

Annual European Union greenhouse gas inventory 1990–2009 and inventory report 2011

Submission to the UNFCCC Secretariat

ISSN 1725-2237



Annual European Union greenhouse gas inventory 1990–2009 and inventory report 2011

Submission to the UNFCCC Secretariat



Cover design: EEA
Layout: EEA/Pia Schmidt

Legal notice

The contents of this publication do not necessarily reflect the official opinions of the European Commission or other institutions of the European Union. Neither the European Environment Agency nor any person or company acting on behalf of the Agency is responsible for the use that may be made of the information contained in this report.

Copyright notice

© EEA, Copenhagen, 2011

Reproduction is authorised, provided the source is acknowledged, save where otherwise stated.

Information about the European Union is available on the Internet. It can be accessed through the Europa server (www.europa.eu).

Luxembourg: Publications Office of the European Union, 2011

ISBN 978-92-9213-203-3

ISSN: 1725-5597

EEA Technical report series: ISSN 1725-2237

doi:10.2800/76096

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

Acknowledgements	4
Executive summary	5
ES.1 Background information on greenhouse gas inventories and climate change...	5
ES.2 Summary of greenhouse gas emission trends in the EU	6
ES.3 Summary of emissions and removals by main greenhouse gas	9
ES.4 Summary of emissions and removals by main source and sink categories.....	11
ES.5 Summary of EU Member State emission trends	12
ES.6 International aviation and maritime transport	14
ES.7 Information on recalculations	14
ES.8 Information on indirect greenhouse gas emissions for the EU-15	17
ES.9 Information on using EU ETS data for national GHG inventories in EU Member States	17

The full report and annexes are available at:
www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2011/

Acknowledgements

This report was prepared on behalf of the European Commission (DG CLIMA) by the European Environment Agency's (EEA) European Topic Centre for Air Pollution and Climate Change Mitigation (ETC/ACM) 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), Caroline Deimel (ETC), Michael Gager (ETC), Sabine Goettlicher (ETC), Giacomo Grassi (JRC), Anke Herold (ETC), Erasmia Kitou (DG CLIMA), Traute Koether (ETC), Adrian Leip (JRC), Nicole Mandl (ETC),

Giorgos Mellios (ETC), Stephan Poupa (ETC), Maria Purzner (ETC), Nikolaos Roubanis (Eurostat), Manfred Ritter (ETC), Margarete Scheffler (ETC), Gudrun Stranner (ETC), Janka Szemsova (JRC), and Ronald Velghe (DG CLIMA).

The EEA project manager was Ricardo Fernandez. He acknowledges the input provided by Andreas Barkman (EEA), Hermann Peifer (EEA), David Simoens (EEA), Sheila Cryan (EEA) and Pia Schmidt (EEA). The EEA also acknowledges the input and comments received from the EU 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 Union (EU), 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 submission under the Kyoto Protocol and covers information and data from Member States available until 28 March 2011. 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 target under the Kyoto Protocol in the same way as the EU-15.

The legal basis for the compilation of the EU inventory is Council Decision 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 the UNFCCC and the Kyoto Protocol obligations relating to national programmes, greenhouse gas inventories, national systems and registries of the EU 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 EU and its Member States to the UNFCCC secretariat.

The EU GHG inventory comprises the sum of the national inventories compiled by the EU Member States making up the EU-15 and the EU-27. Energy data from Eurostat are used for the reference approach for CO₂ emissions from fossil fuels developed by the Intergovernmental Panel on Climate Change (IPCC).

The main institutions involved in the compilation of the EU GHG inventory are the Member States, the European Commission Directorate-General Climate Action (DG CLIMA), the European Environment Agency (EEA) and its European Topic Centre on Air Pollution and Climate Change Mitigation (ETC/ACM), Eurostat, and the Joint Research Centre (JRC).

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

⁽¹⁾ For the EU-15, the base year for CO₂, CH₄ and N₂O 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 EU inventory is the sum of Member State inventories, the EU-15 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.

⁽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.

On 23 January 2008 the European Commission adopted the 'Climate and 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. 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 the EU committed to a unilateral emission reduction target of 20 % ⁽³⁾ by 2020, compared with 1990 levels, and agreed to a reduction of 30 % provided that other major emitters agree to take on their fair share of a global reduction effort.

Both trading, i.e. EU Emissions Trading System (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.

Information on Land Use, Land-Use Change and Forestry (LULUCF) activities is covered in the Kyoto Protocol under Art. 3.3 (afforestation, reforestation and deforestation) and Art. 3.4 (forest land management, cropland management, grazing land management and revegetation). Detailed information on 3.3 and 3.4 LULUCF activities are provided in chapter 11 of this report, for the first time.

In addition, all parties to the Kyoto Protocol must provide information on how they are implementing their greenhouse gas commitments in such a way as to minimise potential adverse social, environmental and economic impacts on developing countries. This information is required under Article 3, paragraph 14 of the Protocol and is set out in Chapter 15 of this report.

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

EU-27

Total GHG emissions, without Land Use, Land-Use Change and Forestry (LULUCF), in the EU-27 decreased by 17.4 % between 1990 and 2009 (974 million tonnes CO₂-equivalents). Emissions decreased by 7.1 % (355 million tonnes CO₂-equivalents) between 2008 and 2009 (Figure ES.1).

EU-15

In 2009, total GHG emissions in the EU-15, without LULUCF, were 12.7 % (542 million tonnes CO₂-equivalents) below its Kyoto base year. Emissions decreased by 6.9 % (274 million tonnes CO₂-equivalents) between 2008 and 2009.

