

Annual European Union greenhouse gas inventory 1990–2010 and inventory report 2012

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-2012>

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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 $t-2$ 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 compiling the EU inventory is Council Decision No 280/2004/EC concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol ⁽²⁾. The purpose of that 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 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 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 CO₂ emissions from fossil fuels developed by the Intergovernmental Panel on Climate Change (IPCC).

The main institutions involved in compiling the EU GHG inventory are the Member States, the European Commission Directorate-General for 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 the 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 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 sets out the objective of

⁽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.

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 sectors, i.e. those operating within the EU Emissions Trading Scheme (ETS), and nontrading sectors will contribute to the 20 % objective. Minimising overall reduction costs implies that by 2020 EU ETS sectors must reduce emissions by 21 % compared to 2005 and that non-EU ETS sectors must reduce emissions by approximately 10 % compared to 2005. The non-trading sectors broadly include direct emissions from households and services, transport, waste and agriculture. The non-trading sectors currently account for 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 those LULUCF activities are provided in Chapter 11 of this report.

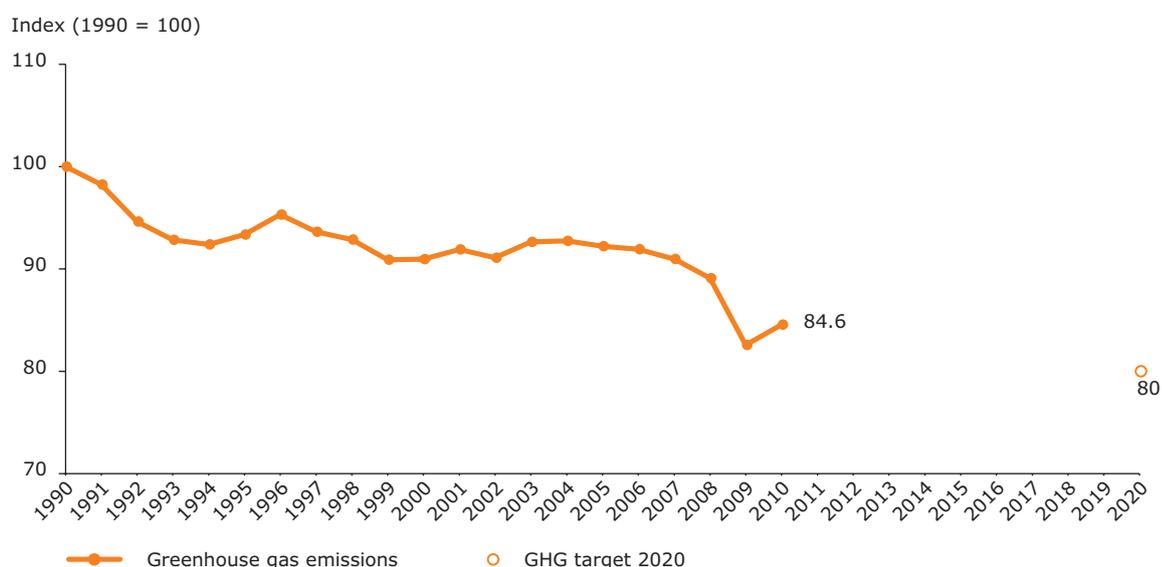
In addition, all parties to the Kyoto Protocol must provide information on how they are implementing their greenhouse gas commitments in such a way as to minimise potential adverse social, environmental and economic impacts on developing countries. This information, required under Article 3, paragraph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

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

EU-27

Total GHG emissions without LULUCF in the EU-27 decreased by 15.4 % between 1990 and 2010 (862 million tonnes CO₂-equivalents). Emissions increased by 2.4 % (111 million tonnes CO₂-equivalents) between 2009 and 2010 (Figure ES.1).

Figure ES.1 EU-27 GHG emissions 1990–2010 (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.

⁽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.

EU-15

In 2010 total GHG emissions in the EU-15 without LULUCF were 10.6 % (452 million tonnes CO₂-equivalents) below 1990, and 11.0 % (468 million tonnes CO₂-equivalents) below the EU-15 Kyoto 'base year' ⁽⁴⁾. Emissions increased by 2.1 % (78.5 million tonnes CO₂equivalents) between 2009 and 2010.

Under the Kyoto Protocol, the EU agreed to reduce its GHG emissions by 8 % by 2008–12 compared to its base year. This can be achieved by a combination of existing and planned domestic policies and measures, use of carbon sinks and use of Kyoto mechanisms. Since 2009 total GHG emissions have been below the EU-15 Kyoto target (Figure ES.2).

