equivalents), but there is no background data available.

N_2O emissions from transport went up by 160 % (EU average: 103 %). One reason for this might be the relative low starting point of cars with catalytic converters in 1990. In 1990, 3 % of Belgian petrol-engined cars were fitted with catalytic converters. This share rose to more than 54 % by 1997.

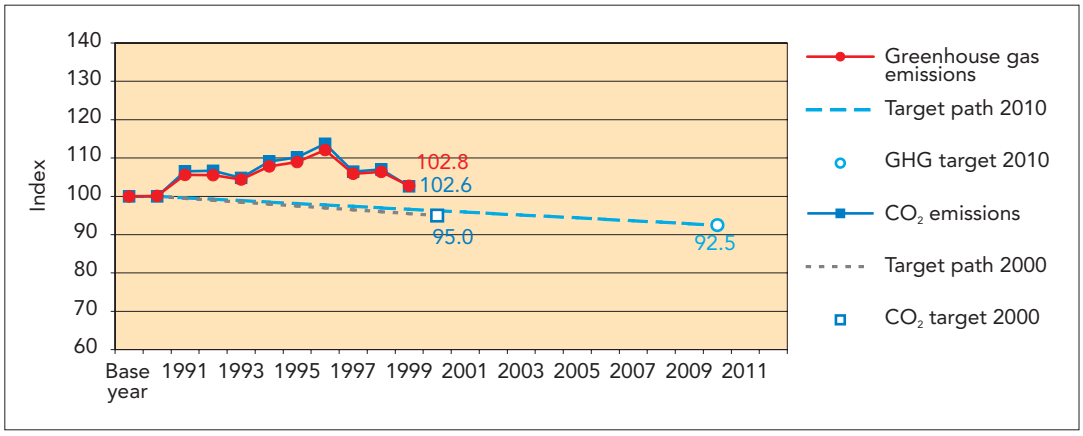
CO_2 emissions from mineral products increased by 8 % between 1990 and 1999, cement production increased by 16 % between 1990 and 1998 according to Cembureau.

The largest reductions of greenhouse gas emissions in absolute terms were achieved in the energy industries. CO_2 emissions from energy industries reduced by 18 % mainly due to a fuel shift from coal to gas. Total electricity production increased by 17 % between 1990 and 1998, but coal-fired power production decreased by 17 %. Power generation from natural gas almost tripled and power production from renewables (mainly hydro-power) increased by almost 50 %.

CH_4 emissions from enteric fermentation decreased by 13 % and cattle population went down by 6 % between 1990 and 1999.

Note that Belgian greenhouse gas emission data for 1999 has to be interpreted with care. Since Belgium did not submit greenhouse gas emission data for 1999 by 1 April 2001, a data gap procedure was applied according to the guidelines (agreed in September 2000) under the monitoring mechanism for 1999. In June 2001 Belgium submitted data for 1998 and 1999, which suggest that the Belgian greenhouse gas emissions in 1998 and 1999 as compiled within the EC inventory are underestimated to some extent. In accordance with the monitoring mechanism guidelines the latest data from Belgium will be included in the next annual EC greenhouse gas inventory, to be finalised 15 April 2002.'

Belgian greenhouse gas emissions compared with targets for 2000 and 2008–12 (excluding LUCF) Figure 37



Belgian greenhouse gas emissions and driving forces (real GDP growth, heating degree days, gross inland energy consumption) and greenhouse gas emissions per capita in relation to EU-15 average Figure 38

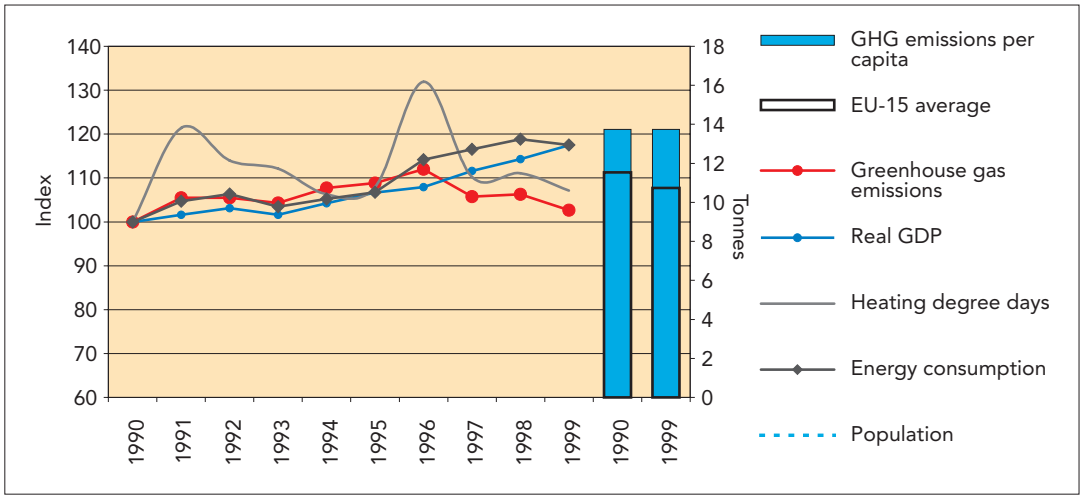


Table 12 **Distance-to-target indicators for Belgium**

Source: Member State submission (CRF tables).

	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Greenhouse gas emissions (without LUCF)	100.0	100.1	105.6	105.6	104.4	107.8	108.9	112.1	105.8	106.4	102.8
DTI 2010	0.0	0.1	6.0	6.3	5.5	9.3	10.8	14.3	8.5	9.4	6.1
CO_2 (without LUCF)	100.0	100.0	106.5	106.7	104.8	109.0	110.2	113.7	106.4	107.0	102.6
DTI 2000	0.0	0.0	7.0	7.7	6.3	11.0	12.7	16.7	9.9	11.0	7.1

Table 13 **Main driving force indicators for Belgium**

Source: Eurostat.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real GDP	100	102	103	102	104	107	108	112	114	117
Heating degree days	100	121	114	112	106	108	132	110	111	107
Population	100	100	101	101	102	102	102	102	102	103
Energy consumption	100	105	106	103	105	107	114	117	119	118

Note: The index of energy consumption in 1999 was calculated on basis of monthly data.

Table 14 **Sectoral emission indicators (key sources) for Belgium**

Source: Member State submission (CRF tables).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1.A.1. Energy Industries (CO_2)	100	106	105	102	90	94	96	87	86	82
1.A.2. Manufacturing Industries and Construction (CO_2)	100	104	98	97	123	118	114	118	119	114
1.A.3. Transport (CO_2)	100	103	109	109	108	110	111	118	120	115
1.A.4. Other Sectors (CO_2) [Small combustion]	100	113	115	113	119	122	136	120	122	117
1.A.5. Other (CO_2)	0	0	0	0	0	0	0	0	0	0
2.A. Mineral Products (CO_2)	100	107	108	110	115	123	123	108	108	108
1.B.1. Fugitive Emissions from Solid Fuels (CH_4)	0	0	0	0	100	100	100	76	76	76
1.B.2. Fugitive Emissions from Oil and Natural Gas (CH_4)	100	106	109	115	118	92	101	100	100	100
4.A. Enteric Fermentation (CH_4)	100	100	99	100	89	90	88	86	87	87
4.B. Manure Management (CH_4)	100	98	98	101	99	101	100	100	100	100
6.A. Solid Waste Disposal on Land (CH_4)	100	102	103	105	106	109	108	106	104	104
1.A.3. Transport (N_2O)	100	116	136	165	186	205	225	247	260	260
2.B. Chemical Industry (N_2O)	100	97	88	95	110	120	131	126	131	131
4.B. Manure Management (N_2O)	0	0	0	0	100	100	323	322	322	322
4.D. Agricultural Soils (N_2O)	100	100	100	98	86	86	86	86	85	85
HFCs	100	100	100	100	100	100	126	159	159	159
PFCs	100	100	100	100	100	100	100	100	0	0
SF_6	100	100	100	100	100	62	62	71	62	62

Note: The list of key sources in this table is the one identified for the EC (see Section 1.2) and differs from the one defined by the Member States for their UNFCCC reporting.

Sectoral background activity indicators for Belgium Table 15

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Fuel combustion in public electricity and heat production	:	:	:	:	:	:	:	:	:	:
Solid fuel combustion in electricity production	:	:	:	:	:	:	:	:	:	:
Gaseous fuel combustion in electricity production	:	:	:	:	:	:	:	:	:	:
Fuel combustion in manufacturing industries	:	:	:	:	:	:	:	:	:	:
Fuel combustion in iron and steel industries	:	:	:	:	:	:	:	:	:	:
Fuel combustion of road transportation	:	:	:	:	:	:	:	:	:	:
Gasoline combustion of road transportation	:	:	:	:	:	:	:	:	:	:
Diesel combustion of road transportation	:	:	:	:	:	:	:	:	:	:
Fuel combustion in households	:	:	:	:	:	:	:	:	:	:
Coal mining and handling	:	:	:	:	:	:	:	:	:	:
Oil refined	:	:	:	:	:	:	:	:	:	:
Cement production	:	:	:	:	:	:	:	:	:	:
Nitric acid production	:	:	:	:	:	:	:	:	:	:
Adipic acid production	:	:	:	:	:	:	:	:	:	:
Iron and Steel production	:	:	:	:	:	:	:	:	:	:
Cattle population	:	:	:	:	:	:	:	:	:	:
Sheep population	:	:	:	:	:	:	:	:	:	:
Pig population	:	:	:	:	:	:	:	:	:	:
Use of synthetic fertilisers	:	:	:	:	:	:	:	:	:	:
Use of animal manures	:	:	:	:	:	:	:	:	:	:
Managed Waste Disposal on Land	:	:	:	:	:	:	:	:	:	:

Source: Member State submission (CRF tables).

Sectoral driving force and policy indicators for Belgium Table 16

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total gross electricity production	100	102	102	100	102	105	107	111	117	:
Gross electricity production from coal	100	97	94	95	99	97	91	80	83	:
Gross electricity production from natural gas	100	115	123	126	153	188	204	213	278	:
Gross electricity production from renewables	100	109	121	111	122	132	130	131	146	:
Industrial production	100	96	99	91	93	99	99	104	107	108
Steel production	100	99	90	89	99	101	94	94	100	95
Final energy consumption in industry	100	102	103	97	102	103	101	109	110	:
Volume passenger transport	100	103	105	108	111	113	114	116	:	:
Volume freight transport	100	137	114	121	141	147	140	144	:	:
Petrol price	100	103	94	97	97	95	106	113	108	105
Diesel price	100	116	108	109	106	101	106	111	101	100
Number of households	100	110	110	110	111	113	115	:	:	:
Final energy consumption in households	100	110	110	109	107	112	127	118	119	:
Cattle population	100	99	99	98	100	100	98	95	95	94
Sheep population	100	95	94	93	87	86	83	84	85	117
Pig population	100	102	107	107	109	111	111	114	118	114
Use of nitrogenous fertilisers	100	98	93	91	90	90	92	:	:	:
Transformation input to refineries	100	110	109	106	108	99	119	123	128	:
Primary production of solid fuels	100	61	21	0	0	0	0	0	0	:
Share of petrol-engined cars with catalytic converters (%)	3	7	11	20	29	37	46	54	:	:

Source: Eurostat, except for 'Number of households' (Euromonitor, 1997) and 'Use of nitrogenous fertilisers' (FAO).

Denmark

Distance-to-target indicator (DTI): Danish greenhouse gas emissions reduced in 1999 compared to 1998, but were well above the base year level (1995 for F-gases). In 1999, total greenhouse gas emissions were 73 Tg (CO_2 equivalents), which was 4 % above the base year level. In the burden sharing agreement to the Kyoto Protocol, Denmark agreed to reduce its greenhouse gas emissions by 21 % by 2008–12, from 1990 levels. However, this reduction target refers to electricity trade adjusted greenhouse gas emissions in 1990. The main reason for this adjustment is the specific situation of Denmark as swing producer of electricity in the Nordic electricity pool. If the greenhouse gas emissions of 1990 are adjusted for electricity trade, emissions in 1999 were 4.6 % below 1990 levels (Figure 39).

Therefore, for Denmark two distance-to-target indicators can be calculated: adjusted greenhouse gas emissions were 4.9 index points above the linear target path from 1990 to 2010 in 1999; non-adjusted data was 13.5 index points above the linear target path.

The same applies to the Danish 5 % reduction target for CO_2. Figure 39 shows that Denmark's adjusted CO_2 emissions are in line with the reduction target. In 1999, Danish non-adjusted CO_2 emissions were 57 Tg, which was 7.4 % above 1990 levels. This corresponds to a DTI of 11.9. But if the base year is adjusted for electricity trade, the distance-to-target indicator is 0.5, which is almost on the linear target path.

Main driving forces: In 1999, real GDP grew by 2.1 % but energy consumption decreased by 2.1 %, compared to 1998; heating degree days were almost stable (Figure 40). As greenhouse gas emissions decreased by 4.6 % and CO_2 emissions by 5.4 %, emissions de-coupled from energy use and even more so from economic growth. One reason for decreasing CO_2 emissions from 1998 to 1999 were lower electricity exports in 1999. Over the whole period from 1990 to 1999, greenhouse gas emissions de-coupled from GDP by 21 index points, and from energy consumption by 9 index points. From 1990 to 1999, Danish greenhouse gas emissions per capita increased slightly to 13.7 tonnes (compared to 10.7 tonnes of EU-15).

Sectoral analysis for selected EC key sources: The main feature of Danish greenhouse gas emissions is the large fluctuations due to (mainly coal based) electricity production, a considerable share of which is used for exports to Norway and Sweden. In the Nordic electricity market, Danish power producers act as swing producer in case of lower hydro-power production in Norway and Sweden due to unfavourable weather conditions.

CO_2 emissions from energy industries were 8 % above 1990 levels in 1999. Fuel combustion in power and heat production increased by 23 % between 1990 and 1999, but solid fuel use decreased by 22 % and gas use increased by a factor of 4. The share of coal-fired power production is still high (58 % in 1998), but power production from natural gas and renewable sources (mainly biomass and wind) increased by factors of 12 and 5 respectively. Due to a well-focused policy, wind power accounted for 7 % of total Danish electricity production in 1998, which was by far the highest share in the EU (see Box 1)

As in most other Member States, CO_2 emissions from transport are a second source of greenhouse gas emissions that increased considerably (+ 17 % from 1990 compared to + 18 % of EU-15). Road fuel use grew by 21 %. N_2O emissions from transport increased by 220 %, the reason for this is the low starting point of petrol-engined cars fitted with catalytic converters in 1990 (2 %). By 1997, this share increased to 50 %.

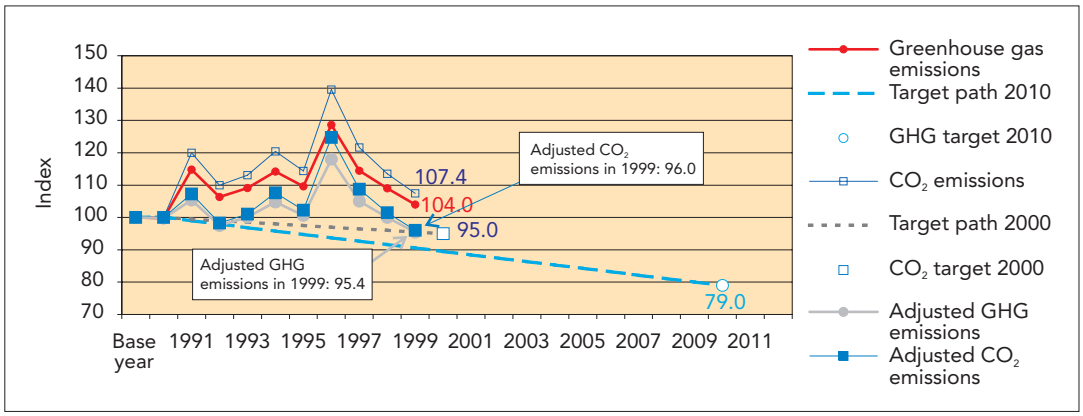
CO_2 emissions from mineral products increased by 39 % which is mainly due to a large increase of cement production (+ 50 %).

The largest reductions in absolute terms achieved Denmark in N_2O emissions from agricultural soils and in CO_2 emissions from small combustion. N_2O emissions from agricultural soils reduced by 18 % between 1990 and 1999 (EU average: – 3 %), one reason for this is the reduced input of synthetic fertilisers (– 36 %).

CO_2 emissions from small combustion reduced by 12 % (compared to a stabilisation at EU level). The main reason for this is a reduction of fuel consumption of households by 8 %. As the number of households was growing (+ 4 % between 1990 and 1995), some reductions might be due to the extension of district heating.

CH_4 emissions from enteric fermentation and from solid waste disposal on land decreased by 15 % each. Cattle numbers went down by 16 %, managed waste disposal in landfills went down by 54 %.

Danish greenhouse gas emissions compared with targets for 2000 and 2008–12 (excluding LUCF) Figure 39



Danish greenhouse gas emissions and driving forces (real GDP growth, heating degree days, gross inland energy consumption and greenhouse gas emissions per capita in relation to EU-15 average Figure 40

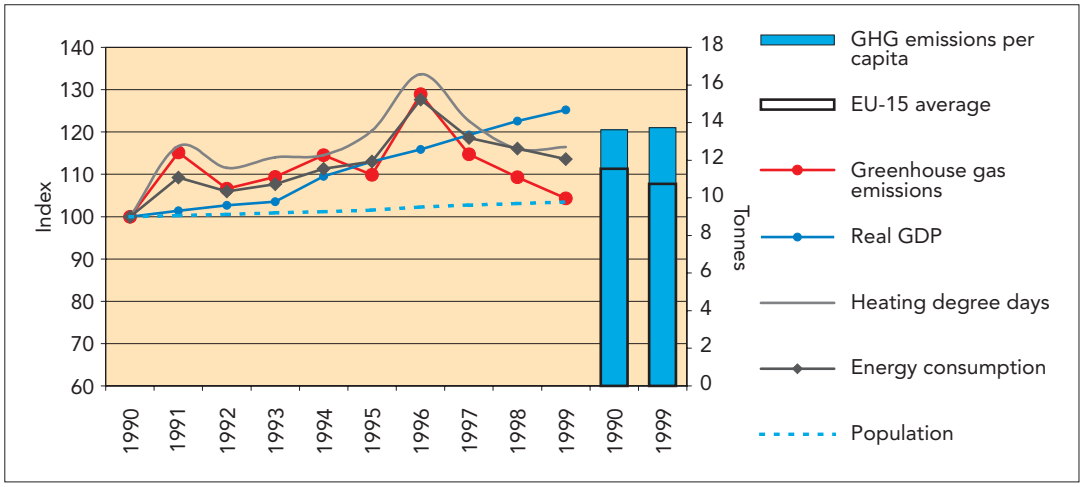


Table 17 **Distance-to-target indicators for Denmark**

Source: Member State submission (CRF tables).

	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Greenhouse gas emissions (without LUCF)	100.0	99.7	114.8	106.3	109.1	114.2	109.6	128.6	114.4	109.0	104.0
DTI 2010 (non-adjusted)	0.0	- 0.3	15.9	8.4	12.3	18.4	14.9	34.9	21.8	17.4	13.5
DTI 2010 (adjusted for electricity trade)	0.0	- 0.2	6.4	- 0.4	3.3	9.0	5.8	24.3	12.3	8.4	4.9
CO_2 (without LUCF)	100.0	100.0	120.0	109.9	113.1	120.4	114.4	139.6	121.7	113.5	107.4
DTI 2000 (non-adjusted)	0.0	0.0	20.5	10.9	14.6	22.4	16.9	42.6	25.2	17.5	11.9
DTI 2000 (adjusted for electricity trade)	0.0	0.0	7.8	- 0.7	2.6	9.6	4.8	27.8	12.3	5.4	0.5

Table 18 **Main driving force indicators for Denmark**

Source: Eurostat.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real GDP	100	101	103	104	110	113	116	119	123	125
Heating degree days	100	117	112	114	115	120	134	123	116	116
Population	100	100	101	101	101	102	102	103	103	103
Energy consumption	100	109	106	108	111	113	128	119	116	114

Note: The index of energy consumption in 1999 was calculated on basis of monthly data.

Table 19 **Sectoral emission indicators (key sources) for Denmark**

Source: Member State submission (CRF tables).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1.A.1. Energy Industries (CO_2)	100	134	114	119	136	123	169	135	120	108
1.A.2. Manufacturing Industries and Construction (CO_2)	100	105	107	106	108	100	105	104	101	101
1.A.3. Transport (CO_2)	100	105	106	108	112	114	116	117	120	117
1.A.4. Other Sectors (CO_2) [Small combustion]	100	103	101	101	89	97	104	95	90	88
1.A.5. Other (CO_2)	100	241	118	199	211	212	148	144	171	153
2.A. Mineral Products (CO_2)	100	117	129	130	131	130	138	153	143	139
1.B.1. Fugitive Emissions from Solid Fuels (CH_4)	100	118	120	144	169	190	190	190	120	101
1.B.2. Fugitive Emissions from Oil and Natural Gas (CH_4)	100	108	108	106	124	121	122	126	123	138
4.A. Enteric Fermentation (CH_4)	100	99	98	99	95	95	95	92	92	85
4.B. Manure Management (CH_4)	100	101	103	109	104	104	103	103	106	94
6.A. Solid Waste Disposal on Land (CH_4)	100	102	104	104	105	100	100	95	89	85
1.A.3. Transport (N_2O)	100	124	144	164	202	227	250	285	310	320
2.B. Chemical Industry (N_2O)	0	0	0	0	0	0	0	0	0	0
4.B. Manure Management (N_2O)	100	102	104	107	107	105	105	97	101	99
4.D. Agricultural Soils (N_2O)	100	98	91	92	89	88	85	82	83	82
HFCs	0	0	100	937	1,786	3,908	8,632	10,657	15,605	19,267
PFCs	0	0	0	0	0	0	0	100	400	860
SF_6	100	142	207	314	284	250	142	170	138	151

Note: The list of key sources in this table is the one identified for the EC (see Section 1.2) and differs from the one defined by the Member States for their UNFCCC reporting.

Sectoral background activity indicators for Denmark Table 20

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Fuel combustion in public electricity and heat production	100	132	114	121	138	129	175	145	134	123
Solid fuel combustion in electricity production	100	138	114	120	130	108	151	111	93	78
Gaseous fuel combustion in electricity production	100	124	110	128	199	253	319	341	412	427
Fuel combustion in manufacturing industries	100	105	109	110	112	103	106	109	107	109
Fuel combustion in iron and steel industries	0	0	0	0	100	100	0	0	0	0
Fuel combustion of road transportation	100	105	106	108	113	114	116	118	124	121
Gasoline combustion of road transportation	100	107	112	115	120	121	122	125	131	127
Diesel combustion of road transportation	100	102	100	99	106	107	109	111	115	115
Fuel combustion in households	100	106	105	108	91	104	112	104	98	92
Coal mining and handling	0	0	0	0	0	0	0	0	0	0
Oil refined	100	107	115	115	0	0	0	0	0	0
Cement production	100	123	137	139	138	140	149	166	156	150
Nitric acid production	0	0	0	0	0	0	0	0	0	0
Adipic acid production	0	0	0	0	0	0	0	0	0	0
Steel production	0	0	0	0	100	100	0	0	0	0
Cattle population	100	99	98	98	94	93	93	90	88	84
Sheep population	100	119	115	99	91	92	107	90	98	43
Pig population	100	103	110	122	115	117	114	120	127	98
Use of synthetic fertilisers	100	99	92	83	81	79	73	72	71	64
Use of animal manures	100	102	104	107	107	105	105	97	101	99
Managed Waste Disposal on Land	100	96	91	87	82	62	79	66	63	46

Source: Member State submission (CRF tables).

Sectoral driving force and policy indicators for Denmark Table 21

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total gross electricity production	100	141	120	131	155	142	207	172	159	:
Gross electricity production from coal	100	145	119	127	140	119	170	123	101	:
Gross electricity production from natural gas	100	77	118	190	353	539	865	1.039	1.237	:
Gross electricity production from renewables	100	135	180	213	253	268	307	420	551	:
Industrial production	100	100	103	101	111	116	118	124	127	129
Steel production	100	104	97	99	118	107	121	129	130	120
Final energy consumption in industry	100	102	93	96	102	103	106	104	102	:
Volume passenger transport	100	103	105	107	110	114	117	121	:	:
Volume freight transport	100	66	103	97	106	108	106	108	:	:
Petrol price	100	104	97	98	99	104	114	114	111	117
Diesel price	100	107	97	105	96	97	98	103	95	96
Number of households	100	100	100	103	103	104	:	:	:	:
Final energy consumption in households	100	108	102	109	108	111	119	109	108	:
Cattle population	100	99	97	94	93	93	92	90	88	88
Sheep population	100	110	92	78	71	84	83	93	97	95
Pig population	100	105	111	117	117	115	119	124	129	128
Use of nitrogenous fertilisers	100	94	84	83	80	74	73	:	:	:
Transformation input to refineries	100	104	108	109	112	124	136	110	100	:
Primary production of solid fuels	:	:	:	:	:	:	:	:	:	:
Share of petrol-engined cars with catalytic converters (%)	2	4	6	12	23	32	41	50	:	:

Source: Eurostat, except for 'Number of households' (Euromonitor, 1997) and 'Use of nitrogenous fertilisers' (FAO).

Finland

Distance-to-target indicator (DTI): Finland's greenhouse gas emissions reduced in 1999 compared to 1998, and were slightly below the 1990 level. In 1999, total greenhouse gas emissions were 76 Tg (CO_2 equivalents), which was 1.1 % below 1990 levels. In the burden sharing agreement to the Kyoto Protocol, Finland agreed to a stabilisation of greenhouse gas emissions at 1990 levels by 2008–12. Therefore, assuming a linear target path from 1990 to 2010, Finnish greenhouse gas emissions were 1.1 index points below this target path in 1999 (Figure 41).

