

# Annual European Union greenhouse gas inventory 1990–2012 and inventory report 2014

Submission to the UNFCCC Secretariat

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The full report and annexes are available at:

<http://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2014>

# 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 for emissions and removals 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 8 May 2014. Under the Kyoto Protocol's first commitment period, the EU-15 took on a common commitment to reduce emissions by 8 % between 2008 and 2012 compared to emissions in the 'base year' <sup>(1)</sup>. The EU-28 does not have a common target under the Kyoto Protocol's first commitment period in the same way as the EU-15.

The legal basis for the compilation of the EU inventory is Regulation (EU) 525/2013 on a mechanism for monitoring and reporting GHG emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC <sup>(2)</sup>.

This Regulation establishes a mechanism for:

- (a) ensuring the timeliness, transparency, accuracy, consistency, comparability and completeness of reporting by the Union and its Member States to the UNFCCC Secretariat;
- (b) reporting and verifying information relating to commitments of the Union and its Member States pursuant to the UNFCCC, to the Kyoto Protocol and to decisions adopted thereunder, and evaluating progress towards meeting those commitments;

- (c) monitoring and reporting all anthropogenic emissions by sources and removals by sinks of GHGs not controlled by the Montreal Protocol on substances that deplete the ozone layer in Member States;
- (d) monitoring, reporting, reviewing and verifying GHG emissions and other information pursuant to Article 6 of Decision No 406/2009/EC;
- (e) reporting the use of revenue generated by auctioning allowances under Article 3d(1) or (2) or Article 10(1) of Directive 2003/87/EC, pursuant to Article 3d(4) and Article 10(3) of that directive;
- (f) monitoring and reporting on the actions taken by Member States to adapt to the inevitable consequences of climate change in a cost-effective manner;
- (g) evaluating progress by the Member States towards meeting their obligations under Decision No 406/2009/EC.

The new Monitoring Mechanism Regulation 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 takes place under this new legal instrument, which replaces and expands the previous Monitoring Mechanism Decision 280/2004/EC <sup>(3)</sup>. More information on the changes to the EU national system, including the legal base, can be found in Chapter 13.

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-28. Energy data from Eurostat are used for the reference approach for CO<sub>2</sub> emissions from fossil fuels developed by the Intergovernmental Panel on Climate Change (IPCC).

<sup>(1)</sup> For the EU-15, the base year for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O 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.

<sup>(2)</sup> OJ L 165, 18/06/2013, p. 13–40 [http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:JOL\\_2013\\_165\\_R\\_0013\\_01](http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:JOL_2013_165_R_0013_01).

<sup>(3)</sup> Decision No 280/2004/EC of the European Parliament and of the Council of 11 February 2004 concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol <http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1397464097337&uri=CELEX:32004D0280>, O.J. 49, 19/02/2004, p. 1–8.

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 indicated below.

1. Member States submit their annual GHG inventories by 15 January each year to the European Commission, DG CLIMA, with a copy to the EEA.
2. 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.
3. 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.
4. 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.
5. 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 % by 2020, compared with 1990 levels<sup>(4)</sup>, and agreed to a conditional offer to move to a 30 % reduction provided that other developed countries commit themselves to comparable emission reductions and developing countries contribute adequately according to their responsibilities and respective capabilities.

The main instruments to reduce emissions under the Climate and Energy Package are:

- 1) the EU Emissions Trading System<sup>(5)</sup>, covering more than 11 000 power stations and industrial plants in 31 countries, as well as airlines; and
- 2) the Effort Sharing Decision<sup>(6)</sup> for sectors not included under the EU emissions trading system (EU ETS).

Both trading (i.e. EU ETS) and non-trading sectors are to 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 GHG 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.

<sup>(4)</sup> All emission information for EU-28 in this report uses 1990 as the starting point when addressing emission reductions. EU-28 does not have a common target under the Kyoto Protocol in the same way as EU-15.

<sup>(5)</sup> See [http://ec.europa.eu/clima/policies/ets/index\\_en.htm](http://ec.europa.eu/clima/policies/ets/index_en.htm).

<sup>(6)</sup> See [http://ec.europa.eu/clima/policies/effort/index\\_en.htm](http://ec.europa.eu/clima/policies/effort/index_en.htm).

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

### EU-28

Total GHG emissions, without LULUCF, in the EU-28 decreased by 19.2 % between 1990 and 2012 (– 1 082 million tonnes CO<sub>2</sub>-equivalents). Emissions decreased by 1.3 % (59 million tonnes CO<sub>2</sub>-equivalents) between 2011 and 2012 (Figure ES.1).

