

Annual European Community greenhouse gas inventory 1990–2001 and inventory report 2003

Submission to the UNFCCC secretariat

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Executive summary

1. Background information on greenhouse gas inventories and climate change

The European Community, as a party to the United Nations Framework Convention on Climate Change (UNFCCC), reports annually on greenhouse gas (GHG) inventories within the area covered by its Member States.

The legal basis for the compilation of the EC inventory is Council Decision 99/296/EC amending Council Decision 93/389/EC for a monitoring mechanism of Community carbon dioxide (CO₂) and other greenhouse gas emissions ⁽¹⁾. The purpose of this decision is to monitor all anthropogenic GHG emissions not controlled by the Montreal Protocol in the Member States and to evaluate progress towards meeting GHG reduction commitments under the UNFCCC and the Kyoto Protocol.

The EC GHG inventory is compiled on the basis of the inventories of the 15 Member States. It is the direct sum of the 15 national inventories, except for the reference approach for CO₂ from fossil fuels developed by the Intergovernmental Panel on Climate Change (IPCC). The main institutions involved in the compilation of the EC GHG inventory are the Member States, the European Commission — Environment DG, the European Environment Agency (EEA) and its European Topic Centre on Air and Climate Change (ETC/ACC), Eurostat, and the Joint Research Centre (JRC).

The process of compilation of the EC GHG inventory is as follows: Member States submit their annual GHG inventories by 31 December each year to the European Commission Environment DG. Then, the EEA ETC/ACC, Eurostat and the JRC perform initial checks on the submitted data. On 1 March, the draft EC GHG inventory and inventory report are circulated to Member States for review and comment. Member States check their national data and information used in the EC inventory report, send updates if necessary, and review the EC inventory report itself by 1 April. The final EC GHG inventory and inventory report are prepared by EEA ETC/ACC by 15 April for submission by the European Commission to the UNFCCC secretariat.

2. Summary of emission- and removal-related trends

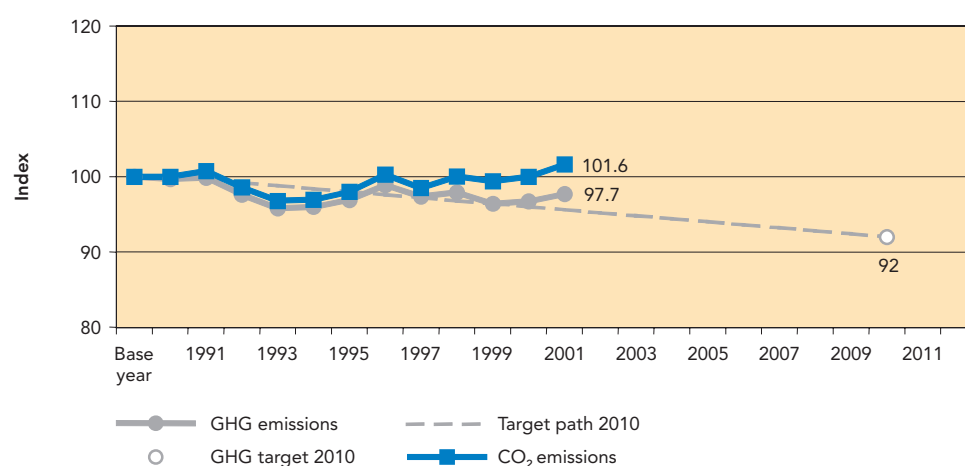
Total GHG emissions without land-use change and forestry (LUCF) in the EC decreased between the base year and 2001 by 95.735 Gg (– 2.3 %). In the Kyoto Protocol, the EC agreed to reduce its GHG emissions by 8 % by 2008–12, from 1990 levels. Assuming a linear target path from 1990 to 2010, total EC GHG emissions were 2.1 index points above this target path in 2001 (see Figure 1).

CO₂ is by far the most important GHG, accounting for 82 % of total EC emissions in 2001. In 2001, EC CO₂ emissions without LUCF were 1.6 % above 1990 levels.

(1) OJ L 117, 5.5.1999, p. 35.

EC GHG emissions for 1990–2001 compared with the target for 2008–12 (excluding LUCF)

Figure 1



Note 1: The linear target path is not intended as an approximation of past and future emission trends. It provides a measure of how close the EC emissions in 2001 are to a linear path of emission reductions from 1990 to the Kyoto target for 2008–12, assuming that only domestic measures will be used. Therefore, it does not deliver a measure of (possible) compliance of the EC with its GHG targets in 2008–12, but aims at evaluating overall EC GHG emissions in 2001. The unit is index points with 1990 emissions being 100.