Finnish CO_2 emissions were 64 Tg, which was 2.8 % above 1990 levels and 84 % of total greenhouse gas emissions in 1999. For CO_2, Finland's target is to stop increases of CO_2 emissions from energy production and use by end of the 1990s. As this target is not quantified, no distance-to-target indicator can be calculated.

Main driving forces: In 1999, real GDP grew by 4.2 % and energy use increased by 6.2 % compared to 1998 (Figure 42). This compares to small reductions of greenhouse gas and CO_2 emissions. Therefore, greenhouse gas emissions de-coupled from economic growth and from energy use. Over the whole period from 1990 to 1999, greenhouse gas emissions de-coupled from GDP by 19 index points, and from energy consumption by 25 index points. Finnish greenhouse gas emissions per capita decreased to 14.8 tonnes in 1999 (compared to 10.7 tonnes of EU-15).

Sectoral analysis for selected EC key sources: One of the striking features of Finnish greenhouse gas emissions compared to the EU average performance is the low increase of transport-related emissions. CO_2 emissions from transport increased by 2 % between 1990 and 1999, which is the lowest increase of EC Member States. Road fuel consumption even decreased by 1 % between 1990 and 1999.

One reason for this favourable trend might be that in Finland prices of private car use rose almost parallel with real disposable income. In other EC Member States, disposable income grew at a faster pace than prices of car use thus reducing road transport prices in relative terms (EEA, 2000a). Accordingly, in 1999, Finnish road fuel prices were amongst the highest of EC Member States in terms of constant 1990 prices (see Figures 16 and 17).

A second striking feature of the Finish greenhouse gas emission performance is a 16 % reduction of CO_2 emissions from small combustion. One reason for this is a decline in the use of heating oil due to increased district and electric heating.

CO_2 emissions from energy industries increased by 14 % (compared to – 9 % at EU level). One reason for this is the increase of district heating and electric heating mentioned above. Total fuel input for electricity and heat production increased by 28 % between 1990 and 1999, but there has been a shift from solid fuels and oil to natural gas and biomass. Total electricity production increased by 37 % between 1990 and 1998.

Also CO_2 emissions from Finnish manufacturing industry increased between 1990 and 1999 (+ 10 % compared to – 9 % at European level). Total fuel combustion in industry increased by 30 %, especially the pulp and paper industry contributed to this growth with + 39 %. In general, industrial output grew at fast pace in recent years.

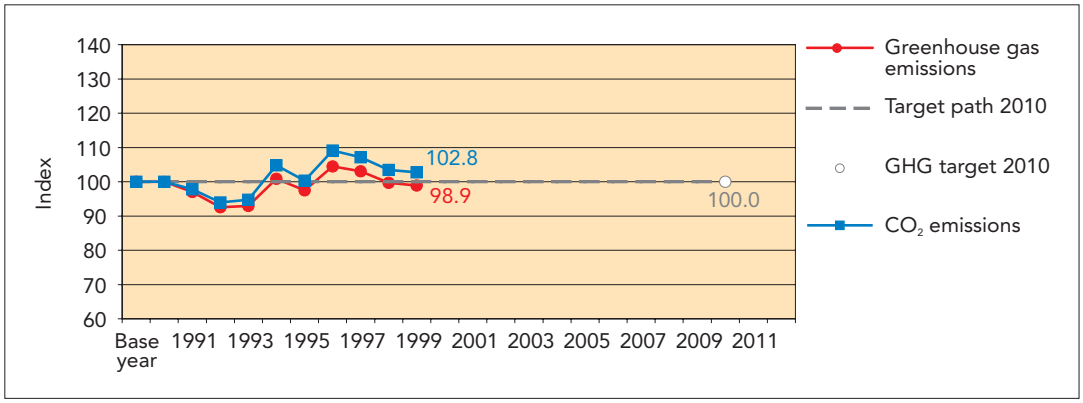
CH_4 emissions from solid waste disposal on land decreased by 56 % (compared to – 22 % at European level) which was the result of a 39 % reduction of solid waste disposal in managed landfills.

N_2O emissions from agricultural soils reduced by 22 % as the use of synthetic fertilisers and the amount of animal wastes applied to the soil dropped by 29 and 21 % respectively.

N_2O emissions from chemical industries decreased by 17 % between 1990 and 1999. One reason for this might be a drop in nitric acid production by equally 17 %.

CH_4 emissions from enteric fermentation decreased by 15 % between 1990 and 1999. Cattle numbers went down by 20 %, but sheep population increased slightly (+ 3 %).

Finnish greenhouse gas emissions compared with targets for 2000 and 2008–12 (excluding LUCF) Figure 41



Finnish greenhouse gas emissions and driving forces (real GDP growth, heating degree days, gross inland energy consumption) and greenhouse gas emissions per capita in relation to EU-15 average Figure 42

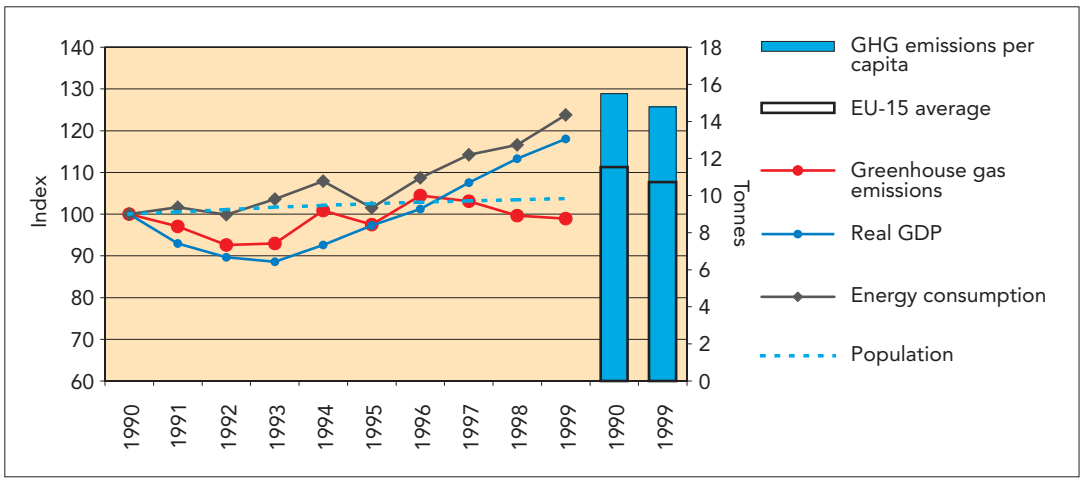


Table 22 **Distance-to-target indicators for Finland**

Source: Member State submission (CRF tables).

	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Greenhouse gas emissions (without LUCF)	100.0	100.0	97.0	92.6	93.0	100.9	97.5	104.5	103.1	99.7	98.9
DTI 2010	0.0	0.0	- 3.0	- 7.4	- 7.0	0.9	- 2.5	4.5	3.1	- 0.3	- 1.1
CO_2 (without LUCF)	100.0	100.0	97.8	93.9	94.7	104.8	100.3	109.1	107.1	103.4	102.8
DTI 2000	:	:	:	:	:	:	:	:	:	:	:

Table 23 **Main driving force indicators for Finland**

Source: Eurostat.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real GDP	100	93	90	89	93	97	101	108	113	118
Heating degree days	:	:	:	:	:	:	:	:	:	:
Population	100	100	101	102	102	103	103	103	103	104
Energy consumption	100	102	100	104	108	101	109	114	117	124

Note: The index of energy consumption in 1999 was calculated on basis of monthly data.

Table 24 **Sectoral emission indicators (key sources) for Finland**

Source: Member State submission (CRF tables).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1.A.1. Energy Industries (CO_2)	100	103	95	108	133	121	149	133	116	114
1.A.2. Manufacturing Industries and Construction (CO_2)	100	96	94	92	97	97	94	106	106	110
1.A.3. Transport (CO_2)	100	93	93	88	91	89	88	92	99	102
1.A.4. Other Sectors (CO_2) [Small combustion]	100	95	97	87	91	88	86	87	88	84
1.A.5. Other (CO_2)	100	134	134	135	149	181	278	187	182	83
2.A. Mineral Products (CO_2)	100	88	80	67	71	71	73	81	78	95
1.B.1. Fugitive Emissions from Solid Fuels (CH_4)	100	100	100	100	100	100	100	100	100	100
1.B.2. Fugitive Emissions from Oil and Natural Gas (CH_4)	100	118	118	118	118	118	346	241	355	207
4.A. Enteric Fermentation (CH_4)	100	95	93	93	93	87	88	89	87	85
4.B. Manure Management (CH_4)	100	95	93	92	93	109	109	113	110	106
6.A. Solid Waste Disposal on Land (CH_4)	100	93	85	75	65	63	58	52	47	44
1.A.3. Transport (N_2O)	100	86	86	90	92	89	95	99	120	113
2.B. Chemical Industry (N_2O)	100	88	79	82	85	87	87	88	83	83
4.B. Manure Management (N_2O)	100	95	94	94	94	84	83	83	80	74
4.D. Agricultural Soils (N_2O)	100	93	84	86	85	87	84	82	81	78
HFCs	100	110	128	126	2,231	9,837	25,556	55,027	80,757	103,837
PFCs	100	114	128	142	156	169	197	253	169	5.362
SF_6	100	67	46	37	37	20	20	23	17	45

Note: The list of key sources in this table is the one identified for the EC (see Section 1.2) and differs from the one defined by the Member States for their UNFCCC reporting.

Sectoral background activity indicators for Finland Table 25

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Fuel combustion in public electricity and heat production	100	105	97	113	139	125	155	142	127	128
Solid fuel combustion in electricity production	100	99	81	101	136	104	149	129	87	89
Gaseous fuel combustion in electricity production	100	105	116	123	146	147	166	172	199	200
Fuel combustion in manufacturing industries	100	98	98	106	114	113	110	126	123	130
Fuel combustion in iron and steel industries	100	96	96	99	127	116	125	145	117	119
Fuel combustion of road transportation	100	97	97	93	96	94	93	97	97	99
Gasoline combustion of road transportation	100	100	100	94	97	95	90	92	91	87
Diesel combustion of road transportation	100	94	93	90	94	93	96	103	105	114
Fuel combustion in households	100	96	88	77	86	104	80	79	81	77
Coal mining and handling	0	0	0	0	0	0	0	0	0	0
Oil refined	100	104	103	97	115	111	121	111	128	125
Cement production	100	81	69	51	52	55	59	70	75	79
Nitric acid production	100	88	78	81	84	87	87	87	82	83
Adipic acid production	0	0	0	0	0	0	0	0	0	0
Iron and Steel production/pig iron	0	0	100	0	0	0	0	0	0	0
Cattle population	100	96	94	92	91	84	84	84	82	80
Sheep population	100	103	105	117	117	154	145	145	124	103
Pig population	100	96	93	91	93	100	100	105	100	97
Use of synthetic fertilisers	100	89	71	74	74	86	79	74	74	71
Use of animal manures	100	95	94	94	94	91	90	90	86	79
Managed Waste Disposal on Land	100	93	87	77	67	69	65	61	63	61

Source: Member State submission (CRF tables).

Sectoral driving force and policy indicators for Finland Table 26

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total gross electricity production	100	122	113	119	128	125	136	135	137	:
Gross electricity production from coal	100	192	118	141	191	164	216	192	129	:
Gross electricity production from natural gas	100	106	111	119	138	142	183	148	189	:
Gross electricity production from renewables	100	113	127	123	116	123	113	124	145	:
Industrial production	100	91	92	97	108	114	119	131	142	149
Steel production	100	101	108	114	120	110	115	130	137	138
Final energy consumption in industry	100	96	96	105	109	109	108	115	121	:
Volume passenger transport	100	99	99	97	97	98	98	101	:	:
Volume freight transport	100	94	94	95	98	88	92	97	:	:
Petrol price	:	:	:	:	:	100	115	115	115	111
Diesel price	:	:	:	:	:	100	108	113	108	107
Number of households	100	104	105	105	106	108	:	:	:	:
Final energy consumption in households	100	104	104	101	105	102	89	96	98	:
Cattle population	:	100	97	97	94	93	91	89	87	85
Sheep population	:	100	101	130	131	188	182	169	157	126
Pig population	:	:	:	:	100	108	109	111	119	115
Use of nitrogenous fertilisers	100	80	84	83	96	89	92	:	:	:
Transformation input to refineries	100	103	103	98	115	113	121	112	128	:
Primary production of solid fuels	100	55	113	69	148	141	154	183	29	:
Share of petrol-engined cars with catalytic converters (%)	2	5	7	12	17	23	29	37	:	:

Source: Eurostat, except for 'Number of households' (Euromonitor, 1997) and 'Use of nitrogenous fertilisers' (FAO).

France

Distance-to-target indicator (DTI): French greenhouse gas emissions reduced in 1999 compared to 1998 and were slightly below the 1990 level. In 1999, total greenhouse gas emissions were 545 Tg (CO_2 equivalents), which was 0.2 % below 1990 levels. In the burden sharing agreement to the Kyoto Protocol, France agreed to stabilise its greenhouse gas emissions at 1990 levels by 2008–12. Therefore, assuming a linear target path from 1990 to 2010, French greenhouse gas emissions were 0.2 index points below this target path in 1999 (Figure 43).

French CO_2 emissions were 405 Tg, which was 5 % above 1990 levels and accounted for 74 % of total greenhouse gas emissions.

Main driving force indicators: In 1999, real GDP grew by 2.9 % and energy use increased by 2.6 %, but heating degree days were 5.2 % below 1998 level (Figure 44). This compares to reductions of both, greenhouse gas emissions (– 2.2 %) and CO_2 emissions (– 1.5 %). Therefore, greenhouse gas emissions de-coupled from economic growth and from energy use. Note that energy use increased despite of lower heating degree days. Over the whole period from 1990 to 1999, greenhouse gas emissions de-coupled from GDP and from energy use by 15 index points each. French greenhouse gas emissions per capita decreased from 9.4 tonnes in 1990 to 8.9 tonnes in 1999 (EU average is 10.7 tonnes). French per capita emissions are low partly due to a high share of nuclear power in electricity production.

Sectoral analysis for selected EC key sources: A main feature of the French greenhouse gas emission performance was large emission reductions of N_2O from chemical industries and large increases of CO_2 emissions from transport. In addition emissions from agriculture are of relatively high importance.

N_2O emissions from chemical industries reduced by 60 % between 1990 and 1999. Most of these reductions were achieved in the last two years due to reduction measures in the adipic acid production. Adipic acid production increased by 7 % between 1990 and 1999.

CO_2 emissions from transport increased by 17 % which is almost the EU average of + 18 % of EU-15. Also road traffic growth rates are approximately at EU average. Road fuel use increased by 16 %, but there is a marked trend to diesel consumption: whereas the use of petrol went down by 20 % between 1990 and 1999, the use of diesel increased by 56 %.

N_2O emissions from transport increased by 163 % (EU-15 average + 103 %), which is probably partly due to the low starting point of cars fitted with catalytic converters in 1990. However, the share of catalyst fitted cars was still below EU average in 1997.

CO_2 emissions from French small combustion increased by 8 % (compared to a stabilisation at EU level). Fuel consumption in households increased by 7 % between 1990 and 1999, final energy consumption by households was 6 % higher in 1998, compared to 1990. There was also a slightly higher growth of household numbers between 1990 and 1995, compared to the EU average.

CO_2 emissions from energy industries decreased by 6 % between 1990 and 1999. French electricity production is characterised by a high share of nuclear power production (76 % in 1998). In addition, France is the largest electricity exporter in the EU. Fuel combustion in French electricity and heat production decreased by 8 %, in addition there was a fuel shift from solid (– 15 %) and liquid fuels (– 5 %) to natural gas (+ 115 %) and biomass (+ 306 %).

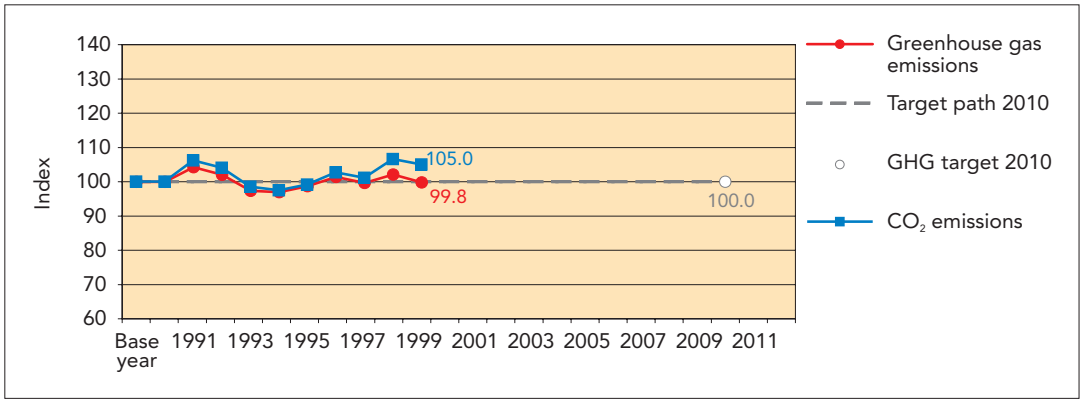
Agriculture accounts for 16 % of total French greenhouse gas emissions (compared to 10 % at EU average). CH_4 emissions from enteric fermentation decreased by 7 % mainly due to reductions in cattle (– 15 %) and sheep population (– 12 %). N_2O emissions from agricultural soils went down by 3 %, also the use of synthetic fertilisers and the input of animal manures to agricultural land went down by 3 % each.

CO_2 emissions from mineral products decreased by 20 %. One reason for this was a substantial cut in cement production (– 23 %).

Fugitive CH_4 emissions from solid fuels dropped by 39 % between 1990 and 1999. The main reason for this was the decline of French coal mining (– 60 %).

CH_4 emissions from solid waste disposal on land went down by 8 % between 1990 and 1999. Waste disposal on land reduced by 16 %.

French greenhouse gas emissions compared with targets for 2000 and 2008–12 (excluding LUCF) Figure 43



French greenhouse gas emissions and driving forces (real GDP growth, heating degree days, gross inland energy consumption and greenhouse gas emissions per capita in relation to EU-15 average Figure 44

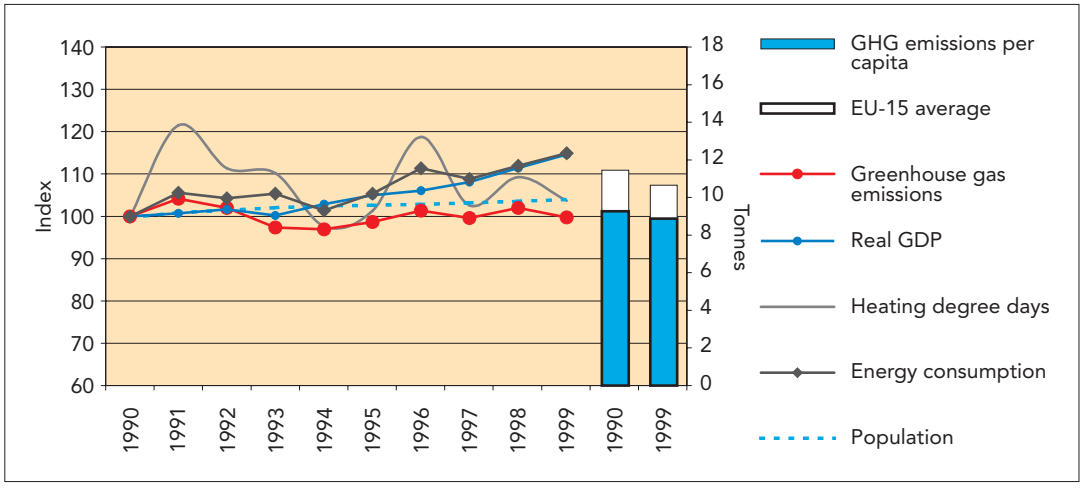


Table 27 **Distance-to-target indicators for France**

Source: Member State submission (CRF tables).

	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Greenhouse gas emissions (without LUCF)	100.0	100.0	104.2	102.0	97.3	96.9	98.7	101.4	99.6	102.1	99.8
DTI 2010	0.0	0.0	4.2	2.0	- 2.7	- 3.1	- 1.3	1.4	- 0.4	2.1	- 0.2
CO_2 (without LUCF)	100.0	100.0	106.1	104.0	98.5	97.5	99.1	102.7	101.1	106.5	105.0
DTI 2000	:	:	:	:	:	:	:	:	:	:	:

Table 28 **Main driving force indicators for France**

Source: Eurostat and Member State submission (CRF tables).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real GDP	100	101	102	100	103	105	106	108	112	115
Heating degree days	100	122	112	110	98	101	119	103	109	104
Population	100	101	102	102	103	103	103	103	104	104
Energy consumption	100	106	104	105	101	105	112	109	112	115

Note: The index of energy consumption in 1999 was calculated on basis of monthly data.

Table 29 **Sectoral emission indicators (key sources) for France**

Source: Member State submission (CRF tables).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1.A.1. Energy Industries (CO_2)	100	118	106	86	80	84	91	85	104	94
1.A.2. Manufacturing Industries and Construction (CO_2)	100	101	98	92	96	95	96	98	100	100
1.A.3. Transport (CO_2)	100	102	106	106	107	109	110	112	114	117
1.A.4. Other Sectors (CO_2) [Small combustion]	100	110	110	107	100	103	112	105	109	108
1.A.5. Other (CO_2)	0	0	0	0	0	0	0	0	0	0
2.A. Mineral Products (CO_2)	100	96	87	82	84	82	80	78	83	80
1.B.1. Fugitive Emissions from Solid Fuels (CH_4)	100	93	97	101	103	102	78	67	65	61
1.B.2. Fugitive Emissions from Oil and Natural Gas (CH_4)	100	107	102	101	93	94	98	89	93	87
4.A. Enteric Fermentation (CH_4)	100	98	96	95	94	95	95	94	93	93
4.B. Manure Management (CH_4)	100	100	100	101	101	102	104	104	104	103
6.A. Solid Waste Disposal on Land (CH_4)	100	107	113	117	122	127	125	104	101	92
1.A.3. Transport (N_2O)	100	106	113	126	150	173	197	220	240	263
2.B. Chemical Industry (N_2O)	100	100	94	84	88	91	89	90	60	40
4.B. Manure Management (N_2O)	100	98	96	96	96	96	97	97	96	96
4.D. Agricultural Soils (N_2O)	100	99	96	93	94	95	96	98	97	97
HFCs	100	67	47	36	36	58	97	137	167	214
PFCs	100	77	67	52	44	42	44	46	52	60
SF_6	100	101	102	103	104	105	109	111	110	110

Note: The list of key sources in this table is the one identified for the EC (see Section 1.2) and differs from the one defined by the Member States for their UNFCCC reporting.

Sectoral background activity indicators for France Table 30

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Fuel combustion in public electricity and heat production	100	128	110	80	72	79	87	77	107	92
Solid fuel combustion in electricity production	100	121	107	76	67	73	84	70	100	85
Gaseous fuel combustion in electricity production	100	120	141	142	154	158	164	204	218	215
Fuel combustion in manufacturing industries	100	101	100	95	98	99	99	102	104	105
Fuel combustion in iron and steel industries	0	0	0	0	0	0	0	0	0	0
Fuel combustion of road transportation	100	102	106	107	107	108	109	111	113	116
Gasoline combustion of road transportation	100	98	98	95	90	86	84	82	80	80
Diesel combustion of road transportation	100	108	116	121	127	134	139	145	151	156
Fuel combustion in households	100	115	111	109	100	102	111	102	108	107
Coal mining and handling	100	95	86	80	70	66	63	53	44	40
Oil refined	100	105	102	107	104	106	112	118	122	113
Cement production	100	95	85	79	80	79	77	74	79	77
Nitric acid production	100	97	89	77	90	90	94	89	86	86
Adipic acid production	100	100	99	94	98	101	99	113	100	107
Iron and Steel production/pig iron production	100	94	91	88	92	92	86	97	97	97
Cattle population	100	99	96	96	96	96	96	95	94	95
Sheep population	100	97	95	93	92	92	91	90	89	88
Pig population	100	100	105	109	110	111	116	116	116	116
Use of synthetic fertilisers	100	0	0	0	0	0	0	0	97	97
Use of animal manures	100	0	0	0	0	0	0	0	97	97
Waste disposal on land	100	103	106	107	108	98	104	110	114	84

Source: Member State submission (CRF tables).

Sectoral driving force and policy indicators for France Table 31

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total gross electricity production	100	108	110	112	113	117	122	120	122	:
Gross electricity production from coal	100	126	109	67	66	77	86	70	107	:
Gross electricity production from natural gas	100	101	106	124	129	136	149	174	177	:
Gross electricity production from renewables	100	107	126	119	141	133	124	120	117	:
Industrial production	100	100	100	97	101	103	104	107	112	115
Steel production	100	97	95	90	95	95	93	104	106	106
Final energy consumption in industry	100	99	100	98	93	100	101	101	106	:
Volume passenger transport	100	102	105	108	111	113	115	117	:	:
Volume freight transport	100	73	104	100	111	122	120	125	:	:
Petrol price	:	100	92	92	93	97	102	104	103	101
Diesel price	100	104	95	95	104	100	108	115	110	109
Number of households	100	101	103	104	105	106	:	:	:	:
Final energy consumption in households	100	114	110	108	101	99	109	103	106	:
Cattle population	100	98	95	94	96	97	96	95	94	94
Sheep population	100	96	94	94	93	91	91	89	86	86
Pig population	100	104	108	119	121	121	125	129	132	133
Use of nitrogenous fertilisers	100	103	86	89	93	96	101	:	:	:
Transformation input to refineries	100	104	102	105	102	104	110	116	120	:
Primary production of solid fuels	100	96	88	81	71	65	64	53	44	:
Share of petrol-engined cars with catalytic converters (%)	3	5	8	15	23	30	38	43	:	:

Source: Eurostat, except for 'Number of households' (Euromonitor, 1997) and 'Use of nitrogenous fertilisers' (FAO).