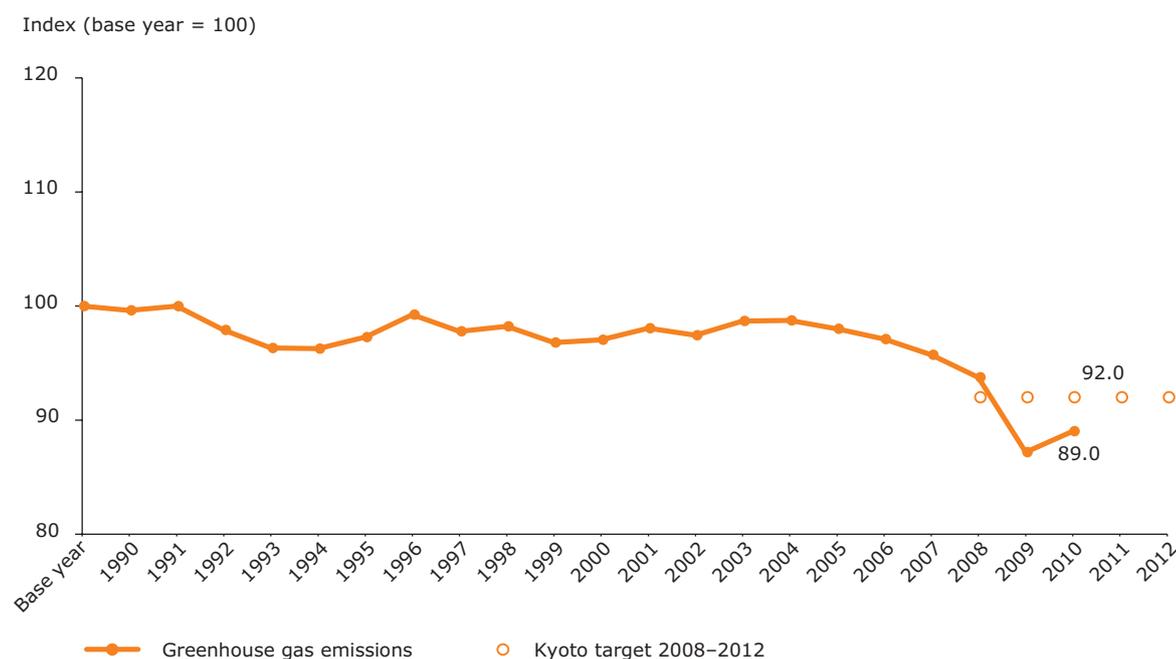
Main trends by source category, 1990–2010

Table ES.1 shows the sources with the largest contribution to the change in total GHG emissions in the EU between 1990 and 2010. Over the 20-year period, EU-15 emissions decreased by 10.6 %, while EU-27 emissions decreased by 15.4 % (Table ES.3).

Main trends by source category, 2009–2010

Table ES.2 shows the sources with the largest contribution to the change in GHG emissions in the EU between 2009 and 2010. This year, EU-15 emissions increased by 2.1 %, while EU-27 emissions increased by 2.4 % (Table ES.3).

Figure ES.2 EU-15 GHG emissions 1990–2010 compared with the target for 2008–2012 (excluding LULUCF)



Note: GHG emissions 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 at 4 265.5 Mt CO₂-equivalents. On average, EU-15 greenhouse gas emissions in the period 2008–2012 would need to be 341 Mt below that base-year figure in order to meet the 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.

⁽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 at 4 265.5 Mt CO₂-equivalents.

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 1990–2010

| Source category | EU-15 | EU-27 |
|---|--|----------------|
| | Million tonnes (CO ₂ -equivalent) | |
| Road transportation (CO ₂ from 1A3b) | 108.3 | 159.3 |
| Consumptions of halocarbons (HFC from 2F) | 70.9 | 82.3 |
| Cement production (CO ₂ from 2A1) | | - 22.2 |
| Production of halocarbons (HFC from 2E) | - 25.8 | - 25.8 |
| Nitric acid production (N ₂ O from 2B2) | - 26.1 | - 36.5 |
| Enteric fermentation (CH ₄ from 4A) | | - 41.8 |
| Households and services (CO ₂ from 1A4) | - 28.5 | - 77.8 |
| Agricultural soils (N ₂ O from 4D) | - 40.1 | - 70.9 |
| Iron and steel production (CO ₂ from 1A2a +2C1) | - 42.9 | - 92.2 |
| 1B fugitive emissions from fuels (CH ₄) | - 49.6 | - 73.4 |
| Manufacture of solid fuels (CO ₂ from 1A1c) | - 51.4 | - 53.6 |
| Adipic acid production (N ₂ O from 2B3) | - 57.3 | - 58.3 |
| Solid waste disposal on land (CH ₄ from 6A) | - 59.9 | - 55.7 |
| Public electricity and heat production (CO ₂ from 1A1a) | - 61.1 | - 208.7 |
| Manufacturing industries (excl. iron and steel) (energy-related CO ₂ from 1A2 excl. 1A2a) | - 114.2 | - 207.9 |
| Total | - 451.70 | - 862.3 |

Note: As the table only presents sectors that have increased or decreased by more than 20 Mt CO₂-equivalents, the sum for each country grouping (EU-15 and EU-27) does not match the total change listed at the bottom of the table. CO₂ emissions from 'cement production' and CH₄ emissions from 'enteric fermentation' in the EU-15 fell by less than 20 million tonnes.