Under the Kyoto Protocol, the EU agreed to reduce its GHG emissions by 8 % by 2008–2012 compared to the 'base year' ⁽⁴⁾. 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. 2009 was the first year emissions (i.e. domestic) fell below the EU-15 Kyoto target (Figure ES.2).

Main trends by source category in the period 1990–2009

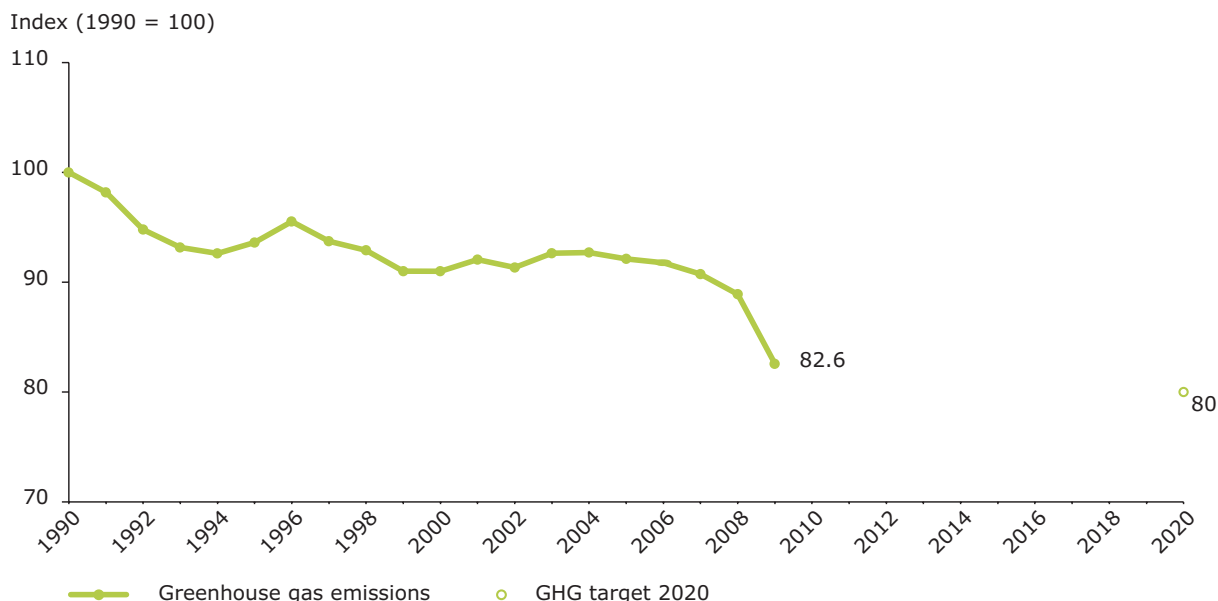
Between 1990 and 2009, EU-15 emissions decreased by 12.7 %, while in the EU-27 emissions decreased by 17.4 % (Table ES.1).

Main trends by source category in the period 2008–2009

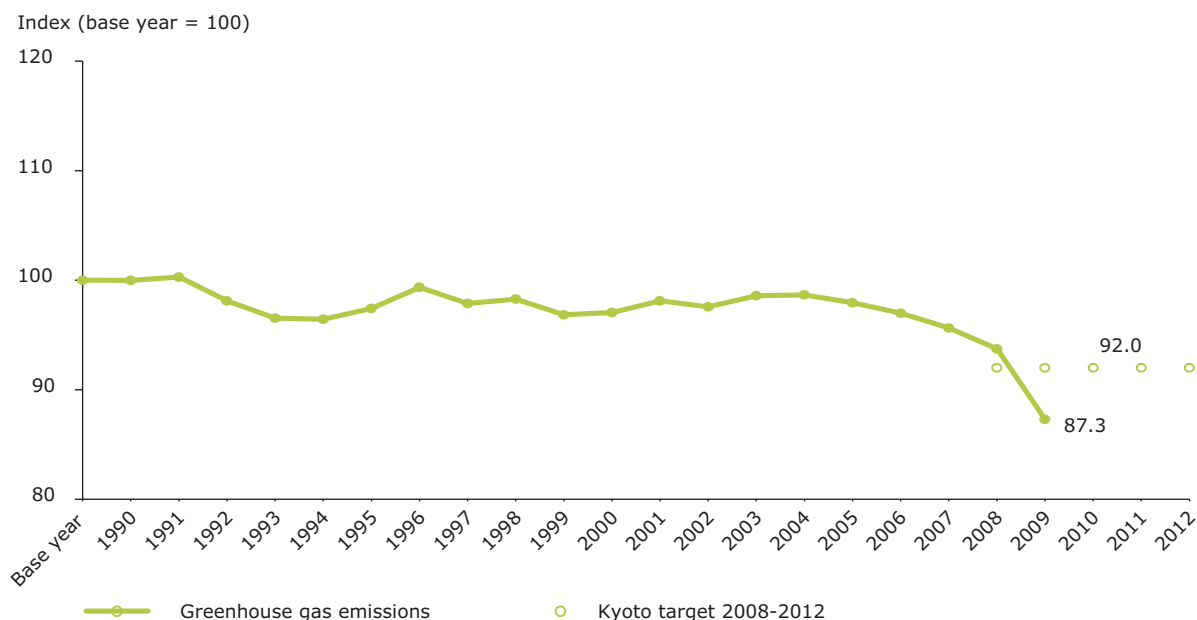
Between 2008 and 2009, EU-15 emissions decreased by 6.9 % while in the EU-27 emissions decreased by 7.1 % (Table ES.2).

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

⁽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 Mt CO₂-equivalent.