Germany

Distance-to-target indicator (DTI): German greenhouse gas emissions reduced in 1999, compared to 1998, and were well below the base year level (1995 for F-gases). In 1999, total greenhouse gas emissions were 982 Tg (CO_2 equivalents), which was 18.7 % below the base year level. In the burden sharing agreement to the Kyoto Protocol, Germany agreed to reduce its greenhouse gas emissions by 21 % by 2008–12. Assuming a linear target path from 1990 to 2010, German greenhouse gas emissions were 9.3 index points below this target path in 1999 (Figure 45).

CO_2 emissions account for 87 % of German greenhouse gas emissions. They were 859 Tg in 1999, which was 15.4 % below 1990 levels.

Main driving forces: In 1999, real GDP grew by 1.6 %, compared to 1998; energy use was stable. Heating degree days were 1 % lower than in 1998 (Figure 46). Taking into account the reductions of greenhouse gas emissions (– 3.7 %) and CO_2 emissions (– 3.3 %), this means that greenhouse gas emissions de-coupled from economic growth and from energy use. Over the whole period from 1990 to 1999, greenhouse gas emissions de-coupled from GDP growth by 33 index points, and from energy use by 15 index points. German greenhouse gas emissions per capita decreased from 15.3 tonnes in 1990 to 12 tonnes in 1999 (compared to 10.7 tonnes of EU-15).

Sectoral analysis for selected EC key sources: The main features of German greenhouse gas emission performance were large reductions of CO_2 emissions from energy industries, manufacturing industries and small combustion. In addition, substantial CH_4 emission cuts were achieved in solid waste disposal on land and in coal mining. Also N_2O emissions from chemical industries reduced substantially. Only emissions from transport increased considerably, as in most other Member States. A recent study suggests that the German reunification accounts for about 50 % of the reduction of all six greenhouse gas emissions (Eichhammer et al., 2001).

CO_2 emissions from energy industries reduced by 20 % between 1990 and 1999 (EU average: – 9 %). The main reason for this are efficiency improvements in coal-fired power plants in Eastern Germany. This is illustrated by the following: whereas electricity production from coal-fired power stations increased by 33 % between 1990 and 1998, coal input to power stations reduced by 12 %. Also wind power, which experienced a take-off in recent years, made a small contribution to CO_2 reductions from energy industries: due to favourable feed-in tariffs, Germany became the largest wind power producer in the EU. In all, 1 % of German electricity was produced in wind power stations in 1998.

CO_2 emissions from German manufacturing industry decreased by 29 % between 1990 and 1999 (EU average: – 9 %). The main reason for is was the economic restructuring and efficiency improvements in Eastern Germany after the German reunification.

CO_2 emissions from small combustion reduced by 14 %. One reason might also be substantial energy efficiency improvements in Eastern German households.

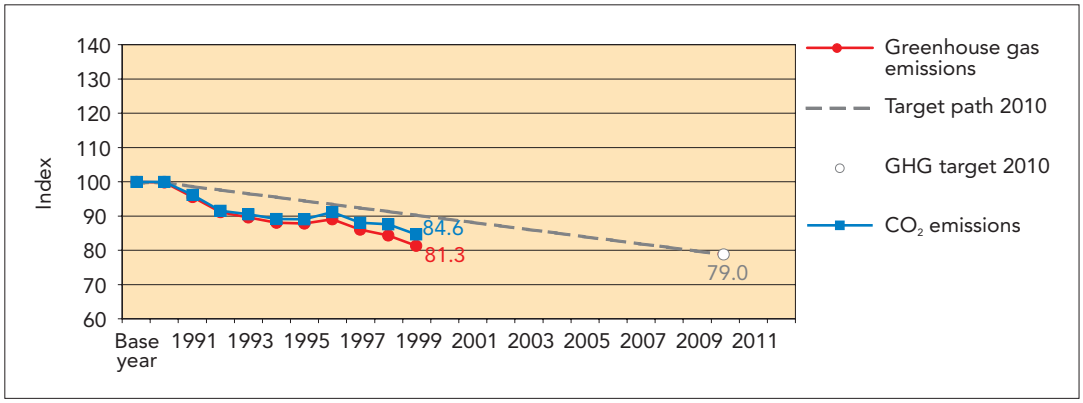
CH_4 emissions from solid waste disposal on land reduced by 57 % (EU average: – 22 %). Fugitive CH_4 emissions from solid fuels reduced by 53 % due to the decline of coal mining. Primary production of solid fuels reduced by 47 % between 1990 and 1998; one reason for this is a gradual reduction of coal subsidies.

N_2O emissions from chemical industry reduced by 84 % between 1990 and 1999, which was mainly due to emission reduction measures in the German adipic acid production in recent years. Adipic acid production increased by 34 % between 1995 and 1999.

German CO_2 emissions from transport increased by 15 %, as in most other Member States. In particular freight transport had a large increase (+ 65 % between 1990 and 1997). Road fuel prices are rather low compared to other Member States, especially the diesel price, which decreased in real terms between 1990 and 1999 (see Figures 16 and 17). The annual increase of the road fuel tax under the German eco-tax scheme is supposed to counterbalance this development.

N_2O emissions from transport increased by 75 %. This increase was below the EU-15 average (+ 103 %), because in 1990 already more than one third of German cars were fitted with catalytic converters (compared to about 12 % in EU-15). Germany (together with Austria and the Netherlands) was amongst the first European countries to introduce catalytic converters in petrol-engined cars.

German greenhouse gas emissions compared with targets for 2000 and 2008–12 (excluding LUCF) Figure 45



German greenhouse gas emissions and driving forces (real GDP growth, heating degree days, gross inland energy consumption) and greenhouse gas emissions per capita in relation to EU-15 average Figure 46

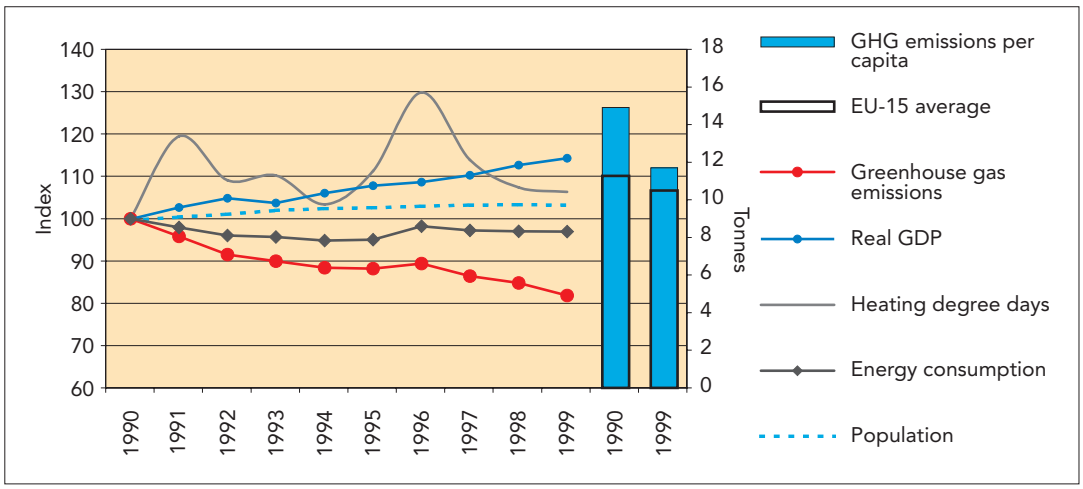


Table 32 **Distance-to-target indicators for Germany**

Source: Member State submission (CRF tables).

	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Greenhouse gas emissions (without LUCF)	100.0	99.8	95.5	91.2	89.6	88.0	87.8	89.0	86.0	84.3	81.3
DTI 2010	0.0	- 0.2	- 3.4	- 6.7	- 7.3	- 7.8	- 6.9	- 4.7	- 6.7	- 7.3	- 9.3
CO_2 (without LUCF)	100.0	100.0	96.2	91.5	90.5	89.1	89.1	91.1	88.1	87.6	84.6
DTI 2000	:	:	:	:	:	:	:	:	:	:	:

Table 33 **Main driving force indicators for Germany**

Source: Eurostat, except for real GDP (OECD).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real GDP	100	103	105	104	106	108	109	111	113	115
Heating degree days	100	120	109	110	103	112	131	114	107	106
Population	100	101	101	102	103	103	103	104	104	104
Energy consumption	100	98	96	96	95	95	98	97	97	97

Note: The index of energy consumption in 1999 was calculated on basis of monthly data.

Table 34 **Sectoral emission indicators (key sources) for Germany**

Source: Member State submission (CRF tables).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1.A.1. Energy Industries (CO_2)	100	97	91	89	88	86	87	83	83	80
1.A.2. Manufacturing Industries and Construction (CO_2)	100	88	81	75	76	76	74	75	73	71
1.A.3. Transport (CO_2)	100	102	106	109	107	109	109	109	111	115
1.A.4. Other Sectors (CO_2) [Small combustion]	100	101	93	97	92	94	106	98	94	86
1.A.5. Other (CO_2)	100	71	54	43	40	35	25	25	26	23
2.A. Mineral Products (CO_2)	100	91	94	94	100	98	90	93	96	97
1.B.1. Fugitive Emissions from Solid Fuels (CH_4)	100	91	88	75	66	68	60	58	50	47
1.B.2. Fugitive Emissions from Oil and Natural Gas (CH_4)	100	105	116	128	122	107	112	108	107	106
4.A. Enteric Fermentation (CH_4)	100	88	84	82	82	82	81	79	78	76
4.B. Manure Management (CH_4)	100	88	84	83	82	82	82	80	80	78
6.A. Solid Waste Disposal on Land (CH_4)	100	90	78	66	60	56	43	43	43	43
1.A.3. Transport (N_2O)	100	119	139	158	158	175	178	178	178	175
2.B. Chemical Industry (N_2O)	100	101	113	102	99	100	106	90	37	16
4.B. Manure Management (N_2O)	0	0	0	0	0	0	0	0	0	0
4.D. Agricultural Soils (N_2O)	100	92	87	86	91	90	89	91	94	93
HFCs	100	100	106	160	170	134	110	147	183	183
PFCs	100	87	79	75	62	65	68	58	63	63
SF_6	100	112	125	139	148	160	149	146	140	140

Note: The list of key sources in this table is the one identified for the EC (see Section 1.2) and differs from the one defined by the Member States for their UNFCCC reporting.

Sectoral background activity indicators for Germany Table 35

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Fuel combustion in public electricity and heat production	:	:	:	:	:	:	:	:	:	:
Solid fuel combustion in electricity production	:	:	:	:	:	:	:	:	:	:
Gaseous fuel combustion in electricity production	:	:	:	:	:	:	:	:	:	:
Fuel combustion in manufacturing industries	:	:	:	:	:	:	:	:	:	:
Fuel combustion in iron and steel industries	:	:	:	:	:	:	:	:	:	:
Fuel combustion of road transportation	:	:	:	:	:	:	:	:	:	:
Gasoline combustion of road transportation	:	:	:	:	:	:	:	:	:	:
Diesel combustion of road transportation	:	:	:	:	:	:	:	:	:	:
Fuel combustion in households	:	:	:	:	:	:	:	:	:	:
Coal mining and handling	:	:	:	:	:	:	:	:	:	:
Oil refined	:	:	:	:	:	:	:	:	:	:
Cement production	:	:	:	:	:	:	:	:	:	:
Nitric acid production	:	:	:	:	:	:	:	:	:	:
Adipic acid production	:	:	:	:	:	:	:	:	:	:
Iron and Steel production/pig iron	:	:	:	:	:	:	:	:	:	:
Cattle population	:	:	:	:	:	:	:	:	:	:
Sheep population	:	:	:	:	:	:	:	:	:	:
Pig population	:	:	:	:	:	:	:	:	:	:
Use of synthetic fertilisers	:	:	:	:	:	:	:	:	:	:
Use of animal manures	:	:	:	:	:	:	:	:	:	:
Managed Waste Disposal on Land	:	:	:	:	:	:	:	:	:	:

Source: Member State submission (CRF tables).

Sectoral driving force and policy indicators for Germany Table 36

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total gross electricity production	100	119	118	116	116	118	122	122	123	:
Gross electricity production from coal	100	140	134	133	132	131	135	129	133	:
Gross electricity production from natural gas	100	100	91	95	111	120	133	139	150	:
Gross electricity production from renewables	100	96	108	110	117	129	134	119	134	:
Industrial production	100	102	101	94	98	99	98	101	105	106
Steel production	100	110	104	98	107	110	104	117	115	110
Final energy consumption in industry	100	91	86	81	82	87	85	82	80	:
Volume passenger transport	100	103	106	107	106	107	108	110	:	:
Volume freight transport	100	134	138	138	149	153	154	165	:	:
Petrol price	100	112	111	108	118	115	119	122	117	119
Diesel price	100	108	98	96	100	97	102	106	97	98
Number of households	:	100	101	103	104	105	106	:	:	:
Final energy consumption in households	100	109	101	109	106	109	121	115	117	:
Cattle population	100	88	83	82	82	82	81	78	77	75
Sheep population	100	77	74	73	72	74	72	71	70	66
Pig population	:	100	102	100	95	91	93	95	101	100
Use of nitrogenous fertilisers	100	96	94	90	100	99	98	:	:	:
Transformation input to refineries	100	99	106	111	114	110	111	108	114	:
Primary production of solid fuels	100	85	78	70	65	63	59	56	53	:
Share of petrol-engined cars with catalytic converters (%)	37	43	49	54	58	63	69	73	:	:

Source: Eurostat, except for 'Number of households' (Euromonitor, 1997) and 'Use of nitrogenous fertilisers' (FAO).

Greece

Distance-to-target indicator (DTI): Greek greenhouse gas emissions decreased in 1999, compared to 1998, but were substantially higher than in 1990. In 1999, total greenhouse gas emissions were 123 Tg (CO_2 equivalents), which was 16.9 % above 1990 levels. In the burden sharing agreement to the Kyoto Protocol, Greece agreed to limit its greenhouse gas emissions to a 25 % increase by 2008–12, from 1990 levels. Assuming a linear target path from 1990 to 2010, Greek greenhouse gas emissions were 5.7 index points above this target path in 1999 (Figure 47). The base year for the F-gases can not be seen from the national greenhouse gas submission, but is assumed to be 1990.

CO_2 emissions account for 80 % of Greek greenhouse gas emissions. In 1999, they were 98 Tg, which was 16.7 % above 1990 levels. For CO_2, Greece set a limitation target of + 15 % between 1990 and 2000. Figure 47 shows that Greek CO_2 emissions were 3.2 index points above the target path for 2000.

Main driving force indicators: In 1999, real GDP grew by 3.4 % and energy use increased by 2.8 %, compared to 1998. Heating degree days were 10 % lower than 1998, but in the southern countries this measure is not as relevant as in the northern countries (Figure 48). As greenhouse gas emissions went down by 0.7 % and CO_2 emissions decreased by 0.9 % in 1999, greenhouse gas emissions de-coupled from economic growth and from energy use. Over the whole period from 1990 to 1999, greenhouse gas emissions de-coupled only slightly from GDP growth (3 index points) and from energy use (7 index points). Greek greenhouse gas emissions per capita increased from 10.4 tonnes in 1990 to 11.7 tonnes in 1999 (compared to 10.7 tonnes of EU-15 in 1999).

Sectoral analysis for selected EC key sources: Main features of Greek greenhouse gas emission performance are substantial increases of CO_2 emissions from energy industries, transport and small combustion. In addition, HFC emissions and CH_4 from solid waste disposal on land increased considerably. The largest reductions in absolute terms were achieved in N_2O emissions from agricultural soils.

CO_2 emissions from energy industries increased by 16 % between 1990 and 1999 (compared to a 9 % reduction at EU level). The Greek electricity production largely depends on domestic lignite: in 1998, 70 % of Greek electricity production was produced in lignite-fired power stations; lignite-fired electricity production increased by 29 % between 1990 and 1998. The increase of power production from renewable sources (mainly hydro-power) and natural gas contributed to the limitation of CO_2 emission growth.

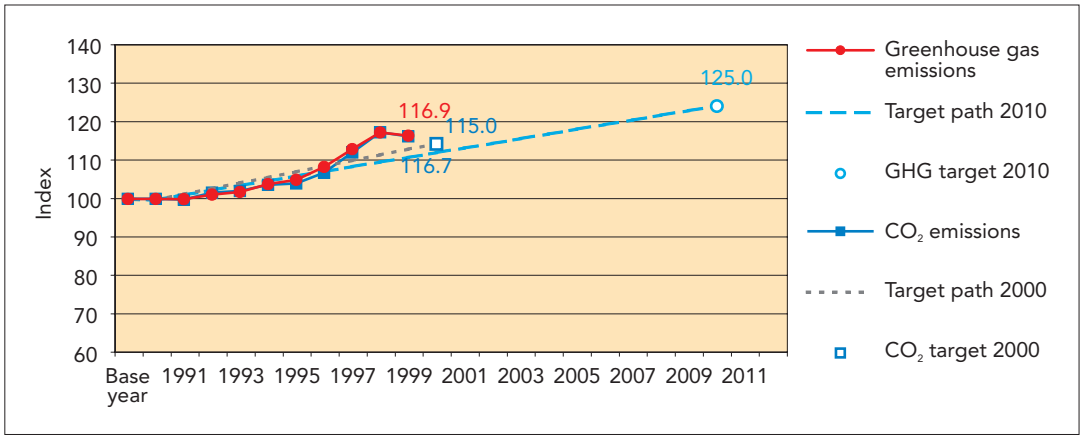
CO_2 emissions from transport increased by 27 % between 1990 and 1999, which was well above the EU average increase (+ 18 %). Passenger and freight transport increased by 32 and 52 % respectively between 1990 and 1997. Lower transport levels (e.g. a low car-ownership ratio) and sustained economic growth might be reasons for higher than average transport growth rates in Greece (as was the case in other cohesion States as well). In addition, low road fuel prices in comparison to the other Member States might have contributed to transport growth (see Figures 16 and 17). Note that road fuel prices show opposing trends in terms of real change between 1990 and 1999. Whereas petrol prices reduced by 23 %, diesel prices increased by 51 %.

CO_2 emissions from small combustion increased by 49 % between 1990 and 1999 (compared to a stabilisation at EU level). Final energy consumption in households increased by 31 % between 1990 and 1998. However, for solar energy Greece achieved remarkable growth rates in the 1990s. Between 1990 and 1998, solar energy production increased by 59 %. In 1998, Greece was the largest producer of solar energy in the EU accounting for 34 % of total EU production.

CH_4 emissions from solid waste disposal on land increased by 36 % (compared to a 22 % reduction at EU level).

N_2O emissions from agricultural soils reduced by 8 % between 1990 and 1999, which might be due to reductions of fertiliser use in Greek agriculture. Between 1990 and 1996, the use of nitrogenous fertiliser went down by 18 %.

Greek greenhouse gas emissions compared with targets for 2000 and 2008–12 (excluding LUCF) Figure 47



Greek greenhouse gas emissions and driving forces (real GDP growth, heating degree days, gross inland energy consumption and greenhouse gas emissions per capita in relation to EU-15 average Figure 48

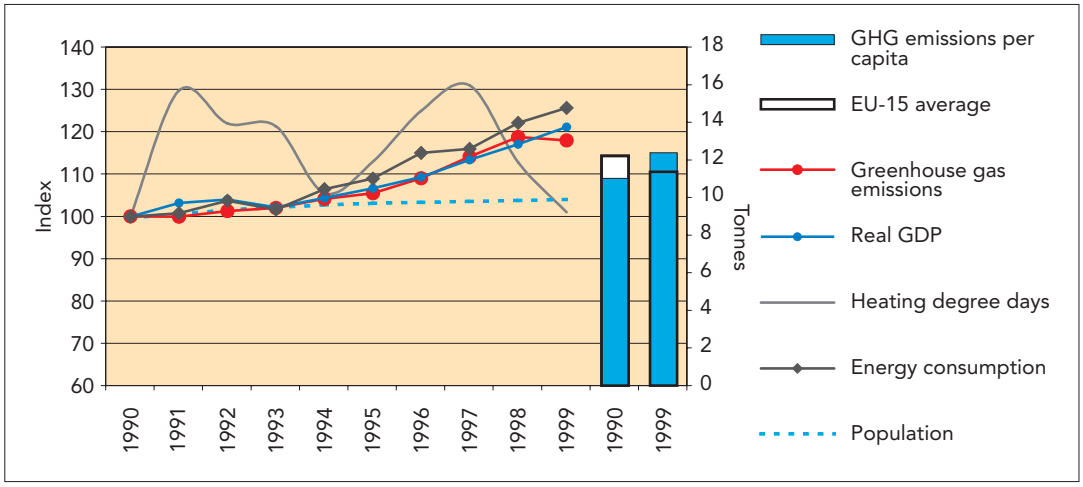


Table 37 **Distance-to-target indicators for Greece**

Source: Member State submission (CRF tables).

	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Greenhouse gas emissions (without LUCF)	100.0	100.0	100.0	101.2	101.9	103.9	105.1	108.5	113.3	117.8	116.9
DTI 2010	0.0	0.0	- 1.3	- 1.3	- 1.9	- 1.1	- 1.1	1.0	4.6	7.8	5.7
CO_2 (without LUCF)	100.0	100.0	99.8	101.7	102.1	103.7	104.1	107.0	112.3	117.8	116.7
DTI 2000	0.0	0.0	- 1.7	- 1.3	- 2.4	- 2.3	- 3.4	- 2.0	1.8	5.8	3.2

Table 38 **Main driving force indicators for Greece**

Source: Eurostat.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real GDP	100	103	104	102	104	106	109	113	116	120
Heating degree days	100	128	121	120	105	112	124	129	112	101
Population	100	101	102	102	103	103	103	104	104	104
Energy consumption	100	101	104	102	106	109	114	115	121	124

Note: The index of energy consumption in 1999 was calculated on basis of monthly data.

Table 39 **Sectoral emission indicators (key sources) for Greece**

Source: Member State submission (CRF tables).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1.A.1. Energy Industries (CO_2)	100	97	102	102	107	104	102	110	116	116
1.A.2. Manufacturing Industries and Construction (CO_2)	100	98	95	92	91	98	106	108	109	96
1.A.3. Transport (CO_2)	100	106	107	108	108	108	110	114	123	127
1.A.4. Other Sectors (CO_2) [Small combustion]	100	104	102	101	101	106	141	146	152	149
1.A.5. Other (CO_2)	0	0	0	0	0	0	0	0	0	0
2.A. Mineral Products (CO_2)	100	100	101	104	101	106	109	109	108	108
1.B.1. Fugitive Emissions from Solid Fuels (CH_4)	100	102	106	106	109	111	115	113	117	120
1.B.2. Fugitive Emissions from Oil and Natural Gas (CH_4)	100	100	86	68	45	41	45	91	305	486
4.A. Enteric Fermentation (CH_4)	100	99	98	98	98	99	100	101	102	102
4.B. Manure Management (CH_4)	100	98	98	98	98	97	104	110	116	116
6.A. Solid Waste Disposal on Land (CH_4)	100	103	107	111	115	119	123	126	131	136
1.A.3. Transport (N_2O)	100	110	110	113	115	113	117	123	128	130
2.B. Chemical Industry (N_2O)	100	83	86	82	80	79	90	80	79	80
4.B. Manure Management (N_2O)	100	100	100	100	100	100	112	124	139	139
4.D. Agricultural Soils (N_2O)	100	100	94	93	93	89	91	92	92	92
HFCs	100	118	97	172	229	348	401	424	400	400
PFCs	100	86	60	35	22	21	20	17	15	8
SF_6	0	0	0	0	0	0	0	0	0	0

Note: The list of key sources in this table is the one identified for the EC (see Section 1.2) and differs from the one defined by the Member States for their UNFCCC reporting.

Sectoral background activity indicators for Greece Table 40

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Fuel combustion in public electricity and heat production	:	:	:	:	:	:	:	:	:	:
Solid fuel combustion in electricity production	:	:	:	:	:	:	:	:	:	:
Gaseous fuel combustion in electricity production	:	:	:	:	:	:	:	:	:	:
Fuel combustion in manufacturing industries	:	:	:	:	:	:	:	:	:	:
Fuel combustion in iron and steel industries	:	:	:	:	:	:	:	:	:	:
Fuel combustion of road transportation	:	:	:	:	:	:	:	:	:	:
Gasoline combustion of road transportation	:	:	:	:	:	:	:	:	:	:
Diesel combustion of road transportation	:	:	:	:	:	:	:	:	:	:
Fuel combustion in households	:	:	:	:	:	:	:	:	:	:
Coal mining and handling	:	:	:	:	:	:	:	:	:	:
Oil refined	:	:	:	:	:	:	:	:	:	:
Cement production	:	:	:	:	:	:	:	:	:	:
Nitric acid production	:	:	:	:	:	:	:	:	:	:
Adipic acid production	:	:	:	:	:	:	:	:	:	:
Iron and Steel production/pig iron	:	:	:	:	:	:	:	:	:	:
Cattle population	:	:	:	:	:	:	:	:	:	:
Sheep population	:	:	:	:	:	:	:	:	:	:
Pig population	:	:	:	:	:	:	:	:	:	:
Use of synthetic fertilisers	:	:	:	:	:	:	:	:	:	:
Use of animal manures	:	:	:	:	:	:	:	:	:	:
Managed Waste Disposal on Land	:	:	:	:	:	:	:	:	:	:

Source: Member State submission (CRF tables).

