EEA Technical report | No 4/2009

Annual European Community greenhouse gas inventory 1990–2007 and inventory report 2009

Submission to the UNFCCC Secretariat

ISSN 1725-2237

European Environment Agency

Annual European Community greenhouse gas inventory 1990–2007 and inventory report 2009

Submission to the UNFCCC Secretariat

European Environment Agency

Cover design: EEA
Layout: EEA/Pia Schmidt

Luxembourg: Office for Official Publications of the European Communities, 2009

ISBN 978-92-9213-001-5
ISSN 1725-2237
DOI 10.2800/11551

European Environment Agency
Kongens Nytorv 6
1050 Copenhagen K
Denmark
Tel.: +45 33 36 71 00
Fax: +45 33 36 71 99
Web: eea.europa.eu
Enquiries: eea.europa.eu/enquiries

Contents

The full report and annexes 1–13 are available at www: www.eea.europa.eu/publications/european-community-greenhouse-gas-inventory-2009/

Acknowledgements

This report was prepared on behalf of the European Commission (DG Environment) by the European Environment Agency (EEA) European Topic Centre for Air and Climate Change (ETC/ACC) supported by the Joint Research Centre (JRC) and Eurostat.

The coordinating author was Bernd Gugele (ETC). Other authors were, in alphabetical order, Viorel Blujdea (JRC), Julia Busche (ETC), Michael Gager (ETC), Sabine Goettlicher (ETC), Giacomo Grassi (JRC), Ralph Harthan (ETC), Anke Herold (ETC), Elisabeth Kampel (ETC), Traute Koether (ETC), Adrian Leip (JRC), Nicole Mandl (ETC), Suvi Monni (Benviroc, Finland), Barbara Muik (ETC), Stephan Poupa (ETC), Nikolaos Roubanis (Eurostat), Manfred Ritter (ETC), Barbara Schodl (ETC), Janka Szemesova (JRC).

The EEA project manager was Ricardo Fernandez. He acknowledges the great input provided by Andreas Barkman (EEA), Hermann Peifer (EEA), David Simoens (EEA), Sheila Cryan (EEA), Ronald Velgue (DG Environment) and Erasmia Kitou (DG Environment). The EEA also acknowledges the input and comments received from the EC Member States, which have been included in the final version of the report as far as practically feasible.

Executive summary

ES.1 Background information on greenhouse gas inventories and climate change

The European Community (EC), as a party to the United Nations Framework Convention on Climate Change (UNFCCC), reports annually on greenhouse gas (GHG) inventories for the year t-2 and within the area covered by its Member States (i.e. domestic emissions taking place within its territory).

The present inventory also constitutes the EU-15 voluntary submission under the Kyoto Protocol. Under the Kyoto Protocol, the EU-15 took on a common commitment to reduce emissions by 8 % between 2008 and 2012 compared to emissions in the 'base year'([1]). The EU-27 does not have a common Kyoto target.

The legal basis for the compilation of the EC inventory is Council Decision No. 280/2004/EC concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol ([2]). The purpose of this decision is:

1. to monitor all anthropogenic GHG emissions covered by the Kyoto Protocol in the Member States;

2. to evaluate progress towards meeting GHG reduction commitments under the UNFCCC and the Kyoto Protocol;

3. to implement UNFCCC and the Kyoto Protocol obligations relating to national programmes, greenhouse gas inventories, national systems and registries of the Community and its Member States, and the relevant procedures under the Kyoto Protocol;

4. to ensure the timeliness, completeness, accuracy, consistency, comparability and transparency of reporting by the Community and its Member States to the UNFCCC secretariat.

The EC GHG inventory comprises the direct sum of the national inventories compiled by the EC Member States making up the EU-15 and the EU-27. Energy data from Eurostat are used for the reference approach for CO_2 emissions from fossil fuels developed by the Intergovernmental Panel on Climate Change (IPCC). The main institutions involved in the compilation of the EC GHG inventory are the Member States, the European Commission Directorate-General for the Environment (DG ENV), the European Environment Agency (EEA) and its European Topic Centre on Air and Climate Change (ETC/ACC), Eurostat, and the Joint Research Centre (JRC).

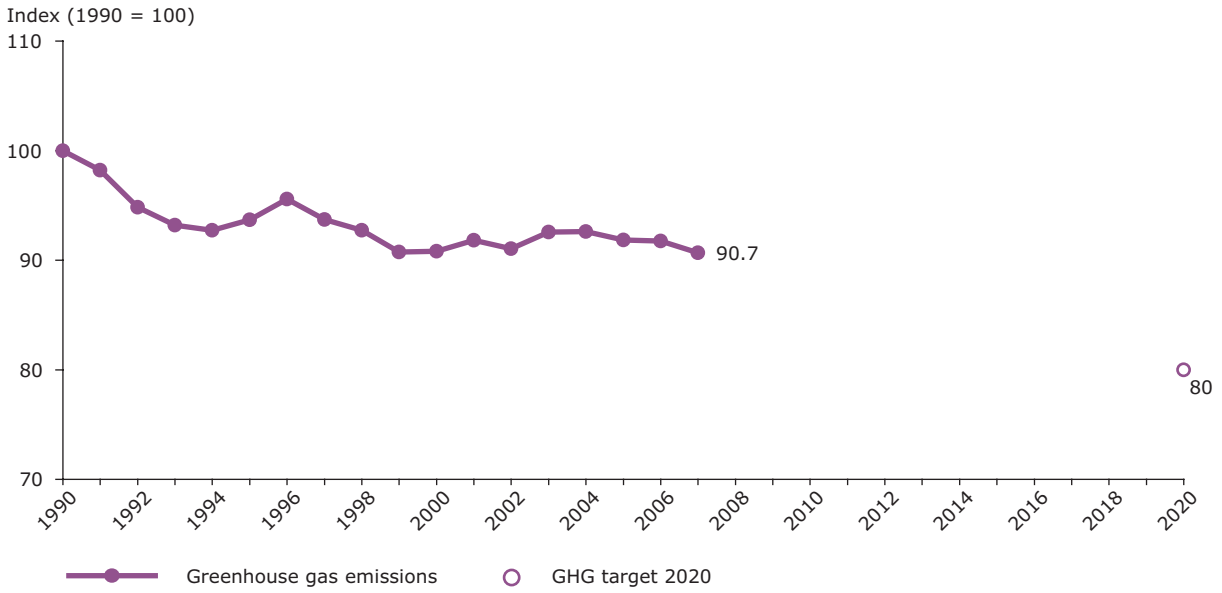
The process of compiling the EC GHG inventory is as follows. Member States submit their annual GHG inventories by 15 January each year to the European Commission, DG ENV, with a copy to the EEA. The EEA and its ETC/ACC, Eurostat and JRC then perform initial checks on the submitted data. The draft EC GHG inventory and inventory report are circulated to Member States for review and comments by 28 February. Member States check their national data and the information presented in the EC GHG inventory report, send updates if necessary and review the EC inventory report itself by 15 March. The EEA prepares the final EC GHG inventory and inventory report through its ETC/ACC by 15 April for submission by the European Commission to the UNFCCC Secretariat; a resubmission is prepared by 27 May, if needed.

