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Annual European Union greenhouse gas inventory 1990–2011 and inventory report 2013

Submission to the UNFCCC Secretariat

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European Environment Agency

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Contents

The full report and annexes are available at:
http://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2013

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 years 1990 to 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 15 May 2013. 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 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 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.

In 2013, the Decision was revised and replaced by a new Monitoring Mechanism Regulation, that has enhanced the reporting rules on GHG emissions to meet requirements arising from current and future international climate agreements as well as the 2009 EU Climate and energy package. Starting in 2014, inventory reporting will take place under this new legal instrument.

The EU GHG inventory comprises the direct 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 CO_2 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

([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 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 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.

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 and its ETC/ACM prepare the final EU GHG inventory and inventory report by 15 April for submission by the European Commission to the UNFCCC Secretariat. A resubmission is prepared by 27 May if needed.

The EU adopted the Climate and Energy Package in 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 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 non-trading sectors currently represent about 60 % of total greenhouse gas emissions.

Information on Land Use activities and 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.

In addition, all parties to the Kyoto Protocol must provide information on how they are striving to implement 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 included in Chapter 15.

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

EU-27

Total GHG emissions, without LULUCF, in the EU-27 decreased by 18.4 % between 1990 and 2011 (– 1 024 million tonnes CO_2-equivalents). Emissions decreased by 3.3 % (155.0 million tonnes CO_2-equivalents) between 2010 and 2011 (Figure ES.1).

EU-15

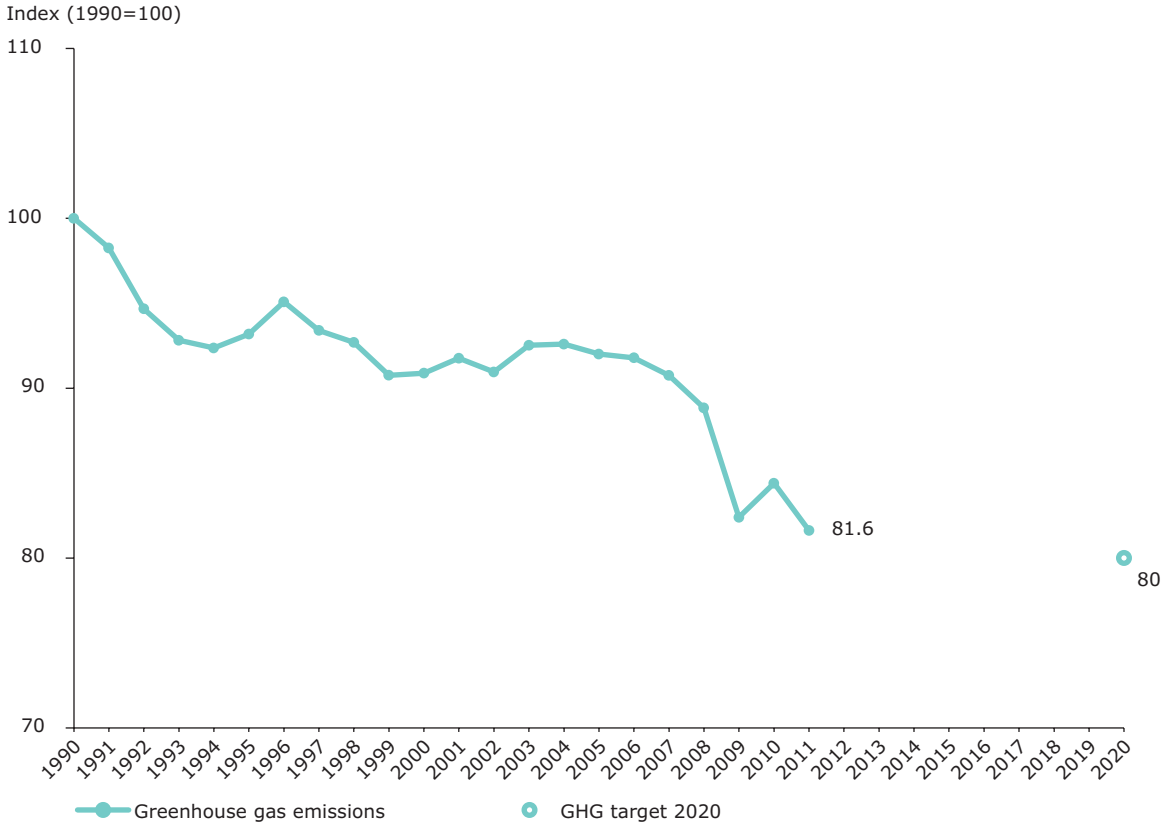
In 2011, total GHG emissions in the EU-15, without LULUCF, were 14.7 % (624 million tonnes CO_2-equivalents) below 1990 levels, and 14.9 % (635 million tonnes CO_2-equivalents) below its Kyoto base year levels. Emissions decreased by 4.2 % (159.6 million tonnes CO_2-equivalents) between 2010 and 2011.

Under the Kyoto Protocol, the EU agreed to reduce its GHG emissions by 8 % by 2008–2012 compared to its '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. Since 2009, total GHG emissions have been below the EU-15 Kyoto target (Figure ES.2).