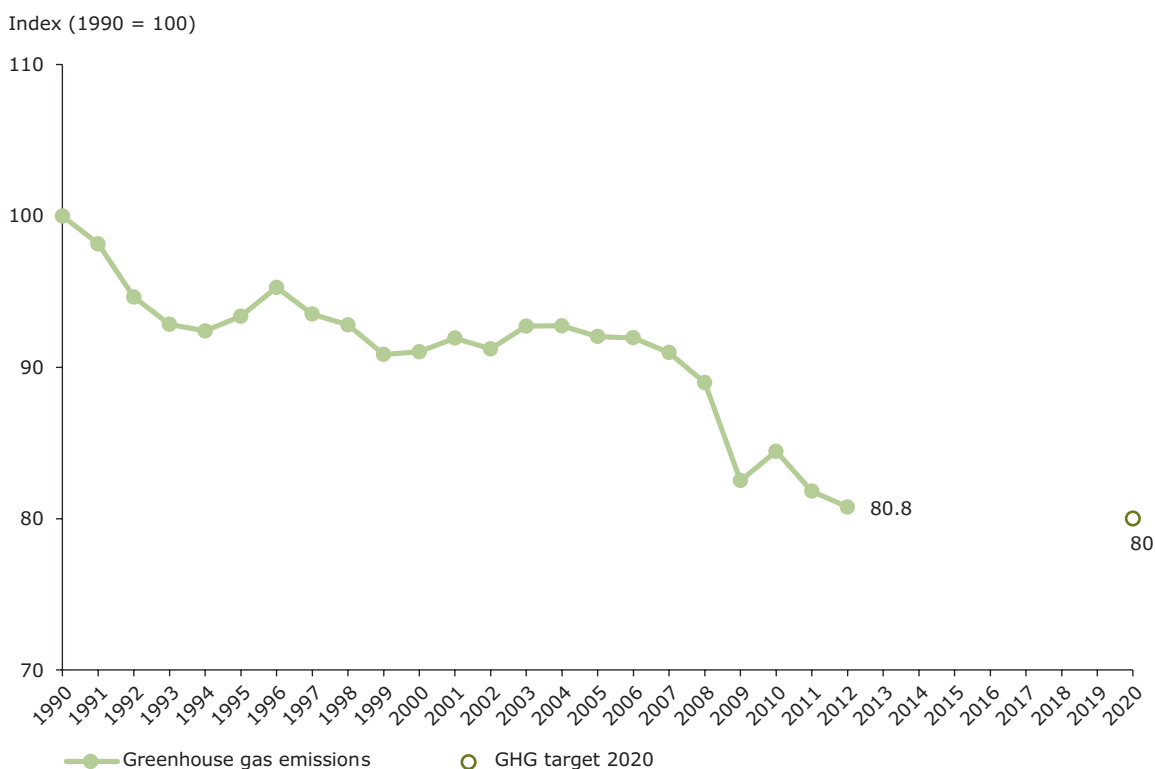
### EU-15

In 2012, total GHG emissions in the EU-15, without LULUCF, were 15.1 % (642 million tonnes CO<sub>2</sub>-equivalents) below 1990 levels, and 15.1 % (646 million tonnes CO<sub>2</sub>-equivalents) below its

Kyoto base-year levels. Emissions decreased by 0.8 % (30 million tonnes CO<sub>2</sub>-equivalents) between 2011 and 2012.

The 15 EU Member States that were members of the EU when the Kyoto Protocol was agreed in 1997 decided to fulfil their commitments for the first commitment period jointly and to reduce the GHG emissions by 8 % by 2008–2012 compared to the EU-15 'base year'. This can be achieved by a combination of 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). Over the entire first commitment period (2008–2012), the EU-15 average emissions stood at 11.8 % below base-year levels. This reduction does not take into account carbon sinks from LULUCF activities, nor the additional use of flexible mechanisms.

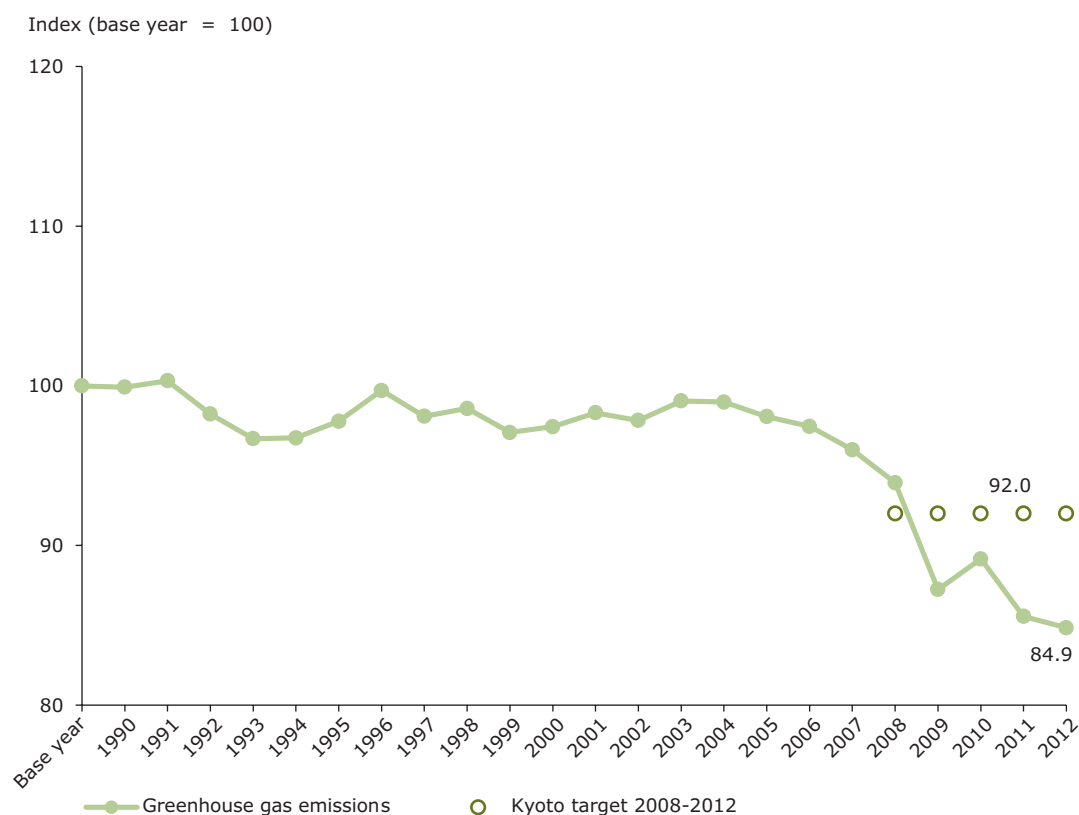
**Figure ES.1 EU-28 GHG emissions 1990–2012 (excl. LULUCF)**



**Notes:** GHG emission data for the EU-28 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<sub>2</sub> 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. Note that the 80 % EU target for 2020, under the EU Climate and Energy Package, includes international aviation and it is therefore not directly comparable with the 1990–2012 GHG emissions shown in the graph.