Sectoral driving force and policy indicators for Greece Table 41

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total gross electricity production	100	102	107	110	116	119	122	124	132	:
Gross electricity production from coal	100	94	106	110	118	114	116	122	129	:
Gross electricity production from natural gas	100	103	88	93	89	83	87	369	1.903	:
Gross electricity production from renewables	100	158	120	129	144	191	227	206	197	:
Industrial production	:	:	:	:	:	:	:	:	:	:
Steel production	100	98	92	98	85	94	85	102	111	95
Final energy consumption in industry	100	95	97	94	95	104	109	110	112	:
Volume passenger transport	100	102	104	110	115	121	126	132	:	:
Volume freight transport	100	110	109	119	118	136	146	152	:	:
Petrol price	:	100	88	109	99	90	88	87	87	77
Diesel price	100	127	160	194	174	164	166	166	155	151
Number of households	100	100	101	101	101	102	:	:	:	:
Final energy consumption in households	100	101	98	98	100	104	123	126	131	:
Cattle population	100	92	92	88	76	80	86	87	84	86
Sheep population	100	97	100	99	91	95	91	94	92	89
Pig population	100	85	96	100	83	80	79	82	82	79
Use of nitrogenous fertilisers	100	96	92	79	78	80	82	:	:	:
Transformation input to refineries	100	92	97	86	99	107	123	125	128	:
Primary production of solid fuels	100	97	99	98	104	112	116	114	118	:
Share of petrol-engined cars with catalytic converters (%)	9	18	28	34	38	43	47	51	:	:

Source: Eurostat, except for 'Number of households' (Euromonitor, 1997) and 'Use of nitrogenous fertilisers' (FAO).

Ireland

Distance-to-target indicator (DTI): Irish greenhouse gas emissions increased in 1999, compared to 1998, and were well above 1990 levels. In 1999, total greenhouse gas emissions were 65 Tg (CO_2 equivalents), which was 22.1 % above 1990 levels. In the burden sharing agreement to the Kyoto Protocol, Ireland agreed to limit its greenhouse gas emission growth to a 13 % increase by 2008–12. Assuming a linear target path from 1990 to 2010, Irish greenhouse gas emissions were 16.3 index points above this target path in 1999 (Figure 49).

CO_2 emissions account for 64 % of Irish greenhouse gas emissions, which is the lowest share of EC Member States. In 1999, Irish CO_2 emissions were 42 Tg, which was 32.7 % above 1990 levels. For CO_2, Ireland aims at limiting emissions to a 20 % increase between 1990 and 2000. Figure 49 shows that Irish CO_2 emissions were 14.7 index points above the target path.

Main driving force indicators: In 1999, real GDP grew by 9.8 %, which was the highest growth rate in the EU. Energy use increased by 15.4 % compared to 1998 and heating degree days were 3.1 % higher than 1998 (Figure 50). This compares to increases of greenhouse gas (+ 2.5 %) and CO_2 emissions (+ 4.7 %). Therefore, in 1999, greenhouse gas emissions de-coupled from economic growth and even more so from energy use. Over the whole period from 1990 to 1999, GDP almost doubled and energy use grew by almost 50 %. This means that greenhouse gas emissions de-coupled considerably from GDP growth (69 index points) and (in recent years) also from energy use (26 index points). From 1990 to 1999, Irish greenhouse gas emissions per capita increased from 15.3 tonnes in 1990 to 17.4 tonnes in 1999 (EU average was 10.7 tonnes in 1999).

Sectoral analysis for selected EC key sources: Main features of the Irish greenhouse gas emission performance are substantial increases in CO_2 emissions from transport and energy industries. A second feature is a 30 % share of agricultural emissions in total greenhouse gas emissions (EU average: 10 %) and increases of CH_4 emissions from enteric fermentation and N_2O emissions from agricultural soils.

CO_2 emissions from transport increased by 96 % between 1990 and 1999, mainly due to the dynamic economic development in Ireland. In contrast to this, passenger and freight transport figures look rather moderate (+ 24 % and + 7 % respectively between 1990 and 1997), but final energy consumption of road transport increased by 52 % between 1990 and 1997. Road fuel prices decreased by 21 % (petrol) and 17 % (diesel) in real terms, which might have contributed to the high growth rate of CO_2 emissions from transport.

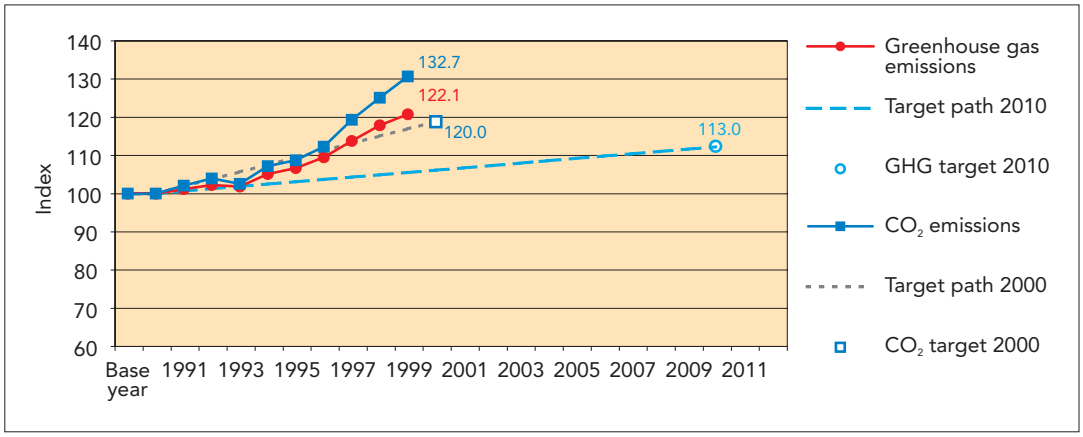
CO_2 emissions from energy industries increased by 42 % between 1990 and 1999 (EU average: – 9 %). This is mainly due to a large increase of power production (+ 46 % from 1990 to 1998). Whereas power production from solid fuels was almost stable between 1990 and 1998, the additional supply was produced from oil, natural gas and renewable energy sources.

CH_4 emissions from enteric fermentation increased by 7 % (EU average: – 8 %). One reason for this might be a 10 % increase in cattle numbers between 1990 and 1999. However, at the same time sheep population dropped by 8 %.

N_2O emissions from agricultural soils increased by 10 % (EU average: – 3 %). The use of synthetic fertilisers was 6 % higher in 1996, compared to 1990.

Note that CO_2 emissions from fossil fuel combustion in manufacturing industries grew by 11 % between 1990 and 1999, whereas industrial production increased by 180 %. This suggests that the new industries located in Ireland have low fossil fuel and carbon intensities.

Irish greenhouse gas emissions compared with targets for 2000 and 2008–12 (excluding LUCF) Figure 49



Irish greenhouse gas emissions and driving forces (real GDP growth, heating degree days, gross inland energy consumption) and greenhouse gas emissions per capita in relation to EU-15 average Figure 50

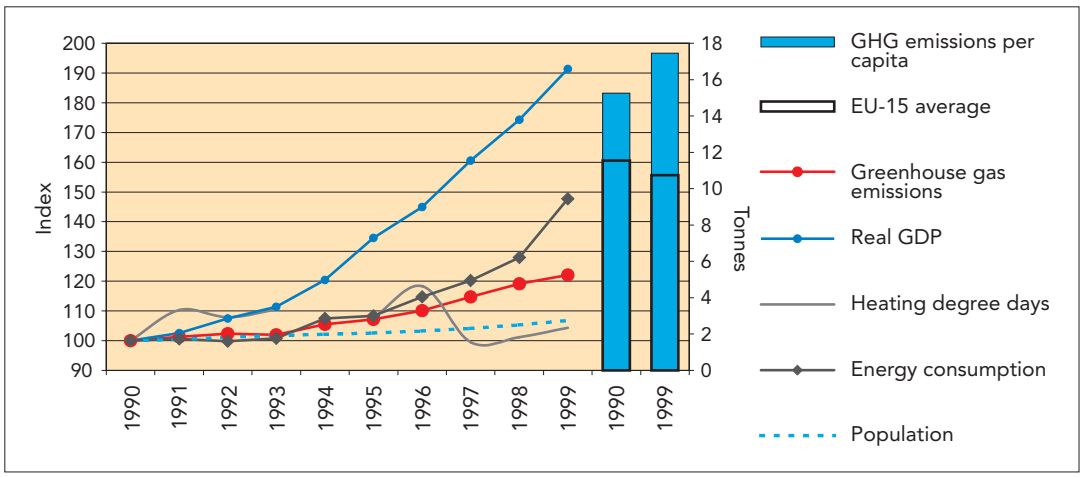


Table 42 **Distance-to-target indicators for Ireland**

Source: Member State submission (CRF tables).

	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Greenhouse gas emissions (without LUCF)	100.0	100.0	101.3	102.4	102.0	105.5	107.1	110.1	114.7	119.1	122.1
DTI 2010	0.0	0.0	0.6	1.1	0.0	2.9	3.9	6.2	10.2	13.9	16.3
CO_2 (without LUCF)	100.0	100.0	102.2	104.2	102.7	107.6	109.3	113.1	120.6	126.7	132.7
DTI 2000	0.0	0.0	0.2	0.2	- 3.3	- 0.4	- 0.7	1.1	6.6	10.7	14.7

Table 43 **Main driving force indicators for Ireland**

Source: Eurostat.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real GDP	100	103	107	111	120	135	145	161	174	191
Heating degree days	100	110	108	111		108	118	100	101	104
Population	100	100	101	102	102	103	103	104	105	107
Energy consumption	100	101	100	101	108	108	115	120	128	148

Note: The index of energy consumption in 1999 was calculated on basis of monthly data.

Table 44 **Sectoral emission indicators (key sources) for Ireland**

Source: Member State submission (CRF tables).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1.A.1. Energy Industries (CO_2)	100	104	111	111	115	120	126	132	136	142
1.A.2. Manufacturing Industries and Construction (CO_2)	100	100	94	94	97	92	92	104	102	111
1.A.3. Transport (CO_2)	100	105	113	113	117	127	142	155	177	196
1.A.4. Other Sectors (CO_2) [Small combustion]	100	99	97	93	98	96	93	97	103	102
1.A.5. Other (CO_2)	0	0	0	0	0	0	0	0	0	0
2.A. Mineral Products (CO_2)	100	98	102	99	115	113	115	126	127	136
1.B.1. Fugitive Emissions from Solid Fuels (CH_4)	0	0	0	0	0	0	0	0	0	0
1.B.2. Fugitive Emissions from Oil and Natural Gas (CH_4)	100	96	92	87	83	80	78	76	67	71
4.A. Enteric Fermentation (CH_4)	100	101	101	102	102	103	105	108	109	107
4.B. Manure Management (CH_4)	100	101	103	104	105	107	110	113	114	112
6.A. Solid Waste Disposal on Land (CH_4)	100	102	104	105	106	107	108	103	90	85
1.A.3. Transport (N_2O)	100	107	118	157	189	196	246	296	364	448
2.B. Chemical Industry (N_2O)	100	78	78	78	78	78	78	78	78	78
4.B. Manure Management (N_2O)	100	101	102	103	104	106	109	112	113	111
4.D. Agricultural Soils (N_2O)	100	100	99	101	104	107	108	105	111	110
HFCs	:	:	:	:	:	:	:	:	:	:
PFCs	:	:	:	:	:	:	:	:	:	:
SF_6	:	:	:	:	:	:	:	:	:	:

Note: The list of key sources in this table is the one identified for the EC (see Section 1.2) and differs from the one defined by the Member States for their UNFCCC reporting.

Sectoral background activity indicators for Ireland Table 45

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Fuel combustion in public electricity and heat production	:	:	:	:	:	:	:	:	:	100
Solid fuel combustion in electricity production	:	:	:	:	:	:	:	:	:	100
Gaseous fuel combustion in electricity production	:	:	:	:	:	:	:	:	:	100
Fuel combustion in manufacturing industries	:	:	:	:	:	:	:	:	:	100
Fuel combustion in iron and steel industries	:	:	:	:	:	:	:	:	:	100
Fuel combustion of road transportation	:	:	:	:	:	:	:	:	:	100
Gasoline combustion of road transportation	:	:	:	:	:	:	:	:	:	100
Diesel combustion of road transportation	:	:	:	:	:	:	:	:	:	100
Fuel combustion in households	:	:	:	:	:	:	:	:	:	100
Coal mining and handling	:	:	:	:	:	:	:	:	:	0
Oil refined	:	:	:	:	:	:	:	:	:	0
Clinker production	:	:	:	:	:	:	:	:	:	100
Nitric acid production	:	:	:	:	:	:	:	:	:	100
Adipic acid production	:	:	:	:	:	:	:	:	:	0
Iron and Steel production	:	:	:	:	:	:	:	:	:	0
Cattle population	:	:	:	:	:	:	:	:	:	100
Sheep population	:	:	:	:	:	:	:	:	:	100
Pig population	:	:	:	:	:	:	:	:	:	100
Use of synthetic fertilisers	:	:	:	:	:	:	:	:	:	100
Use of animal manures	:	:	:	:	:	:	:	:	:	100
Managed Waste Disposal on Land	:	:	:	:	:	:	:	:	:	100

Source: Member State submission (CRF tables).

Sectoral driving force and policy indicators for Ireland Table 46

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total gross electricity production	100	104	110	113	118	123	132	138	146	:
Gross electricity production from coal	100	98	108	104	105	111	112	108	103	:
Gross electricity production from natural gas	100	95	93	115	113	131	160	167	164	:
Gross electricity production from renewables	100	98	108	105	124	100	104	104	147	:
Industrial production	100	103	113	119	133	161	173	204	244	280
Steel production	100	90	79	100	87	95	104	103	110	103
Final energy consumption in industry	100	102	98	82	87	89	91	94	97	:
Volume passenger transport	100	102	107	110	113	117	121	124	:	:
Volume freight transport	100	100	100	99	102	105	107	107	:	:
Petrol price	100	103	96	93	87	88	86	91	84	79
Diesel price	100	104	94	96	92	93	94	98	89	83
Number of households	100	100	100	99	99	99	:	:	:	:
Final energy consumption in households	100	94	97	95	99	101	104	103	111	:
Cattle population	100	101	103	103	105	107	111	115	116	110
Sheep population	100	102	104	102	98	95	92	96	96	92
Pig population	100	108	114	119	120	123	133	137	144	141
Use of nitrogenous fertilisers	100	97	95	108	116	115	106	:	:	:
Transformation input to refineries	100	104	114	109	133	129	123	168	183	:
Primary production of solid fuels	100	84	71	80	83	124	88	52	57	:
Share of petrol-engined cars with catalytic converters (%)	5	14	21	27	35	44	54	66	:	:

Source: Eurostat, except for 'Number of households' (Euromonitor, 1997) and 'Use of nitrogenous fertilisers' (FAO).

Italy

Distance-to-target indicator (DTI): Italian greenhouse gas emissions increased slightly in 1999, compared to 1998, and were clearly higher than in 1990. In 1999, total greenhouse gas emissions were 541 Tg (CO_2 equivalents), which was 4.4 % above 1990 levels. In the burden sharing agreement to the Kyoto Protocol, Italy agreed to a 6.5 % reduction of greenhouse gas emissions by 2008–12. Assuming a linear target path from 1990 to 2010, Italian greenhouse gas emissions were 7.3 index points above this target path in 1999 (Figure 51).

CO_2 emissions account for 84 % of Italian greenhouse gas emissions. They were 457 Tg, which was 4.3 % above 1990 levels. As for CO_2, Italy set a stabilisation target at 1990 levels by 2000, Italian CO_2 emissions were 4.3 index points above the target path in 1999.

Main driving force indicators: In 1999, real GDP grew by 1.6 % but energy consumption reduced slightly by 0.1 %, compared to 1998 (Figure 52). Heating degree days were 3.8 % higher than 1998, but in the southern countries this figure is not as important as in the northern countries. Since greenhouse gas emissions increased by 0.9 % in 1999 and CO_2 emissions rose by 0.5 %, emissions de-coupled from economic growth. Over the whole period from 1990 to 1999, greenhouse gas emissions de-coupled from GDP growth by 8 index points, and from energy use by 7 index points. From 1990 to 1999, Italian greenhouse gas emissions per capita increased slightly to 9.4 tonnes (EU average was 10.7 tonnes in 1999).

Sectoral analysis for selected EC key sources: Some important features of the Italian greenhouse gas emission performance were large reductions of CO_2 emissions from manufacturing industries and from mineral products. In addition, fugitive CH_4 emissions from oil and natural gas and CH_4 emissions from enteric fermentation decreased substantially. The largest increases in absolute terms were CO_2 emissions from transport, small combustion and energy industries.

CO_2 emissions from transport increased by 19 % between 1990 and 1999, which was almost equivalent to the average growth at EU level. In Italy, passenger car transport (+ 22 %) increased more than freight transport (+ 16 %) between 1990 and 1997. Petrol prices decreased by 18 % in real terms between 1990 and 1999, the diesel price increased by 6 %.

CO_2 emissions from small combustion increased by 7 % between 1990 and 1999. Final energy consumption in households increased by 13 % between 1990 and 1998. The increase in energy consumption is in part due to the installation of heating boilers in houses that previously did not have heating boilers (e.g. old buildings in the south of Italy), or due to the implementation of the distribution network of natural gas in areas of Italy not served before. In addition, the growing number of Italian households of + 22 % between 1990 and 1995 (which was by far the largest growth of EC Member States) might have contributed to the increase of CO_2 emissions from small combustion.

CO_2 emissions from energy industries increased by 3 % between 1990 and 1999 (EU average: – 9 %). Total electricity production increased by 19 % between 1990 and 1998. Coal-based power production went down by 27 %, whereas power production from oil, natural gas and renewable sources increased.

CO_2 emissions from manufacturing industries decreased by 7 % between 1990 and 1999. Industrial production was 6 % higher, steel production was 3 % lower than in 1990. Final energy consumption in industry was almost stable in the 1990s.

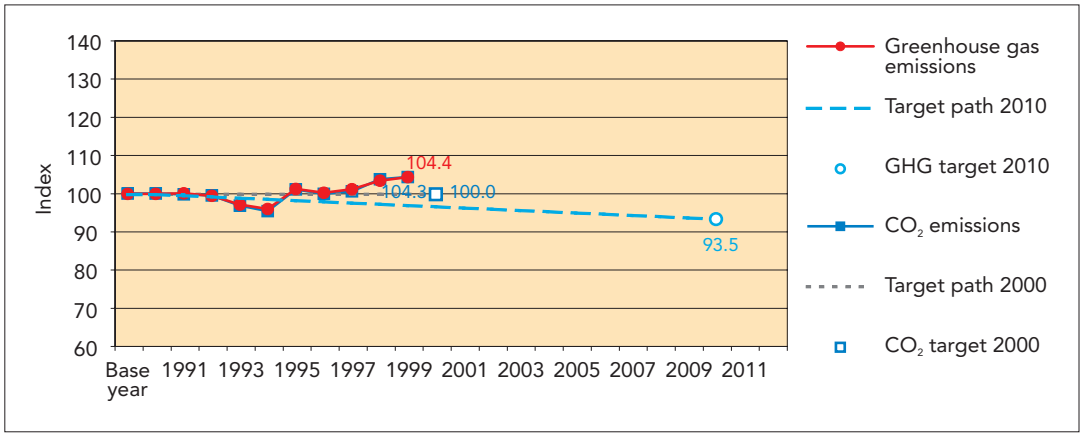
Concerning the trends of CO_2 emissions from energy and manufacturing industries, data of 1998 and 1999 are affected by the liberalisation of the energy market, in the sense that many small and medium plants of energy production, before autoproducers of energy for industry, are now companies producing and selling energy. In the energy balance, their consumption are not any more included in the final consumption of industry but in the energy transformation sector.

CO_2 emissions from mineral products decreased by 9 % between 1990 and 1999. One reason for this might be a decrease of Italian cement production by 11 % between 1990 and 1998.

Fugitive CH_4 emissions from oil and natural gas reduced by 17 % between 1990 and 1999. Transformation input to oil refineries increased by 11 % between 1990 and 1998. Also primary oil and gas production increased.

CH_4 emissions from enteric fermentation decreased by 1 % (EU average: – 8 %). Cattle population went down by 11 %, sheep numbers increased slightly by 1 %.

Italian greenhouse gas emissions compared with targets for 2000 and 2008–12 (excluding LUCF) Figure 51



Italian greenhouse gas emissions and driving forces (real GDP growth, heating degree days, gross inland energy consumption and greenhouse gas emissions per capita in relation to EU-15 average Figure 52

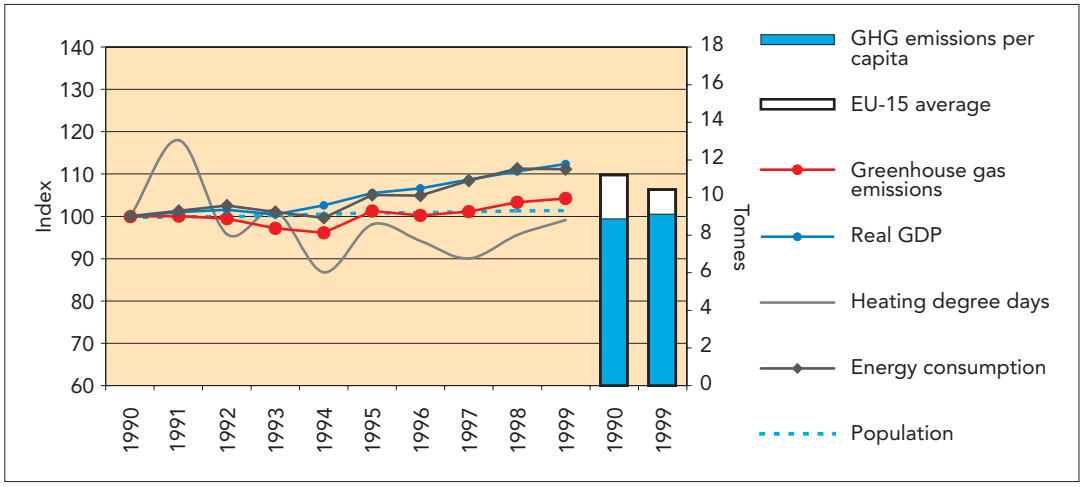


Table 47 **Distance-to-target indicators for Italy**

Source: Member State submission (CRF tables).

	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Greenhouse gas emissions (without LUCF)	100.0	100.0	100.1	99.5	97.1	96.0	101.3	100.2	101.2	103.5	104.4
DTI 2010	0.0	0.0	0.5	0.1	- 1.9	- 2.7	2.9	2.2	3.5	6.1	7.3
CO_2 (without LUCF)	100.0	100.0	99.7	99.5	96.8	95.3	101.1	99.9	100.6	103.8	104.3
DTI 2000	0.0	0.0	- 0.3	- 0.5	- 3.2	- 4.7	1.1	- 0.1	0.6	3.8	4.3

Table 48 **Main driving force indicators for Italy**

Source: Eurostat.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real GDP	100	101	102	101	103	106	107	109	111	113
Heating degree days	100	119	96	101	86	98	94	90	95	99
Population	100	100	100	100	101	101	101	101	102	102
Energy consumption	100	101	103	101	100	105	105	109	111	111

Note: The index of energy consumption in 1999 was calculated on basis of monthly data.

Table 49 **Sectoral emission indicators (key sources) for Italy**

Source: Member State submission (CRF tables).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1.A.1. Energy Industries (CO_2)	100	96	96	89	90	98	94	93	106	103
1.A.2. Manufacturing Industries and Construction (CO_2)	100	97	95	95	97	103	101	106	90	93
1.A.3. Transport (CO_2)	100	103	107	108	108	110	111	113	118	119
1.A.4. Other Sectors (CO_2) [Small combustion]	100	107	101	101	90	99	101	98	102	107
1.A.5. Other (CO_2)	100	93	93	107	90	71	62	78	60	41
2.A. Mineral Products (CO_2)	100	100	101	84	82	84	83	84	88	91
1.B.1. Fugitive Emissions from Solid Fuels (CH_4)	100	98	82	72	64	58	55	54	50	34
1.B.2. Fugitive Emissions from Oil and Natural Gas (CH_4)	100	98	96	92	88	84	85	83	84	83
4.A. Enteric Fermentation (CH_4)	100	102	97	95	97	98	97	99	98	99
4.B. Manure Management (CH_4)	100	100	97	96	94	97	97	99	97	99
6.A. Solid Waste Disposal on Land (CH_4)	100	101	90	91	104	106	106	105	103	99
1.A.3. Transport (N_2O)	100	101	104	108	116	126	136	146	165	179
2.B. Chemical Industry (N_2O)	100	106	98	98	92	106	102	103	101	99
4.B. Manure Management (N_2O)	100	101	97	96	96	99	99	105	103	106
4.D. Agricultural Soils (N_2O)	100	104	105	106	105	103	101	105	105	106
HFCs	100	101	102	101	178	262	217	312	380	822
PFCs	100	97	87	86	89	107	68	70	79	72
SF_6	100	116	126	137	148	162	165	177	212	195

Note: The list of key sources in this table is the one identified for the EC (see Section 1.2) and differs from the one defined by the Member States for their UNFCCC reporting.

Sectoral background activity indicators for Italy Table 50

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Fuel combustion in public electricity and heat production	:	:	:	:	:	:	:	:	100	98
Solid fuel combustion in electricity production	:	:	:	:	:	:	:	:	100	96
Gaseous fuel combustion in electricity production	:	:	:	:	:	:	:	:	100	122
Fuel combustion in manufacturing industries	:	:	:	:	:	:	:	:	100	103
Fuel combustion in iron and steel industries	:	:	:	:	:	:	:	:	100	94
Fuel combustion of road transportation	:	:	:	:	:	:	:	:	100	101
Gasoline combustion of road transportation	:	:	:	:	:	:	:	:	100	98
Diesel combustion of road transportation	:	:	:	:	:	:	:	:	100	106
Fuel combustion in households	:	:	:	:	:	:	:	:	100	106
Coal mining and handling	:	:	:	:	:	:	:	:	100	79
Oil refined	:	:	:	:	:	:	:	:	100	96
Cement production	:	:	:	:	:	:	:	:	100	104
Nitric acid production	:	:	:	:	:	:	:	:	100	90
Adipic acid production	:	:	:	:	:	:	:	:	100	100
Iron and Steel production/pig iron	:	:	:	:	:	:	:	:	100	103
Cattle population	:	:	:	:	:	:	:	:	:	100
Sheep population	:	:	:	:	:	:	:	:	:	100
Pig population	:	:	:	:	:	:	:	:	:	100
Use of synthetic fertilisers	:	:	:	:	:	:	:	:	100	100
Use of animal manures	:	:	:	:	:	:	:	:	100	103
Waste disposal on land	:	:	:	:	:	:	:	:	100	104

Source: Member State submission (CRF tables).