Figure ES.1 EU-27 GHG emissions from 1990 to 2009 (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. CO₂ emissions from biomass with energy recovery are reported as a Memorandum item according to UNFCCC Guidelines and are 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.

Figure ES.2 EU-15 GHG emissions from 1990 to 2009, compared with the target for 2008–2012 (excluding LULUCF)

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. CO₂ emissions from biomass with energy recovery are reported as a Memorandum item according to UNFCCC Guidelines and are 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 Mt CO₂-equivalent. The EU-15 would need to reduce greenhouse gas emissions by about 341 million tonnes, on average between 2008–2012, in order to meet its 8 % 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.1 Overview of EU-27 and EU-15 source categories whose emissions increased or decreased by more than 20 million tonnes CO₂-equivalents in the period 1990–2009

Source category	EU-15	EU-27
	Million tonnes (CO ₂ -equivalent)	
Road transport (CO ₂ from 1A3b)	115.0	164.8
Consumption of halocarbons (HFC from 2F)	63.0	69.9
Cement production (CO ₂ from 2A1)	– 14.7	– 20.5
Enteric fermentation (CH ₄ from 4A)	– 16.4	– 38.9
Nitric acid production (N ₂ O from 2B2)	– 24.4	– 33.4
Production of halocarbons (HFC from 2E)	– 25.6	– 25.6
Agricultural soils (N ₂ O from 4D)	– 42.0	– 76.7
Fugitive emissions (CH ₄ from 1B)	– 46.8	– 71.0
Adipic acid production (N ₂ O from 2B3)	– 48.1	– 49.1
Manufacture of solid fuels (CO ₂ from 1A1c)	– 55.6	– 57.6
Households and services (CO ₂ from 1A4)	– 59.6	– 117.3
Public electricity and heat production (CO ₂ from 1A1a)	– 61.6	– 232.3
Iron and steel production (CO ₂ from 1A2a+2C1)	– 69.3	– 105.1
Solid Waste Disposal (CH ₄ from 6A)	– 69.4	– 63.9
Manufacturing industries (excl. iron and steel) (Energy-related CO ₂ from 1A2 excl. 1A2a)	– 131.8	– 227.7
Total	– 541.2	– 974.3

Note: As the table only presents sectors that have increased or decreased by 20 Mt CO₂-equivalents or more, the sum for each country grouping EU-15/EU-27 does not match the total change listed at the bottom of the table.

Table ES.2 Overview of EU-27 and EU-15 source categories whose emissions increased or decreased by more than 3 million tonnes CO₂-equivalents in the period 2008–2009

Source category	EU-15	EU-27
	Million tonnes (CO ₂ -equivalent)	
Public electricity and heat production (CO ₂ from 1A1a)	– 77.1	– 103.2
Manufacturing industries (excl. iron and steel) (Energy-related CO ₂ from 1A2 excl. 1A2a)	– 54.1	– 65.9
Iron and steel production (CO ₂ from 1A2a+2C1)	– 41.6	– 53.6
Road transport (CO ₂ from 1A3b)	– 20.5	– 23.7
Households and services (CO ₂ from 1A4)	– 21.2	– 22.0
Cement production (CO ₂ from 2A1)	– 13.9	– 18.6
Manufacture of solid fuels (CO ₂ from 1A1c)	– 10.1	– 10.8
Nitric acid production (N ₂ O from 2B2)	– 3.4	– 9.4
Refineries (CO ₂ from 1A1b)	– 8.0	– 8.4
Agricultural soils (N ₂ O from 4D)	– 6.7	– 8.0
Fugitive emissions (CH ₄ from 1B)	– 1.2	– 4.1
Total	– 274.3	– 354.5

Note: As the table only presents sectors whose emissions have increased or decreased by 3 million tonnes of CO₂-equivalents or more, the sum for each country grouping does not match the total change listed at the bottom of the table.

Main reasons for emission changes in EU-15 in the period 2008–2009

The 274.3 million tonnes (CO₂-equivalents) decrease in GHG emissions between 2008–2009 was mainly due to:

- A steep decrease of CO₂ emission (77.1 million tonnes or 8 %) from public electricity and heat production. The United Kingdom (22.1 million tonnes CO₂), Germany (19.8 million tonnes CO₂), Italy (16.5 million tonnes CO₂) and Spain (15.7 million tonnes CO₂) contributed most to this decrease. Seven countries, however, report increases (Belgium, Denmark, Finland, Luxembourg, the Netherlands, Portugal, Sweden). In Spain, Germany and the United Kingdom the main reason for emission reductions was the strong decline in coal use for power generation; in Italy the strong decline in gaseous fuels.
- Strong emission reduction (54.1 million tonnes or 12.5 %) in manufacturing industries excluding iron and steel industry (mainly caused by Germany, Italy, United Kingdom and Spain) as a result of the 2009 economic recession and contraction of industrial output.
- A strong decrease in emissions (41.6 million tonnes or 30.2 %) in the iron and steel production due to a significant decline in crude steel production in all major steel producing countries (a fall of 29.8 % in the EU-15 as a whole, according to the World Steel Association).
- Emissions also fell in households and services (by 21.2 million tonnes or 4 %), despite the colder winter, and in road transport (by 20.5 million tonnes or 2.7 %).

The severity of the 2009 recession affected all economic sectors in the EU. Consumption of fossil fuels (coal, oil and natural gas) fell compared to the previous year, mainly for coal. The decreased demand for energy linked to the economic recession

was accompanied by increased renewable energy use, which together contributed to lower emissions. Despite the relatively cold winter of 2009, emissions fell in the residential sector.