On 23 January 2008 the European Commission adopted the 'Climate Action and Renewable Energy' package. The proposal was part of draft legislation implementing the 'Integrated Energy and Climate Change' package of 10 January 2007, which was endorsed by the European Council in March 2007.

([1]) For the EU-15, the base year for CO_2, CH_4 and N_2O is 1990; for fluorinated gases 12 Member States have selected 1995 as the base year, whereas Austria, France and Italy have chosen 1990. As the EC inventory is the sum of Member State inventories, the EC base-year estimates for fluorinated gas emissions are the sum of 1995 emissions for 12 Member States and 1990 emissions for Austria, France and Italy. The EU-15 base-year emissions also include emissions from deforestation for the Netherlands, Portugal and the United Kingdom (see Tables 1.4 and 1.5).

([2]) OJ L 49, 19.2.2004, p. 1. Note that Council Decision No. 280/2004/EC entered into force in March 2004. Therefore, the compilation of the 2004 inventory report started under the previous Council Decision 1999/296/EC.

Figure ES.1 EU-27 GHG emissions 1990–2007 (excluding LULUCF)



Note: GHG emission data for the EU-27 as a whole refer to domestic emissions (i.e. within its territory) and do not include emissions and removals from LULUCF or emissions from international aviation and international maritime transport.

CO_2 emissions from biomass with energy recovery are reported as a Memorandum item according to the UNFCCC Guidelines and not included in national totals. In addition, no adjustments for temperature variations or electricity trade are considered.

The global warming potentials are those from the 1996 revised IPCC Guidelines for National Greenhouse Gas Inventories.

In December 2008 the European Parliament and the Council reached agreement on the package. It was adopted by the Council on 6 April 2009. The package underlines the objective of limiting the rise in global average temperature to no more than two degrees Celsius above pre-industrial levels. To achieve this goal Member States agreed to reduce total EU greenhouse gas emissions by 20 % compared to 1990 by 2020.

Both trading, i.e. EU Emissions Trading Scheme (ETS), and non-trading sectors will contribute to the 20 % objective. Minimising overall reduction costs implies a 21 % reduction in emissions from EU ETS sectors compared to 2005 by 2020 and a reduction of approximately 10 % compared to 2005 by 2020 for non-EU ETS sectors. The non-trading sectors broadly include direct emissions from households and services, as well as emissions from transport, waste and agriculture. The coverage of the non-trading sectors currently represents about 60 % of total greenhouse gas emissions.

ES.2 Summary of greenhouse gas emission trends in the EC

EU-27

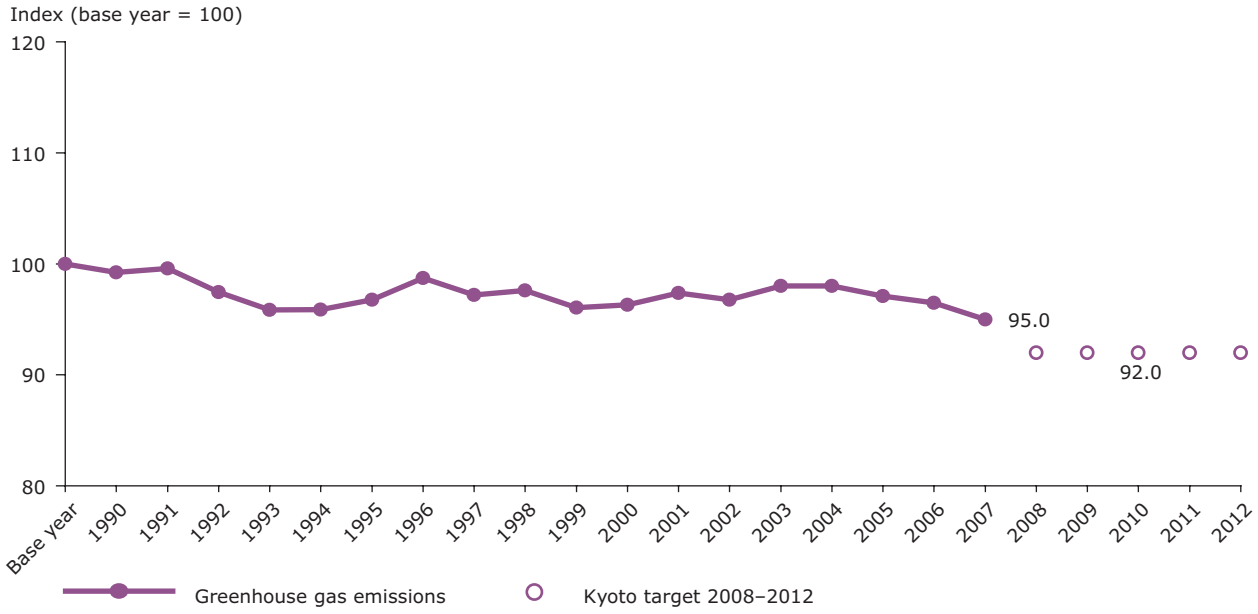
In March 2007 the EC made a firm independent commitment to achieve at least a 20 % reduction of greenhouse gas emissions by 2020 compared to 1990 ([3]). Total GHG emissions, without Land Use, Land-Use Change and Forestry (LULUCF) in the EU-27 decreased by 9.3 % between 1990 and 2007 (519 million tonnes CO_2-equivalents). Emissions decreased by 1.2 % (59 million tonnes CO_2-equivalents) between 2006 and 2007 (Figure ES.1).