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

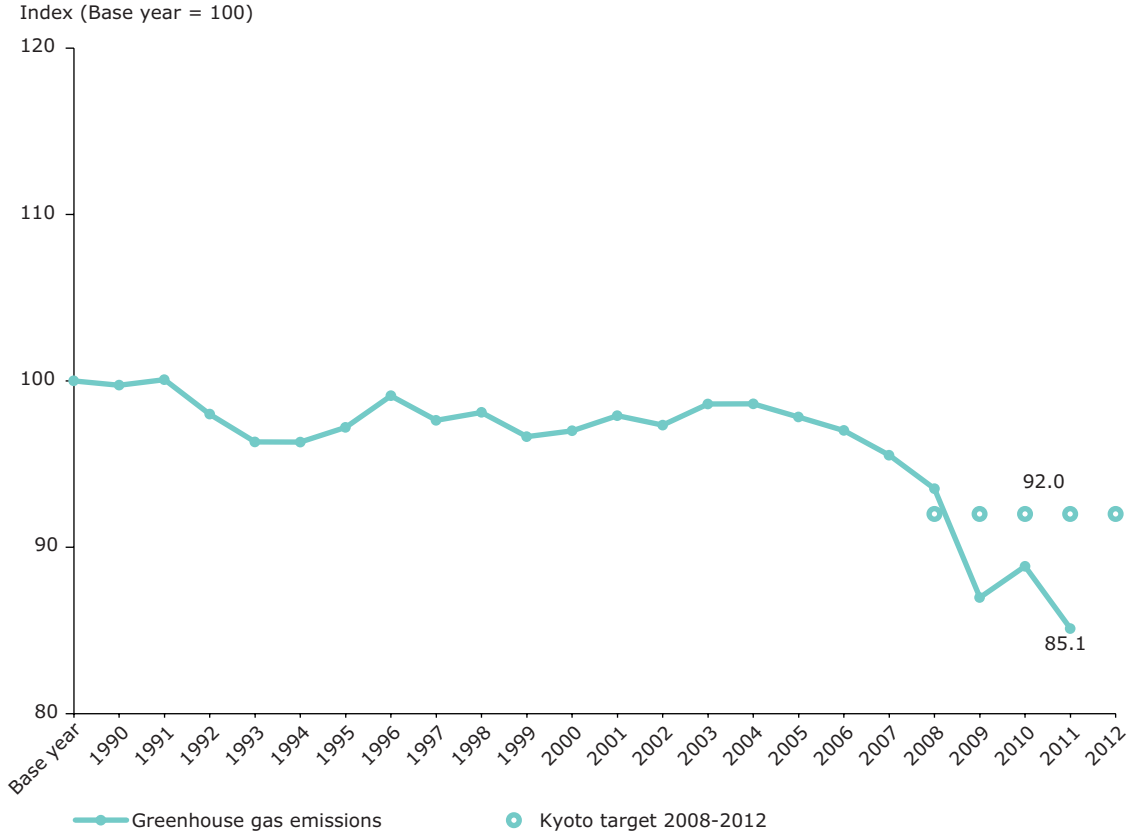
([4]) Following the UNFCCC reviews of Member States' 'initial reports' during 2007 and 2008 and pursuant to Article 3, Paragraphs 7 and 8 of the Kyoto Protocol, the base-year emissions for the EU-15 have been fixed to 4 265.5 Mt CO_2-equivalent.

Figure ES.1 EU-27 GHG emissions 1990–2011 (excluding LULUCF)



Notes: 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; nor do they include emissions from international aviation and international maritime transport. CO_2 emissions from biomass with energy recovery are reported as a Memorandum item according to 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. Note that the 80 % EU target for 2020 includes international aviation and it is therefore not directly comparable with the 1990–2011 GHG emissions shown in the graph.

Figure ES.2 EU-15 GHG emissions 1990–2011 compared with the target for 2008–2012 (excluding LULUCF)



Notes: 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; nor do they include emissions from international aviation and international maritime transport. CO_2 emissions from biomass with energy recovery are reported as a Memorandum item according to 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 Mt CO_2-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 Protocol reduction 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.

Main trends by source category, 1990–2011

Table ES.1 shows the sources with the largest contribution to the change in total GHG emissions in the EU-15 and EU-27 between 1990 and 2011. Over the 21-year period, EU-15 emissions decreased by 14.7 %, while EU-27 emissions decreased by 18.4 % (Table ES.3).

Main trends by source category, 2010–2011

Table ES.2 shows the sources making the largest contribution to the change in GHG emissions in the EU-15 and EU-27 between 2010 and 2011. This year, EU-15 emissions decreased by 4.2 %, while EU-27 emissions decreased by 3.3 % (Table ES.3).