In relative terms, the largest emission reductions occurred in industrial processes, reflecting lower activity levels in the cement, chemical and iron and steel industries. The 2009 verified emissions from the sectors covered by the EU Emission Trading System (EU-ETS) decreased by 11.6 % compared to 2008. The recession in 2009 accelerated, temporarily, the downward trend in total greenhouse gas emissions. The sustained strong growth in the use of renewables was the other key factor explaining the strong decrease in greenhouse gas emissions in 2009.

For a detailed analysis at EU-27 level, see *Why did greenhouse gas emissions fall in the EU in 2009? EEA analysis in brief*⁽⁵⁾.

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

EU-27

Table ES.4 gives an overview of the main trends in EU-27 GHG emissions and removals for 1990–2009. The most important GHG by far is CO₂, accounting for 81.6 % of total EU-27 emissions in 2009 excluding LULUCF. In 2009, EU-27 CO₂ emissions without LULUCF were 3 765 Tg, which was 14.3 % below 1990 levels. Compared to 2008, CO₂ emissions decreased by 8.0 %.

EU-15

Table ES.5 gives an overview of the main trends in EU-15 GHG emissions and removals for 1990–2009. As in the EU-27, the most important GHG in the EU-15 is CO₂, accounting for 82.3 % of total EU-15 emissions in 2009. In 2009, EU-15 CO₂ emissions without LULUCF were 3 063 Tg, which was 8.8 % below 1990 levels. Compared to 2008, CO₂ emissions decreased by 7.8 %.

⁽⁵⁾ <http://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2011>.

Table ES.3 Greenhouse gas emissions in CO₂-equivalents (excluding LULUCF) and Kyoto Protocol targets for 2008–2012

Member State	1990	Kyoto Protocol base year ^(a)	2009	Change 2008–2009	Change 2008–2009	Change 1990–2009	Change base year 2009	Targets 2008–2012 under Kyoto Protocol and 'EU burden sharing'
	(million tonnes)	(million tonnes)	(million tonnes)	(million tonnes)	(%)	(%)	(%)	(%)
Austria	78.2	79.0	80.1	– 6.9	– 7.9 %	2.4 %	1.3 %	– 13.0 %
Belgium	143.3	145.7	124.4	– 10.7	– 7.9 %	– 13.2 %	– 14.6 %	– 7.5 %
Denmark	68.0	69.3	61.0	– 2.7	– 4.2 %	– 10.3 %	– 12.0 %	– 21.0 %
Finland	70.4	71.0	66.3	– 4.1	– 5.8 %	– 5.7 %	– 6.6 %	0.0 %
France	562.9	563.9	517.2	– 21.9	– 4.1 %	– 8.1 %	– 8.3 %	0.0 %
Germany	1 247.9	1 232.4	919.7	– 61.4	– 6.3 %	– 26.3 %	– 25.4 %	– 21.0 %
Greece	104.4	107.0	122.5	– 6.0	– 4.7 %	17.4 %	14.5 %	25.0 %
Ireland	54.8	55.6	62.4	– 5.4	– 8.0 %	13.8 %	12.2 %	13.0 %
Italy	519.2	516.9	491.1	– 50.6	– 9.3 %	– 5.4 %	– 5.0 %	– 6.5 %
Luxembourg	12.8	13.2	11.7	– 0.6	– 4.7 %	– 8.9 %	– 11.3 %	– 28.0 %
Netherlands	211.9	213.0	198.9	– 5.7	– 2.8 %	– 6.1 %	– 6.6 %	– 6.0 %
Portugal	59.4	60.1	74.6	– 3.4	– 4.3 %	25.5 %	24.0 %	27.0 %
Spain	283.2	289.8	367.5	– 37.2	– 9.2 %	29.8 %	26.8 %	15.0 %
Sweden	72.5	72.2	60.0	– 3.6	– 5.6 %	– 17.2 %	– 16.9 %	4.0 %
United Kingdom	776.1	776.3	566.2	– 54.0	– 8.7 %	– 27.0 %	– 27.1 %	– 12.5 %
EU-15	4 264.9	4 265.5	3 723.7	– 274.3	– 6.9 %	– 12.7 %	– 12.7 %	– 8.0 %
Bulgaria	111.4	132.6	59.5	– 9.5	– 13.8 %	– 46.6 %	– 55.1 %	– 8.0 %
Cyprus	5.3	Not applicable	9.4	– 0.8	– 7.7 %	78.3 %	Not applicable	Not applicable
Czech Republic	195.5	194.2	132.9	– 8.2	– 5.8 %	– 32.0 %	– 31.6 %	– 8.0 %
Estonia	41.1	42.6	16.8	– 3.2	– 16.1 %	– 59.0 %	– 60.5 %	– 8.0 %
Hungary	96.8	115.4	66.7	– 6.4	– 8.7 %	– 31.1 %	– 42.2 %	– 6.0 %
Latvia	26.6	25.9	10.7	– 1.2	– 10.0 %	– 59.7 %	– 58.6 %	– 8.0 %
Lithuania	49.6	49.4	21.6	– 2.4	– 10.1 %	– 56.4 %	– 56.3 %	– 8.0 %
Malta	2.1	Not applicable	2.9	– 0.1	– 4.7 %	38.8 %	Not applicable	Not applicable
Poland	452.9	563.4	376.7	– 19.1	– 4.8 %	– 16.8 %	– 33.2 %	– 6.0 %
Romania	250.1	278.2	130.8	– 22.6	– 14.7 %	– 47.7 %	– 53.0 %	– 8.0 %
Slovakia	74.1	72.1	43.4	– 4.8	– 9.9 %	– 41.4 %	– 39.8 %	– 8.0 %
Slovenia	18.5	20.4	19.3	– 1.9	– 9.1 %	4.7 %	– 5.0 %	– 8.0 %
EU-27	5 588.8	Not applicable	4 614.5	– 354.5	– 7.1 %	– 17.4 %	Not applicable	Not applicable

Note: ^(a) Cyprus, Malta and the EU-27 do not have targets under the Kyoto Protocol and do not have applicable Kyoto Protocol base years.