**Figure ES.2 EU-15 GHG emissions 1990–2012 compared with target for 2008–2012 (excl. 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<sub>2</sub> 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<sub>2</sub>-equivalent. The EU-15 would need to reduce GHG 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, 1990–2012*

Table ES.1 shows the sources with the largest contribution to the change in total GHG emissions in the EU-15 and EU-28 between 1990 and 2012.

*Main trends by source category, 2011–2012*

Table ES.2 shows the sources making the largest contribution to the change in GHG emissions in the EU-15 and EU-28 between 2011 and 2012.

**Table ES.1 Overview of EU-28 and EU-15 source categories whose emissions increased or decreased by more than 20 million tonnes CO<sub>2</sub>-equivalents in the period 1990–2012**

Source category	EU-15	EU-28
	Million tonnes (CO <sub>2</sub> -equivalent)	
Road transportation (CO <sub>2</sub> from 1A3b )	72	123
Consumptions of halocarbons (HFC from 2F)	71	85
Enteric fermentation (CH <sub>4</sub> from 4A)	- 21	- 48
Cement production (CO <sub>2</sub> from 2A1)	- 23	- 28
Production of halocarbons (HFC from 2E)	- 27	- 27
Nitric acid production (N <sub>2</sub> O from 2B2)	- 30	- 42
Agricultural soils (N <sub>2</sub> O from 4D)	- 41	- 74
Fugitive emissions from fuels (CH <sub>4</sub> from 1B)	- 49	- 73
Iron and steel production (CO <sub>2</sub> from 1A2a +2C1)	- 54	- 98
Manufacture of solid fuels (CO <sub>2</sub> from 1A1c)	- 58	- 59
Adipic acid production (N <sub>2</sub> O from 2B3)	- 58	- 59
Public electricity and heat production (CO <sub>2</sub> from 1A1a)	- 61	- 214
Solid waste disposal on land (CH <sub>4</sub> from 6A)	- 66	- 61
Households and services (CO <sub>2</sub> from 1A4)	- 78	- 137
Manufacturing industries (excl. iron and steel) (energy-related CO <sub>2</sub> from 1A2 excl. 1A2a)	- 151	- 258
<b>Total</b>	<b>- 643</b>	<b>- 1 082</b>

**Note:** As the table only presents sectors whose emissions have increased or decreased by at least 20 million tonnes CO<sub>2</sub>-equivalent, the sum for each country grouping EU-15/EU-28 do not match the total change listed at the bottom of the table.

**Table ES.2 Overview of EU-28 and EU-15 source categories whose emissions increased or decreased by more than 3 million tonnes CO<sub>2</sub>-equivalents in the period 2011–2012**

Source category	EU-15	EU-28
	Million tonnes (CO <sub>2</sub> -equivalent)	
Public electricity and heat production (CO <sub>2</sub> from 1A1a)	26	10
Households and services (CO <sub>2</sub> from 1A4)	20	20
Solid waste disposal (CH <sub>4</sub> from 6A)	- 3	- 3
Cement production (CO <sub>2</sub> from 2A1)	- 4	- 5
Refineries (CO <sub>2</sub> from 1A1b)	- 4	- 5
Agricultural soils (N <sub>2</sub> O from 4D)	- 4	- 5
Iron and steel production (CO <sub>2</sub> from 1A2a +2C1)	- 6	- 8
Manufacture of solid fuels (CO <sub>2</sub> from 1A1c)	- 9	- 10
Manufacturing industries (excl. iron and steel) (energy-related CO <sub>2</sub> from 1A2 excl. 1A2a)	- 11	- 15
Road transportation (CO <sub>2</sub> from 1A3b )	- 30	- 32
<b>Total</b>	<b>- 30</b>	<b>- 59</b>

**Note:** As the table only presents sectors whose emissions have increased or decreased by at least 3 million tonnes of CO<sub>2</sub>-equivalents, the sum for each country grouping does not match the total change listed at the bottom of the table. Hydrofluorocarbons (HFCs) from refrigeration and air conditioning in EU-15 increased by less than 3 million tonnes and CH<sub>4</sub> emissions from 'solid waste disposal' decreased by less than 3 million tonnes in EU-28.

### Main reasons for emission changes, 2011–2012

The 30 million tonnes (CO<sub>2</sub>-equivalents) decrease in GHG emissions in the EU-15 between 2011 and 2012 was mainly due to the factors outlined below.

- Decreasing CO<sub>2</sub> emissions in road transportation (– 30 million tonnes or – 4 %) – following a decreasing trend for the fifth consecutive year – were driven by reductions in both passenger and freight transportation. In 2012, emissions decreased in particular in the Member States that experienced persisting economic downturn or recession such as Italy, Spain and Greece: road freight transport declined by 16 % in Italy and Spain, and by 21 % in Greece.
- Reduced CO<sub>2</sub> emissions in the category 'manufacturing industries excluding iron and steel industry' (– 11 million tonnes or – 3 %) were mainly driven by a decline in industrial production and a decline in cement production – especially in Italy, Germany, the United Kingdom, Spain and Portugal.
- The overall decrease in CO<sub>2</sub> emissions from the manufacture of solid fuels and other energy industries (– 9 million tonnes or – 17 %) were mainly driven by decreases in Germany, Italy and the United Kingdom. In Italy, the main driver for the reduction in emissions was a decline in iron and steel production and the associated decline in coke production. In the United Kingdom, the main driver was the continued decline in oil and gas production. In Germany, the main driver was the reclassification of certain power production facilities in coal mining from this category to the category 'public electricity and heat production' (this partly explains increases mentioned below for public electricity and heat production).
- The decrease in CO<sub>2</sub> emissions from iron and steel production (– 6 million tonnes or – 4 %) reflects a further decline of crude steel production in the EU-15.