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 1990–2011

Source category	EU-15	EU-27
	Million tonnes (CO_2-equivalent)	
Road transportation (CO_2 from 1A3b)	100.3	152.1
Consumptions of halocarbons (HFC from 2F)	69.5	80.1
Cement production (CO_2 from 2A1)		– 23.1
Production of halocarbons (HFC from 2E)	– 26.7	– 26.7
Nitric acid production (N_2O from 2B2)	– 29.8	– 40.6
Enteric fermentation (CH_4 from 4A)	– 21.4	– 47.4
Manufacture of solid fuels (CO_2 from 1A1c)	– 49.2	– 49.5
Adipic acid production (N_2O from 2B3)	– 58.2	– 59.1
Solid waste disposal on land (CH_4 from 6A)	– 66.4	– 62.7
Agricultural soils (N_2O from 4D)	– 37.3	– 68.0
1B fugitive emissions from fuels (CH_4)	– 50.4	– 73.4
Households and services (CO_2 from 1A4)	– 118.4	– 177.8
Iron and steel production (CO_2 from 1A2a +2C1)	– 47.8	– 85.4
Manufacturing industries (excl. iron and steel) (energy-related CO_2 from 1A2 excl. 1A2a)	– 128.4	– 226.6
Public electricity and heat production (CO_2 from 1A1a)	– 87.8	– 226.5
Total	**– 623.8**	**– 1 024.2**

Note: As the table only presents sectors whose emissions have increased or decreased by at least 20Mt CO_2-equivalent the sum for each country grouping EU-15/EU-27 does not match the total change listed at the bottom of the table. CO_2 emissions from 'cement production' in EU-15 fell by less than 20 million tones.

Table ES.2 Overview of EU-27 and EU-15 source categories whose emissions increased or decreased by more than 3 million tonnes CO_2-equivalents in the period 2009–2011

Source category	EU-15	EU-27
	Million tonnes (CO_2-equivalent)	
Agricultural soils (N_2O from 4D)		4.2
Solid waste disposal (CH_4 from 6A)		– 3.6
Iron and steel production (CO_2 from 1A2a +2C1)	– 4.4	– 3.6
Nitric acid production (N_2O from 2B2)	– 3.8	– 4.0
Road transportation (CO_2 from 1A3b)	– 8.6	– 8.4
Manufacturing industries (excl. iron and steel) (energy– related CO_2 from 1A2 excl. 1A2a)	– 10.5	– 10.7
Public electricity and heat production (CO_2 from 1A1a)	– 28.9	– 19.7
Households and services (CO_2 from 1A4)	– 93.9	– 104.3
Total	**– 159.6**	**– 155.0**

Note: As the table only presents sectors whose emissions have increased or decreased by at least 3 million tonnes of CO_2-equivalents, the sum for each country grouping does not match the total change listed at the bottom of the table. N_2O emissions from 'agricultural soils' in EU-15 increased by less than 3 million tonnes and CH_4 emissions from 'solid waste disposal' decreased by less than 3 million tonnes.

Main reasons for emission changes in the EU-15, 2010–2011

The 159.6 million tonne (CO_2-equivalents) decrease in GHG emissions between 2010–2011 was mainly due to the following factors (Table ES.2):

- A strong emission decrease in households and services (– 93.9 million tonnes or – 15.3 %) in almost all EU-15 Member States. Milder winter conditions and the lower demand for heating can partly explain lower emissions in 2011 compared to 2010.

- Decreasing emissions in electricity and heat production (– 28.9 million tonnes or – 3.2 %) in particular in the United Kingdom and France. In both countries, reductions in demand for electricity was accompanied by greater use of nuclear power and lower use of gas (the United Kingdom) and coal (France) for electricity generation.

- Decreasing emissions in road transportation (– 8.6 million tonnes or – 1.2 %), following a decreasing trend for the forth consecutive year, which was driven by reductions in both passenger and freight transportation.

- Reduced emissions in the category 'manufacturing industries excluding iron and steel industry' (– 10.5 million tonnes or – 2.8 %) in particular in Greece, Italy, Portugal, Spain and the United Kingdom. The main reasons were a decline in cement production (Greece, Portugal, Spain, and Italy) and a fuel shift from oil to natural gas in the UK manufacturing industry.

- A slight decrease in emissions from iron and steel production (– 4.4 million tonnes or – 3 %) following a substantial increase in emissions in 2010 (+ 29.6 million tonnes or + 25.8 %), which was caused by a significant increase in crude steel production due to the recovery from the economic crisis.

- A substantial decrease in emissions from nitric acid production (– 3.8 million tonnes or – 40 %) mainly driven by decreases in Belgium, France and the United Kingdom.

For the EU-27, GHG emissions decreased by 3.3 % in 2011. This decrease in emissions came amid positive economic growth in most EU Member States between 2010 and 2011. GDP increased by 1.6 % in the EU-27, although economic growth was lower than in 2010. A milder 2011 winter compared to 2010 can partly explain lower fossil fuel emissions, as higher winter temperatures, on average, led to lower heating demand and lower emissions from the residential and commercial sectors. The number of heating degree days (an indicator of household demand for heating) fell by about 10 % in 2011 compared to 2010, as reported by Eurostat. In general, GHG emissions decreased in the majority of key sectors in 2011, particularly those relying on fossil fuel combustion. On average, the total consumption of fossil fuels decreased by 5 % in the EU 27. There was, however, an increase in the carbon intensity of fossil fuels at EU level, which prevented GHG emissions from decreasing more in 2011. The use of solid fuels, such as hard coal and lignite, increased by 1.8 %, whereas the use of liquid fuels decreased by 4 %. The consumption of natural gas fell starkly by 10.6 % in 2011. The contribution of renewables was significantly lower than in previous years. Biomass combustion increased by less than 1 % in the EU-27 in 2011 and hydroelectricity production contracted by 16 % in 2011. Wind and solar, however, continued increasing strongly in 2011. Nuclear electricity consumption also declined in the EU-27 in 2011 compared to 2010, mainly due to a very strong reduction in Germany.