Table ES.4 Overview of EU-27 GHG emissions and removals from 1990 to 2009 in CO₂-equivalents (Tg)

Greenhouse gas emissions	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Net CO ₂ emissions/removals	4 043	3 767	3 732	3 780	3 795	3 890	3 883	3 852	3 826	3 795	3 675	3 325
CO ₂ emissions (without LULUCF)	4 396	4 150	4 111	4 189	4 164	4 249	4 262	4 241	4 237	4 185	4 092	3 765
CH ₄	610	551	494	483	474	464	452	445	439	433	428	418
N ₂ O	532	471	424	418	408	403	406	398	387	384	377	358
HFCs	28	41	46	46	49	53	56	60	62	67	70	72
PFCs	20	13	9	8	10	8	6	5	5	4	4	3
SF ₆	11	16	11	10	9	8	8	8	8	7	7	6
Total (with net CO ₂ emissions/removals)	5 244	4 859	4 716	4 744	4 744	4 827	4 810	4 768	4 727	4 691	4 560	4 182
Total (without CO ₂ from LULUCF)	5 597	5 242	5 095	5 154	5 114	5 186	5 189	5 157	5 138	5 080	4 977	4 622
Total (without LULUCF)	5 589	5 232	5 086	5 145	5 105	5 177	5 181	5 149	5 129	5 071	4 969	4 615

Table ES.5 Overview of EU-15 GHG emissions and removals from 1990 to 2009 in CO₂-equivalents (Tg)

Greenhouse gas emissions	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Net CO ₂ emissions/removals	3 125	3 026		3 126	3 157	3 227	3 230	3 212	3 164	3 138	3 040	2 765
CO ₂ emissions (without LULUCF)	3 359	3 290	3 362	3 428	3 419	3 478	3 490	3 473	3 450	3 396	3 323	3 063
CH ₄	452	423	379	369	360	348	337	331	325	321	317	311
N ₂ O	403	382	343	334	326	320	321	312	300	299	291	280
HFCs	28	41	45	44	46	50	51	55	57	60	63	66
PFCs	17	11	7	6	8	7	5	4	4	3	3	2
SF ₆	11	15	10	9	8	8	8	8	7	7	6	6
Total (with net CO ₂ emissions/removals)	4 036	3 898	3 864	3 889	3 905	3 960	3 954	3 922	3 857	3 828	3 720	3 430
Total (without CO ₂ from LULUCF)	4 270	4 162	4 146	4 191	4 167	4 211	4 214	4 183	4 143	4 085	4 003	3 729
Total (without LULUCF)	4 265	4 155	4 140	4 185	4 162	4 205	4 208	4 178	4 137	4 080	3 998	3 724

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

EU-27

Table ES.6 gives an overview of EU-27 GHG emissions in the main source categories for 1990–2009. The most important sector by far is energy (i.e. combustion and fugitive emissions)

accounting for 79.3 % of total EU-27 emissions in 2009. The second largest sector is agriculture (10.3 %), followed by industrial processes (7.0 %).

EU-15

Table ES.7 gives an overview of EU-15 GHG emissions in the main source categories for 1990–2009. More detailed trend descriptions are included in Chapters 3 to 9 of this report.

Table ES.6 Overview of EU-27 GHG emissions in the main source and sink categories 1990 to 2009 in CO₂-equivalents (Tg)

GHG source and sink	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1. Energy	4 284	4 044	3 984	4 071	4 043	4 116	4 113	4 085	4 073	4 010	3 934	3 660
2. Industrial processes	463	441	391	377	372	385	398	403	400	411	387	321
3. Solvent and other product use	17	14	14	14	13	13	13	13	13	13	12	11
4. Agriculture	610	528	515	507	503	496	495	490	487	485	487	476
5. Land use, land-use change and forestry	- 345	- 373	- 370	- 401	- 360	- 351	- 371	- 381	- 402	- 381	- 409	- 432
6. Waste	214	205	182	176	174	168	162	159	157	152	149	147
7. Other	0	0	0	0	0	0	0	0	0	0	0	0
Total (with net CO ₂ emissions/removals)	5 244	4 859	4 716	4 744	4 744	4 827	4 810	4 768	4 727	4 691	4 560	4 182
Total (without LULUCF)	5 589	5 232	5 086	5 145	5 105	5 177	5 181	5 149	5 129	5 071	4 969	4 615

Table ES.7 Overview of EU-15 GHG emissions in the main source and sink categories 1990 to 2009 in CO₂-equivalents (Tg)

GHG source and sink	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1. Energy	3 274	3 200	3 252	3 323	3 313	3 361	3 363	3 342	3 317	3 258	3 196	2 973
2. Industrial processes	353	351	309	298	295	303	311	309	302	306	290	250
3. Solvent and other product use	14	12	12	12	11	11	10	11	11	10	10	9
4. Agriculture	441	419	419	410	404	399	398	393	387	388	387	379
5. Land use, land-use change and forestry	- 229	- 257	- 276	- 296	- 257	- 245	- 255	- 255	- 280	- 252	- 278	- 293
6. Waste	184	173	148	142	138	132	126	123	121	117	115	112
7. Other	0	0	0	0	0	0	0	0	0	0	0	0
Total (with net CO ₂ emissions/removals)	4 036	3 898	3 864	3 889	3 905	3 960	3 954	3 922	3 857	3 828	3 720	3 430
Total (without LULUCF)	4 265	4 155	4 140	4 185	4 162	4 205	4 208	4 178	4 137	4 080	3 998	3 724

ES.5 Summary of EU Member State emission trends

Table ES.8 gives an overview of Member State contributions to EU GHG emissions for 1990–2009. Member States show large variations in GHG emission trends.