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 2009–2010

| Source category | EU-15 | EU-27 |
|---|--|--------------|
| | Million tonnes (CO ₂ -equivalent) | |
| Households and services (CO ₂ from 1A4) | 32.7 | 43.1 |
| Iron and steel production (CO ₂ from 1A2a +2C1) | 28.0 | 32.9 |
| Manufacturing industries (excl. iron and steel) (energy-related CO ₂ from 1A2 excl. 1A2a) | 18.4 | 19.8 |
| Public electricity and heat production (CO ₂ from 1A1a) | | 14.1 |
| Manufacture of solid fuels (CO ₂ from 1A1c) | 5.1 | 5.8 |
| Consumptions of halocarbons (HFC from 2F) | 4.4 | 4.4 |
| Road transportation (CO ₂ from 1A3b) | - 5.2 | - 4.7 |
| Adipic acid production (N ₂ O from 2B3) | - 9.2 | - 9.2 |
| Total | 78.5 | 111.0 |

Note: As the table only presents sectors whose emissions have increased or decreased by at least 3 million tonnes of CO₂-equivalents, the sum for each country grouping does not match the total change listed at the bottom of the table. CO₂ emissions from 'public electricity and heat production' in EU-15 increased by less than 3 million tonnes.

Main reasons for emission changes in the EU-15, 2009–2010

The 78.5 million tonnes CO₂-equivalents increase in GHG emissions between 2009–2010 was mainly due to the following factors (Table ES.2):

- Increasing emissions in households and services (32.7 million tonnes or 5.7 %) were mainly caused by Belgium, Germany and the Netherlands. Winter temperatures in Europe in 2010 were, on average, below 2009 levels (i.e. colder).
- A substantial increase in emissions from iron and steel production (28.0 million tonnes or 24.8 %) was caused by a significant growth in crude steel production due to the recovery from the 2009 economic crisis and the strong rise in industrial output. According to the World Steel Association, crude steel production in the EU-15 declined in all major steel producing countries in 2009 (by 30 %) and increased again in 2010 (by 25 %).
- Emissions from manufacturing industries excluding the iron and steel industry (18.4 million tonnes or 5.1 %) increased significantly, mainly in Germany and Italy.
- HFC emissions from the consumption of halocarbons (4.4 million tonnes or 6.6 %) increased, stemming from refrigeration and air conditioning. This continued the trend observed since 1990, with Finland, Italy, Spain and the United Kingdom reporting the largest increases in absolute terms.

For the EU-27, the increase in emissions in 2010 was partly driven by the economic recovery from the 2009 recession in many European countries, which had itself caused substantial emissions reductions in 2008 and 2009 in all Member States. In 2010 the winter was also colder than in the previous year, leading to increased demand for heating and higher emissions from the residential and commercial sectors.

CO₂ emissions from fossil fuel combustion increased by 2.8 % in the EU-27 in 2010. This was driven by strong growth in emissions from natural gas (7.4 % in 2010), underpinned by significantly lower gas prices, and higher emissions from solid fuels (up 4.1 %), partly offset by lower emissions from the combustion of liquid fuels (down 1.3 %). The use of nuclear power also increased in 2010. As in previous

years, strong growth in the use of renewables continued in 2010, partially offsetting the increase in GHG emissions.

Emissions from iron and steel production and other manufacturing industries also increased significantly in 2010, reflecting the economic recovery and stronger growth of industrial gross value added in many EU Member States in 2010. Indeed, the 2010 verified emissions from sectors covered by the EU Emissions Trading Scheme (EU ETS) increased overall by 2.9 %, with industrial sectors increasing by 5.1 %.

For a detailed analysis at the EU-27 level, see 'Why did greenhouse gas emissions increase in the EU in 2010? EEA analysis in brief', available from 30 May 2012 at <http://www.eea.europa.eu/publications/european-union-greenhouse-gas-inventory-2012>.

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

EU-27

Table ES.4 gives an overview of the main trends in EU-27 GHG emissions and removals for 1990–2010. The most important GHG by far is CO₂, accounting for 82.4 % of total EU-27 emissions in 2010 excluding LULUCF. In 2010, EU-27 CO₂ emissions without LULUCF were 3 891 Tg, which was 12.0 % below 1990 levels. Compared to 2009, CO₂ emissions increased by 3.1 %. Emissions of CH₄ and N₂O decreased in 2010, while HFCs increased again in 2010.

EU-15

Table ES.5 gives an overview of the main trends in EU-15 GHG emissions and removals for 1990–2010. As in the EU-27, in the EU-15 the most important GHG is CO₂, accounting for 82.9 % of total EU-15 emissions in 2010. In 2010, EU-15 CO₂ emissions without LULUCF were 3 147 Tg, which was 6.4 % below 1990 levels. Compared to 2009, CO₂ emissions increased by 2.8 %. As in the EU-27, CH₄ and N₂O emissions decreased in 2010, whereas HFC emissions increased.