For a detailed analysis, see *Why did greenhouse gas emissions decrease in the EU in 2011? EEA analysis*, which will be available from 29 May 2013 at http://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2013.

Table ES.3 Greenhouse gas emissions in CO_2-equivalents (excluding LULUCF) and Kyoto Protocol targets for 2008–2012

Member State	1990	Kyoto Protocol base year ([a])	2011	2010–2011	Change 2010–2011	Change 1990–2011	Change base year–2011	Targets 2008–2012 under Kyoto Protocol and 'EU burden sharing'
	(million tonnes)	(million tonnes)	(million tonnes)	(million tonnes)	(%)	(%)	(%)	(%)
Austria	78.2	79.0	82.8	– 2.2	– 2.6	6.0	4.8	– 13.0
Belgium	143.1	145.7	120.2	– 11.6	– 8.8	– 16.0	– 17.5	– 7.5
Denmark	68.7	69.3	56.2	– 5.0	– 8.1	– 18.1	– 18.9	– 21.0
Finland	70.4	71.0	67.0	– 7.5	– 10.1	– 4.9	– 5.6	0.0
France	556.4	563.9	485.5	– 28.7	– 5.6	– 12.7	– 13.9	0.0
Germany	1250.3	1232.4	916.5	– 27.0	– 2.9	– 26.7	– 25.6	– 21.0
Greece	104.6	107.0	115.0	– 2.2	– 1.9	10.0	7.5	25.0
Ireland	55.2	55.6	57.5	– 4.0	– 6.5	4.1	3.4	13.0
Italy	519.0	516.9	488.8	– 11.5	– 2.3	– 5.8	– 5.4	– 6.5
Luxembourg	12.9	13.2	12.1	– 0.15	– 1.3	– 6.2	– 8.1	– 28.0
Netherlands	211.8	213.0	194.4	– 14.8	– 7.1	– 8.2	– 8.8	– 6.0
Portugal	61.0	60.1	70.0	– 1.4	– 2.0	14.8	16.4	27.0
Spain	282.8	289.8	350.5	1.8	0.5	23.9	21.0	15.0
Sweden	72.8	72.2	61.4	– 4.0	– 6.2	– 15.5	– 14.8	4.0
United Kingdom	767.3	776.3	552.6	– 41.3	– 7.0	– 28.0	– 28.8	– 12.5
EU-15	**4254.5**	**4265.5**	**3630.7**	**– 159.6**	**– 4.2**	**– 14.7**	**– 14.9**	**– 8.0**
Bulgaria	109.5	132.6	66.1	5.8	9.6	– 39.6	– 50.1	– 8.0
Cyprus	6.1	Not applicable	9.2	– 0.3	– 3.1	50.3	Not applicable	Not applicable
Czech Republic	196.0	194.2	133.5	– 3.9	– 2.9	– 31.9	– 31.3	– 8.0
Estonia	40.5	42.6	21.0	1.0	4.8	– 48.3	– 50.8	– 8.0
Hungary	99.0	115.4	66.1	– 1.8	– 2.6	– 33.2	– 42.7	– 6.0
Latvia	26.3	25.9	11.5	– 0.5	– 4.5	– 56.3	– 55.6	– 8.0
Lithuania	48.8	49.4	21.6	0.5	2.3	– 55.7	– 56.3	– 8.0
Malta	2.0	Not applicable	3.0	0.02	0.8	50.6	Not applicable	Not applicable
Poland	457.0	563.4	399.4	– 2.3	– 0.6	– 12.6	– 29.1	– 6.0
Romania	244.4	278.2	123.3	6.7	5.8	– 49.5	– 55.7	– 8.0
Slovakia	71.8	72.1	45.3	– 0.6	– 1.3	– 36.9	– 37.1	– 8.0
Slovenia	18.4	20.4	19.5	0.0	0.1	5.8	– 4.1	– 8.0
EU-27	**5574.4**	**Not applicable**	**4550.2**	**– 155.0**	**– 3.3**	**– 18.4**	**Not applicable**	**Not applicable**

Note: ([a]) As Cyprus, Malta and the EU-27 do not have targets under the Kyoto Protocol's first commitment period, they do not have applicable Kyoto Protocol base years..

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 1990–2011. The most important GHG by far is CO_2, accounting for 82.3 % of total EU-27 emissions in 2011 excluding LULUCF. In 2011, EU-27 CO_2 emissions without LULUCF were 3 743Tg, which was 15.1 % below 1990 levels. Compared to 2010, CO_2 emissions decreased by 3.8 %. Emissions of CH_4 and N_2O decreased in 2011, while HFCs and PFCs increased in 2011.