EU-15

In 2007 total GHG emissions in the EU-15, without LULUCF, were 4.3 % (181 million tonnes CO_2-equivalents) below 1990. Emissions decreased by 1.6 % (64 million tonnes CO_2-equivalents) between 2006 and 2007.

([3]) All emissions information for the EU-27 in this report uses 1990 as the starting point when addressing emission reductions. Unlike the EU-15, the EU-27 does not have a common target under the Kyoto Protocol.

Figure ES.2 EU-15 GHG emissions 1990–2007 (excluding LULUCF) compared with the target for 2008–2012



Note: GHG emission data for the EU-15 as a whole refer to domestic emissions (i.e. within its territory) and do not include emissions and removals from LULUCF or emissions from international aviation and international maritime transport.

CO_2 emissions from biomass with energy recovery are reported as a Memorandum item according to the UNFCCC Guidelines and not included in national totals. In addition, no adjustments for temperature variations or electricity trade are considered. The global warming potentials are those from the 1996 revised IPCC Guidelines for National Greenhouse Gas Inventories.

Following the UNFCCC reviews of Member States' 'initial reports' during 2007 and 2008 and pursuant to Article 3, Paragraphs 7 and 8 of the Kyoto Protocol, the base-year emissions for the EU-15 have been fixed to 4 265.5 million tonnes CO_2-equivalents. The EU-15 would need to reduce greenhouse gas emissions by about 341 million tonnes, on average between 2008 and 2012, on the basis of the 2009 greenhouse gas inventory in order to meet its 8 % Kyoto target. This can be achieved through a combination of existing and planned domestic policies and measures, and using carbon sinks and Kyoto mechanisms.

Table ES.1 Overview of EU-27 and EU-15 source categories whose emissions increased or decreased by more than 20 million tonnes CO_2-equivalents in the period 2006–2007

Source category	EU-27	EU-15
	Million tonnes (CO_2-equivalent)	
Public electricity and heat production (CO_2 from 1A1a)	+ 15.0	+ 10.7
Road transport (CO_2 from 1A3b)	+ 5.3	+ 1.7
Cement production (CO_2 from 2A1)	+ 4.5	+ 2.0
Consumption of halocarbons (HFC from 2F)	+ 4.4	+ 3.1
Manufacture of solid fuels (CO_2 from 1A1c)	+ 3.6	+ 1.0
Fugitive emissions (CH_4 from 1B)	– 3.1	– 2.2
Iron and steel production (CO_2 from 1A2a + 2C1)	– 3.8	– 2.2
Manufacturing industries (excl. iron and steel) (energy-related CO_2 from 1A2 excl. 1A2a)	– 4.7	– 8.2
Households and services (CO_2 from 1A4)	– 79.1	– 66.8
Total change 2006–2007	**– 59.4**	**– 64.0**

Note: Overview of EU-27 and EU-15 source categories whose emissions increased or decreased by more than 20 million tonnes CO_2-equivalents in the period 2006–2007.

Under the Kyoto Protocol, the EC agreed to reduce its GHG emissions by 8 % by 2008–12 compared to the 'base year' ([4]) This can be achieved by a combination of existing and planned domestic policies and measures, and using carbon sinks and Kyoto mechanisms. Emissions (i.e. domestic) in 2007 were 5.0 % or 214 million tonnes CO_2-equivalents lower than emissions in the base year (Figure ES.1).

Main trends by source category, 2006–2007

Between 2006 and 2007, EU-15 emissions decreased by 1.6 %, which was a little more than in the EU-27 (– 1.2 %). This was mainly due to larger increases of CO_2 emissions from public electricity and heat production and road transport in the EU-27, and smaller emission decreases from manufacturing industries (Table ES.1).

Main reasons for changes in EU-15 emissions, 2006–2007

The 64.0 million tonnes (CO_2-equivalents) decrease in GHG emissions between 2006 and 2007 was mainly due to:

- Lower CO_2 emissions from households and services ([5]) (– 66.8 million tonnes or – 10.8 %). The use of fossil fuels (i.e. oil, gas and coal) decreased further (– 10.1 %), particularly in households, mainly due to a lower number of heating degree days. Germany reported the highest emission decrease (– 22.9 %), as a result of a warmer winter, meaning fewer days requiring heating (– 7.1 %); a fuel tax increase in 2007, which encouraged accrual of stocks in 2006; and a sharp increase in nominal gas prices for households in 2007. These reasons might also be relevant for other EU Member States.

- Lower CO_2 emissions from manufacturing industries (excluding iron and steel) (– 8.2 million or – 1.9 %) tonnes, mainly in Italy, Spain and the United Kingdom.

- Lower CH_4 fugitive emissions (– 2.2 million tonnes or – 6.5 %) mainly in Germany and the United Kingdom, due to reduced coal mining activity and improvements to the gas distribution network.

- Lower emissions from iron and steel production due to reduced energy use, mainly in Germany (– 2.2 million tonnes or – 1.4 %).