The overall EU GHG emission trend is dominated by the two largest emitters, Germany and the United Kingdom, together accounting for about one third of total EU-27 GHG emissions. These two Member States have achieved total GHG emission reductions of 538 million tonnes CO₂-equivalents compared to 1990 ⁽⁶⁾.

⁽⁶⁾ The EU-15 as a whole needs GHG emission reductions of 8 %, i.e. 341 million tonnes, 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 Member States' contributions to EU GHG emissions (excluding LULUCF) from 1990 to 2009 in CO₂-equivalents (Tg)

Member State	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Austria	78	80	80	84	86	92	91	93	90	87	87	80
Belgium	143	150	145	145	144	146	147	143	138	133	135	124
Denmark	68	76	68	70	69	74	68	64	72	67	64	61
Finland	70	71	69	74	77	84	80	68	80	78	70	66
France	563	560	567	569	564	566	566	569	553	545	539	517
Germany	1 248	1 120	1 042	1 057	1 037	1 031	1 021	1 000	1 002	980	981	920
Greece	104	109	126	127	127	131	131	134	131	133	129	123
Ireland	55	58	68	70	68	68	68	69	69	68	68	62
Italy	519	530	552	557	559	573	577	575	564	555	542	491
Luxembourg	13	10	10	10	11	11	13	13	13	12	12	12
Netherlands	212	223	213	215	214	215	217	211	207	205	205	199
Portugal	59	69	81	82	87	82	84	86	81	79	78	75
Spain	283	315	380	380	397	404	420	434	426	437	405	368
Sweden	72	74	69	70	70	71	70	68	67	66	64	60
United Kingdom	776	710	670	674	653	658	656	651	645	634	620	566
EU-15	4 265	4 155	4 140	4 185	4 162	4 205	4 208	4 178	4 137	4 080	3 998	3 724
Bulgaria	111	81	63	66	63	68	68	67	68	72	69	59
Cyprus	5	7	9	9	9	9	9	10	10	10	10	9
Czech Republic	196	154	147	150	145	144	145	145	146	147	141	133
Estonia	41	20	18	18	18	19	20	19	19	22	20	17
Hungary	97	78	77	79	77	80	79	79	78	75	73	67
Latvia	27	13	10	11	11	11	11	11	12	12	12	11
Lithuania	50	22	19	20	21	21	22	23	23	25	24	22
Malta	2	2	3	3	3	3	3	3	3	3	3	3
Poland	453	440	389	386	373	385	386	388	402	401	396	377
Romania	250	188	142	148	155	161	160	156	160	156	153	131
Slovakia	74	53	49	51	50	51	51	50	50	48	48	43
Slovenia	18	18	19	20	20	20	20	20	20	21	21	19
EU-27	5 589	5 232	5 086	5 145	5 105	5 177	5 181	5 149	5 129	5 071	4 969	4 615

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 German reunification. The reduction of GHG emissions in the United Kingdom was primarily the result of liberalising energy markets and the subsequent fuel switches from oil and coal to gas in electricity production, and N₂O emission reduction measures in the production of adipic acid.

France and Italy were the third and fourth largest emitters with a share of 11.2 % and 10.6 % of total emissions, respectively. Italy's GHG emissions were 5.4 % below 1990 levels in 2009. Italian GHG emissions initially increased, primarily from road transport, electricity and heat production and petrol refining, however, they have decreased significantly between 2008 and 2009 (by 9.3 %). France's emissions were 8.1 % below 1990 levels in 2009. In France, large reductions were achieved

in N₂O emissions from adipic acid production, but CO₂ emissions from road transport and HFC emissions from consumption of halocarbons increased considerably between 1990 and 2009.

Poland and Spain are the fifth and sixth largest emitters in the EU-27, each accounting for about 8 % of total EU-27 GHG emissions in 2009. Spain increased emissions by almost 30 % between 1990 and 2009. This was largely due to emission increases from road transport, electricity and heat production, and manufacturing industries. Poland decreased GHG emissions by 16.8 % between 1990 and 2009 (and 33.2 % 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

EU-27 emissions of greenhouse gases from international aviation and shipping activities decreased as a whole for the second year in a row, which partly reflects the impacts of economic recession. Between 2008 and 2009 emissions from these sectors, currently not included in the national greenhouse gas totals, decreased by 7 % for aviation and by 10 % for international shipping. EU 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 in emissions since 1990 were 3.6 % and 2.0 %, respectively. Together, the two sectors currently equal 6.3 % of total greenhouse gas emissions.

For detailed information on emissions from international bunkers see Section 3.7 of this report.

ES.7 Information on recalculations

The UNFCCC has permanently fixed the base year emissions for the EU-15 (at 4 265.5 million tonnes CO₂-equivalents) based on reviews during 2007 and 2008. However, recalculations of past emissions data occur every year, based on the inventory improvements that Member States are required to undertake for the whole time series.