Substantial emission increases between 2011 and 2012 were reported for the source categories listed below.

- **CO<sub>2</sub> from public electricity and heat production (+ 26 million tonnes or + 3 %)**  
Increasing emissions occurred in particular in Germany, the United Kingdom and Spain. In Germany, power production from coal increased mainly due to lower nuclear power production as well as higher exports and lower imports of electricity. In the United Kingdom there was a substantial increase in the use of coal for power generation. In Spain, the main reasons are a decline in hydropower production and a considerable shift from natural gas to coal use in public power production.
- **CO<sub>2</sub> from households and services (+ 20 million tonnes or + 4 %)**  
Emissions increased in almost all EU-15 Member States. The colder winter and higher demand for heating can partly explain higher emissions in 2012 compared to 2011.

For the EU-28, GHG emissions decreased by 1.3 % in 2012. The strong decline in road transport emissions within the EU-15 is also reflected in the EU-28 emissions. In addition, the increase in emissions from public electricity and heat production is much smaller in the EU-28 than in the EU-15. The main reason for this is that CO<sub>2</sub> emissions from public electricity dropped sharply in Bulgaria, Poland, Romania and Estonia. In Bulgaria, power production from solid fuels decreased considerably. In Poland, a shift from solid fuels to biomass in power production can be observed. In Romania, one reason for the decline in emissions from electricity production was the increase in wind power production. Finally, Estonia compensated lower power production from solid fuels with higher electricity imports.

For a detailed analysis, see the EEA publications 'Why did greenhouse gas emissions decrease in the EU between 2011 and 2012? EEA analysis' and 'Why did greenhouse gas emissions decrease in the EU between 1990 and 2012? EEA analysis' <sup>(8)</sup>.

<sup>(8)</sup> <http://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2014>.

**Table ES.3 Greenhouse gas emissions in CO<sub>2</sub>-equivalents (excluding LULUCF) and Kyoto Protocol targets for 2008–2012**

Member State	1990	Kyoto Protocol base year (*)	2012	2011–2012	Change 2011–2012	Change 1990–2012	Change base year–2012	Targets 2008–2012 under Kyoto Protocol and 'EU burden sharing'
	(million tonnes)	(million tonnes)	(million tonnes)	(million tonnes)	(%)	(%)	(%)	(%)
Austria	78.1	79.0	80.1	- 2.7	- 3.3	2.5	1.3	- 13.0
Belgium	143.0	145.7	116.5	- 3.6	- 3.0	- 18.5	- 20.0	- 7.5
Denmark	68.7	69.3	51.6	- 4.9	- 8.6	- 24.8	- 25.5	- 21.0
Finland	70.3	71.0	61.0	- 5.9	- 8.8	- 13.3	- 14.1	0.0
France	557.4	563.9	490.1	0.1	0.0	- 12.1	- 13.1	0.0
Germany	1 248.0	1 232.4	939.1	10.4	1.1	- 24.8	- 23.8	- 21.0
Greece	104.9	107.0	111.0	- 3.7	- 3.3	5.8	3.7	25.0
Ireland	55.2	55.6	58.5	0.8	1.4	5.9	5.3	13.0
Italy	519.1	516.9	460.1	- 26.5	- 5.4	- 11.4	- 11.0	- 6.5
Luxembourg	12.9	13.2	11.8	- 0.29	- 2.4	- 8.2	- 10.1	- 28.0
Netherlands	211.8	213.0	191.7	- 3.4	- 1.7	- 9.5	- 10.0	- 6.0
Portugal	60.8	60.1	68.8	- 0.6	- 0.8	13.1	14.3	27.0
Spain	283.7	289.8	340.8	- 5.1	- 1.5	20.1	17.6	15.0
Sweden	72.7	72.2	57.6	- 3.2	- 5.2	- 20.8	- 20.2	4.0
United Kingdom	775.5	776.3	580.8	18.1	3.2	- 25.1	- 25.2	- 12.5
<b>EU-15</b>	<b>4 262.1</b>	<b>4 265.5</b>	<b>3 619.5</b>	<b>- 30.5</b>	<b>- 0.8</b>	<b>- 15.1</b>	<b>- 15.1</b>	<b>- 8.0</b>
Bulgaria	109.1	132.6	61.0	- 5.0	- 7.5	- 44.1	- 54.0	- 8.0
Croatia	31.9	31.3	26.4	- 2.1	- 7.4	- 17.3	- 15.7	- 5.0
Cyprus	6.1	Not applicable	9.3	- 0.4	- 4.4	52.1	Not applicable	Not applicable
Czech Republic	196.1	194.2	131.5	- 3.8	- 2.8	- 33.0	- 32.3	- 8.0
Estonia	40.6	42.6	19.2	- 1.3	- 6.3	- 52.8	- 55.0	- 8.0
Hungary	97.6	115.4	62.0	- 4.1	- 6.1	- 36.5	- 46.3	- 6.0
Latvia	26.2	25.9	11.0	- 0.2	- 1.4	- 58.1	- 57.6	- 8.0
Lithuania	48.7	49.4	21.6	- 0.1	- 0.3	- 55.6	- 56.2	- 8.0
Malta	2.0	Not applicable	3.1	0.1	3.7	57.7	Not applicable	Not applicable
Poland	466.4	563.4	399.3	- 6.5	- 1.6	- 14.4	- 29.1	- 6.0
Romania	247.7	278.2	118.8	- 2.7	- 2.3	- 52.0	- 57.3	- 8.0
Slovakia	73.2	72.1	42.7	- 2.0	- 4.4	- 41.7	- 40.7	- 8.0
Slovenia	18.4	20.4	18.9	- 0.6	- 2.8	2.5	- 7.1	- 8.0
<b>EU-28</b>	<b>5 626.3</b>	<b>Not applicable</b>	<b>4 544.2</b>	<b>- 59.0</b>	<b>- 1.3</b>	<b>- 19.2</b>	<b>Not applicable</b>	<b>Not applicable</b>