Substantial increases in GHG emissions between 2006–2007 took place in the following source categories:

- CO_2 emissions from public electricity and heat production (+ 10.7 million tonnes or + 1.0 %). Countries show diverse trends. CO_2 emissions from public electricity and heat production increased mainly in Germany, Greece, the Netherlands and Spain, due to higher electricity production in conventional thermal power plants. Denmark, Finland and the United Kingdom reported decreases. Denmark produced less electricity from coal and higher imports and lower exports; Finland reduced electricity production from coal and made more use of hydropower. The United Kingdom's reductions were mainly due to a further shift from coal to gas. In the EU-15 the use of liquid fuels decreased by 21 %, while the use of solid fuels was constant and the use of gaseous fuels increased by 8 %. These trends are reflected in emissions trends.

- Increases in HFC from the consumption of halocarbons (+ 3.1 million tonnes or + 6.1 %) stem from refrigeration and air conditioning. France, Germany and Italy report the highest increases.

Main reasons for changes in EU-27 emissions, 2006–2007

Between 2006 and 2007, decreases in EU-27 emissions were mainly due to:

- CO_2 households and services (– 79.1 million tonnes or – 10.9 %).
  Reductions in the EU-27 were higher than in the EU-15 due to substantial decreases in the Czech Republic, Hungary and Poland. In these countries the use of solid, gaseous and liquid

([4]) Following the UNFCCC reviews of Member States' 'initial reports' during 2007 and 2008 and pursuant to Article 3, paragraphs 7 and 8 of the Kyoto Protocol, the base-year emissions for the EU-15 have been fixed to 4 265.5 million tonnes CO_2-equivalents.

([5]) This includes emissions from fuel combustion in commercial and institutional buildings, and all emissions from fuel combustion in households. It also includes a smaller source category covering fuel combustion emissions from agriculture, forestry and fishing. It should be noted that greenhouse gas emissions from households and services do not include indirect emissions. That is, greenhouse gas emissions resulting from the production of heat and electricity supplied to households and services are included under public electricity and heat production. Direct combustion emissions from households are outside the EU ETS.

fuels decreased in response to warmer weather conditions in 2007.

- CO_2 from manufacturing industries excluding iron and steel (– 4.7 million tonnes or – 0.9 %).

  The decrease is mainly due to EU-15 Member States. Several newer Member States report increased emissions, with the Czech Republic reporting the highest increase.

- CO_2 from iron and steel production (– 3.8 million tonnes or – 1.8 %).
  The Czech Republic reported an emission decrease even larger than the EU-15.

- Fugitive CH_4 emissions from energy supply (– 3.1 million tonnes or – 4.4 %).
  The decrease in the EU-27 is mainly due to the EU-15, as well as the Czech Republic and Poland.

Table ES.2 Greenhouse gas emissions in CO_2-equivalents (excluding LULUCF) and Kyoto Protocol targets for 2008–2012

Member State	1990	Kyoto Protocol base year [a])	2007	Change 2006–2007	Change 2006–2007	Change 1990–2007	Change base year 2007	Targets 2008–2012 under Kyoto Protocol and 'EU burden sharing'
	(million tonnes)	(million tonnes)	(million tonnes)	(million tonnes)	(%)	(%)	(%)	(%)
Austria	79.0	79.0	88.0	– 3.6	– 3.9 %	11.3 %	11.3 %	– 13.0 %
Belgium	143.2	145.7	131.3	– 5.3	– 3.9 %	– 8.3 %	– 9.9 %	– 7.5 %
Denmark	69.1	69.3	66.6	– 4.4	– 6.2 %	– 3.5 %	– 3.9 %	– 21.0 %
Finland	70.9	71.0	78.3	– 1.6	– 2.0 %	10.6 %	10.3 %	0.0 %
France	562.6	563.9	531.1	– 10.6	– 2.0 %	– 5.6 %	– 5.8 %	0.0 %
Germany	1 215.2	1 232.4	956.1	– 23.9	– 2.4 %	– 21.3 %	– 22.4 %	– 21.0 %
Greece	105.6	107.0	131.9	3.8	2.9 %	24.9 %	23.2 %	25.0 %
Ireland	55.4	55.6	69.2	– 0.5	– 0.7 %	25.0 %	24.5 %	13.0 %
Italy	516.3	516.9	552.8	– 10.2	– 1.8 %	7.1 %	6.9 %	– 6.5 %
Luxembourg	13.1	13.2	12.9	– 0.39	– 2.9 %	– 1.6 %	– 1.9 %	– 28.0 %
Netherlands	212.0	213.0	207.5	– 1.0	– 0.5 %	– 2.1 %	– 2.6 %	– 6.0 %
Portugal	59.3	60.1	81.8	– 2.9	– 3.4 %	38.1 %	36.1 %	27.0 %
Spain	288.1	289.8	442.3	9.3	2.1 %	53.5 %	52.6 %	15.0 %
Sweden	71.9	72.2	65.4	– 1.5	– 2.2 %	– 9.1 %	– 9.3 %	4.0 %
United Kingdom	771.1	776.3	636.7	– 11.2	– 1.7 %	– 17.4 %	– 18.0 %	– 12.5 %
EU-15	**4 232.9**	**4 265.5**	**4 052.0**	**– 64.0**	**– 1.6 %**	**– 4.3 %**	**– 5.0 %**	**– 8.0 %**
Bulgaria	117.7	132.6	75.5	4.2	5.9 %	– 35.8 %	– 43.0 %	– 8.0 %
Cyprus	5.5	Not applicable	10.1	0.2	1.6 %	85.3 %	Not applicable	Not applicable
Czech Republic	194.7	194.2	150.8	1.7	1.2 %	– 22.5 %	– 22.4 %	– 8.0 %
Estonia	41.9	42.6	22.0	2.8	14.8 %	– 47.5 %	– 48.3 %	– 8.0 %
Hungary	99.2	115.4	75.9	– 2.9	– 3.7 %	– 23.5 %	– 34.2 %	– 6.0 %
Latvia	26.7	25.9	12.1	0.4	3.5 %	– 54.7 %	– 53.4 %	– 8.0 %
Lithuania	49.1	49.4	24.7	1.9	8.1 %	– 49.6 %	– 49.9 %	– 8.0 %
Malta	2.0	Not applicable	3.0	0.07	2.3 %	45.7 %	Not applicable	Not applicable
Poland	459.5	563.4	398.9	– 0.4	– 0.1 %	– 13.2 %	– 29.2 %	– 6.0 %
Romania	243.0	278.2	152.3	– 1.6	– 1.0 %	– 37.3 %	– 45.3 %	– 8.0 %
Slovakia	73.3	72.1	47.0	– 2.0	– 4.1 %	– 35.9 %	– 34.8 %	– 8.0 %
Slovenia	18.6	20.4	20.7	0.2	0.7 %	11.6 %	1.8 %	– 8.0 %
EU-27	**5 564.0**	**Not applicable**	**5 045.1**	**– 59.4**	**– 1.2 %**	**– 9.3 %**	**Not applicable**	**Not applicable**