Sectoral driving force and policy indicators for Italy Table 51

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total gross electricity production	100	102	104	103	107	111	113	116	119	:
Gross electricity production from coal	100	89	67	52	62	75	69	64	73	:
Gross electricity production from natural gas	100	92	90	101	103	120	128	157	181	:
Gross electricity production from renewables	100	128	129	126	134	119	134	134	138	:
Industrial production	100	100	98	95	98	103	103	106	106	106
Steel production	100	99	98	101	103	109	94	101	101	97
Final energy consumption in industry	100	98	98	95	97	101	99	101	99	:
Volume passenger transport	100	103	115	115	115	118	120	122	:	:
Volume freight transport	100	103	104	101	105	109	111	116	:	:
Petrol price	100	90	88	86	86	87	86	87	82	82
Diesel price	100	112	111	112	111	112	112	115	106	106
Number of households	100	109	112	118	122	122	:	:	:	:
Final energy consumption in households	100	106	100	101	92	99	102	108	113	:
Cattle population	100	98	94	92	88	90	90	89	89	89
Sheep population	100	96	96	96	98	98	101	100	100	101
Pig population	100	97	93	94	91	91	92	94	94	95
Use of nitrogenous fertilisers	100	103	104	104	100	105	102	:	:	:
Transformation input to refineries	100	100	104	104	103	101	99	107	111	:
Primary production of solid fuels	100	75	80	52	20	29	22	8	2	:
Share of petrol-engined cars with catalytic converters (%)	3	6	9	15	21	27	33	41	:	:

Source: Eurostat, except for 'Number of households' (Euromonitor, 1997) and 'Use of nitrogenous fertilisers' (FAO).

Luxembourg

Distance-to-target indicator (DTI): Luxembourg's greenhouse gas emissions increased in 1999, compared to 1998, but were far below the 1990 level. In 1999, total greenhouse gas emissions were 6.1 Tg (CO_2 equivalents), which was 43.3 % below 1990 levels. In the burden sharing agreement to the Kyoto Protocol, Luxembourg agreed to reduce its greenhouse gas emissions by 28 % by 2008–12, from 1990 levels. Assuming a linear target path from 1990 to 2010, Luxembourg's greenhouse gas emissions were 30.7 index points below this target path in 1999 (Figure 53).

CO_2 emissions account for 89 % of Luxembourg's greenhouse gas emissions. In 1999, they were 5.4 Tg, which was 46.3 % below 1990 levels. For CO_2, Luxembourg set a stabilisation target at 1990 level by 2000. Therefore, Luxembourg's CO_2 emissions were 46.3 index points below the target path for 2000.

Main driving force indicators: In 1999, real GDP grew by 7.5 %, compared to 1998, which was the second highest growth rate in the EU after Ireland. Energy use increased by 6.2 % but heating degree days were 2.4 % lower than 1998 (Figure 54). As greenhouse gas emissions went up by 4.6 % (CO_2 emissions by 5.2 %), in 1999, greenhouse gas emissions de-coupled from economic growth and from energy use. Over the whole period from 1990 to 1999, GDP grew by 50 % and energy use was stable. This means that greenhouse gas emissions de-coupled considerably from GDP growth (94 index points) and also from energy use (41 index points). From 1990 to 1999, Luxembourg's greenhouse gas emissions per capita halved from 28.6 tonnes in 1990 to 14.3 tonnes in 1999 (EU average was 10.7 tonnes in 1999).

Sectoral analysis for selected EC key sources: Main features of Luxembourg's greenhouse gas emission performance are substantial decreases of CO_2 emissions from manufacturing industries (mainly steel) and energy industries. Increases can be observed in CO_2 emissions from transport and from small combustion.

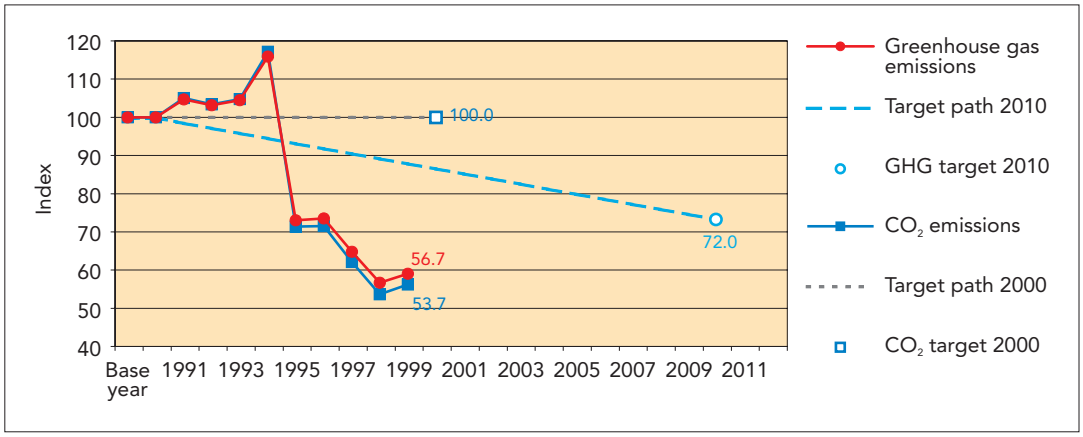
CO_2 emissions from fossil fuel combustion in manufacturing industries fell by 67 % between 1990 and 1999. The main reason for this was a sharp decrease in coke consumption after the conversion of the steel industry to electric arc furnaces.

CO_2 emissions from energy industries decreased by 95 % between 1990 and 1999. This was due to reductions in thermal power generation (– 56 %) between 1990 and 1998, which were offset by increases in hydro-power (+ 28 %) and increases in electricity imports (+ 36 %). In 1998, net electricity imports were about 4 times higher than domestic electricity production.

CO_2 emissions from transport increased by 55 % between 1990 and 1999 (EU average: + 18 %). Passenger transport grew by 20 % between 1990 and 1997, freight transport by 49 %. A high real GDP growth rate of + 51 % between 1990 and 1999 (EU-average: + 20 %) and low road fuel prices (see Figures 16 and 17) might have contributed to the high growth rate of CO_2 emissions from transport.

Note that Luxembourg's greenhouse gas emission data for 1999 has to be interpreted with care. Since Luxembourg did not submit greenhouse gas emission data for 1999 by 1 April 2001, a data gap procedure was applied according to the guidelines under the monitoring mechanism for this year. After this deadline, Luxembourg submitted data for 1999, that suggest that the data compiled under the monitoring mechanism slightly overestimate Luxembourg's greenhouse gas emissions in 1999. In accordance with the monitoring mechanism guidelines the latest data from Luxembourg will be included in the next annual EC greenhouse gas inventory, to be finalised 15 April 2002.

Luxembourg's greenhouse gas emissions compared with targets for 2000 and 2008–12 (excluding LUCF) Figure 53



Luxembourg's greenhouse gas emissions and driving forces (real GDP growth, heating degree days, gross inland energy consumption) and greenhouse gas emissions per capita in relation to EU-15 average Figure 54

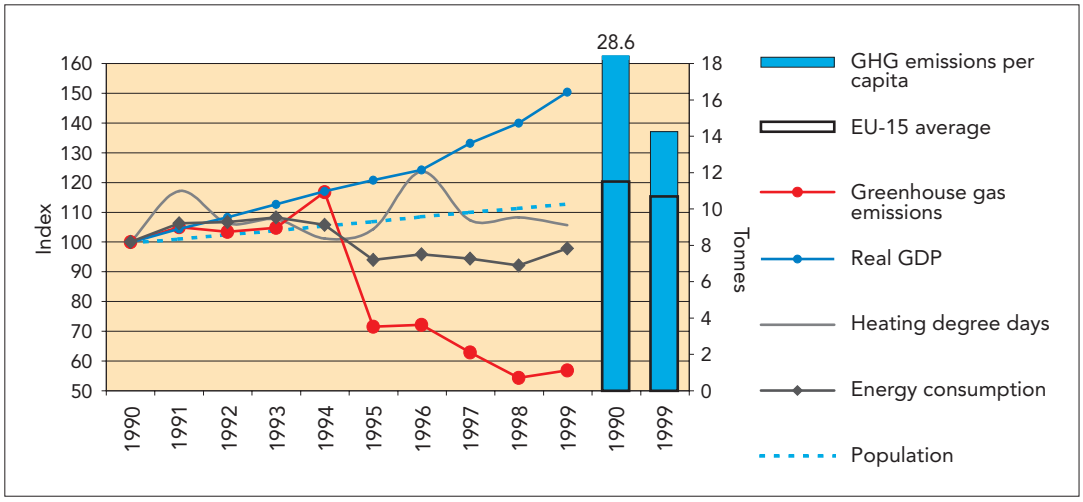


Table 52 **Distance-to-target indicators for Luxembourg**

Source: Member State submission.

	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Greenhouse gas emissions (without LUCF)	100.0	100.0	105.0	103.4	104.8	116.8	71.5	72.0	62.8	54.2	56.7
DTI 2010	0.0	0.0	6.4	6.2	9.0	22.4	- 21.5	- 19.6	- 27.4	- 34.6	- 30.7
CO_2 (without LUCF)	100.0	100.0	105.3	103.6	105.1	118.2	69.7	69.9	59.9	51.0	53.7
DTI 2000	0.0	0.0	5.3	3.6	5.1	18.2	- 30.3	- 30.1	- 40.1	- 49.0	- 46.3

Table 53 **Main driving force indicators for Luxembourg**

Source: Eurostat.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real GDP	100	105	108	113	117	121	124	133	140	151
Heating degree days	100	117	106	108	101	104	124	107	108	106
Population	100	101	103	104	106	107	109	110	112	113
Energy consumption	100	106	107	108	106	94	96	94	92	98

Note: The index of energy consumption in 1999 was calculated on basis of monthly data.

Table 54 **Sectoral emission indicators (key sources) for Luxembourg**

Source: Member State submission.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1.A.1. Energy Industries (CO_2)	100	106	104	106	83	64	58	32	5	5
1.A.2. Manufacturing Industries and Construction (CO_2)	100	106	104	106	104	66	65	45	32	33
1.A.3. Transport (CO_2)	100	106	104	106	424	136	143	142	146	155
1.A.4. Other Sectors (CO_2) [Small combustion]	100	106	104	106	101	97	108	111	129	136
1.A.5. Other (CO_2)	0	0	0	0	:	100	96	0	0	0
2.A. Mineral Products (CO_2)	100	100	100	100	:	:	:	62	62	62
1.B.1. Fugitive Emissions from Solid Fuels (CH_4)	0	0	0	0	0	0	0	0	0	0
1.B.2. Fugitive Emissions from Oil and Natural Gas (CH_4)	100	100	100	100	117	134	142	146	147	147
4.A. Enteric Fermentation (CH_4)	100	100	100	100	96	96	100	100	96	96
4.B. Manure Management (CH_4)	100	100	100	100	94	94	97	97	94	94
6.A. Solid Waste Disposal on Land (CH_4)	100	100	100	100	73	73	107	107	87	87
1.A.3. Transport (N_2O)	100	100	100	100	243	268	275	325	350	350
2.B. Chemical Industry (N_2O)	0	0	0	0	0	0	0	0	0	0
4.B. Manure Management (N_2O)	0	0	0	0	0	0	0	0	0	0
4.D. Agricultural Soils (N_2O)	100	100	100	100	101	101	102	102	102	102
HFCs	:	:	:	:	:	:	:	:	:	:
PFCs	:	:	:	:	:	:	:	:	:	:
SF_6	:	:	:	:	:	:	:	:	:	:

Note: The list of key sources in this table is the one identified for the EC (see Section 1.2) and differs from the one defined by the Member States for their UNFCCC reporting.

Sectoral background activity indicators for Luxembourg Table 55

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Fuel combustion in public electricity and heat production	:	:	:	:	:	:	:	:	:	:
Solid fuel combustion in electricity production	:	:	:	:	:	:	:	:	:	:
Gaseous fuel combustion in electricity production	:	:	:	:	:	:	:	:	:	:
Fuel combustion in manufacturing industries	:	:	:	:	:	:	:	:	:	:
Fuel combustion in iron and steel industries	:	:	:	:	:	:	:	:	:	:
Fuel combustion of road transportation	:	:	:	:	:	:	:	:	:	:
Gasoline combustion of road transportation	:	:	:	:	:	:	:	:	:	:
Diesel combustion of road transportation	:	:	:	:	:	:	:	:	:	:
Fuel combustion in households	:	:	:	:	:	:	:	:	:	:
Coal mining and handling	:	:	:	:	:	:	:	:	:	:
Oil refined	:	:	:	:	:	:	:	:	:	:
Cement production	:	:	:	:	:	:	:	:	:	:
Nitric acid production	:	:	:	:	:	:	:	:	:	:
Adipic acid production	:	:	:	:	:	:	:	:	:	:
Iron and Steel production/pig iron	:	:	:	:	:	:	:	:	:	:
Cattle population	:	:	:	:	:	:	:	:	:	:
Sheep population	:	:	:	:	:	:	:	:	:	:
Pig population	:	:	:	:	:	:	:	:	:	:
Use of synthetic fertilisers	:	:	:	:	:	:	:	:	:	:
Use of animal manures	:	:	:	:	:	:	:	:	:	:
Managed Waste Disposal on Land	:	:	:	:	:	:	:	:	:	:

Source: Member State submission.

Sectoral driving force and policy indicators for Luxembourg Table 56

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total gross electricity production	100	101	87	78	86	90	95	91	95	:
Gross electricity production from coal	:	:	:	:	:	:	:	:	:	:
Gross electricity production from natural gas	100	78	83	64	131	419	664	492	567	:
Gross electricity production from renewables	100	94	75	59	85	102	106	114	128	:
Industrial production	100	101	101	98	100	100	98	103	109	111
Steel production	100	95	86	93	86	73	70	72	70	73
Final energy consumption in industry	:	:	:	:	:	:	:	:	:	:
Volume passenger transport	100	104	108	113	115	118	118	120	:	:
Volume freight transport	100	31	129	141	135	147	148	149	:	:
Petrol price	100	94	92	93	96	98	100	101	97	97
Diesel price	100	100	101	114	115	113	116	121	112	109
Number of households	100	100	101	102	103	103	:	:	:	:
Final energy consumption in households	100	118	107	114	109	111	124	121	84	:
Cattle population	100	95	94	95	95	95	97	95	94	94
Sheep population	100	84	98	98	84	98	91	92	99	102
Pig population	100	91	94	102	97	104	110	105	115	117
Use of nitrogenous fertilisers	:	:	:	:	:	:	:	:	:	:
Transformation input to refineries	:	:	:	:	:	:	:	:	:	:
Primary production of solid fuels	:	:	:	:	:	:	:	:	:	:
Share of petrol-engined cars with catalytic converters (%)	5	12	17	30	41	52	62	70	:	:

Source: Eurostat, except for 'Number of households' (Euromonitor, 1997) and 'Use of nitrogenous fertilisers' (FAO).

Netherlands

Distance-to-target indicator (DTI): Dutch greenhouse gas emissions decreased in 1999, compared to 1998, but were well above the base year level (1995 for F-gases). In 1999, total greenhouse gas emissions were 230 Tg (CO_2 equivalents), which was 6.1 % above 1990 levels. In the burden sharing agreement to the Kyoto Protocol, the Netherlands agreed to reduce its greenhouse gas emissions by 6 % by 2008–12. Assuming a linear target path from 1990 to 2010, Dutch greenhouse gas emissions were 8.8 index points above this target path in 1999 (Figure 55).

CO_2 emissions account for 76 % of Dutch greenhouse gas emissions. In 1999, they were 174 Tg, which was 8 % above 1990 levels. For CO_2, the Netherlands set a 3 % reduction target for temperature adjusted emissions by 2000, from 1990 levels. As temperature adjusted CO_2 emissions rose by 7.1 % between 1990 and 1999, Dutch CO_2 emissions were 9.8 index points above the target path in 1999. The distance-to-target indicator for non-adjusted CO_2 emissions was 10.7 in 1999.

Main driving force indicators: In 1999, real GDP grew by 3.9 %, compared to 1998, but energy use decreased by 2 %. Heating degree days were 2.8 % lower than in 1998 (Figure 56). This compares to decreases of greenhouse gas (– 2.9 %) and CO_2 emissions (– 3.8 %). Therefore, in 1999, greenhouse gas emissions de-coupled from economic growth and also — to a lesser extent — from energy use. However, these figures are partially masked by an artefact in 1999 emissions due to elimination of CO_2 related to statistical differences and due to an increase in net import of electricity of over 50 %. Over the whole period from 1990 to 1999, greenhouse gas emissions de-coupled from GDP growth by 22 index points, but from energy growth by 3 index points only. In 1999, Dutch greenhouse gas emissions per capita were 14.6 tonnes (EU average: 10.7 tonnes), which was almost the same as in 1990.

Sectoral analysis for selected EC key sources: Main features of the Dutch greenhouse gas emission performance are substantial increases in CO_2 emissions from transport, energy industries and manufacturing industries. In addition HFCs and N_2O emissions from chemical industries and agricultural soils increased considerably in absolute terms. On the other hand, CH_4 emissions from solid waste disposal on land, enteric fermentation, and fugitive emissions from oil and gas reduced substantially in absolute terms.

CO_2 emissions from transport increased by 19 % between 1990 and 1999, which was almost equivalent to the EU average growth. Volumes of passenger and freight transport increased by 11 and 42 % respectively between 1990 and 1997. Road fuel consumption increased by 22 % between 1990 and 1999. Road fuel prices increased in real terms by 13 % (petrol) and 21 % (diesel), which were the third highest increases in the EU.

CO_2 emissions from energy industries increased by 9 % between 1990 and 1999 (EU average: – 9 %). Fuel combustion in electricity and heat production increased by 14 %, but, as in many other Member States, there was a fuel shift from coal (– 18 %) to gas (+ 48 %). In addition, the share of net imported electricity in domestic consumption increased to 17 % in 1999. Between 1990 and 1998, gross electricity production increased by 26 %. In the same period, coal-fired power production reduced slightly (– 4 %), whereas power production from natural gas (+ 42 %) and renewable sources (+ 225 %) increased. Power production from biomass tripled and wind power increased by a factor of 10. See also Section 3.2.1 for a structural decomposition of Dutch CO_2 emissions from electricity production.

CO_2 emissions from fossil fuel use in manufacturing industries grew by 4 % between 1990 and 1999, industrial production increased by 12 %. Fuel combustion in manufacturing industries was 8 % below 1990 levels. CO_2 emissions from feedstock use of energy in the petrochemical industry account for about 25 % of the industry total.

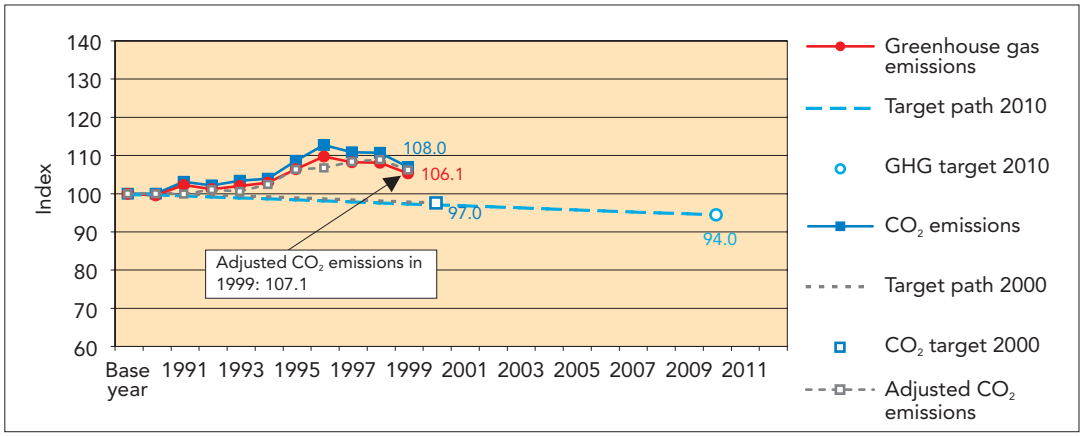
N_2O emissions from chemical industries increased by 15 % (EU average: – 57 %). The main reductions at EU level were achieved by reduction measures in the adipic acid production. In the Netherlands, there is no production of adipic acid, therefore most of the N_2O emissions from chemical industries are generated in the nitric acid production. The Netherlands also report N_2O emissions from caprolactam and acrylonitril production.

N_2O emissions from agricultural soils went up by 16 % (EU average: – 3 %). The use of synthetic fertilisers went down by 3 %, the application of animal manure to agricultural soils was stable between 1990 and 1999. The amount of manure produced per swine has decreased by 9 % in recent years. The increase in emissions from soils are mainly due to a change of manure management. Due to the policy of reducing ammonia emissions, manure is now incorporated into the soil instead of spread on the surface of the soil.

CH_4 emissions from solid waste disposal on land decreased by 24 %. One reason for this was that managed waste disposal on land dropped by 64 % between 1990 and 1999. In addition, methane recovery increased to 14 % in 1999.

CH_4 emissions from enteric fermentation decreased by 17 % (EU average: – 8 %). The number of cattle decreased by 15 %, the sheep population went down by 18 %.

Dutch greenhouse gas emissions compared with targets for 2000 and 2008–12 (excluding LUCF) Figure 55



Dutch greenhouse gas emissions and driving forces (real GDP growth, heating degree days, gross inland energy consumption and greenhouse gas emissions per capita in relation to EU-15 average Figure 56

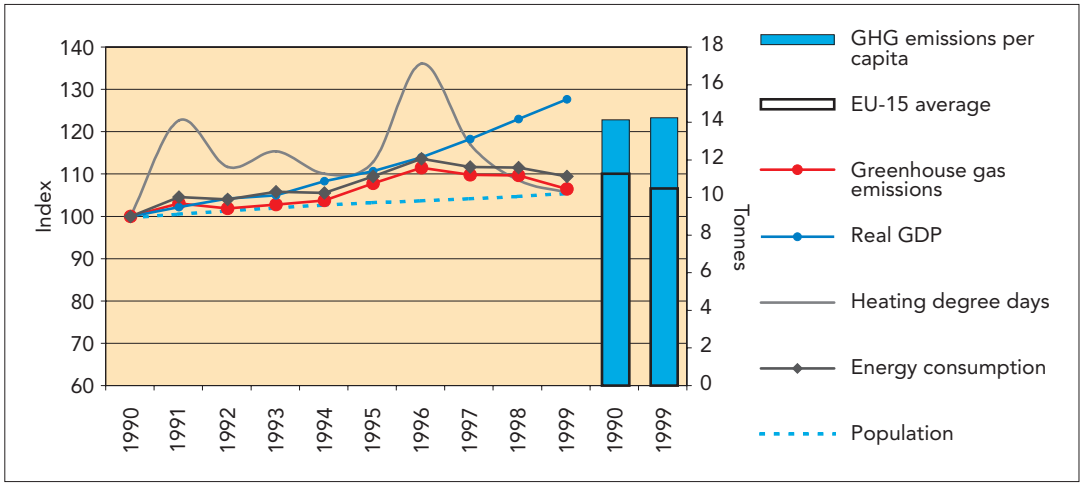


Table 57 **Distance-to-target indicators for the Netherlands**

Source: Member State submission (CRF tables).

	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Greenhouse gas emissions (without LUCF)	100.0	99.5	102.6	101.4	102.3	103.3	107.4	111.2	109.5	109.3	106.1
DTI 2010	0.0	- 0.5	2.9	2.0	3.2	4.5	8.9	13.0	11.6	11.7	8.8
CO_2 (without LUCF)	100.0	100.0	103.6	102.5	103.9	104.5	109.9	114.6	112.4	112.2	108.0
DTI 2000 (non-adjusted)	0.0	0.0	3.9	3.1	4.8	5.7	11.4	16.4	14.5	14.6	10.7
DTI 2000 (temperature adjusted)	0.0	0.0	0.2	1.8	1.6	4.0	8.8	9.6	11.7	12.6	9.8

Table 58 **Main driving force indicators for the Netherlands**

Source: Eurostat.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real GDP	100	102	104	105	109	111	114	119	124	128
Heating degree days	100	123	112	116	110	113	137	117	109	106
Population	100	101	102	102	103	104	104	105	105	106
Energy consumption	100	105	104	106	106	110	114	112	112	110

Note: The index of energy consumption in 1999 was calculated on basis of monthly data.

Table 59 **Sectoral emission indicators (key sources) for the Netherlands**

Source: Member State submission (CRF tables).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1.A.1. Energy Industries (CO_2)	100	100	104	103	107	110	113	111	115	109
1.A.2. Manufacturing Industries and Construction (CO_2)	100	102	102	95	98	104	101	106	105	104
1.A.3. Transport (CO_2)	100	98	103	105	106	110	116	114	117	119
1.A.4. Other Sectors (CO_2) [Small combustion]	100	118	109	117	112	113	132	106	104	103
1.A.5. Other (CO_2)	100	95	- 33	147	50	225	178	565	321	3
2.A. Mineral Products (CO_2)	100	94	100	141	141	151	121	146	140	144
1.B.1. Fugitive Emissions from Solid Fuels (CH_4)	0	0	0	0	0	0	0	0	0	0
1.B.2. Fugitive Emissions from Oil and Natural Gas (CH_4)	100	105	91	88	94	97	99	87	82	81
4.A. Enteric Fermentation (CH_4)	100	103	100	98	95	94	91	88	84	83
4.B. Manure Management (CH_4)	100	102	101	101	98	96	95	91	90	88
6.A. Solid Waste Disposal on Land (CH_4)	100	99	96	93	90	85	85	83	79	76
1.A.3. Transport (N_2O)	100	137	159	159	159	163	157	158	137	132
2.B. Chemical Industry (N_2O)	100	102	96	95	100	100	101	111	114	115
4.B. Manure Management (N_2O)	100	106	106	121	121	121	106	103	98	97
4.D. Agricultural Soils (N_2O)	100	103	118	118	119	124	124	117	114	116
HFCs	100	95	89	99	125	131	146	153	169	172
PFCs	100	100	86	87	78	77	84	89	102	107
SF_6	100	69	74	76	102	121	111	126	92	95

Note: The list of key sources in this table is the one identified for the EC (see Section 1.2) and differs from the one defined by the Member States for their UNFCCC reporting.