**Note:** (\*) As Cyprus, Malta and the EU-28 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-28

Table ES.4 gives an overview of the main trends in EU-28 GHG emissions and removals for 1990–2012. The most important GHG by far is CO<sub>2</sub>, accounting for 82 % of total EU-28 emissions in 2012 excluding LULUCF. In 2012, EU-28 CO<sub>2</sub> emissions without LULUCF were 3 717 million tonnes, which was 16 % below 1990 levels. Compared to 2011, CO<sub>2</sub> emissions decreased by 1 %. Emissions of CH<sub>4</sub>, N<sub>2</sub>O, perfluorocarbons (PFCs) and SF<sub>6</sub> decreased in 2012, while HFCs increased in 2012.

#### EU-15

Table ES.5 gives an overview of the main trends in EU-15 GHG emissions and removals for 1990–2012. In the EU-15, the most important GHG is also CO<sub>2</sub>, accounting for 83 % of total EU-15 emissions in 2012. In 2012, EU-15 CO<sub>2</sub> emissions without LULUCF were 2 988 million tonnes, which was 11 % below 1990 levels. Compared to 2011, CO<sub>2</sub> emissions decreased by 1 %. As in the EU-28, CH<sub>4</sub>, N<sub>2</sub>O, and PFC emissions decreased in the last year, whereas HFC and SF<sub>6</sub> emissions increased in 2012.

More detailed information can be found in Chapter 2.

**Table ES.4 Overview of EU-28 GHG emissions and removals from 1990 to 2012 in CO<sub>2</sub>-equivalents (million tonnes)**

Greenhouse gas emissions	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012
Net CO <sub>2</sub> emissions/removals	4 168	3 866	3 821	3 947	3 930	3 943	3 784	3 443	3 585	3 445	3 401
CO <sub>2</sub> emissions (without LULUCF)	4 437	4 169	4 136	4 262	4 274	4 224	4 123	3 788	3 908	3 767	3 717
CH <sub>4</sub>	607	552	501	449	443	436	430	420	413	405	403
N <sub>2</sub> O	533	474	430	402	389	389	380	359	350	348	341
HFCs	28	41	47	62	65	70	74	77	82	84	86
PFCs	21	14	10	6	5	5	4	3	3	3	3
SF <sub>6</sub>	11	16	11	8	8	7	7	7	7	6	6
Total (with net CO <sub>2</sub> emissions/removals)	5 368	4 963	4 819	4 874	4 840	4 850	4 679	4 309	4 439	4 292	4 241
Total (without CO <sub>2</sub> from LULUCF)	5 637	5 266	5 134	5 190	5 185	5 131	5 017	4 654	4 762	4 614	4 556
Total (without LULUCF)	5 626	5 253	5 122	5 178	5 173	5 119	5 006	4 642	4 751	4 603	4 544

**Table ES.5 Overview of EU-15 GHG emissions and removals from 1990 to 2012 in CO<sub>2</sub>-equivalents (million tonnes)**

Greenhouse gas emissions	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012
Net CO <sub>2</sub> emissions/removals	3 221	3 127	3 181	3 297	3 279	3 246	3 118	2 846	2 952	2 812	2 789
CO <sub>2</sub> emissions (without LULUCF)	3 369	3 307	3 375	3 477	3 470	3 412	3 333	3 064	3 156	3 011	2 988
CH <sub>4</sub>	443	423	383	333	326	321	316	310	304	298	296
N <sub>2</sub> O	402	383	344	313	301	299	292	281	272	269	264
HFCs	28	40	44	55	56	59	63	66	69	70	72
PFCs	17	12	8	5	5	5	4	3	3	3	3
SF <sub>6</sub>	11	15	11	8	7	7	6	6	6	6	6
Total (with net CO <sub>2</sub> emissions/removals)	4 123	4 000	3 971	4 010	3 974	3 937	3 799	3 511	3 606	3 458	3 429
Total (without CO <sub>2</sub> from LULUCF)	4 270	4 180	4 165	4 191	4 165	4 104	4 014	3 729	3 811	3 658	3 628
Total (without LULUCF)	4 262	4 171	4 156	4 183	4 157	4 095	4 007	3 722	3 803	3 650	3 619

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

accounting for 79 % of total EU-28 emissions in 2012. The second largest sector is agriculture (10 %), followed by industrial processes (7 %).

##### EU-28

Table ES.6 gives an overview of EU-28 GHG emissions in the main source categories for 1990–2012. The most important sector by far is energy (i.e. combustion and fugitive emissions),

##### EU-15

Table ES.7 gives an overview of EU-15 GHG emissions in the main source categories for 1990–2012. More detailed trend descriptions are included in Chapters 3 to 9.