Note: [a]) The base year under the Kyoto Protocol for each Member State and the EU-15 is outlined in Tables 1.4 and 1.5. As Cyprus, Malta and the EU-27 do not have targets under the Kyoto Protocol, they do not have applicable Kyoto Protocol base years.

Substantial emission increases were due to:

- CO_2 from public electricity and heat production (+ 15.0 million tonnes or + 1.1 %).
  The increase was caused by the EU-15, as well as emissions growth in Bulgaria, the Czech Republic and Estonia due to increased electricity generation from conventional thermal power plants. Poland and Slovakia reported decreases due to increased electricity imports.

- CO_2 from road transportation (+ 5.3 million tonnes or + 0.6 %).
  Apart from EU-15 States, the highest increases were reported by the Czech Republic, Lithuania, Slovakia and Slovenia, mostly due to increased use of diesel oil.

- Higher CO_2 emission from cement production (+ 4.5 million tonnes or + 4.4 %).
  Beside the increases in the EU-15, Poland reported a major increase in emissions from cement production.

- Increases in HFC from the consumption of halocarbons (+ 4.4 million tonnes or + 7.8 %) stems from refrigeration and air conditioning. From the new Member States, the Czech Republic and Poland reported the highest increases.

- Higher CO_2 emissions from the manufacture of solid fuels (+ 3.6 million tonnes or + 5.4 %). Poland contributed most to this increase.

ES.3 Summary of emissions and removals by main greenhouse gas

EU-27

Table ES.3 gives an overview of the main trends in EU-27 GHG emissions and removals for 1990–2007. The most important GHG by far is CO_2, accounting for 83 % of total EU-27 emissions in 2007 excluding LULUCF. In 2007, EU-27 CO_2 emissions without LULUCF were 4 187 Tg, which was 4.8 % below 1990 levels. Compared to 2006, CO_2 emissions decreased by 1.3 %.

EU-15

Table ES.4 gives an overview of the main trends in EU-15 GHG emissions and removals for 1990–2007. Also in the EU-15 the most important GHG is CO_2, accounting for 84 % of total EU-15 emissions in 2007. In 2007, EU-15 CO_2 emissions without LULUCF were 3 391 Tg, which was 0.9 % above 1990 levels. Compared to 2006, CO_2 emissions decreased by 1.8 %.

Table ES.3 Overview of EU-27 GHG emissions and removals from 1990 to 2007, expressed in CO_2-equivalents (Tg)

Greenhouse gas emissions	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Net CO_2 emissions/ removals	4 057	3 755	3 838	3 753	3 741	3 669	3 714	3 758	3 722	3 793	3 819	3 783	3 794	3 771
CO_2 emissions (without LULUCF)	4 400	4 150	4 251	4 163	4 152	4 084	4 106	4 184	4 158	4 252	4 264	4 232	4 243	4 187
CH_4	602	547	541	525	505	494	481	466	457	446	433	426	422	416
N_2O	513	455	460	458	434	411	409	403	392	391	394	389	375	374
HFCs	28	41	47	54	55	48	47	46	49	53	54	58	59	63
PFCs	20	14	13	11	10	10	8	8	9	8	6	5	5	4
SF_6	11	16	15	14	13	11	11	11	10	9	9	9	10	10
Total (with net CO_2 emissions/removals)	5 230	4 827	4 915	4 813	4 758	4 643	4 671	4 692	4 638	4 700	4 717	4 671	4 665	4 638
Total (without CO_2 from LULUCF)	5 573	5 223	5 328	5 223	5 169	5 059	5 062	5 118	5 074	5 159	5 162	5 119	5 114	5 054
Total (without LULUCF)	5 564	5 213	5 318	5 214	5 159	5 049	5 053	5 109	5 066	5 150	5 153	5 111	5 104	5 045

Table ES.4 Overview of EU-15 GHG emissions and removals from 1990 to 2007, expressed in CO_2-equivalents (Tg)

Greenhouse gas emissions	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Net CO_2 emissions/ removals	3 138	3 024	3 080	3 025	3 077	3 037	3 087	3 135	3 111	3 156	3 190	3 156	3 158	3 126
CO_2 emissions (without LULUCF)	3 360	3 286	3 363	3 308	3 355	3 328	3 354	3 422	3 411	3 477	3 488	3 459	3 452	3 391
CH_4	436	411	406	394	385	376	366	354	344	331	320	314	309	305
N_2O	387	371	375	374	354	334	331	323	315	313	314	309	295	292
HFCs	28	41	47	53	54	47	46	44	46	50	50	53	54	57
PFCs	17	11	11	10	9	9	7	6	8	7	5	4	4	3
SF_6	11	15	15	14	13	11	11	10	9	9	9	9	9	9
Total (with net CO_2 emissions/removals)	4 016	3 873	3 934	3 870	3 891	3 813	3 848	3 873	3 834	3 866	3 888	3 845	3 828	3 793
Total (without CO_2 from LULUCF)	4 239	4 136	4 218	4 153	4 170	4 104	4 114	4 160	4 134	4 187	4 187	4 148	4 122	4 058
Total (without LULUCF)	4 233	4 128	4 210	4 146	4 163	4 098	4 108	4 154	4 127	4 180	4 180	4 141	4 116	4 052

ES.4 Summary of emissions and removals by main source and sink categories

EU-27

Table ES.5 gives an overview of EU-27 GHG emissions in the main source categories for 1990–2007. The most important sector by far is energy (i.e. combustion and fugitive emissions) accounting for 79 % of total EU-27 emissions in 2007. The second largest sector is agriculture (9.2 %), followed by industrial processes (8.5 %).