Note 2: GHG emission data for the EC as a whole do not include emissions and removals from LUCF. In addition, no adjustments for temperature variations or electricity trade are considered.

Note 3: For fluorinated gases the base year 1995 was used for all Member States, which is in line with the base year indicated so far by most Member States individually.

Overview of EC GHG emissions and removals for 1990–2001

Table 1

Greenhouse gas emissions	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
	CO ₂ equivalent (Gg)											
Net CO ₂ emissions/ removals	3 137 195	3 138 005	3 080 042	3 009 213	3 026 711	3 071 406	3 139 324	3 079 282	3 138 854	3 109 487	3 148 754	3 180 074
CO ₂ emissions (without LUCF)	3 329 139	3 354 486	3 282 261	3 222 223	3 227 362	3 262 960	3 339 599	3 279 607	3 329 936	3 308 900	3 329 314	3 383 556
CH ₄	414 145	404 840	393 880	384 199	374 686	370 569	366 408	357 279	350 730	343 154	335 189	329 588
N ₂ O	408 947	402 710	391 975	383 328	388 660	389 434	396 282	394 276	372 024	351 055	349 367	344 495
HFCs	25 668	24 425	25 991	28 453	33 088	39 255	43 692	49 753	54 070	41 449	45 033	43 383
PFCs	13 403	11 808	9 643	8 258	7 523	7 679	7 717	7 358	7 063	6 885	6 163	5 527
SF ₆	8 311	8 940	9 594	10 365	11 269	12 709	12 839	12 827	12 187	9 890	9 765	9 537
Total (with net CO ₂ emissions/ removals)	4 007 668	3 990 728	3 911 125	3 823 817	3 841 937	3 891 053	3 966 262	3 900 775	3 934 928	3 861 919	3 894 272	3 912 604
Total (without LUCF)	4 191 729	4 199 406	4 105 362	4 028 907	4 034 691	4 074 811	4 158 724	4 093 280	4 117 858	4 053 531	4 066 658	4 108 256

Table 1 gives an overview of the main trends in EC GHG emissions and removals for 1990–2001. In 2001 CO₂ emissions made up 82 % of the total GHG emissions in the EC. This was an increase of 54 417 Gg (1.6 %) compared to 1990. This increase was compensated by decreases in CH₄ and N₂O emissions in the same period: CH₄ decreased by 84 557 Gg (–20.4 %) and N₂O decreased by 64 452 Gg (–15.8 %). Fluorinated gases showed opposing trends. While HFC and SF₆ emissions increased by 17.715 Gg (69.0 %) and 1 226 Gg (14.7 %), PFC emissions decreased by 7.875 Gg (–58.8 %).

3. Overview of source and sink category emission estimates and trends

Table 2 gives an overview of EC GHG emissions in the main source categories for 1990–2001. The emissions from the largest source category ‘Energy’, with an 81 % share of the total emissions, increased by 34 170 (1.0 %). This increase was offset by decreases in the second-, third- and fourth-largest categories: emissions from ‘Agriculture’ decreased by 33 543 Gg (–7.7 %), emissions from ‘Industrial processes’ by 50.861 Gg

Table 2 Overview of EC GHG emissions in the main source categories for 1990–2001

Greenhouse gas source and sink categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
	CO ₂ equivalent (Gg)											
1. Energy	3 309 531	3 343 140	3 273 632	3 213 816	3 206 413	3 236 580	3 315 931	3 249 818	3 299 503	3 274 547	3 288 521	3 343 702
2. Industrial processes	302 005	290 366	282 760	274 908	287 732	299 731	302 536	307 258	287 768	251 500	255 935	251 143
3. Solvent and other product use	9 559	9 469	9 258	8 860	8 827	8 857	8 872	8 939	8 974	8 936	9 039	8 771
4. agriculture	433 768	423 311	412 802	407 912	409 350	408 989	412 257	412 354	410 496	410 097	406 816	400 225
5. Land-use change and forestry	- 184 060	- 208 678	- 194 237	- 205 090	- 192 753	- 183 758	- 192 462	- 192 506	- 182 930	- 191 612	- 172 386	- 195 652
6. Waste	134 998	131 282	125 080	121 631	120 452	118 728	117 210	113 134	109 172	106 473	104 392	102 501
7. Other	1 865	1 835	1 828	1 776	1 918	1 937	1 929	1 778	1 946	1 978	1 954	1 914