EU-15

Table ES.5 gives an overview of the main trends in EU-15 GHG emissions and removals for 1990–2011. In the EU-15, the most important GHG is also CO_2, accounting for 82.7 % of total EU-15 emissions in 2011. In 2011, EU-15 CO_2 emissions without LULUCF were 3 003 Tg, which was 10.8 % below 1990 levels. Compared to 2010, CO_2 emissions decreased by 4.8 %. As in the EU-27, CH_4 and N_2O emissions decreased in the last year, whereas HFC emissions increased in 2011.

Table ES.4 Overview of EU-27 GHG emissions and removals from 1990 to 2011 in CO_2-equivalents (Tg)

Greenhouse gas emissions	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011
Net CO_2 emissions/removals	4 143	3 851	3 822	3 963	3 944	3 927	3 790	3 449	3 595	3 445
CO_2 emissions (without LULUCF)	4 407	4 139	4 112	4 246	4 250	4 196	4 101	3 770	3 891	3 743
CH_4	596	535	480	428	422	415	409	400	397	389
N_2O	522	462	417	389	376	376	367	346	336	335
HFCs	28	40	47	61	64	69	72	76	80	81
PFCs	20	14	10	6	5	5	4	3	3	4
SF_6	11	15	10	8	8	7	7	6	7	6
Total (with net CO_2 emissions/removals)	5 320	4 918	4 786	4 856	4 819	4 799	4 650	4 280	4 417	4 260
Total (without CO_2 from LULUCF)	5 584	5 205	5 076	5 138	5 126	5 068	4 961	4 602	4 714	4 558
Total (without LULUCF)	5 574	5 195	5 066	5 129	5 117	5 059	4 952	4 593	4 705	4 550

Table ES.5 Overview of EU-15 GHG emissions and removals from 1990 to 2011 in CO_2-equivalents (Tg)

Greenhouse gas emissions	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011
Net CO_2 emissions/removals	3 224	3 128		3 319	3 282	3 249	3 143	2 876	2 980	2 823
CO_2 emissions (without LULUCF)	3 367	3 298	3 373	3 484	3 467	3 408	3 332	3 067	3 155	3 003
CH_4	438	410	369	320	313	308	304	298	296	289
N_2O	400	379	339	308	295	294	286	275	266	264
HFCs	28	40	45	54	56	59	63	66	69	71
PFCs	17	12	8	5	5	5	4	3	3	3
SF_6	11	15	10	8	7	7	6	6	6	6
Total (with net CO_2 emissions/removals)	4 118	3 984	3 960	4 014	3 959	3 922	3 806	3 524	3 620	3 457
Total (without CO_2 from LULUCF)	4 261	4 154	4 144	4 179	4 144	4 081	3 995	3 716	3 796	3 636
Total (without LULUCF)	4 255	4 146	4 138	4 173	4 138	4 075	3 989	3 710	3 790	3 631

EA.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 1990–2011. The most important sector by far is Energy (i.e. combustion and fugitive emissions) accounting for 79.4 % of total EU-27 emissions in 2011. The second largest sector is Agriculture (10.1 %), followed by Industrial Processes (7.3 %).

EU-15

Table ES.7 gives an overview of EU-15 GHG emissions in the main source categories for 1990–2011. More detailed trend descriptions are included in Chapters 3 to 9.

Table ES.6 Overview of EU-27 GHG emissions in the main source and sink categories from 1990 to 2011 in CO_2-equivalents (Tg)

GHG source and sink	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011
1. Energy	4 297	4 029	3 981	4 084	4 080	4 015	3 936	3 659	3 763	3 614
2. Industrial processes	458	437	390	403	400	412	388	323	335	332
3. Solvent and other product use	17	14	13	12	12	12	11	10	10	10
4. Agriculture	600	517	505	478	474	475	474	463	460	461
5. Land use, land-use change and forestry	– 255	– 277	– 280	– 273	– 298	– 260	– 303	– 313	– 288	– 290
6. Waste	204	198	177	152	150	146	142	139	137	133
7. Other	0	0	0	0	0	0	0	0	0	0
Total (with net CO_2 emissions/removals)	5 320	4 918	4 786	4 856	4 819	4 799	4 650	4 280	4 417	4 260
Total (without LULUCF)	5 574	5 195	5 066	5 129	5 117	5 059	4 952	4 593	4 705	4 550

Table ES.7 Overview of EU-15 GHG emissions in the main source and sink categories from 1990 to 2011 in CO_2-equivalents (Tg)

GHG source and sink	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011
1. Energy	3 282	3 206	3 259	3 348	3 329	3 265	3 200	2 972	3 048	2 898
2. Industrial processes	353	350	310	311	303	308	292	254	261	253
3. Solvent and other product use	13	12	11	10	10	9	9	8	8	8
4. Agriculture	433.9	412	413.4	385	380.1	380	379.0	370	369.5	370
5. Land use, land-use change and forestry	– 137	– 163	– 177	– 159	– 180	– 153	– 183	– 186	– 170	– 174
6. Waste	172	166	144	119	116	113	109	106	104	102
7. Other	0	0	0	0	0	0	0	0	0	0
Total (with net CO_2 emissions/removals)	4 118	3 984	3 960	4 014	3 959	3 922	3 806	3 524	3 620	3 457
Total (without LULUCF)	4 255	4 146	4 138	4 173	4 138	4 075	3 989	3 710	3 790	3 631

ES.5 Summary of EU Member State emission trends

Table ES.8 gives an overview of Member State contributions to EU GHG emissions for 1990–2011. 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, accounting for about one third of total EU-27 GHG emissions. These two Member States have achieved total GHG emission reductions in 2011 of 549 million tonnes of CO_2-equivalents compared to 1990 ([5]).