EU-15

Table ES.6 gives an overview of EU-15 GHG emissions in the main source categories for 1990–2007. More detailed trend descriptions are included in Chapters 3 to 9 of the present report.

Table ES.5 Overview of EU-27 GHG emissions from the main source and sink categories from 1990 to 2007, expressed in CO_2-equivalents (Tg)

Ghg source and sink	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1. Energy	4 277	4 032	4 142	4 037	4 024	3 964	3 970	4 053	4 023	4 109	4 106	4 066	4 068	3 999
2. Industrial processes	478	456	452	460	432	393	405	393	390	401	412	420	417	430
3. Solvent and other product use	16	14	14	14	14	14	14	13	13	13	13	12 405	13	12
4. Agriculture	579	504	506	507	505	501	493	485	479	474	473	466	463	462
5. Land use, land-use change and forestry	– 334	– 385	– 403	– 400	– 401	– 406	– 383	– 417	– 427	– 450	– 436	– 439	– 440	– 407
6. Waste	213	207	203	196	184	178	172	164	160	154	149	146	144	141
7. Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (with net CO_2 emissions/removals)	5 230	4 827	4 915	4 813	4 758	4 643	4 671	4 692	4 638	4 700	4 717	4 671	4 665	4 638
Total (without LULUCF)	5 564	5 213	5 318	5 214	5 159	5 049	5 053	5 109	5 066	5 150	5 153	5 111	5 104	5 045

Table ES.6 Overview of EU-15 GHG emissions from the main source and sink categories from 1990 to 2007, expressed in CO_2-equivalents (Tg)

Ghg source and sink	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1. Energy	3 257	3 178	3 263	3 195	3 238	3 213	3 228	3 299	3 284	3 343	3 345	3 313	3 301	3 233
2. Industrial processes	372	371	369	378	357	325	330	321	320	325	331	332	325	332
3. Solvent and other product use	14	12	12	12	12	12	12	11	11	11	10	10.432	10	10
4. Agriculture	419	402	406	407	407	406	403	394	389	385	383	377	373	371
5. Land use, land-use change and forestry	– 217	– 255	– 276	– 276	– 271	– 284	– 260	– 280	– 294	– 314	– 292	– 296	– 288	– 259
6. Waste	171	165	161	153	148	141	136	129	123	117	112	109	107	105
7. Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (with net CO_2 emissions/removals)	4 016	3 873	3 934	3 870	3 891	3 813	3 848	3 873	3 834	3 866	3 888	3 845	3 828	3 793
Total (without LULUCF)	4 233	4 128	4 210	4 146	4 163	4 098	4 108	4 154	4 127	4 180	4 180	4 141	4 116	4 052

Table ES.7 Overview of Member State contributions to EC GHG emissions excluding LULUCF from 1990 to 2007, expressed in CO_2-equivalents (Tg)

Member State	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Austria	79	81	84	83	82	81	81	85	87	93	92	93	92	88
Belgium	143	149	154	145	151	144	145	145	143	146	146	142	137	131
Denmark	69	76	90	80	76	73	68	69	69	74	68	63	71	67
Finland	71	71	77	76	72	72	70	75	77	85	80	69	80	78
France	563	556	571	565	578	562	557	558	549	552	552	554	542	531
Germany	1 215	1 085	1 105	1 068	1 042	1 010	1 008	1 025	1 006	1 007	997	969	980	956
Greece	106	110	113	118	123	123	127	128	128	131	131	132	128	132
Ireland	55	59	61	63	66	67	69	71	69	69	69	70	70	69
Italy	516	530	523	529	540	546	550	555	556	570	574	574	563	553
Luxembourg	13	10	10	10	9	9	10	10	11	12	13	13	13	13
Netherlands	212	225	233	226	227	215	214	216	215	217	218	212	209	208
Portugal	59	70	68	71	76	84	82	84	89	84	86	89	85	82
Spain	288	319	312	333	343	372	386	386	403	410	426	441	433	442
Sweden	72	74	77	73	73	70	68	69	70	70	70	67	67	65
United Kingdom	771	712	733	708	704	671	674	677	656	661	658	653	648	637
EU-15	**4 233**	**4 128**	**4 210**	**4 146**	**4 163**	**4 098**	**4 108**	**4 154**	**4 127**	**4 180**	**4 180**	**4 141**	**4 116**	**4 052**
Bulgaria	118	89	87	84	74	69	69	69	66	72	71	71	71	76
Cyprus	5	7	7	7	8	9	9	9	9	9	10	10	10	10
Czech Republic	195	153	160	153	145	141	147	149	145	146	147	146	149	151
Estonia	42	21	22	21	20	18	18	19	18	20	20	20	19	22
Hungary	99	80	82	80	80	80	78	80	78	81	80	80	79	76
Latvia	27	13	13	12	12	11	10	11	11	11	11	11	12	12
Lithuania	49	22	23	23	23	21	19	20	21	21	22	23	23	25
Malta	2	3	3	3	3	3	3	3	3	3	3	3	3	3
Poland	459	446	454	449	414	400	389	385	371	384	384	387	399	399
Romania	243	181	187	167	149	132	136	140	147	154	155	149	154	152
Slovakia	73	53	51	50	50	49	48	50	49	50	50	49	49	47
Slovenia	19	19	19	20	19	19	19	20	20	20	20	20	21	21
EU-27	**5 564**	**5 213**	**5 318**	**5 214**	**5 159**	**5 049**	**5 053**	**5 109**	**5 066**	**5 150**	**5 153**	**5 111**	**5 104**	**5 045**

Note: For some countries the data provided in this table is based on gap filling (see Chapter 1.8.2 for details.).