Based on Member State inventories in 2011, total EU-15 emissions in both 1990 and 2008 were 0.4 percentage points higher than indicated in the 2010 inventories.

Similarly, recalculation of EU-27 emissions in 1990 and 2008 based on the comparison of the inventories submitted in 2011 and 2010 revealed increases of 0.4 percentage points for each.

For detailed information on recalculations see Chapter 10 and the sector-specific recalculations.

Table ES.9 Overview of major recalculations in the EU-15 in 1990

Source category	Member State	Deviation		Explanation for recalculation
		Gg CO ₂ -equivalent	%	
1A2_Manufacturing industries and construction CO ₂	Germany	21 152	13.6924369	Reallocation of CO ₂ emissions from blast furnace gas combustion in sinter plants and rolling mills from source category 2C1 to source category 1A2a. New available data from national statistics.
1A1_Energy industries CO ₂	Germany	8 564	2.06438207	Reallocation of CO ₂ emissions from blast furnace gas combustion in cokeries from source category 2C1 to source category 1A1 New available data from national statistics
4D_Agricultural soils N ₂ O	Germany	7 343	17.1906876	Estimation procedure has been corrected in accordance with IPCC (1996b) procedure. Correction of error in the estimation of TAN-immobilization in solid manure systems. Correction of emission factors (1996 GL instead of 2006 GL). Revision of method that considers N-losses due to emissions from N-species.
6A_Solid waste disposal on land CH ₄	United Kingdom	6 377	12.8497363	Major review and update to the model used to estimate emissions from landfilled waste. A new time series of waste sent to landfill and waste composition has been identified and is now used.
2E_Production of halocarbons HFC	Germany	4 329	100	From the submission 2011 the so far confidential emissions of the production can be reported in 2E. But the producer requested to report the HFCs as unspecified mix.
6A_Solid waste disposal on land CH ₄	Germany	2 688	7.48538012	Revision of methane recovery from landfills.
1A3_Transport CO ₂	Spain	- 2 223	- 3.93437979	New methodology following application of the national MECETA model for aviation. The revision has effect in the fuel consumption as well as in the emission factors.
1A3_Transport CO ₂	United Kingdom	- 2 639	- 2.26691841	Road transport — updated distribution of vkm data between road types and between buses and coaches. Update to vkm data for motorcycles. Revised activity data for freight railways from the ORR for all years. Revised data for passenger rail from 2005 onwards. Reallocation of flights between the United Kingdom and OTs/CDs between domestic and international as appropriate. Reallocation of shipping emissions between international and domestic based on port movement data. Coal use in rail reported from 2005.
1A2_Manufacturing industries and construction CO ₂	France	- 3 083	- 3.61350158	Data consumption for the auto-production in industry have been corrected since 1990 due to a revision of data by SOEs (french energy statistics) has been made.
2C_Metal production CO ₂	Germany	- 25 614	- 51.468154	Recalculation of CO ₂ emissions from blast furnace gas combustion in industrial power plants from source category 2C1 to 1A2f and 1A1

Note: Explanations for recalculations as provided by the Parties in their national greenhouse gas inventory reports.

Table ES.10 Overview of major recalculations in the EU-15 in 2008

Source category	Member State	Deviation		Explanation for recalculation
		Gg CO ₂ -equivalent	%	
1A2_Manufacturing industries and construction CO ₂	Germany	23 011	24	'Reallocation of CO ₂ emissions from blast furnace gas combustion in sinter plants and rolling mills from source category 2C1 to source category 1A2a. New available data from national statistics'.
6A_Solid waste disposal on land CH ₄	France	11 230	194	Mise a jour taux de captage du biogaz suite à la revue CCNUCC
1A1_Energy industries CO ₂	Germany	10 296	3	'Reallocation of CO ₂ emissions from blast furnace gas combustion in cokeries from source category 2C1 to source category 1A1. New available data from national statistics'.
4D_Agricultural soils N ₂ O	Germany	6 663	17	'Estimation procedure has been corrected in accordance with IPCC (1996b) procedure. Correction of error in the estimation of TAN-immobilization in solid manure systems. Correction of emission factors (1996 GL instead of 2006 GL). Revision of method that considers N-losses due to emissions from N-species.'
1A4_Other sectors CO ₂	Germany	3 168	2	New available data from national statistics.
1A2_Manufacturing industries and construction CO ₂	United Kingdom	2 818	4	'Method of calculating activity data in lime production reviewed and improved. Also causes reallocation of petcoke and gas and coal and coke in other industry. Method improvement in cement industry affects activity data of lubricants. National energy stats changes affected EFs for coal coke coke over gas and BF gas as based on reported emissions. EU ETS EFs now used from 2005 for Colliery methane and from 2008 for OPG and pet coke. Earlier years interpolated. Other industry timeseries affected by reallocation of burning oil and fuel oil and gas oil to the crown dependencies. Other activity data affected from 2005 onwards by changes to national energy statistics.'
6A_Solid waste disposal on land CH ₄	Germany	2 352	31	Revision of methane recovery from landfills.
6A_Solid waste disposal on land CH ₄	Italy	2 288	21	'Industrial wastes disposed into MSW landfills have been added and revision of rapidly biodegradable fractions. Revision of sludge time series and addition of industrial wastes. New waste composition from 2006 and revision of previous waste compositions'.
2B_Chemical industries CO ₂	Germany	2 080	14	'For the CO ₂ -Emissions from methanol production the default emission factor of the IPCC GL 2006 is used, because the old emissions could not be explained. Inclusion of CO ₂ recovery from ammonia production'.
1A3_Transport CO ₂	Spain	- 2 135	- 2	New methodology following application of the national MECETA model for aviation. The revision has effect in the fuel consumption as well as in the emission factors.
1A2_Manufacturing industries and construction CO ₂	France	- 2 394	- 3	Data consumption for the auto-production in industry have been corrected since 1990 due to a revision of data by SOes (French energy statistics) has been made.
1A4_Other sectors CO ₂	United Kingdom	- 2 699	- 3	'New EF based on carbon content measurements for domestic pet coke. GCV revised for coal for 2006 onwards. Revision to national energy statistics for coke for 2007 onwards. Northern Ireland domestic peat use data for all years. Revised national energy stats 2005 onward. Updates to CDs caused reallocation of LPG fuel oil and gas oil for all years. New AD for domestic petcoke. Improvements to offroad model 2004 onwards. Addition of fishing vessels in 1A4c.'
6A_Solid waste disposal on land CH ₄	United Kingdom	- 3 784	- 19	'Major review and update to the model used to estimate emissions from landfilled waste. A new time series of waste sent to landfill and waste composition has been identified and is now used.'
1A3_Transport CO ₂	United Kingdom	- 4 167	- 3	'Road transport — updated distribution of vkm data between road types and between buses and coaches. Update to vkm data for motorcycles. Revised activity data for freight railways from the ORR for all years. Revised data for passenger rail from 2005 onwards. Reallocation of flights between the United Kingdom and OTs/CDs between domestic and international as appropriate. Reallocation of shipping emissions between international and domestic based on port movement data. Coal use in rail reported from 2005.'
2C_Metal production CO ₂	Germany	- 24 087	- 55	Recalculation of CO ₂ emissions from blast furnace gas combustion in industrial power plants from source category 2C1 to 1A2f and 1A1.