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 N_2O emission reduction measures in the production of adipic acid.

Table ES.8 Overview of Member State contributions to EU GHG emissions (excluding LULUCF) from 1990 to 2011 in CO_2-equivalents (Tg)

Member State	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011
Austria	78	80	80	93	90	87	87	80	85	83
Belgium	143	150	146	143	139	134	137	124	132	120
Denmark	69	76	68	64	72	67	64	61	61	56
Finland	70	71	69	69	80	78	70	66	75	67
France	556	552	559	558	546	536	531	508	514	486
Germany	1 250	1 118	1 041	998	1 000	976	975	911	944	916
Greece	105	109	126	135	131	134	130	124	117	115
Ireland	55	59	68	69	69	68	68	62	61	58
Italy	519	530	551	574	564	555	541	491	500	489
Luxembourg	13	10	10	13	13	12	12	12	12	12
Netherlands	212	223	213	209	206	204	203	198	209	194
Portugal	61	72	84	88	83	81	78	75	71	70
Spain	283	313	379	433	424	432	399	363	349	350
Sweden	73	74	69	67	67	66	63	59	65	61
United Kingdom	767	709	674	658	654	644	630	577	594	553
EU-15	**4 255**	**4 146**	**4 138**	**4 173**	**4 138**	**4 075**	**3 989**	**3 710**	**3 790**	**3 631**
Bulgaria	110	76	60	64	65	68	67	58	60	66
Cyprus	6	7	9	9	10	10	10	10	9	9
Czech Republic	196	151	146	145	147	148	142	133	137	133
Estonia	41	20	17	18	18	21	20	16	20	21
Hungary	99	80	78	79	78	76	74	67	68	66
Latvia	26	13	10	11	12	12	12	11	12	11
Lithuania	49	22	20	23	24	26	25	20	21	22
Malta	2	2	3	3	3	3	3	3	3	3
Poland	457	432	385	390	406	408	400	381	402	399
Romania	244	173	134	142	146	143	140	120	117	123
Slovakia	72	53	49	51	51	49	49	44	46	45
Slovenia	18	19	19	20	21	21	21	19	19	20
EU-27	**5 574**	**5 195**	**5 066**	**5 129**	**5 117**	**5 059**	**4 952**	**4 593**	**4 705**	**4 550**

([5]) The EU-15 as a whole needs emission reductions of total GHG 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.

France and Italy were the third- and fourth-largest emitters in 2011, with a share of 10.7 % each. Italy's GHG emissions were 5.8 % below 1990 levels in 2011. Italian GHG emissions increased from 1990, due primarily to increases in road transport, electricity and heat production, and petroleum refining. However, Italian emissions decreased significantly from 2004. France's emissions were 12.7 % below 1990 levels in 2011. In France, large reductions were achieved in N_2O emissions from adipic acid production, but CO_2 emissions from road transport and HFC emissions from consumption of halocarbons increased considerably between 1990 and 2011.

Poland and Spain are the fifth- and sixth-largest emitters in the EU-27, accounting for 8.8 % and 7.7 % of total EU-27 GHG emissions in 2011. Spain increased emissions by almost 24 % between 1990 and 2011. This was largely due to emission increases from road transport, electricity and heat production, and manufacturing industries. Poland decreased GHG emissions by 12.6 % between 1990 and 2011 (– 29.1 % since the base year, which in the case of Poland is 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 increased constantly between 1992 and 2007. Emissions decreased between 2007 and 2010 in the EU-27, partly reflecting the economic recession, but have increased again in 2011. EU greenhouse gas emissions from international aviation are lower than for international maritime transport, but were growing more rapidly until 2007. The average annual EU-27 growth rates in emissions since 1990 were 3.3 % and 2.0 %, respectively. Total GHG emissions from international transport reached 299 million of CO_2-equivalents in 2011.

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 of CO_2-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 EU Member States' GHG inventories in 2013, total EU-15 GHG emissions in 2010 were 0.2 % lower than reported in 2012 GHG inventories. Total EU-15 emissions in 1990 reported in 2012 GHG inventories were 0.1 % higher than 1990 emissions reported in 2012 inventories.