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 (*) | 2010 | Change 2009–2010 | Change 2009–2010 | Change 1990–2010 | Change base year 2010 | Targets 2008–2012 under Kyoto Protocol and 'EU burden sharing' |
|----------------|------------------|------------------------------|------------------|------------------|------------------|------------------|-----------------------|--|
| | (million tonnes) | (million tonnes) | (million tonnes) | (million tonnes) | (%) | (%) | (%) | (%) |
| Austria | 78.2 | 79.0 | 84.6 | 4.9 | 6.1 | 8.2 | 7.0 | – 13.0 |
| Belgium | 143.3 | 145.7 | 132.5 | 7.3 | 5.8 | – 7.6 | – 9.1 | – 7.5 |
| Denmark | 68.6 | 69.3 | 61.1 | 0.4 | 0.6 | – 11.0 | – 11.9 | – 21.0 |
| Finland | 70.4 | 71.0 | 74.6 | 8.4 | 12.8 | 6.0 | 5.0 | 0.0 |
| France | 559.0 | 563.9 | 522.4 | 7.8 | 1.5 | – 6.6 | – 7.4 | 0.0 |
| Germany | 1 246.1 | 1 232.4 | 936.5 | 24.7 | 2.7 | – 24.8 | – 24.0 | – 21.0 |
| Greece | 105.0 | 107.0 | 118.3 | – 6.4 | – 5.1 | 12.6 | 10.6 | 25.0 |
| Ireland | 55.2 | 55.6 | 61.3 | – 0.4 | – 0.7 | 11.2 | 10.3 | 13.0 |
| Italy | 519.2 | 516.9 | 501.3 | 9.8 | 2.0 | – 3.5 | – 3.0 | – 6.5 |
| Luxembourg | 12.8 | 13.2 | 12.1 | 0.56 | 4.9 | – 5.9 | – 8.3 | – 28.0 |
| Netherlands | 212.0 | 213.0 | 210.1 | 11.1 | 5.6 | – 0.9 | – 1.4 | – 6.0 |
| Portugal | 60.1 | 60.1 | 70.6 | – 3.8 | – 5.1 | 17.5 | 17.4 | 27.0 |
| Spain | 282.8 | 289.8 | 355.9 | – 10.4 | – 2.8 | 25.8 | 22.8 | 15.0 |
| Sweden | 72.8 | 72.2 | 66.2 | 6.6 | 11.0 | – 9.0 | – 8.2 | 4.0 |
| United Kingdom | 763.9 | 776.3 | 590.2 | 17.9 | 3.1 | – 22.7 | – 24.0 | – 12.5 |
| EU-15 | 4 249.3 | 4 265.5 | 3 797.6 | 78.5 | 2.1 | – 10.6 | – 11.0 | – 8.0 |
| Bulgaria | 114.3 | 132.6 | 61.4 | 2.5 | 4.3 | – 46.3 | – 53.7 | – 8.0 |
| Cyprus | 6.5 | Not applicable | 10.8 | – 0.3 | – 2.4 | 67.6 | Not applicable | Not applicable |
| Czech Republic | 195.8 | 194.2 | 139.2 | 4.4 | 3.3 | – 28.9 | – 28.4 | – 8.0 |
| Estonia | 40.9 | 42.6 | 20.5 | 4.1 | 25.2 | – 49.8 | – 51.9 | – 8.0 |
| Hungary | 97.3 | 115.4 | 67.7 | 0.8 | 1.2 | – 30.4 | – 41.4 | – 6.0 |
| Latvia | 26.6 | 25.9 | 12.1 | 1.1 | 10.2 | – 54.5 | – 53.4 | – 8.0 |
| Lithuania | 49.4 | 49.4 | 20.8 | 0.9 | 4.3 | – 57.9 | – 57.9 | – 8.0 |
| Malta | 2.0 | Not applicable | 3.0 | 0.02 | 0.6 | 49.1 | Not applicable | Not applicable |
| Poland | 457.4 | 563.4 | 400.9 | 19.1 | 5.0 | – 12.4 | – 28.9 | – 6.0 |
| Romania | 253.3 | 278.2 | 121.4 | – 2.0 | – 1.6 | – 52.1 | – 56.4 | – 8.0 |
| Slovakia | 71.8 | 72.1 | 46.0 | 1.8 | 4.1 | – 35.9 | – 36.2 | – 8.0 |
| Slovenia | 18.5 | 20.4 | 19.5 | 0.1 | 0.3 | 5.7 | – 4.1 | – 8.0 |
| EU-27 | 5 583.1 | Not applicable | 4 720.9 | 111.0 | 2.4 | – 15.4 | Not applicable | Not applicable |

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

Table ES.4 Overview of EU-27 GHG emissions and removals from 1990 to 2010 (Tg CO₂-equivalents)

| Greenhouse gas emissions | 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Net CO ₂ emissions/removals | 4 126 | 3 839 | 3 810 | 3 946 | 3 926 | 3 897 | 3 779 | 3 423 | 3 572 |
| CO ₂ emissions (without LULUCF) | 4 420 | 4 149 | 4 117 | 4 255 | 4 255 | 4 204 | 4 108 | 3 773 | 3 891 |
| CH ₄ | 595 | 540 | 486 | 436 | 429 | 422 | 417 | 409 | 405 |
| N ₂ O | 518 | 462 | 417 | 390 | 377 | 376 | 368 | 347 | 338 |
| HFCs | 28 | 42 | 48 | 63 | 67 | 73 | 78 | 80 | 84 |
| PFCs | 20 | 14 | 10 | 6 | 6 | 5 | 5 | 3 | 3 |
| SF ₆ | 11 | 15 | 10 | 8 | 7 | 7 | 7 | 6 | 7 |
| Total (with net CO ₂ emissions/removals) | 5 297 | 4 913 | 4 780 | 4 848 | 4 812 | 4 781 | 4 653 | 4 268 | 4 409 |
| Total (without CO ₂ from LULUCF) | 5 591 | 5 222 | 5 087 | 5 157 | 5 141 | 5 087 | 4 982 | 4 618 | 4 729 |
| Total (without LULUCF) | 5 583 | 5 213 | 5 078 | 5 149 | 5 132 | 5 079 | 4 974 | 4 610 | 4 721 |