ES.5 Summary of EC Member State emission trends

Table ES.7 gives an overview of Member State contributions to EC GHG emissions in 1990–2007. Member States show large variations in GHG emission trends.

The overall EC GHG emission trend is dominated by the two largest emitters, Germany and the United Kingdom, which account for about a third of total EU-27 GHG emissions. These two Member States have achieved total GHG emission reductions of 393 million tonnes CO_2-equivalents compared to 1990 ([6]).

The main reasons for the favourable trend in Germany were increasing efficiency in power and heating plants and the economic restructuring of the five new Länder after the German reunification. Reduced GHG emissions in the United Kingdom were primarily the result of liberalising energy markets and the subsequent fuel switches from oil and coal to gas in electricity production and N_2O emission reduction measures in adipic acid production.

Italy and France are the third and fourth largest emitters both with a share of 11 %. Italy's GHG emissions are about 7 % above 1990 levels in 2007. Italian GHG emissions increased since 1990 primarily from road transport, electricity and heat production and petrol refining. France's emissions were 6 % below 1990 levels in 2007. In France large reductions were achieved in N_2O emissions from adipic acid production but CO_2 emissions from road transport increased considerably between 1990 and 2007.

Spain and Poland are the fifth and sixth largest emitters in the EU-27, accounting for 9 % and 8 % repectively of total EU-27 GHG emissions. Spain increased emissions by 54 % between 1990 and 2007. This was largely due to emission increases from road transport, electricity and heat production, and manufacturing industries. Poland decreased GHG emissions by 13 % between 1990 and 2007 (– 29 % since its base year of 1988). The main factors for decreasing emissions in Poland — as for other new Member States — were the decline of energy inefficient heavy industry and the overall restructuring of the economy in the late 1980s and early 1990s. The notable exception was transport (especially road transport) where emissions increased.

ES.6 International aviation and maritime transport

Emissions of greenhouse gases from international aviation and shipping activities continued to rise in 2007, increasing by 1.8 % in the EU-27. Contributions from these sectors, currently not included in the national greenhouse gas totals, rose by 3.7 million tonnes for aviation and 1.8 million tonnes for international shipping. EC greenhouse gas emissions from international aviation are lower than for international maritime transport but are growing significantly more rapidly. The average annual EU-27 growth rates since 1990 were 4.5 % and 2.9 %, respectively. Together, the two sectors currently account for about 6 % of total greenhouse gas emissions.

ES.7 Information on recalculations

Base-year emissions for the EU-15 are fixed (i.e. 4 265.5 million tonnes CO_2-equivalents) as a result of the UNFCCC reviews during 2007 and 2008. The recalculation is the result of inventory improvements, which Member States were required to undertake for the whole time series to ensure consistency.

In the EU-15, the change in emissions between 2006 and 2007 was – 1.6 %, between 1990 and 2007 it was – 4.3 %, and between the fixed Kyoto base year and 2007 it was – 5.0 %. The effect of the recalculation in 2006, comparing the 2008 and 2009 inventories, was 0.8 %. This means that of the 5.0 % reduction in emissions between the Kyoto base year and 2007, 0.8 % has been due to recalculations. These were mainly due to the revised energy balance in Germany and the use of a revised emission factor for agriculture (nitrogen leaching) in Germany. The other main reason was more widespread use of the COPERT4 model for estimating N_2O emissions from road transport. The N_2O emission factor in COPERT4 is lower than in COPERT3. This has the effect of reducing N_2O emissions more in later years because of the upward trend in the use of catalysts to reduce NO_X emissions.

In the EU-15, recalculations for the year 1990 were of minor influence (– 0.3 % between the 2008 and 2009 submissions). In the EU-27, recalculations affected the year 1990 by – 0.2 % and the year 2006 by – 0.7 %.

([6]) The EU-15 as a whole needs emission reductions of total GHG of 8 %, i.e. 341 million tonnes on the basis of the 2008 inventory in order to meet the Kyoto target. This can be achieved by a combination of existing and planned domestic policies and measures, the use of carbon sinks and the use of Kyoto mechanisms.

Table ES.8 Overview of major recalculation in 1990

Source catagory	Member State	Deviation		Explanation for recalculation
		Gg CO_2-equivalent	%	
4.D.3.2-Nitrogen leaching and run-off, N_2O	Germany	– 8 198	– 68.4	A lower emission factor has been used
4.A-Enteric fermentation, dairy cattle, CH_4	Germany	– 3 050	– 24.1	'Estimation of a new MCF Use of a different mean emission factor Population data has been updated'
EU-15 Total recalculations	EU-15	– 10 922	– 0.3	
EU-27 Total recalculations	EU-27	– 13 318	– 0.2	