Note: Explanations for recalculations as provided by the Parties in their national greenhouse gas inventory reports

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

Emissions of CO, NO_x, NMVOC and SO₂ have to be reported to the UNFCCC Secretariat because they influence climate change indirectly: the former three substances are precursor substances for ground-level ozone which itself is a greenhouse gas. Sulphur emissions can contribute to formation of microscopic particles (aerosols) that can reflect sunlight back out into space and also affect cloud formation.

Table ES.11 shows the total indirect GHG and SO₂ emissions in the EU-15 between 1990–2009. All emissions were reduced significantly from 1990 levels: the largest reduction was achieved in SO₂ (84 %), followed by CO (65 %), NMVOC (54 %) and NO_x (45 %).

In the EU-27, SO₂ emissions decreased by 78 %, followed by CO (61 %), NMVOC (50 %) and NO_x (44 %) (Table ES.12).

EU Member States also annually report emissions of these substances to the United Nations Economic Commission for Europe (UNECE) Convention on Long-Range Transboundary Air Pollution (LRTAP), and report emissions of NO_x, NMVOCs and SO₂ under the EU's National Emissions Ceilings Directive (NECD).

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

This report also includes an analysis of the use of data and emissions reported under the European Union Greenhouse Gas Emission Trading System (EU ETS) for preparing national GHG inventories in the EU-15. The analysis shows that most Member States used the ETS data to improve and refine the estimation and reporting of CO₂ emissions from energy and industrial processes. Twenty-six of 27 Member States indicated that they used ETS data at least for quality assurance/quality control purposes and checked data consistency between both sources. This is a higher share of Member States than in 2010.

Sixteen Member States have used verified emissions reported by installations under the EU ETS in their national greenhouse gas inventories. Eighteen Member States used ETS data to improve country-specific emission factors. Twelve Member States reported that they used activity data (e.g. fuel use) provided under the ETS in their national inventory. The use of ETS data improved the quality of greenhouse gas inventory data with respect to completeness (additional emission sources can be estimated for which no data were available before the EU ETS), accuracy (e.g. due to improved country-specific emission factors) and allocation of emissions to correct CRF source categories.

Table ES.11 Overview of EU-15 indirect GHG and SO₂ emissions for 1990–2009 (Gg)

Greenhouse gas emissions	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
(Gg)												
NO _x	13 555	11 963	10 517	10 312	10 060	9 902	9 749	9 502	9 207	8 900	8 201	7 503
CO	52 547	41 837	31 817	30 166	28 174	27 046	25 954	24 002	22 782	21 642	20 685	18 310
NMVOC	15 928	13 012	10 634	10 131	9 608	9 604	8 966	8 730	8 629	8 070	7 697	7 265
SO ₂	16 485	9 981	6 153	5 887	5 638	5 161	4 932	4 560	4 348	4 162	3 100	2 608

Table ES.12 Overview of EU-27 indirect GHG and SO₂ emissions for 1990–2009 (Gg)

Greenhouse gas emissions	1990	1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
(Gg)												
NO _x	16 954	14 714	12 728	12 468	12 193	12 133	11 957	11 716	11 453	11 155	10 351	9 528
CO	64 783	51 436	40 716	37 841	35 624	34 492	33 779	30 600	29 423	28 252	27 506	24 965
NMVOC	18 491	14 944	12 389	11 806	11 301	11 345	11 037	10 636	10 598	10 500	9 501	9 260
SO ₂	25 367	16 795	10 387	10 201	9 713	9 255	8 685	8 037	7 877	7 667	6 392	5 509

European Environment Agency

**Annual European Union greenhouse gas
inventory 1990–2009 and inventory report 2011**

Submission to the UNFCCC Secretariat

2011 — 17 pp. — 21 x 29.7 cm

ISBN 978-92-9213-203-3

ISSN: 1725-5597

EEA Technical report series: ISSN 1725-2237

doi:10.2800/76096

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