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	1990		Main recalculation
		Gg CO_2-equivalent	%	
1A1_Energy industries CO_2	United Kingdom	– 1 030	– 0.4	Updated emission factor for combustion at gas separation plant under 1A1c.
1A2_Manufacturing industries and construction CO_2	France	2 489	3.0	La prise en compte des données individuelles pour le calcul des émissions de CO_2, CH_4 et N_2O dans différents secteurs de la combustion pour les procédés énergétiques avec contact, afin d'obtenir des facteurs d'émission rapportés à la consommation de combustibles et non plus à la production. Ce travail nécessite d'être affiné l'année prochaine.
1A2_Manufacturing industries and construction CO_2	United Kingdom	2 212	2.2	Liquid fuels: Addition of estimates of emissions from combustion of byproducts at ethylene crackers following UNFCCC review.
4A_Enteric fermentation CH_4	Germany	2 890	10.8	New national method in 4.A Enteric Fermentation \ Cattle \ Option A \ Dairy Cattle Re-allocation within the cattle category in 4.A Enteric Fermentation \ Cattle \ Option A \ Non-Dairy Cattle Updated "piglets per sow" ratio in 4.A Enteric Fermentation \ Swine.
4B_Manure management CH_4	Spain	1 242	31.6	New national methodology for Cattle introduced that also includes new information regarding manure management systems.
4B_Manure management CH_4	France	– 3 979	– 32.4	"Les séries statistiques de 1990 à 2011 portant sur les effectifs animaux ont été modifiées suite au Recensement Agricole de 2010. Ces modifications ont eu un impact sur les données d'activités et sur les facteurs d'émissions pour les catégories animales agrégées. Les VS des bovins ont été mis à jour suite à la livraison des premiers résultats de l'étude MONDFERENT. Cette mise à jour méthodologique permet d'améliorer la transparence de la méthode et s'accompagne d'une mise en cohérence des calculs d'émissions de méthane entérique et de méthane liées à la gestion des déjections. Les valeurs utilisées pour le paramètre FCM ont été modifiées, passant d'un climat « tempéré » à un climat « froid » pour la métropole, suite à la revue ESD de l'année 2012."
4B_Manure management N_2O	Germany	1 348	52.5	"New emission factor in 4.B Manure Management \ Solid storage and dry lot. Digesters are now part of liquid systems in 4.B Manure Management \ Liquid system."
6B_Waste water handling CH_4	United Kingdom	1 398	502.4	Consultation with water companies has lead to updated data.

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 2010

Source catagory	Member State	2010		Explanation for recalculation
		Gg CO_2-equivalent	%	
1A1_Energy industries CO_2	Germany	2 677	0.8	Final data available from the national energy balance.
1A2_Manufacturing industries and construction CO_2	United Kingdom	3 047	4.6	Liquid fuels: Addition of estimates of emissions from combustion of byproducts at ethylene crackers following UNFCCC review.
1A2_Manufacturing industries and construction CO_2	Spain	– 3 780	– 6.1	El cambio de alcance más relevante es la revisión sistemática que se hace del balance de combustibles que se utiliza específicamente para el inventario de emisiones. Debe reseñarse aquí que para el último año de cada edición del inventario sólo se dispone de los cuestionarios energéticos internacionales, y de éstos a veces sólo un avance, lo que implica en general que en la edición del año siguiente deban ser revisadas las cifras que en el año anterior se habían tomado de dichos cuestionarios al disponerse en este momento posterior de la información de los propios balances energéticos de AIE y EUROSTAT.
1A3_Transport CO_2	Belgium	2 858	11.9	Final energy balance available; Liquid Fuels: Copert EFs according ICR.
1A3_Transport CO_2	United Kingdom	– 1 578	– 1.3	Liquid fuels: Updated fleet composition and vkm data.
1A4_Other sectors CO_2	Germany	4 617	3.2	Gaseous fuels: final data available from the national energy balance.
1A4_Other sectors CO_2	France	1 844	1.8	Pour tout le secteur, les consommations de combustibles ont été mises à jour. De plus, la répartition des consommations entre les secteurs résidentiel et tertiaire a été modifiée, entrainant un ajustement des émissions de l'année 2010 touchant principalement le CO_2 (– 1,38 Tg pour le tertiaire, + 2,84 Tg pour le résidentiel, + 0,39 Tg pour l'agriculture et la pêche).
1A4_Other sectors CO_2	Belgium	– 2 208	– 6.8	'Brussels: new OFFREM run. Flanders: integration of results from a new survey (automn 2012) RBC: update (validation) of the 2010 regional energy balance. Final EB for Wallonia and Flanders (– 19,5 PJ for Flanders).'
2B_Chemical industries CO_2	Belgium	– 1 387	– 44.0	'Flanders: optimisation emissions 2010 for cat. 2B5/other (completed survey by the industry). Flanders: re-allocation of some emission to flaring from 2B5 to 6C2 flaring (complete timeseries, 592 kton CO_2 in 2010).'
2C_Metal production CO_2	France	1 170	34.0	Les consommations d'énergie et matière fournies par la FFA ont été mises à jour pour 2010. De plus, une modification des teneurs en carbone des combustibles et matières premières, à partir de la moyenne 2001–2008 calculée grâce aux bilans de la Fédération Française de l'Acier, entrainent des modifications des émissions de CO2 sur toute la période (+ 0,15 Tg CO_2 en 1990, + 1,25 Tg CO_2 en 2010).
2F_Consumption of halocarbons HFC	France	– 1 784	– 10.7	"Toute la période d'inventaire a été revue suite à l'étude de EReIE réalisée en 2012. Un nouveau type de HFC, le HFC-245fa, est rapporté. Celui-ci apparait sous l'appellation « Unspecified mix of HFCs » dans la Table2(II).Fs1. D'importantes modifications ont eu lieu suite à la mise en place d'une nouvelle méthodologie de calcul des émissions d'aérosols techniques et à de nouvelles données de ventes pour les aérosols pharmaceutiques."
2F_Consumption of halocarbons HFC	Germany	– 2 634	– 23.4	Implementation of an improved calculation method with new data sources and changed EFs.
4A_Enteric fermentation CH_4	Spain	– 1 433	– 11.6	New national methodology introduced.
4B_Manure management CH_4	Spain	1 158	21.4	New national methodology for Cattle introduced that also includes new information regarding manure management systems.