Sectoral background activity indicators for the Netherlands Table 60

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Fuel combustion in public electricity and heat production	100	0	0	0	0	0	0	0	117	114
Solid fuel combustion in electricity production	100	0	0	0	0	0	0	0	98	82
Gaseous fuel combustion in electricity production	100	0	0	0	0	0	0	0	138	148
Fuel combustion in manufacturing industries	100	0	0	0	0	0	0	0	95	92
Fuel combustion in iron and steel industries	100	0	0	0	0	0	0	0	0	0
Fuel combustion of road transportation	100	0	0	0	0	0	119	116	119	122
Gasoline combustion of road transportation	100	0	0	0	0	0	121	116	117	119
Diesel combustion of road transportation	100	0	0	0	0	0	126	125	130	138
Fuel combustion in households	100	0	0	0	0	0	0	0	97	97
Coal mining and handling	0	0	0	0	0	0	0	0	0	0
Refinery input	100	0	0	0	0	0	0	123	126	111
Clinker production	0	0	0	100	101	93	69	82	94	94
Nitric acid production	100	0	0	113	107	0	0	0	0	0
Adipic acid production	0	0	0	0	0	0	0	0	0	0
Iron and Steel production	0	0	0	0	0	0	0	0	0	0
Cattle population	100	0	0	0	0	0	92	90	87	85
Sheep population	100	0	0	0	0	0	96	86	82	82
Pig population	100	0	0	0	0	0	104	109	97	97
Use of synthetic fertilisers	100	0	0	0	0	0	0	97	97	97
Use of animal manures	100	0	0	0	0	0	0	100	94	100
Managed Waste Disposal on Land	100	86	82	81	65	61	49	42	38	36

Source: Member State submission (CRF tables).

Sectoral driving force and policy indicators for the Netherlands Table 61

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total gross electricity production	100	103	107	107	111	113	119	120	126	:
Gross electricity production from coal	100	90	90	85	98	104	96	92	96	:
Gross electricity production from natural gas	100	112	118	120	119	115	129	138	142	:
Gross electricity production from renewables	100	110	119	133	149	165	225	290	325	:
Industrial production	100	101	100	99	102	104	106	106	109	112
Steel production	100	96	100	111	114	118	117	123	118	112
Final energy consumption in industry	100	93	95	100	94	96	100	100	99	:
Volume passenger transport	100	100	102	103	108	108	107	111	:	:
Volume freight transport	100	73	125	124	128	133	138	142	:	:
Petrol price	100	108	106	103	107	104	109	114	113	113
Diesel price	100	111	103	115	119	114	123	130	121	121
Number of households	100	101	101	102	103	104	:	:	:	:
Final energy consumption in households	100	113	104	109	108	114	126	110	106	:
Cattle population	100	101	99	96	95	94	90	89	87	85
Sheep population	100	96	87	69	69	77	74	66	69	61
Pig population	100	100	99	101	101	101	103	83	97	95
Use of nitrogenous fertilisers	100	100	100	95	104	100	95	:	:	:
Transformation input to refineries	100	103	106	108	110	116	118	118	119	:
Primary production of solid fuels	:	:	:	:	:	:	:	:	:	:
Share of petrol-engined cars with catalytic converters (%)	32	40	48	53	59	65	71	76	:	:

Source: Eurostat, except for 'Number of households' (Euromonitor, 1997) and 'Use of nitrogenous fertilisers' (FAO).

Portugal

Distance-to-target indicator (DTI): Portuguese greenhouse gas emissions increased in 1999, compared to 1998, and were well above the base year level (1995 for F-gases). In 1999, total greenhouse gas emissions were 79 Tg (CO_2 equivalents), which was 22.4 % above the base year level. In the burden sharing agreement to the Kyoto Protocol, Portugal agreed to limit its greenhouse gas emission growth to a 27 % increase by 2008–12. Assuming a linear target path from 1990 to 2010, Portuguese greenhouse gas emissions were 10.2 index points above this target path in 1999 (Figure 57).

CO_2 emissions account for 73 % of Portuguese greenhouse gas emissions. In 1999, they were 58 Tg, which was 31.2 % above 1990 levels.

Main driving force indicators: In 1999, real GDP grew by 3 %, energy use increased by 8.7 %, compared to 1998 (Figure 58). Heating degree days were 13.2 % higher than in 1998, but in the southern Member States this indicator is not as important as in the northern countries. This compares to increases of greenhouse gas emissions by 2.9 % and of CO_2 emissions by 3.8 %. Therefore, in 1999, greenhouse gas emissions did not de-couple from economic growth, but energy use was less greenhouse gas intensive in 1999, compared to 1998. Over the whole period from 1990 to 1999, greenhouse gas emissions de-coupled hardly from GDP growth (2 index points), but considerably from energy use (24 index points). Note that energy use increased at a faster rate than GDP. From 1990 to 1999, Portuguese greenhouse gas emissions per capita increased from 6.5 tonnes in 1990 to 7.9 tonnes in 1999 (EU average was 10.7 tonnes in 1999).

Sectoral analysis for selected EC key sources: Main features of the Portuguese greenhouse gas emission performance are large increases in CO_2 emissions from fossil fuel combustion in transport, energy industries, small combustion and manufacturing industries. In addition CO_2 emissions from mineral products and CH_4 from solid waste disposal on land showed considerable increases in absolute terms. Reductions were achieved in CH_4 emissions from manure management and from enteric fermentation.

CO_2 emissions from transport increased by 66 % between 1990 and 1999, which was the second highest growth of EC Member States. Road fuel use increased by 72 % from 1990 to 1999. The volume of passenger transport increased by 68 % between 1990 and 1997, the growth of freight transport was only 11 %. Therefore, sustained economic growth seems to stimulate rather the use of private cars (low car-ownership ratio), than commercial transportation. Decreasing fuel prices in real terms (more than 20 % between 1990 and 1999) might have also played a role in stimulating road transport.

CO_2 emissions from energy industries increased by 14 % between 1990 and 1999 (EU average: – 9 %). Fuel combustion in electricity and heat production increased by 11 %; in contrast to most other Member States, coal combustion increased by 23 %. Total electricity production went up by 37 % between 1990 and 1998. Power production from renewable energies increased by 42 % between 1990 and 1998; in addition, three years ago gas was introduced for power generation.

CO_2 emissions from small combustion increased by 46 % between 1990 and 1999, which was mainly due to a 45 % increase of oil consumption in the households sector. The number of households increased by 6 % between 1990 and 1995, the final energy demand of households grew by 15 % between 1990 and 1998.

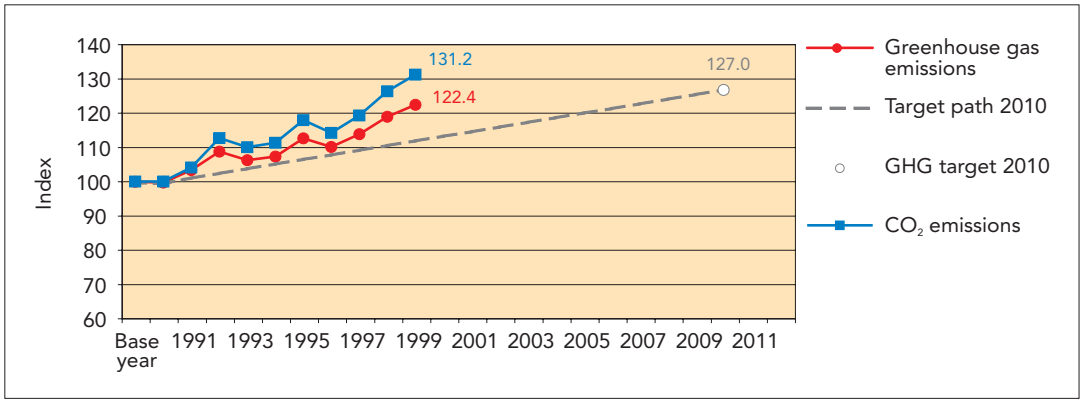
CO_2 emissions from fossil fuel combustion in manufacturing industries grew by 18 % between 1990 and 1999. The fuel combustion in the manufacturing industries increased by 21 %. The use of solid fuels reduced by 30 %, whereas the use of oil, gas and biomass increased.

CO_2 emissions from mineral products increased by 28 % between 1990 and 1999. One of the main reasons might be the 30 % increase of cement production.

CH_4 emissions from solid waste disposal on land increased by 10 % from 1990 to 1999 (EU average: – 22 %). Waste disposal on land rose by 29 %.

CH_4 emissions from manure management decreased by 13 % and CH_4 from enteric fermentation went down by 7 %. One reason for this might be a 9 % reduction of cattle numbers between 1990 and 1999. Sheep population increased slightly (+ 3 %).

Portuguese greenhouse gas emissions compared with targets for 2000 and 2008–12 (excluding LUCF) Figure 57



Portuguese greenhouse gas emissions and driving forces (real GDP growth, heating degree days, gross inland energy consumption) and greenhouse gas emissions per capita in relation to EU-15 average Figure 58

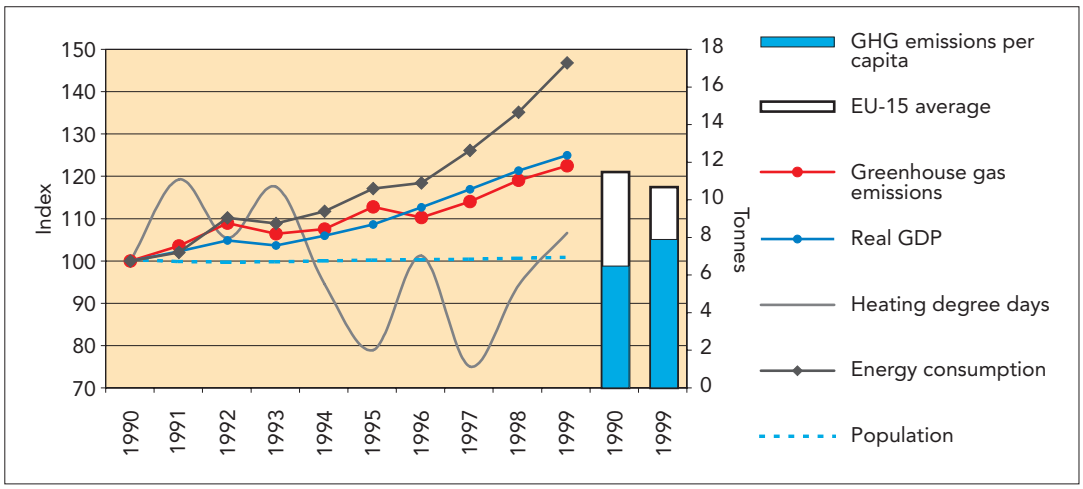


Table 62 **Distance-to-target indicators for Portugal**

Source: Member State submission (CRF tables).

	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Greenhouse gas emissions (without LUCF)	100.0	99.8	103.4	108.7	106.2	107.3	112.6	110.1	113.9	118.9	122.4
DTI 2010	0.0	- 0.2	2.0	6.0	2.2	1.9	5.9	2.0	4.4	8.1	10.2
CO_2 (without LUCF)	100.0	100.0	104.1	112.6	110.0	111.2	117.9	114.2	119.3	126.3	131.2
DTI 2000	:	:	:	:	:	:	:	:	:	:	:

Table 63 **Main driving force indicators for Portugal**

Source: Eurostat.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real GDP	100	102	105	104	106	109	113	117	122	125
Heating degree days	100	119	106	118	95	79	101	75	94	107
Population	100	100	99	99	100	100	100	100	100	101
Energy consumption	100	102	110	109	112	117	119	126	135	147

Note: The index of energy consumption in 1999 was calculated on basis of monthly data.

Table 64 **Sectoral emission indicators (key sources) for Portugal**

Source: Member State submission (CRF tables).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1.A.1. Energy Industries (CO_2)	100	104	123	112	108	124	103	106	118	114
1.A.2. Manufacturing Industries and Construction (CO_2)	100	103	102	100	106	103	108	107	108	118
1.A.3. Transport (CO_2)	100	106	115	120	124	129	136	143	157	166
1.A.4. Other Sectors (CO_2) [Small combustion]	100	104	107	108	116	111	127	139	130	146
1.A.5. Other (CO_2)	100	72	68	37	5	0	0	0	0	0
2.A. Mineral Products (CO_2)	100	103	101	106	108	114	113	129	125	128
1.B.1. Fugitive Emissions from Solid Fuels (CH_4)	100	97	90	84	63	0	0	0	0	0
1.B.2. Fugitive Emissions from Oil and Natural Gas (CH_4)	100	91	108	103	129	123	112	135	223	244
4.A. Enteric Fermentation (CH_4)	100	102	98	96	96	96	95	94	94	93
4.B. Manure Management (CH_4)	100	97	96	88	92	91	90	90	90	87
6.A. Solid Waste Disposal on Land (CH_4)	100	101	103	104	105	106	107	109	108	110
1.A.3. Transport (N_2O)	100	107	115	144	171	196	228	260	298	335
2.B. Chemical Industry (N_2O)	100	100	101	84	63	101	101	101	101	101
4.B. Manure Management (N_2O)	100	117	114	112	113	118	118	120	125	126
4.D. Agricultural Soils (N_2O)	100	107	104	102	103	104	104	105	108	108
HFCs	0	0	0	0	0	0	0	0	0	0
PFCs	0	0	0	0	0	100	100	100	100	100
SF_6	0	0	0	0	0	100	102	104	106	109

Note: The list of key sources in this table is the one identified for the EC (see Section 1.2) and differs from the one defined by the Member States for their UNFCCC reporting.

Sectoral background activity indicators for Portugal Table 65

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Fuel combustion in public electricity and heat production	100	106	128	113	103	122	94	99	116	111
Solid fuel combustion in electricity production	100	106	109	120	126	145	133	137	126	123
Gaseous fuel combustion in electricity production	0	0	0	0	0	0	0	100	591	303
Fuel combustion in manufacturing industries	100	105	104	102	105	105	109	105	114	121
Fuel combustion in iron and steel industries	100	83	111	125	115	98	91	117	112	125
Fuel combustion of road transportation	100	107	117	124	128	133	141	150	160	172
Gasoline combustion of road transportation	100	110	123	131	133	136	141	142	143	144
Diesel combustion of road transportation	100	105	112	118	125	131	140	156	175	195
Fuel combustion in households	100	99	99	99	97	95	95	97	95	96
Coal mining and handling	100	96	79	70	52	0	0	0	0	0
Oil refined	100	95	107	102	119	114	106	111	121	123
Cement production	100	104	101	107	108	112	117	130	127	130
Nitric acid production	100	100	101	84	63	101	101	101	101	101
Adipic acid production	0	0	0	0	0	0	0	0	0	0
Iron and Steel production	100	105	176	176	187	141	124	204	195	231
Cattle population	100	103	98	96	96	96	95	93	92	91
Sheep population	100	101	100	98	102	102	101	102	105	103
Pig population	100	96	96	85	91	90	88	89	88	85
Use of synthetic fertilisers	100	99	95	93	91	88	90	92	94	96
Use of animal manures	100	102	99	98	98	102	102	103	108	109
Waste disposal on land	100	108	113	118	119	122	129	134	136	129

Source: Member State submission (CRF tables).

Sectoral driving force and policy indicators for Portugal Table 66

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total gross electricity production	100	105	106	109	110	117	121	120	137	:
Gross electricity production from coal	100	108	112	126	128	148	139	143	132	:
Gross electricity production from natural gas	0	0	0	0	0	0	0	100	2.267	:
Gross electricity production from renewables	100	100	60	97	117	95	159	143	142	:
Industrial production	:	:	:	:	:	:	:	:	:	:
Steel production	100	77	103	104	100	111	116	121	125	139
Final energy consumption in industry	100	103	106	106	110	105	114	128	133	:
Volume passenger transport	100	104	110	128	138	153	162	168	:	:
Volume freight transport	100	89	100	94	107	107	109	111	:	:
Petrol price	:	100	90	90	87	86	83	86	82	79
Diesel price	100	106	96	95	88	84	84	88	83	78
Number of households	100	100	102	104	105	106	:	:	:	:
Final energy consumption in households	100	103	106	109	111	131	117	116	115	:
Cattle population	100	103	98	96	97	96	95	93	92	102
Sheep population	100	101	100	98	102	102	101	102	103	103
Pig population	100	95	96	100	91	90	88	89	88	88
Use of nitrogenous fertilisers	100	90	85	87	85	90	100	:	:	:
Transformation input to refineries	100	92	106	102	126	122	112	118	126	:
Primary production of solid fuels	100	96	79	70	52	0	0	0	0	:
Share of petrol-engined cars with catalytic converters (%)	1	3	5	9	13	16	19	22	:	:

Source: Eurostat, except for 'Number of households' (Euromonitor, 1997) and 'Use of nitrogenous fertilisers' (FAO).

Spain

Distance-to-target indicator (DTI): Spanish greenhouse gas emissions increased in 1999, compared to 1998, and were well above the base year level (1995 for F-gases). In 1999, total greenhouse gas emissions were 380 Tg (CO_2 equivalents), which was 23.2 % above the base year level. In the burden sharing agreement to the Kyoto Protocol, Spain agreed to limit its greenhouse gas emission growth to a 15 % increase by 2008–12. Assuming a linear target path from 1990 to 2010, Spanish greenhouse gas emissions were 16.5 index points above this target path in 1999 (Figure 59).

CO_2 emissions account for 74 % of Spanish greenhouse gas emissions. In 1999, they were 281 Tg, which was 24.3 % above 1990 levels. For CO_2, Spain aims to limit the emission increase to 11–13 % between 1990 and 2000. Therefore, taking a mean of 12 %, Spanish CO_2 emissions were 13.5 index points above the target path in 1999.

Main driving force indicators: In 1999, real GDP grew by 4 %, energy use increased by 6.2 %, compared to 1998 (Figure 60). Heating degree days were 3.8 % higher than in 1998 (but in the southern Member States this indicator is not as important as in the northern countries). This compares to increases of greenhouse gas emissions by 6.1 % and of CO_2 emissions by 4.7 %. Therefore, in 1999, the greenhouse gas intensity of GDP increased, whereas the greenhouse gas intensity of energy use was stable. Over the whole period from 1990 to 1999, the greenhouse gas intensity of GDP did not improve, but greenhouse gas emissions de-coupled from energy use by 8 index points. From 1990 to 1999, Spanish greenhouse gas emissions per capita increased from 7.9 tonnes in 1990 to 9.7 tonnes in 1999 (EU average was 10.7 tonnes in 1999).

Sectoral analysis for selected EC key sources: Main features of the Spanish greenhouse gas emission performance are substantial increases in CO_2 emissions from fossil fuel combustion, but also in CH_4 emissions from solid waste and CH_4 and N_2O emissions from agriculture. Some reductions were achieved in N_2O emissions from chemical industries and in fugitive CH_4 emissions from solid fuels.

CO_2 emissions from transport increased by 45 % between 1990 and 1999, which is above EU average (+ 18 %) and in line with other cohesion States. The volume of passenger and freight transport increased at approximately the same level (+ 24 % and + 22 % respectively between 1990 and 1997).

CO_2 emissions from energy industries increased by 18 % between 1990 and 1999 (EU average: – 9 %). Gross electricity production increased by 29 % between 1990 and 1998, but power production from coal was almost at 1990 level in 1998. Instead electricity production from natural gas (increase by a factor of 10), renewable source (+ 50 %) and oil (+ 103 %) increased. In recent years, Spain has become the third wind power producer in the EU (after Germany and Denmark) accounting for 18 % of total EU wind power production.

CH_4 emissions from solid waste disposal on land increased by 76 % between 1990 and 1999 (EU average: – 22 %).

CO_2 emissions from fossil fuel combustion in manufacturing industries grew by 12 % between 1990 and 1999 (EU average: – 9 %). Industrial production increased by 15 % from 1990 to 1999, final energy demand in industry grew by 11 % between 1990 and 1998.

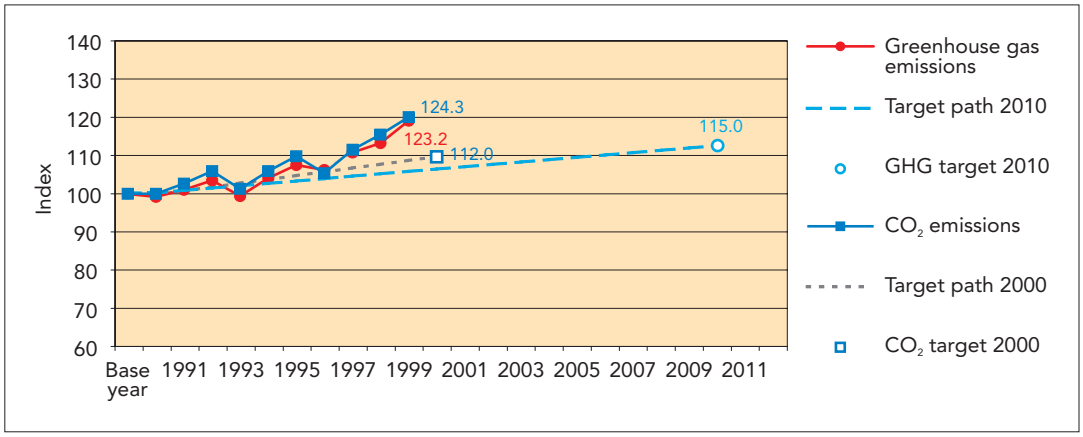
CO_2 emissions from small combustion grew by 23 % between 1990 and 1999. CO_2 emissions from fossil fuel combustion in households grew by 25 %. Final energy demand in households increased by 20 % between 1990 and 1998.

CO_2 emissions from mineral products increased by 25 % between 1990 and 1999. One of the main reasons might be a substantial increase in cement production (+ 15 %) between 1990 and 1998.

Also agricultural emissions went up: CH_4 emissions from manure management and from enteric fermentation increased by 15 and 8 % respectively. Cattle and pig population grew by 23 and 41 % respectively, sheep population stayed at 1990 levels.

Fugitive CH_4 emissions from solid fuels declined by 19 % between 1990 and 1999 due to a drop of coal mining (– 20 % between 1990 and 1998).

Spanish greenhouse gas emissions compared with targets for 2000 and 2008–12 (excluding LUCF) Figure 59



Spanish greenhouse gas emissions and driving forces (real GDP growth, heating degree days, gross inland energy consumption and greenhouse gas emissions per capita in relation to EU-15 average Figure 60

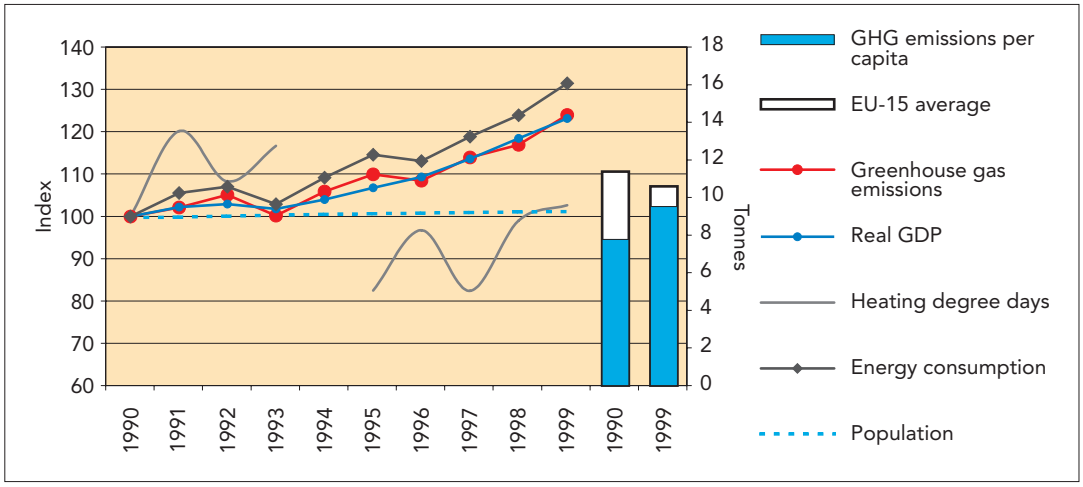


Table 67 **Distance-to-target indicators for Spain**

Source: Member State submission (CRF tables).

	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Greenhouse gas emissions (without LUCF)	100.0	99.1	101.3	104.3	99.4	105.1	109.1	107.6	113.1	116.2	123.2
DTI 2010	0.0	- 0.9	0.5	2.8	- 2.9	2.1	5.4	3.1	7.9	10.2	16.5
CO_2 (without LUCF)	100.0	100.0	103.2	107.2	101.5	107.2	111.9	106.5	114.0	118.8	124.3
DTI 2000	0.0	0.0	2.0	4.8	- 2.1	2.4	5.9	- 0.7	5.6	9.2	13.5

Table 68 **Main driving force indicators for Spain**

Source: Eurostat.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real GDP	100	102	103	102	104	107	109	114	119	123
Heating degree days	100	120	108	117		82	97	82	99	103
Population	100	100	100	101	101	101	101	101	101	101
Energy consumption	100	106	107	103	109	115	113	119	124	132

Note: The index of energy consumption in 1999 was calculated on basis of monthly data.