Table ES.9 Overview of major recalculation in 2006

Source catagory	Member State	Deviation		Explanation for recalculation
		Gg CO_2-equivalent	%	
1.AA.2.C-Chemicals, solid fuels, CO_2	Czech Republic	– 9 433	– 94.9	'For all 1A2: there are some allocation problems Recalculated from the final Energy balance'
1.AA.1.A-Public electricity and heat production, solid fuels, CO_2	Germany	– 7 239	– 2.5	'Improvement of the calculation method as a result of quality control new available data'
4.D.3.2-Nitrogen leaching and run-off, N_2O	Germany	– 6 692	– 66.8	A lower emission factor has been used
1.AA.2.F-Other (please specify), liquid fuels, CO_2	Germany	– 4 920	– 29.6	Revision of activity data from 2003 onwards
1.AA.4.B-Residential, gaseous fuels, CO_2	Germany	– 3 202	– 5.6	New available data
1.AA.1.A-Public electricity and heat production, solid fuels, CO_2	Poland	– 4 008	– 2.3	'Activity data on fuel consumption for years 1990–2006 were updated due to correction made in EUROSTAT database. CO_2 emissions for individual sub-sectors of 1.A category for 2006 were verified for harmonization of distribution of particular ETS installations into given sub-categories for the years 2005, 2006 and 2007'
1.AA.3.B-Road Transportation,Gasoline, N_2O	United Kingdom	– 3 127	– 83.4	Change to N_2O factors, revised from COPERT4 and Emissions Inventory Guidebook
1.AA.3.A-Civil aviation, jet kerosene, CO_2	Germany	– 3 051	– 57.7	Recalculations are due to a) separate reporting of Aviation Gasoline and b) a changed split factor used for separating national and international aviation
1.AA.2.A-Iron and steel, solid fuels, CO_2	Germany	– 3 051	– 41.3	New available data
1.AA.2.A-Iron and steel, solid fuels, CO_2	Czech Republic	3 794	322.6	For all 1A2: there are some allocation problems
1.AA.2.F-Other (please specify), solid fuels, CO_2	Czech Republic	3 910	126.2	For all 1A2: there are some allocation problems
2.C.1-Iron and steel production, CO_2	Poland	4 271	104.3	For 2005–2006 CO_2 emission values were verified for 2.C.1 sub-categories as follows: Iron Ore Sintering,. Blast Furnaces Process, Basic Oxygen Furnace Steel and Electric Furnace Steel. For the sub-categories listed above, CO_2 emission values were taken from verified reports. For the reason, that these emissions include also emissions from fuel consumption in the mentioned processes, this fuel consumption was subtracted from 1.A.2.a)
1.AA.1.A-Public electricity and heat production, gaseous fuels, CO_2	Germany	9 356	30.9	New available data
EU-15 Total recalculations	EU-15	– 35 166	– 0.8	
EU-27 Total recalculations	EU-27	– 36 577	– 0.7	

ES.8 Information on indirect greenhouse gas emissions for the EU-15

Emissions of CO, NO_X, NMVOC and SO_2 have to be reported to the UNFCCC Secretariat because they influence climate change indirectly: all are precursor substances for ozone which itself is a greenhouse gas. Sulphur emissions produce microscopic particles (aerosols) that can reflect sunlight back out into space and also affect cloud formation.

Table ES.10 shows the total indirect GHG and SO_2 emissions in the EU-15 between 1990 and 2007. All emissions were reduced significantly from 1990 levels: the largest reduction was achieved in SO_2 (75 %), followed by CO (58 %), NMVOC (48 %) and NO_X (35 %).

In the EU-27, SO_2 emissions decreased by 70 %, followed by CO (55 %), NMVOC (45 %) and NO_X (34 %) (Table ES.11).

ES.9 Information on using EU ETS for national GHG inventories in EU Member States

The NIR 2009 includes an analysis of the use of data and emissions reported under the ETS for preparing national GHG inventories in the EU-15. This analysis shows that most Member States used the ETS data to improve and refine the estimation and reporting of CO_2 emissions from energy and industrial processes. Fourteen countries used ETS data for quality assurance/quality control purposes and checked data consistency between both sources.

From EU-15 Member States, seven countries used ETS emissions directly in the inventory, five used activity data provided under the ETS and six used ETS information to improve country-specific emission factors for the inventory. The use of ETS data improved the inventory data quality with respect to completeness (additional emission sources can be estimated for which no data were available before the ETS data), accuracy (e.g. due to improved country-specific emission factors) and improved allocation of emissions to correct CRF source categories.

Table ES.10 Overview of EU-15 indirect GHG and SO_2 emissions for 1990–2007 (Gg)

Greenhouse gas emissions	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
							(Gg)							
NO_X	13 448	11 870	11 610	11 209	11 039	10 761	10 494	10 279	10 007	9 916	9 704	9 442	9 141	8 812
CO	52 273	41 593	40 008	38 062	36 410	34 028	31 691	29 885	28 046	27 186	26 076	24 120	23 083	22 083
NMVOC	15 877	12 941	12 441	12 230	11 806	11 333	10 631	10 153	9 676	9 735	9 113	8 875	8 704	8 205
SO_2	16 464	9 941	8 914	8 163	7 623	6 756	6 072	5 807	5 567	5 096	4 879	4 562	4 354	4 163

Table ES.11 Overview of EU-27 indirect GHG and SO_2 emissions for 1990–2007 (Gg)

Greenhouse gas emissions	1990	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
							(Gg)							
NO_X	16 740	14 488	14 287	13 807	13 423	12 997	12 314	11 965	11 674	11 640	11 845	11 538	11 352	10 977
CO	64 251	50 994	50 048	47 649	45 400	42 717	37 559	35 139	33 148	32 295	34 142	31 738	30 139	28 914
NMVOC	17 949	14 754	14 352	14 096	13 630	13 078	12 280	11 755	11 301	11 392	10 742	10 468	10 403	9 799
SO_2	24 952	16 622	15 463	14 414	12 741	11 287	9 978	9 650	9 167	8 671	8 458	7 956	7 799	7 587

European Environment Agency

Annual European Community greenhouse gas inventory 1990–2007 and inventory report 2009
Submission to the UNFCCC Secretariat

2009 — 15 pp. — 21 x 29.7 cm

ISBN 978-92-9213-001-5
EEA Technical report series: ISSN 1725-2237
DOI 10.2800/11551

TH-AK-09-004-EN-N
DOI 10.2800/11551

ISBN 978-92-9213-001-5

European Environment Agency
Kongens Nytorv 6
1050 Copenhagen K
Denmark

Tel.: +45 33 36 71 00
Fax: +45 33 36 71 99

Web: eea.europa.eu
Enquiries: eea.europa.eu/enquiries

Publications Office

European Environment Agency