**Table ES.6 Overview of EU-28 GHG emissions in the main source and sink categories from 1990 to 2012 in CO<sub>2</sub>-equivalents (million tonnes)**

GHG source and sink	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012
1. Energy	4 325	4 058	4 004	4 103	4 107	4 044	3 961	3 678	3 783	3 642	3 604
2. Industrial processes	462	441	394	403	401	412	388	324	335	332	321
3. Solvent and other product use	17	14	14	12.288	12	12	11	10	11	10	10
4. Agriculture	617	533	521	493	490	490	489	478	475	475	469
5. Land use, land-use change and forestry	- 258	- 291	- 302	- 304	- 333	- 268	- 328	- 334	- 312	- 311	- 304
6. Waste	206	207	190	166	164	160	156	152	147	144	141
7. Other	0	0	0	0	0	0	0	0	0	0	0
Total (with net CO <sub>2</sub> emissions/removals)	5 368	4 963	4 819	4 874	4 840	4 850	4 679	4 309	4 439	4 292	4 241
Total (without LULUCF)	5 626	5 253	5 122	5 178	5 173	5 119	5 006	4 642	4 751	4 603	4 544

**Table ES.7 Overview of EU-15 GHG emissions in the main source and sink categories from 1990 to 2012 in CO<sub>2</sub>-equivalents (million tonnes)**

GHG source and sink	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012
1. Energy	3 281	3 215	3 261	3 341	3 330	3 268	3 201	2 968	3 048	2 906	2 893
2. Industrial processes	354	351	310	311	304	308	292	253	260	252	243
3. Solvent and other product use	13	12	11	9.672	10	9	9	8	8	8	8
4. Agriculture	443	421	423	394	389	388	388	379	378	378	373
5. Land use, land-use change and forestry	- 139	- 171	- 185	- 173	- 184	- 158	- 208	- 210	- 197	- 192	- 191
6. Waste	171	172	152	127	125	121	117	113	109	106	102
7. Other	0	0	0	0	0	0	0	0	0	0	0
Total (with net CO <sub>2</sub> emissions/removals)	4 123	4 000	3 971	4 010	3 974	3 937	3 799	3 511	3 606	3 458	3 429
Total (without LULUCF)	4 262	4 171	4 156	4 183	4 157	4 095	4 007	3 722	3 803	3 650	3 619

## ES.5 Summary of EU Member State emission trends

Table ES.8 gives an overview of Member State contributions to EU GHG emissions for 1990–2012. 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-28 GHG emissions in 2012. These two Member States have achieved total domestic GHG emission reductions in 2012 of 504 million

tonnes of CO<sub>2</sub>-equivalents compared to 1990<sup>(9)</sup>, not counting carbon sinks and the use of Kyoto mechanisms.

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 were primarily the result of liberalising energy markets and the subsequent fuel switches from oil and coal to gas in electricity production, and N<sub>2</sub>O emission reduction measures in the production of adipic acid.

**Table ES.8 Overview of Member States' contributions to EU GHG emissions (excluding LULUCF) from 1990 to 2012 in CO<sub>2</sub>-equivalents (million tonnes)**

Member State	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012
Austria	78	80	80	93	90	87	87	80	85	83	80
Belgium	143	150	146	142	138	133	136	123	131	120	117
Denmark	69	76	69	64	72	67	64	61	61	57	52
Finland	70	71	69	69	80	78	70	66	74	67	61
France	557	553	561	559	547	538	533	509	516	490	490
Germany	1 248	1 118	1 040	994	1 002	977	980	913	946	929	939
Greece	105	110	127	135	132	135	131	124	118	115	111
Ireland	55	59	68	70	69	68	68	62	62	58	59
Italy	519	530	551	574	563	555	541	490	499	487	460
Luxembourg	13	10	10	13	13	12	12	12	12	12	12
Netherlands	212	223	213	209	206	204	203	198	209	195	192
Portugal	61	71	84	88	83	80	78	75	71	69	69
Spain	284	322	380	431	424	432	398	360	347	346	341
Sweden	73	74	69	67	67	65	63	59	65	61	58
United Kingdom	775	723	690	675	672	662	643	590	606	563	581
<b>EU-15</b>	<b>4 262</b>	<b>4 171</b>	<b>4 156</b>	<b>4 183</b>	<b>4 157</b>	<b>4 095</b>	<b>4 007</b>	<b>3 722</b>	<b>3 803</b>	<b>3 650</b>	<b>3 619</b>
Bulgaria	109	76	59	64	65	68	67	58	60	66	61
Croatia	32	24	27	31	31	33	31	29	29	29	26
Cyprus	6	8	9	10	10	10	11	10	10	10	9
Czech Republic	196	152	146	146	147	147	142	134	137	135	131
Estonia	41	20	17	18	18	21	20	16	20	20	19
Hungary	98	78	77	78	77	76	73	67	68	66	62
Latvia	26	13	10	11	12	12	11	11	12	11	11
Lithuania	49	22	20	23	24	26	25	20	21	22	22
Malta	2	2	3	3	3	3	3	3	3	3	3
Poland	466	441	396	399	414	415	406	388	407	406	399
Romania	248	175	134	141	145	143	140	120	116	122	119
Slovakia	73	53	49	50	50	48	49	45	45	45	43
Slovenia	18	19	19	20	21	21	21	19	19	19	19
<b>EU-28</b>	<b>5 626</b>	<b>5 253</b>	<b>5 122</b>	<b>5 178</b>	<b>5 173</b>	<b>5 119</b>	<b>5 006</b>	<b>4 642</b>	<b>4 751</b>	<b>4 603</b>	<b>4 544</b>

<sup>(9)</sup> 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 2012, with a share in the EU total of 11 % and 10 % respectively. Italy's GHG emissions were 11 % below 1990 levels in 2012. Italian GHG emissions increased from 1990, primarily due to increases in road transport, electricity and heat production, and petroleum refining. However, Italian emissions decreased from 2004 with significant drops in 2009 and 2012, which were mainly due to the economic crisis and reductions in industrial output during these years. France's emissions were 12 % below 1990 levels in 2012. In France, large reductions were achieved in N<sub>2</sub>O emissions from adipic acid production, but CO<sub>2</sub> emissions from road transport and HFC emissions from consumption of halocarbons increased considerably between 1990 and 2012.