Table ES.10 Overview of major recalculations in the EU-15 in 2010 (cont.)

Source catagory	Member State	2010		Explanation for recalculation
		Gg CO_2-equivalent	%	
4B_Manure management CH_4	France	– 3 596	– 26.5	"Les séries statistiques de 1990 à 2011 portant sur les effectifs animaux ont été modifiées suite au Recensement Agricole de 2010. Ces modifications ont eu un impact sur les données d'activités et sur les facteurs d'émissions pour les catégories animales agrégées. Les VS des bovins ont été mis à jour suite à la livraison des premiers résultats de l'étude MONDFERENT. Cette mise à jour méthodologique permet d'améliorer la transparence de la méthode et s'accompagne d'une mise en cohérence des calculs d'émissions de méthane entérique et de méthane liées à la gestion des déjections. Les valeurs utilisées pour le paramètre FCM ont été modifiées, passant d'un climat « tempéré » à un climat « froid » pour la métropole, suite à la revue ESD de l'année 2012."
6A_Solid waste disposal on land CH_4	Germany	3 045	34.0	New statistical data for CH4-recovery.
6A_Solid waste disposal on land CH_4	France	– 6 587	– 42.1	La soumission précédente était basée sur le principe d'une non prise en compte du captage faute de pouvoir l'estimer sur la base des mesures comme demandé par l'équipe de revue CCNUCC de septembre 2010. Suite à l'enquête auprès des ISDND, l'estimation 2013 intègre la prise en compte du captage du biogaz généré et sa combustion en torchères ou installations de valorisation.
6B_Waste water handling CH_4	United Kingdom	1 276	377.9	Consultation with water companies has lead to updated data.
6B_Waste water handling CH_4	Spain	– 1 651	– 70.1	New information available about domestic and commercial wastewater.

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

ES.8 Information on indirect greenhouse gas emissions

Emissions of CO, NO_x, NMVOC and SO_2 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 SO_2 emissions in the EU-15 between 1990–2011. All emissions were reduced significantly from 1990 levels: the largest reduction was achieved in SO_2 (– 85 %), followed by CO (– 67 %), NMVOC (– 57 %) and NO_x (– 49 %).

In the EU-27, SO_2 emissions decreased by 78 %, followed by CO (–64 %), NMVOC (– 55 %) and NO_x (– 48 %) (Table ES.12).

EU Member States also annually report emissions of these same substances to the United Nations Economic Commission for Europe (UNECE) Convention on Long-Range Transboundary Air Pollution (LRTAP). The Member States also report emissions of NO_x, NMVOCs and SO_2 under the EU's National Emissions Ceilings Directive (NECD).

Table ES.11 Overview of EU-15 indirect GHG and SO_2 emissions for 1990–2011 (Gg)

Greenhouse gas emissions	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011
					(Gg)					
NO_x	13 673	12 023	10 490	9 482	9 175	8 866	8 140	7 453	7 246	6 966
CO	53 825	42 345	31 937	23 992	22 568	22 087	20 478	18 419	19 239	17 844
NMVOC	15 270	12 596	10 237	8 385	8 239	7 621	7 178	6 824	6 751	6 549
SO_2	16 459	9 986	6 144	4 572	4 353	4 142	3 090	2 668	2 451	2 390

Table ES.12 Overview of EU-27 indirect GHG and SO_2 emissions for 1990–2011 (Gg)

Greenhouse gas emissions	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011
					(Gg)					
NO_x	16 996	14 676	12 674	11 573	11 292	10 938	10 125	9 284	9 145	8 821
CO	66 440	51 296	38 708	30 561	29 226	28 526	27 121	24 839	25 882	24 103
NMVOC	17 845	14 411	11 873	9 975	9 847	9 182	8 749	8 267	8 225	7 993
SO_2	25 204	16 733	10 401	8 243	8 074	7 743	6 375	5 616	5 434	5 616

ES.9 Information on using EU ETS 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 CO_2 emissions from energy and industrial processes. All 27 Member States indicated that they used ETS data at least for quality assurance/quality control purposes and checked data consistency between both sources (Section 1.3.2 and Section 16.2.2).

Fourteen Member States indicated that they directly use the verified emissions reported by installations under the ETS. Twenty-one Member States used ETS data to improve country-specific emission factors and 17 Member States reported that they used activity data (e.g. fuel use) provided under the ETS in the 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 improved allocation of emissions to correct CRF source categories.

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