Table 69 **Sectoral emission indicators (key sources) for Spain**

Source: Member State submission (CRF tables).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1.A.1. Energy Industries (CO_2)	100	100	111	103	104	112	95	109	109	118
1.A.2. Manufacturing Industries and Construction (CO_2)	100	103	101	97	105	113	101	112	116	112
1.A.3. Transport (CO_2)	100	105	112	105	113	115	124	124	137	145
1.A.4. Other Sectors (CO_2) [Small combustion]	100	114	112	107	112	111	115	114	117	123
1.A.5. Other (CO_2)	0	0	0	0	0	0	0	0	0	0
2.A. Mineral Products (CO_2)	100	96	88	83	97	104	101	107	115	125
1.B.1. Fugitive Emissions from Solid Fuels (CH_4)	100	94	94	90	86	87	83	85	79	81
1.B.2. Fugitive Emissions from Oil and Natural Gas (CH_4)	100	111	117	113	123	143	163	213	226	259
4.A. Enteric Fermentation (CH_4)	100	98	98	100	98	98	105	106	106	108
4.B. Manure Management (CH_4)	100	103	107	103	108	111	108	112	72	115
6.A. Solid Waste Disposal on Land (CH_4)	100	107	112	122	131	139	148	159	168	176
1.A.3. Transport (N_2O)	100	106	113	118	136	149	169	185	217	244
2.B. Chemical Industry (N_2O)	100	90	76	63	75	79	85	80	75	81
4.B. Manure Management (N_2O)	100	97	100	104	98	96	105	100	98	106
4.D. Agricultural Soils (N_2O)	100	99	93	80	92	87	105	95	97	102
HFCs	100	89	99	78	134	193	222	239	242	316
PFCs	100	95	94	96	95	95	92	95	90	84
SF_6	100	107	111	115	126	152	163	194	225	289

Note: The list of key sources in this table is the one identified for the EC (see Section 1.2) and differs from the one defined by the Member States for their UNFCCC reporting.

Sectoral background activity indicators for Spain Table 70

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Fuel combustion in public electricity and heat production	:	:	:	:	:	:	:	:	:	:
Solid fuel combustion in electricity production	:	:	:	:	:	:	:	:	:	:
Gaseous fuel combustion in electricity production	:	:	:	:	:	:	:	:	:	:
Fuel combustion in manufacturing industries	:	:	:	:	:	:	:	:	:	:
Fuel combustion in iron and steel industries	:	:	:	:	:	:	:	:	:	:
Fuel combustion of road transportation	:	:	:	:	:	:	:	:	:	:
Gasoline combustion of road transportation	:	:	:	:	:	:	:	:	:	:
Diesel combustion of road transportation	:	:	:	:	:	:	:	:	:	:
Fuel combustion in households	:	:	:	:	:	:	:	:	:	:
Coal mining and handling	:	:	:	:	:	:	:	:	:	:
Oil refined	:	:	:	:	:	:	:	:	:	:
Cement production	:	:	:	:	:	:	:	:	:	:
Nitric acid production	:	:	:	:	:	:	:	:	:	:
Adipic acid production	:	:	:	:	:	:	:	:	:	:
Iron and Steel production/pig iron	:	:	:	:	:	:	:	:	:	:
Cattle population	:	:	:	:	:	:	:	:	:	:
Sheep population	:	:	:	:	:	:	:	:	:	:
Pig population	:	:	:	:	:	:	:	:	:	:
Use of synthetic fertilisers	:	:	:	:	:	:	:	:	:	:
Use of animal manures	:	:	:	:	:	:	:	:	:	:
Managed Waste Disposal on Land	:	:	:	:	:	:	:	:	:	:

Source: Member State submission (CRF tables).

Sectoral driving force and policy indicators for Spain Table 71

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total gross electricity production	100	103	105	104	107	110	115	125	129	:
Gross electricity production from coal	100	98	108	105	103	110	90	105	103	:
Gross electricity production from natural gas	100	90	113	79	214	249	448	1.204	1.074	:
Gross electricity production from renewables	100	108	82	100	114	99	161	144	150	:
Industrial production	100	100	95	89	95	100	98	104	111	115
Steel production	100	99	95	100	104	107	94	106	115	115
Final energy consumption in industry	100	102	98	97	100	101	100	109	111	:
Volume passenger transport	100	104	108	111	113	116	120	124	:	:
Volume freight transport	100	199	109	111	117	120	117	122	:	:
Petrol price	:	100	103	106	106	102	103	105	101	98
Diesel price	100	112	110	116	114	108	111	117	108	109
Number of households	100	101	101	102	102	103	:	:	:	:
Final energy consumption in households	100	110	106	106	111	108	114	116	120	:
Cattle population	100	99	97	98	103	108	116	115	117	123
Sheep population	100	102	102	99	96	89	100	103	101	100
Pig population	100	108	114	114	115	114	116	122	135	141
Use of nitrogenous fertilisers	100	94	77	87	92	86	108	:	:	:
Transformation input to refineries	100	102	106	100	104	104	103	107	114	:
Primary production of solid fuels	100	94	98	95	90	87	86	85	80	:
Share of petrol-engined cars with catalytic converters (%)	4	5	7	10	15	18	22	26	:	:

Source: Eurostat, except for 'Number of households' (Euromonitor, 1997) and 'Use of nitrogenous fertilisers' (FAO).

Sweden

Distance-to-target indicator (DTI): Swedish greenhouse gas emissions went down in 1999, compared to 1998, and were slightly above the base year level (1995 for F-gases). In 1999, total greenhouse gas emissions were 71 Tg (CO_2 equivalents), which was 1.5 % above 1990 levels. In the burden sharing agreement to the Kyoto Protocol, Sweden agreed to limit its greenhouse gas emission growth to a 4 % increase by 2008–12. Assuming a linear target path from 1990 to 2010, Swedish greenhouse gas emissions were 0.3 index points below this target path in 1999 (Figure 61).

CO_2 emissions account for 80 % of Swedish greenhouse gas emissions. In 1999, they were 56 Tg, which was 2.5 % above 1990 levels. For CO_2, Sweden set a stabilisation target at 1990 levels by 2000. Therefore, Swedish CO_2 emissions were 2.5 index points above the target path.

Main driving force indicators: In 1999, real GDP grew by 4.1 %, energy use decreased by 1.2 %, compared to 1998 (Figure 62). This compares to decreases of greenhouse gas emissions by 2.6 % and of CO_2 emissions by 2.9 %. Therefore, in 1999, greenhouse gas emissions de-coupled from economic growth and also — but to a lesser extent — from energy use. Over the whole period from 1990 to 1999, greenhouse gas emissions de-coupled from GDP growth by 12 index points, but greenhouse gas intensity of energy use hardly decreased. From 1990 to 1999, Swedish greenhouse gas emissions per capita stayed at approximately the same level, i.e. 8 tonnes (compared to 10.7 tonnes of EU average).

Sectoral analysis for selected EC key sources: Main features of the Swedish greenhouse gas emission performance are increases in CO_2 emissions from transport and energy industries. The largest decreases in absolute terms were achieved in CO_2 emissions from small combustion and CH_4 from solid waste disposal on land.

CO_2 emissions from transport increased by 6 % between 1990 and 1999 (EU average: + 18 %). which was the third lowest figure of EC Member States. Also road fuel consumption increased by 6 % between 1990 and 1999. Transport patterns showed opposing trends: whereas passenger transport decreased by 6 % between 1990 and 1997, freight transport increased by 25 %. Road fuel prices are amongst the highest in the EU in real 1990 terms.

CO_2 emissions from energy industries increased by 9 % between 1990 and 1999 (EU average: – 9 %). They show large fluctuations because fossil fuel combustion is used to compensate for low hydro-power production. Only about 4 % of Swedish power is produced from fossil fuels; hydro-power and nuclear power account for more than 90 %. Fuel combustion of electricity and heat production was 57 % higher in 1999 compared to 1990, but combustion of solid fuels went down by 32 %. The use of biomass increased by more than 400 %, oil and gas grew by 58 and 54 % respectively. Total electricity production increased by 8 % between 1990 and 1998.

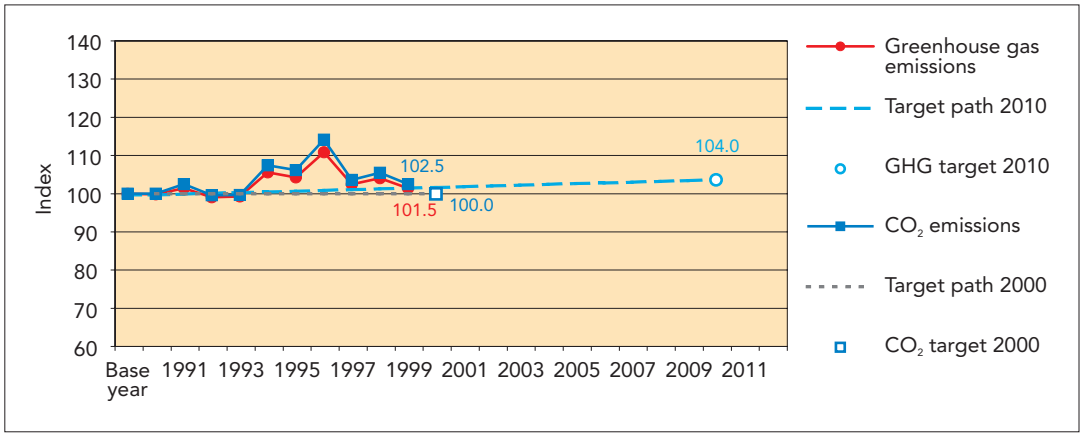
CO_2 emissions from small combustion fell by 19 % between 1990 and 1999 (compared to a stabilisation at EU level). This was the largest decrease in the EU. CO_2 emissions from fuel combustion in households went down by 14 %, fuel combustion itself by 10 %. The number of households hardly increased between 1990 and 1995, but final energy consumption in households increased by 19 % between 1990 and 1998 (this includes electricity consumption). One reason for falling CO_2 emissions from households might be increased production of district heating. In Sweden, fuel consumption for heat generation more than doubled between 1990 and 1998.

CH_4 emissions from solid waste disposal on land decreased by 16 % between 1990 and 1999. Managed waste disposal on land declined by 45 %.

N_2O emissions from agricultural soils decreased by 5 % between 1990 and 1999. The use of synthetic fertiliser and the use of animal manure went down by 20 % and 10 % respectively.

CO_2 emissions from mineral products declined by 10 % from 1990 to 1999. Cement production also decreased by 10 %.

Swedish greenhouse gas emissions compared with targets for 2000 and 2008–12 (excluding LUCF) Figure 61



Swedish greenhouse gas emissions and driving forces (real GDP growth, heating degree days, gross inland energy consumption) and greenhouse gas emissions per capita in relation to EU-15 average Figure 62

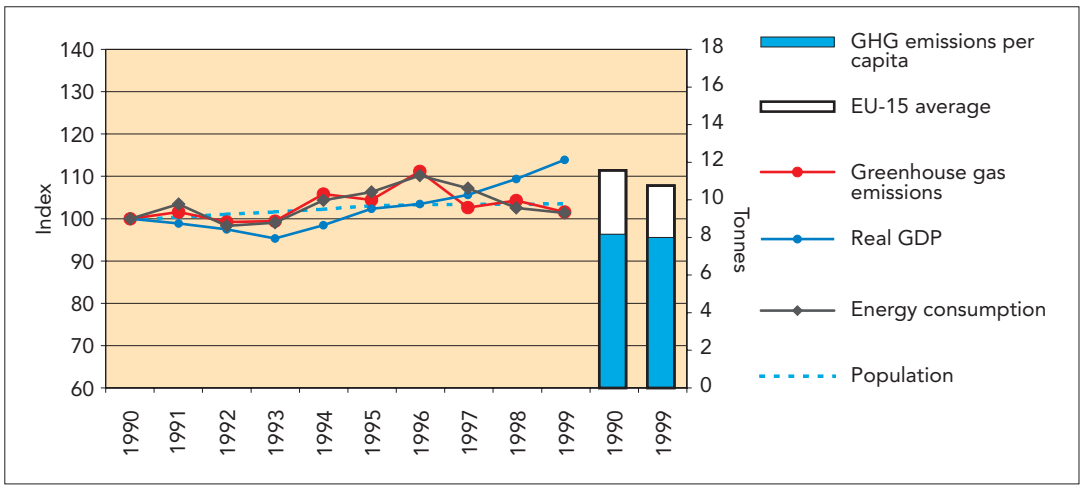


Table 72 **Distance-to-target indicators for Sweden**

Source: Member State submission (CRF tables).

	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Greenhouse gas emissions (without LUCF)	100.0	99.9	101.5	99.1	99.3	105.7	104.3	111.0	102.5	104.2	101.5
DTI 2010	0.0	- 0.1	1.3	- 1.3	- 1.3	4.9	3.3	9.8	1.1	2.6	- 0.3
CO_2 (without LUCF)	100.0	100.0	102.6	99.6	99.6	107.6	106.3	114.4	103.7	105.6	102.5
DTI 2000	0.0	0.0	2.6	- 0.4	- 0.4	7.6	6.3	14.4	3.7	5.6	2.5

Table 73 **Main driving force indicators for Sweden**

Source: Eurostat.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real GDP	100	99	97	95	98	102	103	106	109	114
Heating degree days	:	:	:	:	:	:	:	:	:	:
Population	100	101	101	102	103	103	104	104	104	104
Energy consumption	100	103	98	99	104	106	110	107	103	101

Note: The index of energy consumption in 1999 was calculated on basis of monthly data.

Table 74 **Sectoral emission indicators (key sources) for Sweden**

Source: Member State submission (CRF tables).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1.A.1. Energy Industries (CO_2)	100	111	111	106	129	114	164	113	125	109
1.A.2. Manufacturing Industries and Construction (CO_2)	100	99	88	98	111	115	110	112	109	103
1.A.3. Transport (CO_2)	100	100	102	97	99	101	101	101	104	106
1.A.4. Other Sectors (CO_2) [Small combustion]	100	98	91	91	91	88	88	81	79	81
1.A.5. Other (CO_2)	100	100	100	100	98	110	98	51	35	29
2.A. Mineral Products (CO_2)	100	92	86	87	92	102	97	93	93	90
1.B.1. Fugitive Emissions from Solid Fuels (CH_4)	100	99	79	92	144	131	116	94	109	118
1.B.2. Fugitive Emissions from Oil and Natural Gas (CH_4)	0	0	0	0	0	0	0	0	0	0
4.A. Enteric Fermentation (CH_4)	100	97	101	101	101	99	99	99	97	96
4.B. Manure Management (CH_4)	100	97	108	116	126	124	124	121	120	118
6.A. Solid Waste Disposal on Land (CH_4)	100	102	102	98	94	94	93	91	89	84
1.A.3. Transport (N_2O)	100	93	95	100	105	107	114	122	118	126
2.B. Chemical Industry (N_2O)	100	95	95	95	87	87	84	83	93	93
4.B. Manure Management (N_2O)	100	98	95	91	92	82	84	88	86	83
4.D. Agricultural Soils (N_2O)	100	96	93	97	99	97	98	100	100	95
HFCs	100	260	401	1.525	4.191	8.392	12.586	21.397	27.119	33.573
PFCs	100	97	94	91	89	88	78	72	69	75
SF_6	100	101	101	109	119	141	127	180	114	119

Note: The list of key sources in this table is the one identified for the EC (see Section 1.2) and differs from the one defined by the Member States for their UNFCCC reporting.

Sectoral background activity indicators for Sweden Table 75

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Fuel combustion in public electricity and heat production	100	118	124	135	154	152	220	158	174	157
Solid fuel combustion in electricity production	100	104	105	93	92	83	107	77	86	68
Gaseous fuel combustion in electricity production	100	121	154	167	145	159	157	159	152	154
Fuel combustion in manufacturing industries	100	104	98	104	117	115	114	113	110	106
Fuel combustion in iron and steel industries	100	111	115	118	127	144	126	125	131	132
Fuel combustion of road transportation	100	101	103	99	101	103	102	103	103	106
Gasoline combustion of road transportation	100	102	104	99	100	102	100	98	96	96
Diesel combustion of road transportation	100	99	100	99	103	106	108	115	123	133
Fuel combustion in households	100	99	97	96	96	97	98	89	88	90
Coal mining and handling	0	0	0	0	0	0	0	0	0	0
Oil refined	0	0	0	0	0	0	0	0	0	0
Cement production	100	89	86	86	87	102	96	87	90	90
Nitric acid production	0	0	0	0	0	0	0	0	0	0
Adipic acid production	0	0	0	0	0	0	0	0	0	0
Iron and Steel production/use of dolomite	100	118	116	103	99	141	145	154	139	128
Cattle population	100	99	103	105	106	103	104	104	101	100
Sheep population	100	103	110	116	119	114	116	109	104	108
Pig population	100	97	101	101	103	102	104	104	101	93
Use of synthetic fertilisers	100	93	79	92	96	88	86	91	92	80
Use of animal manures	100	98	100	102	105	96	94	94	93	90
Managed Waste Disposal on Land	100	95	92	89	81	74	72	76	62	55

Source: Member State submission (CRF tables).

Sectoral driving force and policy indicators for Sweden Table 76

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total gross electricity production	100	101	100	100	98	101	96	102	108	:
Gross electricity production from coal	100	141	154	130	155	141	222	121	121	:
Gross electricity production from natural gas	100	128	163	209	181	167	144	153	108	:
Gross electricity production from renewables	100	88	102	103	82	94	72	96	103	:
Industrial production	:	:	:	:	:	:	:	:	:	:
Steel production	100	95	98	103	111	110	110	115	115	112
Final energy consumption in industry	100	98	95	100	104	107	105	107	104	:
Volume passenger transport	100	102	102	101	93	97	94	94	:	:
Volume freight transport	100	96	92	98	102	111	118	125	:	:
Petrol price	:	:	:	:	:	100	103	108	109	104
Diesel price	:	:	:	:	:	100	94	96	91	88
Number of households	100	99	100	100	101	101	:	:	:	:
Final energy consumption in households	100	109	110	120	121	114	124	120	119	:
Cattle population	:	:	:	:	100	99	98	95	96	94
Sheep population	:	100	107	112	115	110	112	105	100	104
Pig population	:	:	:	:	100	100	100	101	100	87
Use of nitrogenous fertilisers	100	83	100	107	99	101	95	:	:	:
Transformation input to refineries	100	96	102	110	109	108	115	121	119	:
Primary production of solid fuels	100	126	119	113	100	117	135	103	127	:
Share of petrol-engined cars with catalytic converters (%)	4	8	11	20	30	40	52	67	:	:

Source: Eurostat, except for 'Number of households' (Euromonitor, 1997) and 'Use of nitrogenous fertilisers' (FAO).

United Kingdom

Distance-to-target indicator (DTI): UK greenhouse gas emissions decreased in 1999, compared to 1998, and were well below 1990 levels. In 1999, total greenhouse gas emissions were 638 Tg (CO_2 equivalents), which was 14 % below 1990 levels. In the burden sharing agreement to the Kyoto Protocol, the UK agreed to reduce its greenhouse gas emissions by 12.5 % by 2008–12. Assuming a linear target path from 1990 to 2010, UK greenhouse gas emissions were 8.4 index points below this target path in 1999 (Figure 63).

CO_2 emissions account for 83 % of UK greenhouse gas emissions. In 1999, they were 532 Tg, which was 8.9 % below 1990 levels. For CO_2, the UK set a stabilisation target at 1990 level by 2000. Therefore, in 1999 UK CO_2 emissions were 8.9 index points below the target path 2000.

Main driving force indicators: In 1999, real GDP grew by 2.3 %, energy use decreased by 1.5 %, compared to 1998. The heating degree days were 0.9 % lower than in 1998 (Figure 64). This compares to decreases of greenhouse gas emissions by 6.5 % and of CO_2 emissions by 2.2 %. Therefore, in 1999, greenhouse gas emissions de-coupled from economic growth and from energy use. Over the whole period from 1990 to 1999, greenhouse gas emissions de-coupled from GDP growth by 33 index points, and from energy use by 22 index points. From 1990 to 1999, UK greenhouse gas emissions per capita decreased from 12.9 tonnes in 1990 to 10.8 tonnes in 1999 (EU average was 10.7 tonnes in 1999).

Sectoral analysis for selected EC key sources: Main features of the UK greenhouse gas emission performance are large reductions of CO_2 emissions from energy industries and of N_2O emissions from chemical industries. In addition, large reductions in absolute terms were achieved in fugitive CH_4 emissions from solid fuels, CH_4 emissions from solid waste disposal on land, CO_2 emissions from manufacturing industries and HFCs. The largest increases in absolute terms can be observed in CO_2 emissions from small combustion and transport, and in N_2O emissions from transport. A recent study suggests that the UK electricity market liberalisation accounts for about 50 % of the reduction of all six greenhouse gas emissions (Eichhammer et al., 2001).

CO_2 emissions from energy industries decreased by 21 % between 1990 and 1999 (EU average: – 9 %). This was mainly due to a large fuel shift in electricity production from coal (and to a lesser extent oil) to natural gas, nuclear power and renewable energies. Total fuel combustion decreased by 12 % between 1990 and 1999; coal went down by 51 %, but gas increased by a factor of 3 200. Total power production increased by 13 % between 1990 and 1998. The main reason for the fuel shift was the liberalisation of the electricity market in the UK (see Box 2).

N_2O emissions from chemical industries decreased by 88 % between 1990 and 1999. This was due to reduction measures in the adipic acid production especially in the last year, but also to a decline of adipic acid production (– 46 %).

Fugitive CH_4 emissions from solid fuels decreased by 62 % between 1990 and 1999. This was mainly due to a decline of coal mining by 60 %. CH_4 emissions from solid waste disposal on land declined by 36 % between 1990 and 1999. In the same period, waste disposal on land grew by 5 %, but also the share of CH_4 recovery from landfills increased.

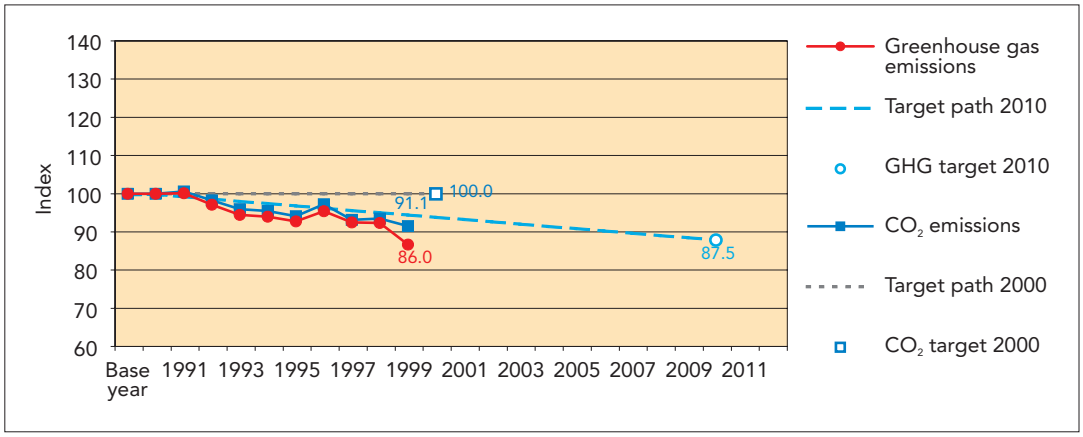
CO_2 emissions from fossil fuel combustion in manufacturing industries decreased by 6 % between 1990 and 1999, but industrial production increased by 9 %. Total fuel combustion in manufacturing industries declined by 1 %; again a fuel shift from coal (– 34 %) and oil (– 26 %) to gas (+ 39 %) can be observed.

HFC emissions reduced by 45 % (EU average: + 66 %). The UK was the only Member State to reduce HFC emissions in the 1990s. The cuts were achieved by emission reduction measures in the HCFC production in 1999.

CO_2 emissions from small combustion increased by 5 % between 1990 and 1999. Fuel combustion in the household sector increased by 12 %. Also in this sector fuel use shifted from solid fuels to gas.

CO_2 emissions from transport increased by 4 % between 1990 and 1999 (EU average: + 18 %), which was the second lowest increase in the EU. Road fuel consumption rose by 5 %, but a shift from gasoline (– 11 %) to diesel (+ 43 %) can be observed. Transport volumes increased by 5 % (passenger) and 15 % (freight) between 1990 and 1997. One reason for low growth of CO_2 emissions from transport might be the road-fuel duty escalator, which was introduced in 1993 and discontinued in 1999. Under this scheme, the road fuel tax was increased each year, first by 5 % in real terms, then by 6 % (see Box 3). This way, the UK had the highest growth rates of road fuel prices in real terms in the 1990s in the EU (see Figures 16 and 17).

UK greenhouse gas emissions compared with targets for 2000 and 2008–12 (excluding LUCF) Figure 63



UK greenhouse gas emissions and driving forces (real GDP growth, heating degree days, gross inland energy consumption and greenhouse gas emissions per capita in relation to EU-15 average Figure 64

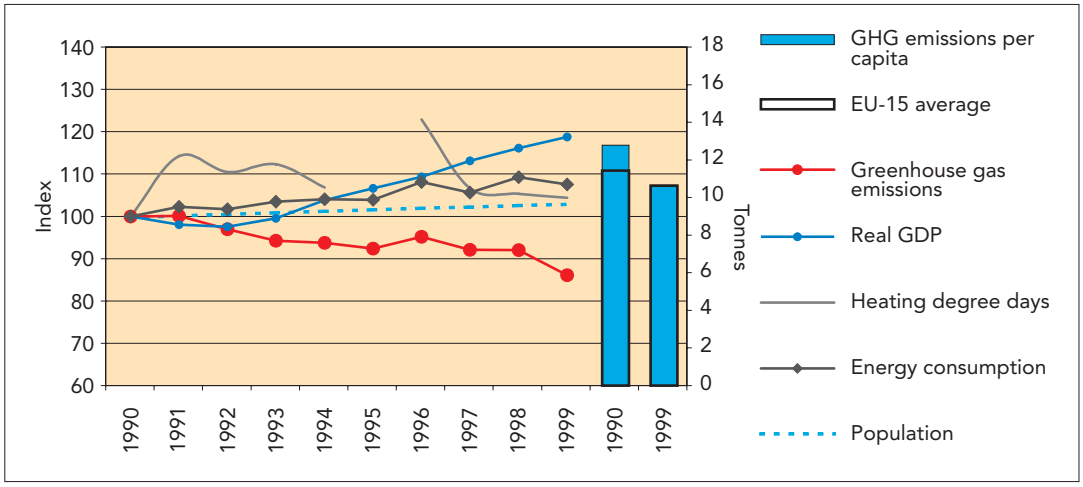


Table 77 **Distance-to-target indicators for the United Kingdom**

Source: Member State submission (CRF tables).