Poland and Spain are the fifth and sixth largest emitters in the EU-28, accounting for 9 % and 7 % of total EU-28 GHG emissions in 2012. Spain increased emissions by 20 % between 1990 and 2012. This was largely due to emission increases from road transport, electricity and heat production, and households and services. Poland decreased GHG emissions by 14 % between 1990 and 2012. The main factors for decreasing emissions in Poland — as with 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 GHGs from international aviation and shipping activities increased constantly between 1992 and 2007. Emissions decreased between 2007 and 2010 in the EU-28 — partly reflecting the economic recession — but increased again in 2011 and subsequently decreased again in 2012. EU GHG emissions from international aviation are lower than the emissions from international maritime transport, but they were increasing more rapidly until 2007. The average annual EU-28 growth rates in emissions since 1990 were 3 % for aviation and 1 % for maritime transport. Total GHG emissions from international transport reached 281 million tonnes of CO<sub>2</sub>-equivalents in 2012.

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 4 266 million tonnes of CO<sub>2</sub>-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 2014, total EU-15 GHG emissions for 2011 were 0.5% higher than those reported in the 2013 GHG inventories. Total EU-15 emissions in 1990 reported in 2014 GHG inventories were 0.2 % higher than the 1990 emissions reported in 2013 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 explanations
		Gg CO <sub>2</sub> -equivalent	%	
1A1_Energy industries N <sub>2</sub> O	Germany	- 1 077	- 25	Correction of some emission factors in order to increase time series consistency. Final data available from the National Energy Balance.
1A2_Manufacturing industries and construction CO <sub>2</sub>	Spain	- 2 314	- 5	Activity included (fuel consumption) in the revision of the inventory fuel balance.
1A2_Manufacturing industries and construction CO <sub>2</sub>	United Kingdom	1 216	1	'National energy statistics revised for many sectors from 2008 onwards. 1A2c: New source: refinery gas combustion in chemical industry. National energy statistics revised for many sectors from 2008 onwards. 1A2f: Correction to EUETS data has caused a change to OPG CEF for all years. Correction to allocation of petcoke to lime sector. Reallocation of refinery gas to chemical sector.'
1A3_Transport CO <sub>2</sub>	Spain	3 339	6	Activity data have been revised due to the adoption in the current submission of the national energy balance published by the international entities (IEA and EUROSTAT) and the international questionnaires submitted to the said international agencies by the Ministry of Industry, Energy and Tourism, as the reference sources for this category.
4B_Manure management CH <sub>4</sub>	United Kingdom	5 527	161	Dated AWMS values in response to ERT 2013. Decreased allocation to daily spread; changed SSDL to Deep litter. Updated MCF value from 1 % to 39 % for deep litter (previously solid storage and dry lot) in response to ERT 2013. Updated feed digestibility for dairy cows from 75.0 to 74.5234142710097.
4B_Manure management N <sub>2</sub> O	United Kingdom	1 388	71	Dated AWMS values in response to ERT 2013. Decreased allocation to daily spread; changed SSDL to Deep litter. Updated MCF value from 1 % to 39 % for deep litter (previously solid storage and dry lot).

**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 2011**

Source category	Member State	2010		Main explanations
		Gg CO <sub>2</sub> -equivalent	%	
1A1_Energy industries CO <sub>2</sub>	Belgium	1 056	5	'1A1a solid fuels: Flemish region: difference mainly due to wrong allocation between solid fuel and biomass of one electric power installation in 2011. 1A1a other fuels: Flemish region: by finalising the definitive energy balance for 2011, 1,1 PJ more other fuels was reported (+ 112 kton CO <sub>2</sub> ) + RBC: AD revision (waste incinerated).'
1A1_Energy industries CO <sub>2</sub>	France	- 1 106	- 2	'1A1a: Completeness of data: improved accuracy and temporal coherence. 1A1b: Filtering method and improved allocation of emissions.'
1A2_Manufacturing industries and construction CO <sub>2</sub>	France	- 1 921	- 3	Updated energy balance SOeS statistics for several years (decrease of the quantity of petroleum products) and revision of the fuel split of petroleum products (-> impact on the consumption of petroleum coke and LPG). - Correction of a double counting of the new fuel category 'GNR' (for off road machineries), i.e. non-road diesel oil, for the first introduction year 2011 (impact for all sector in the CRF code 1A2).
1A2_Manufacturing industries and construction CO <sub>2</sub>	Germany	2 241	2	Final data available from the National Energy Balance.
1A2_Manufacturing industries and construction CO <sub>2</sub>	Spain	-11 076	- 19	Activity included (fuel consumption) in the revision of the inventory fuel balance.
1A2_Manufacturing industries and construction CO <sub>2</sub>	United Kingdom	- 3 164	- 5	'National energy statistics revised for many sectors from 2008 onwards. 1A2c: New source: refinery gas combustion in chemical industry. National energy statistics revised for many sectors from 2008 onwards. 1A2f: Correction to EUETS data has caused a change to OPG CEF for all years. Correction to allocation of petcoke to lime sector. Reallocation of reinery gas to chemical sector.'
1A3_Transport CO <sub>2</sub>	France	1 845	1	'1A3a, 1A3c + 1A3d: Updated data: improved accuracy. 1A3b: Recalculation is due to revision of biofuels dataset: present use of actual volumes incorporated into the fuels (new available statistics from customs vs previous estimated ratios as energy).'
1A4_Other sectors CO <sub>2</sub>	Belgium	- 1 029	- 4	'Energy balance update (final values 2011) 1A4a liquid fuels: reallocation of off-road activities in harbours, airports and transhipment companies in 1A3e and 1A5b (defence) instead of 1A4a before 1A4b liquid fuels: Flanders: for fuel oil, the data from 2002 were based on an estimate of the number of households from the latest census of 2001 using heating oil as main energy source, corrected with newly built homes (+) and demolished houses (-). The switch in existing houses from fuel oil to natural gas was so far not taken into account, leading to an accumulated overestimation of households using fuel oil as main energy source. This correction was made during the 2014 submission for the years 2002–2012. 1A4b biomass: Flanders en Wallonia: new methodology to estimate the woodconsumption for households. The methodology uses the urbanisation degree and unweighted average uses of biomass as main heating source or as secondary heating source from the Eurostat survey to calculate the total biomass used for the period 1990–2011. 1A4c liquid fuels: RBC : Offroad AD revision (energy).'
1A4_Other sectors CO <sub>2</sub>	France	1 512	2	Recalculations performed are due to changes in activity data: - update of energy balance statistics, - update of fuel type split for petroleum products (data from CPDP statistics).
1A4_Other sectors CO <sub>2</sub>	Germany	9 831	8	Final data available from the National Energy Balance.