Table ES.5 Overview of EU-15 GHG emissions and removals from 1990 to 2010 (Tg CO₂ equivalents)

| Greenhouse gas emissions | 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Net CO ₂ emissions/removals | 3 191 | 3 100 | | 3 302 | 3 261 | 3 227 | 3 137 | 2 859 | 2 964 |
| CO ₂ emissions (without LULUCF) | 3 362 | 3 293 | 3 368 | 3 480 | 3 459 | 3 404 | 3 328 | 3 062 | 3 147 |
| CH ₄ | 437 | 413 | 373 | 325 | 319 | 314 | 311 | 306 | 304 |
| N ₂ O | 400 | 382 | 341 | 311 | 298 | 297 | 289 | 278 | 269 |
| HFCs | 28 | 41 | 46 | 57 | 59 | 62 | 66 | 69 | 73 |
| PFCs | 17 | 12 | 8 | 5 | 5 | 5 | 4 | 3 | 3 |
| SF ₆ | 11 | 15 | 10 | 7 | 7 | 7 | 6 | 6 | 6 |
| Total (with net CO ₂ emissions/removals) | 4 083 | 3 964 | 3 941 | 4 008 | 3 949 | 3 912 | 3 813 | 3 521 | 3 620 |
| Total (without CO ₂ from LULUCF) | 4 254 | 4 156 | 4 145 | 4 186 | 4 147 | 4 089 | 4 004 | 3 724 | 3 803 |
| Total (without LULUCF) | 4 249 | 4 149 | 4 139 | 4 180 | 4 142 | 4 083 | 3 999 | 3 719 | 3 798 |

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 1990–2010. The most important sector by far is energy (i.e. combustion and fugitive emissions), accounting for 79.7 % of total EU-27 emissions in 2010. The second largest sector is agriculture (9.8 %), 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 1990–2010. More detailed trend descriptions are included in Chapters 3 to 9 of this report.

ES.5 Summary of EU Member State emission trends

Table ES.8 gives an overview of Member State contributions to EU GHG emissions for 1990–2010. 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 of 483 million tonnes CO₂-equivalents compared to 1990.

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

Table ES.6 Overview of EU-27 GHG emissions in the main source and sink categories from 1990 to 2010 (Tg CO₂-equivalents)

| GHG source and sink | 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1. Energy | 4 304 | 4 040 | 3 986 | 4 093 | 4 085 | 4 022 | 3 943 | 3 661 | 3 763 |
| 2. Industrial processes | 465 | 442 | 394 | 408 | 406 | 419 | 397 | 330 | 343 |
| 3. Solvent and other product use | 17 | 14 | 14 | 13 | 13 | 12 | 12 | 11 | 12 |
| 4. Agriculture | 594 | 515 | 504 | 479 | 475 | 476 | 475 | 464 | 462 |
| 5. Land use, land-use change and forestry | - 286 | - 300 | - 298 | - 300 | - 320 | - 298 | - 322 | - 342 | - 312 |
| 6. Waste | 203 | 201 | 180 | 156 | 154 | 149 | 147 | 143 | 142 |
| 7. Other | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total (with net CO ₂ emissions/removals) | 5 297 | 4 913 | 4 780 | 4 848 | 4 812 | 4 781 | 4 653 | 4 268 | 4 409 |
| Total (without LULUCF) | 5 583 | 5 213 | 5 078 | 5 149 | 5 132 | 5 079 | 4 974 | 4 610 | 4 721 |

Table ES.7 Overview of EU-15 GHG emissions in the main source and sink categories from 1990 to 2010 (Tg CO₂-equivalents)

| GHG source and sink | 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1. Energy | 3 278 | 3 205 | 3 258 | 3 348 | 3 324 | 3 264 | 3 198 | 2 969 | 3 042 |
| 2. Industrial processes | 353 | 352 | 311 | 313 | 306 | 311 | 296 | 257 | 265 |
| 3. Solvent and other product use | 13 | 12 | 12 | 10 | 11 | 10 | 10 | 9 | 10 |
| 4. Agriculture | 434 | 414 | 414 | 389 | 384 | 384 | 383 | 375 | 374 |
| 5. Land use, land-use change and forestry | - 166 | - 185 | - 198 | - 172 | - 193 | - 171 | - 186 | - 198 | - 178 |
| 6. Waste | 171 | 166 | 145 | 120 | 118 | 114 | 112 | 110 | 108 |
| 7. Other | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total (with net CO ₂ emissions/removals) | 4 083 | 3 964 | 3 941 | 4 008 | 3 949 | 3 912 | 3 813 | 3 521 | 3 620 |
| Total (without LULUCF) | 4 249 | 4 149 | 4 139 | 4 180 | 4 142 | 4 083 | 3 999 | 3 719 | 3 798 |

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 in 2010, respectively accounting for 11.1 % and 10.6 % of total EU-27 emissions. France's emissions were 6.6 % below 1990 levels in 2010. In France, large reductions were achieved in N₂O emissions from the adipic acid production, but CO₂ emissions from road transport and HFC emissions from consumption of halocarbons increased considerably between 1990 and 2010. Italy's GHG emissions were 3.5 % below 1990 levels in 2010. Emissions increased since 1990 primarily from road transport, electricity and heat production and petroleum refining but the country's total GHG emissions have decreased significantly (7.2 %) since 2008.