	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Greenhouse gas emissions (without LUCF)	100.0	100.0	100.1	96.9	94.2	93.7	92.3	95.1	92.1	91.9	86.0
DTI 2010	0.0	0.0	0.7	- 1.8	- 3.9	- 3.8	- 4.5	- 1.1	- 3.6	- 3.1	- 8.4
CO_2 (without LUCF)	100.0	100.0	100.6	98.2	95.7	95.2	93.8	97.1	92.8	93.2	91.1
DTI 2000	0.0	0.0	0.6	- 1.8	- 4.3	- 4.8	- 6.2	- 2.9	- 7.2	- 6.8	- 8.9

Table 78 **Main driving force indicators for the United Kingdom**

Source: Eurostat.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real GDP	100	98	98	100	104	107	109	113	116	119
Heating degree days	100	114	111	112	107		123	107	105	104
Population	100	100	101	101	101	102	102	103	103	103
Energy consumption	100	102	102	103	104	104	108	106	109	108

Note: The index of energy consumption in 1999 was calculated on basis of monthly data.

Table 79 **Sectoral emission indicators (key sources) for the United Kingdom**

Source: Member State submission (CRF tables).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1.A.1. Energy Industries (CO_2)	100	99	95	87	86	87	87	80	83	79
1.A.2. Manufacturing Industries and Construction (CO_2)	100	101	99	98	99	97	98	98	95	94
1.A.3. Transport (CO_2)	100	100	101	102	102	101	105	106	105	104
1.A.4. Other Sectors (CO_2) [Small combustion]	100	110	107	110	105	102	113	105	106	105
1.A.5. Other (CO_2)	100	81	77	78	75	74	72	69	60	60
2.A. Mineral Products (CO_2)	100	85	80	80	88	90	92	101	101	96
1.B.1. Fugitive Emissions from Solid Fuels (CH_4)	100	102	98	88	56	62	58	54	45	38
1.B.2. Fugitive Emissions from Oil and Natural Gas (CH_4)	100	97	96	94	94	93	90	89	88	84
4.A. Enteric Fermentation (CH_4)	100	99	99	99	99	98	99	98	98	98
4.B. Manure Management (CH_4)	100	99	99	100	100	99	100	99	100	98
6.A. Solid Waste Disposal on Land (CH_4)	100	97	92	88	85	82	78	74	69	64
1.A.3. Transport (N_2O)	100	104	114	142	178	214	251	287	323	355
2.B. Chemical Industry (N_2O)	100	94	76	65	76	65	69	71	63	12
4.B. Manure Management (N_2O)	100	99	97	98	99	98	100	99	98	101
4.D. Agricultural Soils (N_2O)	100	100	94	92	95	95	96	99	98	95
HFCs	100	104	109	113	121	134	143	162	177	55
PFCs	100	78	42	36	43	48	40	29	29	30
SF_6	100	107	115	123	147	157	175	174	178	181

Note: The list of key sources in this table is the one identified for the EC (see Section 1.2) and differs from the one defined by the Member States for their UNFCCC reporting.

Sectoral background activity indicators for the United Kingdom Table 80

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Fuel combustion in public electricity and heat production	100	99	94	88	87	89	90	86	89	88
Solid fuel combustion in electricity production	100	100	94	78	73	72	66	57	59	49
Gaseous fuel combustion in electricity production	100	230	13,193	82,917	120,187	151,347	200,980	254,427	269,553	319,957
Fuel combustion in manufacturing industries	100	100	98	97	101	99	101	101	99	99
Fuel combustion in iron and steel industries	100	99	98	101	111	110	110	111	105	106
Fuel combustion of road transportation	100	99	101	102	102	101	105	106	106	105
Gasoline combustion of road transportation	100	99	99	98	94	90	92	92	90	89
Diesel combustion of road transportation	100	100	105	111	121	126	135	141	143	143
Fuel combustion in households	100	111	108	113	108	104	119	109	112	112
Coal mining and handling	100	101	92	74	53	57	53	52	44	40
Oil refinery throughput	100	104	104	109	105	105	109	109	106	100
Clinker production	100	82	75	76	87	86	88	92	94	90
Nitric acid production	100	101	102	103	104	100	101	98	108	101
Adipic acid production	100	101	78	58	65	58	57	59	62	54
Iron and steel production/pig iron production	100	97	94	93	96	98	103	105	102	97
Cattle population	100	98	98	97	98	97	99	95	94	94
Sheep population	100	99	100	100	99	97	95	96	101	100
Pig population	100	102	102	104	105	101	101	107	108	97
Use of synthetic fertilisers	100	100	90	85	89	91	89	96	95	87
Use of animal manures	100	100	96	97	99	97	98	97	97	101
Managed Waste Disposal on Land	100	101	102	104	105	111	109	108	106	105

Source: Member State submission (CRF tables).

Sectoral driving force and policy indicators for the United Kingdom Table 81

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total gross electricity production	100	101	102	101	102	105	109	108	113	:
Gross electricity production from coal	100	101	95	82	79	77	71	58	60	:
Gross electricity production from natural gas	100	125	180	1,075	1,407	1,913	2,479	3,246	3,538	:
Gross electricity production from renewables	100	98	118	94	108	108	93	109	136	:
Industrial production	100	96	96	97	103	105	106	107	108	109
Steel production	100	92	89	93	97	99	101	104	95	92
Final energy consumption in industry	100	100	101	94	102	99	108	105	102	:
Volume passenger transport	100	99	99	99	101	101	104	105	:	:
Volume freight transport	100	96	93	99	106	110	113	115	:	:
Petrol price	100	105	104	107	111	116	110	121	126	126
Diesel price	100	106	105	109	115	120	115	127	131	134
Number of households	100	100	100	101	101	101	:	:	:	:
Final energy consumption in households	100	102	101	102	98	95	107	100	103	:
Cattle population	100	98	98	99	100	98	96	95	94	94
Sheep population	100	96	98	97	98	95	92	98	102	97
Pig population	100	102	104	107	107	99	103	107	101	94
Use of nitrogenous fertilisers	100	90	80	83	88	87	88	:	:	:
Transformation input to refineries	100	104	104	109	105	105	109	110	106	:
Primary production of solid fuels	100	102	93	75	55	58	56	55	48	:
Share of petrol-engined cars with catalytic converters (%)	3	5	7	13	20	27	33	40	:	:

Source: Eurostat, except for 'Number of households' (Euromonitor, 1997) and 'Use of nitrogenous fertilisers' (FAO).

European Union

This section presents indicators for the EU referred to in Chapters 2 and 3 including distance-to-target indicators, main driving force indicators, sectoral greenhouse gas indicators, and sectoral driving force indicators.

Table 82 **Distance-to-target indicators for the EC**

Source: EEA (2001a) based on submissions by the Member States (CRF tables).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Greenhouse gas emissions (without LUCF)	100.0	100.3	97.9	95.7	96.1	97.2	99.1	97.5	97.9	96.0
DTI 2010	0.0	0.7	- 1.3	- 3.1	- 2.3	- 0.8	1.5	0.3	1.1	- 0.4
CO_2 (without LUCF)	100.0	100.8	98.6	96.5	96.9	98.0	100.2	98.4	99.7	98.4
DTI 2000	0.0	0.8	- 1.4	- 3.5	- 3.1	- 2.0	0.2	- 1.6	- 0.3	- 1.6

Table 83 **Main driving force indicators for the EC**

Source: Eurostat; heating degree days are taken from EC (2000e).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Real GDP	100	103	104	104	107	109	111	114	117	120
Heating degree days	100	119	112	110	99	103	116	102	101	:
Population	100	100	101	101	102	102	102	103	103	103
Energy consumption	100	102	101	101	101	103	107	107	109	110

Note: The index of energy consumption in 1999 was calculated on basis of monthly data.

Table 84 **Sectoral emission indicators (key sources) for the EC**

Source: EEA (2001a) based on submissions by the Member States (CRF tables).

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1.A.1. Energy Industries (CO_2)	100	100	97	92	93	94	95	91	94	91
1.A.2. Manufacturing Industries and Construction (CO_2)	100	97	93	89	93	94	92	95	92	91
1.A.3. Transport (CO_2)	100	102	106	106	107	108	111	112	116	118
1.A.4. Other Sectors (CO_2) [Small combustion]	100	107	102	104	99	100	110	102	103	100
1.A.5. Other (CO_2)	100	80	61	66	58	66	61	77	61	36
2.A. Mineral Products (CO_2)	100	96	94	90	94	95	93	95	98	100
1.B.1. Fugitive Emissions from Solid Fuels (CH_4)	100	96	93	83	68	71	63	60	52	48
1.B.2. Fugitive Emissions from Oil and Natural Gas (CH_4)	100	101	101	102	100	96	98	96	96	95
4.A. Enteric Fermentation (CH_4)	100	97	95	94	94	94	94	93	93	92
4.B. Manure Management (CH_4)	100	96	95	94	95	95	95	95	89	95
6.A. Solid Waste Disposal on Land (CH_4)	100	98	94	90	90	89	85	81	80	78
1.A.3. Transport (N_2O)	100	112	123	136	147	161	172	183	194	203
2.B. Chemical Industry (N_2O)	100	98	93	85	89	88	91	88	66	43
4.B. Manure Management (N_2O)	100	99	99	101	99	98	104	102	101	106
4.D. Agricultural Soils (N_2O)	100	99	95	93	95	95	97	97	98	97
HFCs	100	97	97	106	126	145	160	183	201	166
PFCs	100	88	71	61	56	58	57	55	59	62
SF_6	100	108	117	126	136	144	141	141	135	134

Note: The index of energy consumption in 1999 was calculated on basis of monthly data.

Sectoral driving force and policy indicators for the EC Table 85

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total gross electricity production	100	108	108	108	112	113	117	118	121	:
Gross electricity production from coal	100	117	110	103	104	105	105	97	99	:
Gross electricity production from natural gas	100	102	103	130	146	168	197	235	259	:
Gross electricity production from renewables	100	103	111	112	115	114	116	120	127	:
Industrial production	:	:	:	:	:	100	100	104	107	109
Steel production	100	100	97	97	102	105	99	108	107	105
Final energy consumption in industry	:	:	:	:	:	:	:	:	:	:
Volume passenger transport	100	102	106	108	109	111	113	115	:	:
Volume freight transport	100	109	110	110	118	123	124	129	:	:
Petrol price	:	:	:	:	:	:	:	:	:	:
Diesel price	:	:	:	:	:	:	:	:	:	:
Number of households	:	100	101	103	104	105	:	:	:	:
Final energy consumption in households	100	108	103	106	102	104	113	108	110	:
Cattle population	:	:	:	:	100	101	100	99	98	98
Sheep population	:	100	100	99	97	95	97	99	99	97
Pig population	:	:	:	:	100	99	101	101	107	106
Use of nitrogenous fertilisers	100	97	89	90	94	94	97	:	:	:
Transformation input to refineries	100	102	105	106	108	107	110	112	115	:
Primary production of solid fuels	100	90	84	74	66	66	63	60	55	:
Share of petrol-engined cars with catalytic converters (%)	12	16	20	27	33	39	46	52	:	:

Source: Eurostat, except for 'Number of households' (Euromonitor, 1997) and 'Use of nitrogenous fertilisers' (FAO).

Annex 2: Summary of EC and Member States greenhouse gas emissions data

This annex gives a short summary of the inventory data used in this report which is taken from the EEA technical report *Annual European Community greenhouse gas inventory 1990–99*, submission to UNFCCC (EEA, 2001a). This report includes all detailed emission tables and is available on the EEA web site (http://www.eea.eu.int/).

Greenhouse gas emission data, as referred to in this report, do not include emissions and removals from LUCF. See Section 1.4 for details.

Table 86 **Austria**

	Base Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Tg = million tons)										
CO_2 (without LUCF)	62.1	62.1	66.0	60.2	59.9	61.8	63.8	64.9	66.8	65.5	65.8
CH_4 (without LUCF)	11.3	11.3	11.1	10.8	10.7	10.5	10.3	10.1	9.9	9.6	9.5
N_2O (without LUCF)	2.0	2.0	2.1	2.1	2.2	2.3	2.3	2.3	2.3	2.3	2.3
HFCs	0.5	0.0	0.0	0.0	0.0	0.0	0.5	0.6	0.7	0.8	0.9
PFCs	0.0	1.0	1.0	0.6	0.0	0.1	0.0	0.0	0.0	0.0	0.0
SF_6	1.2	0.5	0.7	0.7	0.8	1.0	1.2	1.2	1.1	1.0	0.7
Total (without LUCF)	77.2	76.9	80.9	74.4	73.7	75.6	78.0	79.1	80.8	79.2	79.2

Table 87 **Belgium**

	Base Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Tg = million tons)										
CO_2 (without LUCF)	114.0	114.0	121.4	121.6	119.5	124.3	125.6	129.7	121.3	122.0	117.0
CH_4 (without LUCF)	12.7	12.7	12.7	12.8	13.0	12.4	12.4	12.4	12.3	12.2	12.2
N_2O (without LUCF)	9.4	9.4	9.4	9.1	9.4	9.8	10.2	10.4	10.2	10.4	10.4
HFCs	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.5	0.5
PFCs	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
SF_6	0.2	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2
Total (without LUCF)	136.6	136.7	144.2	144.2	142.6	147.3	148.8	153.1	144.6	145.4	140.4

Note: This data was collected under the EC greenhouse gas monitoring mechanism and used for the EC submission to the UNFCCC. For Belgium, a data gap procedure had to be used for 1999, as Belgium did not report greenhouse gas emission data for 1999 by 1 April 2001. In June 2001, Belgium submitted data for 1999 and updated data for 1998, that suggest that the data compiled under the monitoring mechanism — to some extent — underestimate Belgian GHG emissions in 1998 and 1999.

Denmark Table 88

	Base Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Tg = million tons)										
CO_2 (without LUCF)	59.3	53.0	63.7	58.3	60.0	63.9	60.7	74.0	64.5	60.2	57.0
CH_4 (without LUCF)	5.9	5.9	5.9	5.9	6.0	5.9	5.9	5.9	5.7	6.0	5.6
N_2O (without LUCF)	11.0	11.0	10.9	10.3	10.4	10.2	10.1	10.0	9.6	9.7	9.6
HFCs	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.3	0.5	0.6
PFCs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SF_6	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total (without LUCF)	76.4	70.0	80.5	74.6	76.5	80.1	76.9	90.2	80.3	76.5	73.0

Note: Base year emissions are adjusted for electricity trade.

Finland Table 89

	Base Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Tg = million tons)										
CO_2 (without LUCF)	62.5	62.5	61.1	58.7	59.2	65.5	62.7	68.1	66.9	64.6	64.2
CH_4 (without LUCF)	6.1	6.1	5.8	5.4	5.0	4.7	4.6	4.5	4.3	4.1	3.9
N_2O (without LUCF)	8.4	8.4	7.9	7.3	7.5	7.6	7.8	7.8	8.1	7.9	7.7
HFCs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.3
PFCs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SF_6	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total (without LUCF)	77.1	77.1	74.8	71.4	71.7	77.8	75.2	80.5	79.4	76.8	76.2

France Table 90

	Base Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Tg = million tons)										
CO_2 (without LUCF)	385.5	385.5	409.1	401.0	379.7	375.7	382.0	395.9	389.6	410.7	404.7
CH_4 (without LUCF)	63.2	63.2	64.4	64.6	65.3	65.4	66.5	65.5	60.2	59.6	57.5
N_2O (without LUCF)	89.3	89.3	89.1	85.7	81.5	83.3	85.0	85.8	86.9	78.8	73.1
HFCs	2.3	2.3	1.5	1.1	0.8	0.8	1.3	2.2	3.1	3.8	4.8
PFCs	3.2	3.2	2.5	2.1	1.7	1.4	1.4	1.4	1.5	1.7	1.9
SF_6	2.2	2.2	2.2	2.2	2.3	2.3	2.3	2.4	2.4	2.4	2.4
Total (without LUCF)	545.7	545.7	568.8	556.8	531.2	528.9	538.5	553.2	543.7	556.9	544.5

Germany Table 91

	Base Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Tg = million tons)										
CO_2 (without LUCF)	1,014.5	1,014.5	976.0	928.3	918.3	904.1	903.7	924.6	893.5	888.3	858.5
CH_4 (without LUCF)	117.0	117.0	105.3	97.7	89.6	84.5	81.8	75.0	73.0	70.4	68.7
N_2O (without LUCF)	66.2	66.2	64.7	66.5	63.7	64.0	64.9	66.6	62.2	49.5	43.7
HFCs	3.1	2.3	2.3	2.5	3.8	4.0	3.1	2.6	3.5	4.3	4.3
PFCs	1.8	2.7	2.4	2.1	2.0	1.7	1.8	1.8	1.6	1.7	1.7
SF_6	6.2	3.9	4.3	4.9	5.4	5.8	6.2	5.8	5.7	5.5	5.5
Total (without LUCF)	1,208.8	1,206.6	1,154.9	1,102.1	1,082.8	1,064.1	1,061.5	1,076.4	1,039.4	1,019.6	982.4

Table 92 **Greece**

	Base Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Tg = million tons)										
CO_2 (without LUCF)	84.3	84.3	84.2	85.8	86.1	87.5	87.8	90.2	94.8	99.3	98.5
CH_4 (without LUCF)	9.3	9.3	9.4	9.5	9.6	9.8	9.9	10.2	10.4	10.6	10.7
N_2O (without LUCF)	10.4	10.4	10.3	10.2	9.9	10.0	9.7	10.1	10.2	10.3	10.2
HFCs	0.9	0.9	1.1	0.9	1.6	2.1	3.3	3.7	4.0	3.7	3.7
PFCs	0.4	0.4	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0
SF_6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total (without LUCF)	105.3	105.3	105.3	106.6	107.3	109.5	110.8	114.3	119.4	124.1	123.2

Table 93 **Ireland**

	Base Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Tg = million tons)										
CO_2 (without LUCF)	31.6	31.6	32.3	32.9	32.4	34.0	34.5	35.7	38.1	40.0	41.9
CH_4 (without LUCF)	12.8	12.8	13.0	13.0	13.1	13.2	13.3	13.6	13.7	13.6	13.3
N_2O (without LUCF)	9.1	9.1	8.9	8.9	9.0	9.3	9.5	9.7	9.5	10.1	10.1
HFCs	:	:	:	:	:	:	:	:	:	:	:
PFCs	:	:	:	:	:	:	:	:	:	:	:
SF_6	:	:	:	:	:	:	:	:	:	:	:
Total (without LUCF)	53.5	53.5	54.2	54.8	54.5	56.4	57.3	58.9	61.4	63.7	65.3

Table 94 **Italy**

	Base Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Tg = million tons)										
CO_2 (without LUCF)	437.7	437.7	436.5	435.5	423.5	417.3	442.5	437.4	440.2	454.2	456.5
CH_4 (without LUCF)	40.0	40.0	40.5	38.8	38.5	39.7	40.2	40.4	41.2	41.2	41.2
N_2O (without LUCF)	39.7	39.7	41.1	40.4	40.5	39.5	40.9	40.4	41.6	38.9	39.9
HFCs	0.4	0.4	0.4	0.4	0.4	0.6	0.9	0.8	1.1	1.3	2.9
PFCs	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.2
SF_6	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4
Total (without LUCF)	518.3	518.3	519.0	515.5	503.4	497.6	525.0	519.4	524.6	536.2	541.1

Table 95 **Luxembourg**

	Base Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Tg = million tons)										
CO_2 (without LUCF)	10.2	10.2	10.7	10.5	10.7	12.0	7.1	7.1	6.1	5.2	5.4
CH_4 (without LUCF)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
N_2O (without LUCF)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
HFCs	:	:	:	:	:	:	:	:	:	:	:
PFCs	:	:	:	:	:	:	:	:	:	:	:
SF_6	:	:	:	:	:	:	:	:	:	:	:
Total (without LUCF)	10.8	10.8	11.4	11.2	11.4	12.7	7.7	7.8	6.8	5.9	6.1

Note: This data was collected under the EC greenhouse gas monitoring mechanism and used for the EC submission to the UNFCCC. For Luxembourg, a data gap procedure had to be used for 1999, as Luxembourg did not report greenhouse gas emission data for 1999 by 1 April 2001. After this deadline, Luxembourg submitted data for 1999, that suggest that the data compiled under the monitoring mechanism slightly overestimate Luxembourg's GHG emissions in 1999.

Netherlands Table 96

	Base Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Tg = million tons)										
CO_2 (without LUCF)	161.2	161.2	166.9	165.2	167.5	168.4	177.1	184.7	181.2	180.9	174.1
CH_4 (without LUCF)	27.1	27.1	27.5	26.4	25.7	25.3	24.6	24.4	23.2	22.3	21.7
N_2O (without LUCF)	19.8	19.8	20.7	21.5	21.4	21.9	22.4	22.2	22.8	22.6	22.7
HFCs	6.7	5.1	4.9	4.6	5.1	6.4	6.7	7.5	7.9	8.7	8.8
PFCs	1.9	2.4	2.4	2.1	2.1	1.9	1.9	2.0	2.2	2.5	2.6
SF_6	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1
Total (without LUCF)	216.8	215.8	222.5	219.8	221.9	224.1	232.9	241.1	237.4	237.1	230.1

Portugal Table 97

	Base Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Tg = million tons)										
CO_2 (without LUCF)	44.1	44.1	45.9	49.7	48.5	49.1	52.0	50.4	52.6	55.7	57.9
CH_4 (without LUCF)	12.9	12.9	12.9	12.8	12.5	12.7	12.7	12.7	12.7	12.7	12.7
N_2O (without LUCF)	7.6	7.6	8.2	8.0	7.8	7.8	8.1	8.1	8.3	8.5	8.6
HFCs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PFCs	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2
SF_6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total (without LUCF)	64.8	64.6	67.0	70.5	68.8	69.6	73.0	71.3	73.8	77.1	79.3

Spain Table 98

	Base Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Tg = million tons)										
CO_2 (without LUCF)	226.1	226.1	233.3	242.3	229.5	242.3	253.0	240.8	257.7	268.5	281.1
CH_4 (without LUCF)	34.7	34.7	35.3	36.2	36.7	37.7	38.7	40.7	42.6	40.6	45.0
N_2O (without LUCF)	41.2	41.2	40.5	39.6	37.2	39.4	38.6	43.2	40.9	41.3	44.0
HFCs	5.6	2.9	2.6	2.9	2.3	3.9	5.6	6.4	6.9	7.0	9.1
PFCs	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7
SF_6	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2
Total (without LUCF)	308.5	305.8	312.5	321.8	306.6	324.2	336.7	332.1	349.0	358.4	380.2

Sweden Table 99

	Base Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Tg = million tons)										
CO_2 (without LUCF)	55.1	55.1	56.5	54.9	54.9	59.2	58.5	63.0	57.1	58.1	56.5
CH_4 (without LUCF)	6.8	6.8	6.7	6.9	6.8	6.7	6.6	6.6	6.5	6.4	6.2
N_2O (without LUCF)	7.1	7.1	6.9	6.8	6.9	7.1	6.9	7.1	7.1	7.3	7.2
HFCs	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.4
PFCs	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3
SF_6	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total (without LUCF)	69.6	69.5	70.7	69.0	69.2	73.6	72.6	77.3	71.4	72.5	70.7

Table 100 **United Kingdom**

	Base Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Tg = million tons)										
CO_2 (without LUCF)	583.5	583.5	587.2	572.8	558.7	555.8	547.2	566.4	541.7	543.7	531.5
CH_4 (without LUCF)	77.1	77.1	76.0	74.1	71.0	64.4	64.1	62.7	60.7	58.0	55.2
N_2O (without LUCF)	66.9	66.9	65.0	58.1	54.5	58.9	56.3	58.4	60.2	58.2	42.9
HFCs	11.4	11.4	11.9	12.3	12.9	13.8	15.2	16.3	18.4	20.2	6.2
PFCs	2.3	2.3	1.8	1.0	0.8	1.0	1.1	0.9	0.7	0.7	0.7
SF_6	0.7	0.7	0.8	0.8	0.9	1.1	1.1	1.3	1.3	1.3	1.3
Total (without LUCF)	741.9	741.9	742.7	719.1	698.7	695.0	685.1	705.9	682.9	682.1	637.9

Table 101 **European Community**

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Tg = million tons)									
CO_2 (without LUCF)	3,325.4	3,350.7	3,277.5	3,208.2	3,220.7	3,258.1	3,332.9	3,272.1	3,317.0	3,270.5
CH_4 (without LUCF)	437.5	427.0	415.3	404.0	393.3	392.1	385.1	376.8	367.8	364.1
N_2O (without LUCF)	388.4	386.0	374.7	362.1	371.3	372.8	382.3	379.9	356.1	332.9
HFCs	25.6	25.0	25.0	27.2	32.2	37.3	41.0	46.9	51.4	42.6
PFCs	13.5	11.8	9.6	8.2	7.5	7.8	7.8	7.4	8.0	8.4
SF_6	8.3	9.0	9.7	10.4	11.3	11.9	11.7	11.7	11.2	11.1
Total (without LUCF)	4,198.7	4,209.4	4,111.7	4,020.1	4,036.3	4,080.0	4,160.8	4,094.8	4,111.5	4,029.6

Note: For the fluorinated gases most Member States have selected a base year other than 1990 (namely 1995), as allowed for under the Kyoto Protocol. The European Community (EC) as a whole has not yet selected a base year for the fluorinated gases other than 1990. For the analysis of EU emission trends in this report 1990 emissions data have been used as the base year for all gases, for consistency reasons, resulting in an EC total of 4 198.7 million tonnes of CO_2 equivalents. Assuming 1995 as base year for the fluorinated gases for all Member States would result in EC total base year emissions of 4 208.3 million tonnes of CO_2 equivalents. Alternatively, adding up base year emissions, assuming the Member States' choice for the fluorinated gas emissions' base year (not all Member States have selected 1995 as the base year), would result in slightly different EC total base year emissions of 4 211.4 million tonnes of CO_2 equivalents.