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

Source category	Member State	2010		Main explanations
		Gg CO <sub>2</sub> -equivalent	%	
1A4_Other sectors CO <sub>2</sub>	Spain	7 792	23	'Light differences due to a revision of the significant digits of the emission factor for diesel/gas-oil. Activity data have been revised due to the adoption in the current submission of the national energy balance published by the international entities (IEA and Eurostat) and the international questionnaires submitted to the said international agencies by the Ministry of Industry, Energy and Tourism, as the reference sources for this category.'
1A4_Other sectors CO <sub>2</sub>	United Kingdom	3 189	4	'National energy statistics revised for many sectors from 2008 onwards. 1A4b: Revision to carbon balance approach to use AD and EFS from ISSB/Tata in preference to DUKES stats and historic EF defaults.'
1B2_Oil and natural gas CO <sub>2</sub>	France	1 057	36	'1B2a: Error correction: improved accuracy. New data: improving completeness. Change of use: improving transparency. 1B2b: Refinement of reporting: improving the completeness and transparency. 1B2c: Filtering method that takes into account new data: improved accuracy.'
4B_Manure management CH <sub>4</sub>	United Kingdom	4 098	163	Dated AWMS values in response to ERT 2013. Decreased allocation to daily spread; changed SSDL to Deep litter. Updated MCF value from 1 % to 39 % for deep litter (previously solid storage and dry lot) in response to ERT 2013. Updated feed digestibility for dairy cows from 75.0 to 74.5234142710097.
4B_Manure management N <sub>2</sub> O	United Kingdom	1033	63	Dated AWMS values in response to ERT 2013. Decreased allocation to daily spread; changed SSDL to Deep litter. Updated MCF value from 1% to 39% for deep litter (previously solid storage and dry lot).
6A_Solid waste disposal on land CH <sub>4</sub>	United Kingdom	5395	38	Methane recovery data for landfills now taken from monitored data.

**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<sub>x</sub>, non-methane volatile organic compounds (NMVOCs) and SO<sub>2</sub> have to be reported to the UNFCCC because they influence climate change indirectly: the former three substances are precursor substances for ground-level ozone, which in itself is a GHG. Sulphur emissions can contribute to the 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<sub>2</sub> emissions in the EU-15 between 1990 and 2012. All emissions were reduced significantly from 1990

levels: the largest reduction was achieved in SO<sub>2</sub> (– 87 %), followed by CO (– 67 %), NMVOC (– 60 %) and NO<sub>x</sub> (– 51 %).

In the EU-28, SO<sub>2</sub> emissions decreased by 81 %, followed by CO (– 64 %), NMVOC (– 58 %) and NO<sub>x</sub> (– 51 %) (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). Additionally, Member States also report emissions of NO<sub>x</sub>, NMVOCs and SO<sub>2</sub> under the EU's National Emissions Ceilings Directive (NECD).

**Table ES.11 Overview of EU-15 indirect GHG and SO<sub>2</sub> emissions for 1990–2012 (1 000 tonnes)**

Emissions	1990	1995	2000	2005	2010	2011	2012
	(Gg)						
NO <sub>x</sub>	13 769	12 087	10 533	9 501	7 214	6 902	6 685
CO	54 467	42 142	32 461	24 126	19 327	18 082	18 133
NMVOC	14 654	12 016	9 744	7 886	6 264	6 040	5 881
SO <sub>2</sub>	16 444	10 036	6 118	4 518	2 380	2 291	2 217

**Table ES.12 Overview of EU-28 indirect GHG and SO<sub>2</sub> emissions for 1990–2012 (1 000 tonnes)**

Emissions	1990	1995	2000	2005	2010	2011	2012
	(Gg)						
NO <sub>x</sub>	17 473	14 842	12 807	11 620	9 171	8 827	8 516
CO	68 648	51 639	39 722	31 005	26 082	24 546	24 377
NMVOC	17 500	13 940	11 442	9 514	7 814	7 557	7 367
SO <sub>2</sub>	26 251	16 827	10 375	8 155	5 397	5 534	5 116

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### **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 EU ETS for preparing national GHG inventories. The analysis shows that most Member States used the ETS data to improve and refine the estimation and reporting of CO<sub>2</sub> emissions from energy and industrial processes. Twenty-seven Member States indicated that they used ETS data for quality assurance/quality control purposes and checked data consistency between both sources (Section 1.3.2 and Section 16.2.2). Croatia joined the EU in July 2013 and participates in the EU ETS since January 2013. For the 2014 submission, Croatia did not use any ETS data, but has plans to improve its GHG emission estimates with ETS data

Sixteen Member States indicated that they directly use the verified emissions reported by installations under the ETS. Twenty-two Member States used ETS data to improve country-specific emission factors and 22 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 GHG 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 CRF source categories.



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