Poland and Spain are the fifth and sixth largest emitters in the EU-27, accounting for 8.5 % and 7.5 % of total EU-27 GHG emissions in 2010. Poland decreased GHG emissions by 12.4 % between

1990 and 2010 (and by 28.9 % since the base year, which in Poland's case 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. Spain increased emissions by almost 26 % between 1990 and 2010. This was largely due to emission increases from road transport, electricity and heat production, and manufacturing industries.

ES.6 International aviation and maritime transport

Emissions of greenhouse gases from international aviation and shipping activities increased constantly between 1992 and 2007. Since 2007 emissions have decreased in the EU-27, which partly reflects the economic recession. EU greenhouse gas emissions from international aviation are lower than for international maritime transport but have been growing more rapidly until 2007. The average

Table ES.8 Overview of Member State contributions to EU GHG emissions (excluding LULUCF) from 1990 to 2010 (Tg CO₂-equivalents)

| Member State | 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|----------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Austria | 78 | 80 | 80 | 93 | 90 | 87 | 87 | 80 | 85 |
| Belgium | 143 | 151 | 146 | 144 | 139 | 134 | 137 | 125 | 132 |
| Denmark | 69 | 76 | 68 | 64 | 72 | 67 | 64 | 61 | 61 |
| Finland | 70 | 71 | 69 | 69 | 80 | 78 | 70 | 66 | 75 |
| France | 559 | 555 | 565 | 567 | 552 | 542 | 537 | 515 | 522 |
| Germany | 1 246 | 1 117 | 1 039 | 997 | 999 | 977 | 976 | 912 | 937 |
| Greece | 105 | 110 | 127 | 136 | 132 | 135 | 131 | 125 | 118 |
| Ireland | 55 | 59 | 68 | 69 | 69 | 68 | 68 | 62 | 61 |
| Italy | 519 | 532 | 552 | 575 | 564 | 556 | 542 | 492 | 501 |
| Luxembourg | 13 | 10 | 10 | 13 | 13 | 12 | 12 | 12 | 12 |
| Netherlands | 212 | 223 | 213 | 211 | 207 | 206 | 205 | 199 | 210 |
| Portugal | 60 | 70 | 82 | 87 | 82 | 79 | 78 | 74 | 71 |
| Spain | 283 | 314 | 381 | 435 | 427 | 436 | 404 | 366 | 356 |
| Sweden | 73 | 74 | 69 | 67 | 67 | 66 | 64 | 60 | 66 |
| United Kingdom | 764 | 706 | 670 | 654 | 650 | 640 | 626 | 572 | 590 |
| EU-15 | 4 249 | 4 149 | 4 139 | 4 180 | 4 142 | 4 083 | 3 999 | 3 719 | 3 798 |
| Bulgaria | 114 | 82 | 63 | 66 | 67 | 71 | 69 | 59 | 61 |
| Cyprus | 6 | 10 | 10 | 11 | 11 | 11 | 11 | 11 | 11 |
| Czech Republic | 196 | 150 | 146 | 146 | 148 | 149 | 144 | 135 | 139 |
| Estonia | 41 | 20 | 17 | 19 | 18 | 21 | 20 | 16 | 21 |
| Hungary | 97 | 79 | 77 | 79 | 78 | 76 | 73 | 67 | 68 |
| Latvia | 27 | 13 | 10 | 11 | 12 | 12 | 12 | 11 | 12 |
| Lithuania | 49 | 22 | 19 | 23 | 23 | 25 | 24 | 20 | 21 |
| Malta | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| Poland | 457 | 433 | 385 | 389 | 405 | 407 | 401 | 382 | 401 |
| Romania | 253 | 181 | 141 | 149 | 153 | 150 | 147 | 123 | 121 |
| Slovakia | 72 | 53 | 49 | 51 | 51 | 49 | 50 | 44 | 46 |
| Slovenia | 18 | 18 | 19 | 20 | 21 | 21 | 21 | 19 | 20 |
| EU-27 | 5 583 | 5 213 | 5 078 | 5 149 | 5 132 | 5 079 | 4 974 | 4 610 | 4 721 |

annual EU-27 growth rates in emissions since 1990 were 3.3 % for international aviation and 1.6 % for international maritime transport. Total GHG emissions from international transport reached 285 million tonnes CO₂-equivalents in 2010.

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. Recalculations of past emissions data occur every year, however, based on the inventory improvements that Member States are required to undertake for the whole time series.

Based on EU Member State GHG inventories in 2012, total EU-15 GHG emissions in 2009 were 0.1 % lower than reported in the 2011 GHG inventories. Similarly, total EU-15 emissions in 1990 reported in 2012 GHG inventories were 0.4 % lower than the 1990 emissions reported in 2011 inventories.

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

ES.8 Information on indirect greenhouse gas emissions

Emissions of CO, NO_x, NMVOC and SO₂ must be reported to the UNFCCC Secretariat because they influence climate change indirectly. The first three substances are precursor substances for groundlevel

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 | France | 1 635 | 2.0 | '1990 : report grandes installations de combustion 1992 donc prise en compte des combustibles hors bilan de l'énergie (gaz industriels notamment) 2009 : Mise à jour bilan de l'énergie' |
| 1A3_Transport CO ₂ | France | 1 301 | 1.1 | 'Mise à jour des chiffres des Comptes des Transports de la Nation (CCTN)' |
| 1A2_Manufacturing industries and construction CO ₂ | United Kingdom | 1 260 | 1.3 | ' Emission factors: Revision to coke emission factor due to updated GCV figures. Now reported to greater accuracy in national energy statistics Activity data: Revisions made for some fuels from 2005 onwards in the national energy statistics. Reallocation: Reallocations across sectors for gas oil. Reallocations within 1A2 to disaggregate emissions from 1A2f. More detail within the NIR.' |
| 1A1_Energy industries CO ₂ | United Kingdom | 1 250 | 0.5 | ' Methods: A gap in reporting of OPG use in refineries has been identified and resolved. This affects 2005 onwards; also some revisions to assumptions on EU ETS data for recent years in power stations and refineries. Emission factors: Revisions have been made to solid fuel carbon factors as GCVs are now reported to a higher level of precision. Activity data: Offshore installation data revised following consultation with the offshore regulatory agency and site operators. Activity data revised for powerstations from 2001 for gas oil.' |
| 4D_Agricultural soils N ₂ O | France | - 1 346 | - 2.4 | Changement méthode de l'estimation du N2O issu de la décomposition des résidus de cultures |
| 1A4_Other sectors CO ₂ | United Kingdom | - 1 450 | - 1.3 | ' Revised assumptions: No domestic combustion of natural gas in Gibraltar. Revisions to gas oil activity data based on new research. Revisions made for some fuels in national energy statistics from 2005 onwards.' |
| 4B_Manure management CH ₄ | France | - 1 516 | - 11.0 | Création d'un modèle de calcul des émissions au niveau régional pour 41 catégories + Mise à jour des systèmes de gestion des déjections en bâtiment + Mise à jour des facteurs d'excrétion azotée |
| 4A_Enteric fermentation CH ₄ | France | - 1 595 | - 5.0 | Création d'un modèle de calcul des émissions au niveau régional pour 41 catégories + Mise à jour des systèmes de gestion des déjections en bâtiment + Mise à jour des facteurs d'excrétion azotée |
| 4D_Agricultural soils N ₂ O | Germany | - 2 411 | - 4.8 | Adjusted N-excretion model for 4D1.2 and 4D2; adjusted activity data for 4D1.4, 4D1.5, 4D3.1, 4D3.2. |
| 6A_Solid waste disposal on land CH ₄ | United Kingdom | - 13 075 | - 23.3 | Correction to model. Previous version included an error that over estimated DDOC landfilled. |

Note: The explanations for recalculations are presented as provided by the parties in their national greenhouse gas inventory reports.

ozone which is itself a greenhouse gas. Sulphur dioxide emissions can contribute to forming microscopic particles (aerosols), which 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 and 2010. All

emissions were reduced significantly from 1990 levels; the largest reduction was achieved in SO₂ (85 %), followed by CO (65 %), NMVOC (55 %) and NO_x (47 %).

In the EU-27, SO₂ emissions decreased by 78 %, followed by CO (61 %), NMVOC (53 %) and NO_x (46 %) (Table ES.12).

Table ES.10 Overview of major recalculations in the EU-15 in 2009

| Source category | Member State | Deviation | | Explanation for recalculation |
|---|----------------|--------------------------------|-------|--|
| | | Gg CO ₂ -equivalent | % | |
| 1A1_Energy industries CO ₂ | United Kingdom | 4 541 | 2.5 | ' Methods: A gap in reporting of OPG use in refineries has been identified and resolved. This affects 2005 onwards; also some revisions to assumptions on EU ETS data for recent years in power stations and refineries. Emission factors: Revisions have been made to solid fuel carbon factors as GCVs are now reported to a higher level of precision. Activity data: Offshore installation data revised following consultation with the offshore regulatory agency and site operators. Activity data revised for powerstations from 2001 for gas oil.' |
| 2F_Consumption of halocarbons HFC | United Kingdom | 3 043 | 28.3 | The refrigeration and air conditioning model has been re built to utilise bottom up data across all categories. All parameters have been reviewed and revised. |
| 1A4_Other sectors CO ₂ | France | 1 844 | 1.9 | Mise à jour activité |
| 2C_Metal production CO ₂ | Germany | 1 790 | 14.8 | Activity data: new statistical data available. |
| 6A_Solid waste disposal on land CH ₄ | Germany | 1 281 | 15.1 | Activity data: updated statistical data. |
| 1A4_Other sectors CO ₂ | Italy | 1 191 | 1.4 | ' Update of CO ₂ natural gas emission factor Update of waste fuel consumption for commercial heating.' |
| 4D_Agricultural soils N ₂ O | United Kingdom | 1 150 | 4.6 | ' Crop areas production and categories have been updated. The N ₂ O-N emitted during manure management is no longer subtracted from the N available to apply to soils. Animal numbers and categories were revised and updated. The time spent grazing for dairy and beef cattle has been changed. AWMS distribution has been updated. Crop areas.' |
| 1A1_Energy industries CO ₂ | Italy | - 1 215 | - 0.9 | ' Update of CO ₂ emission factors for pet coke, synthesis gases and derived gases: update of CO ₂ natural gas emission factor Reallocation of fuel oil and natural gas consumptions between energy production and manufacturing industries.' |
| 6A_Solid waste disposal on land CH ₄ | France | - 1 369 | - 8.0 | ' 6A1: Pour le CH ₄ , la baisse des émissions est à imputer à une surestimation (liée à une approche simplificatrice) des émissions de la re-soumission de mai 2011 compensée en partie par une hausse des émissions due à la révision à la hausse du COD (Carbone Organique Degradable). 6A2: Modification du COD de 110 à 114 avant 2000 (mais ef fet de cinétique).' |
| 1A1_Energy industries CO ₂ | Germany | - 1 626 | - 0.5 | ' 1A1a, gaseous fuels, activity data: New statistical data available. 1A1c, solid fuels, activity data: New statistical data available.' |
| 1A2_Manufacturing industries and construction CO ₂ | Italy | - 1 782 | - 3.2 | ' Update of CO ₂ emission factor for residual gas from chemical processes; update of CO ₂ natural gas emission factor; update of CO ₂ emission factors for petcoke, refinery gas and derived solid gases. Reallocation of fuel oil and natural gas consumptions between energy production and manufacturing industries.' |
| 4D_Agricultural soils N ₂ O | Germany | - 3 292 | - 7.6 | Adjusted N-excretion model for 4D1.2 and 4D2; adjusted activity data for 4D1.4, 4D1.5, 4D3.1, 4D3.2. |
| 1A4_Other sectors CO ₂ | Germany | - 4 252 | - 2.9 | New statistical data available. |

Note: The explanations for recalculations are presented as provided by the parties in their national greenhouse gas inventory reports.

In addition, EU Member States annually report emissions of these substances to the United Nations Economic Commission for Europe (UNECE) Convention on Long-range Transboundary Air Pollution (LRTAP). Emissions of NO_x, NMVOCs and SO₂ are also reported under the EU's National Emissions Ceilings Directive ⁽⁵⁾.

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

The present report also includes an analysis of the use of data and emissions reported under the European Union Emissions Trading System

⁽⁵⁾ Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001, OJ L 309, 27.11.2001, p. 22–30.

Table ES.11 Overview of EU-15 indirect GHG and SO₂ emissions for 1990–2010 (Gg)

| Greenhouse gas emissions | 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|--------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | | | | | | | | (Gg) |
| NO _x | 13 695 | 12 054 | 10 512 | 9 504 | 9 191 | 8 882 | 8 175 | 7 460 | 7 259 |
| CO | 53 271 | 42 107 | 31 816 | 24 029 | 22 710 | 21 735 | 20 569 | 18 191 | 18 745 |
| NMVOG | 15 379 | 12 765 | 10 400 | 8 514 | 8 391 | 7 804 | 7 412 | 7 063 | 6 978 |
| SO ₂ | 16 501 | 9 987 | 6 191 | 4 623 | 4 396 | 4 174 | 3 097 | 2 660 | 2 429 |

Table ES.12 Overview of EU-27 indirect GHG and SO₂ emissions for 1990–2010 (Gg)

| Greenhouse gas emissions | 1990 | 1995 | 2000 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|--------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | | | | | | | | (Gg) |
| NO _x | 17 173 | 14 769 | 12 723 | 11 663 | 11 354 | 11 042 | 10 226 | 9 382 | 9 285 |
| CO | 66 241 | 51 013 | 39 545 | 30 316 | 29 004 | 27 998 | 26 964 | 24 467 | 25 620 |
| NMVOG | 17 967 | 14 570 | 12 039 | 10 095 | 9 946 | 9 341 | 8 911 | 8 506 | 8 478 |
| SO ₂ | 25 266 | 16 749 | 10 523 | 8 150 | 8 015 | 7 671 | 6 392 | 5 609 | 5 443 |

(EU ETS) for preparing national GHG inventories in the EU-15. The analysis shows that most Member States use the ETS data to improve and refine the estimation and reporting of CO₂ emissions from energy and industrial processes. All 27 Member States indicated that they used ETS data for quality assurance/quality control purposes and checked data consistency between both sources (see Sections 1.3.2 and 16.2.2).

Fourteen Member States indicated that they directly use the verified emissions reported by installations under the ETS for their national GHG inventories. Twenty-one Member States used ETS data to

improve country-specific emission factors. Seventeen Member States reported that they used activity data (e.g. fuel use) provided under the ETS in the national inventory.

Using ETS data improved the quality of greenhouse gas inventory data in terms of 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 common reporting format (CRF) source categories.

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