Table 3 Overview of Member State contribution to EC GHG emissions excluding LUCF for 1990–2001 in CO₂ equivalents (Gg)

Member State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Austria	78 073	82 241	75 291	76 580	77 768	80 797	84 624	84 146	83 819	82 123	81 951	85 880
Belgium	141 216	147 107	145 641	144 038	147 636	151 773	154 182	149 243	153 403	150 054	149 943	150 169
Denmark	69 217	79 910	73 459	76 209	80 039	77 335	90 778	80 945	75 797	72 750	68 181	69 410
Finland	77 233	75 281	72 173	72 829	79 195	76 652	82 122	81 056	78 512	77 831	75 391	80 888
France	560 775	583 739	573 892	552 304	548 945	558 052	573 851	566 525	582 082	564 074	557 909	560 757
Germany	1 211 579	1 158 262	1 104 970	1 086 585	1 065 314	1 058 861	1 077 642	1 040 112	1 015 984	982 932	981 468	993 505
Greece	104 755	104 760	106 172	106 714	109 238	110 429	114 220	119 504	124 343	123 697	129 652	132 176
Ireland	53 420	54 461	55 284	54 983	56 707	57 583	59 249	62 030	64 124	66 256	68 184	70 018
Italy	508 629	510 208	507 441	498 038	492 169	520 385	514 671	521 598	532 608	538 627	543 751	545 355
Luxembourg	10 883	10 455	10 303	10 595	10 257	7 792	7 851	6 851	5 919	6 029	5 996	6 077
Netherlands	210 004	217 795	216 651	219 569	220 869	223 314	232 901	220 330	225 156	216 446	216 816	219 694
Portugal	61 441	63 251	67 322	65 617	66 253	69 972	67 496	69 670	74 577	82 880	82 256	83 823
Spain	287 609	294 203	303 051	291 330	306 069	319 363	311 373	332 546	343 082	371 057	387 104	382 789
Sweden	72 756	72 873	72 042	71 881	76 679	75 085	78 687	73 772	74 907	72 239	68 949	70 485
United Kingdom	744 139	744 862	721 671	701 635	697 555	687 417	709 075	684 952	683 543	646 537	649 107	657 232
EU15	4 191 729	4 199 406	4 105 362	4 028 907	4 034 691	4 074 811	4 158 724	4 093 280	4 117 858	4 053 531	4 066 658	4 108 256

(- 16.8 %), and emissions from 'Waste' by 32 498 Gg (- 24.1 %).

Table 3 gives an overview of the Member States' contribution to the EC GHG emissions for 1990–2001. The largest emitter with a 24.2 % share of the total EC emissions in 2001 was Germany with 993 505 Gg and the smallest with a 0.15 % share was Luxembourg with 6 077 Gg.

Germany reduced its emissions significantly (- 18 %) between 1990 and 2001, although the emissions increased again between 2000 and 2001 (1.2 %). Similarly, the second-largest emitter, the United Kingdom reduced its emissions by 12 % between 1990 and 2001, though they increased between 2000 and 2001 by 1.3 %. The third-largest emitter, France, stabilised its 2001 emissions at the level of 1990, despite a 0.5 % increase compared to 2000. The smallest emitter, Luxembourg, decreased its emissions

continuously from 1990 to 2001; the overall reduction from the 1990 level was 44 %.

4. Information on indirect greenhouse gas and sulphur dioxide emissions

Emissions of CO, NO_x, NMVOC and SO₂ have to be reported to the UNFCCC secretariat because they influence climate change indirectly: CO, NO_x and NMVOC are precursor substances for ozone which itself is a greenhouse gas. Sulphur emissions produce microscopic particles (aerosols) that can reflect sunlight back out into space and also affect cloud formation. Table 4 shows the total indirect GHG and SO₂ emissions in the EC between 1990 and 2001. All emissions were reduced significantly from the 1990 levels: the largest reduction was achieved for SO₂ (- 63.6 %) followed by CO (- 40.2 %), NMVOC (- 29.4 %) and NO_x (- 25.8 %).

Overview of EC indirect GHG emissions for 1990–2001 (Gg)

Table 4

Greenhouse gas emissions	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
	Gg											
NO _x	13 402	13 295	12 985	12 368	11 995	11 673	11 566	11 083	10 774	10 417	10 129	9 941
CO	50 387	48 511	46 579	44 189	41 955	40 446	39 219	37 417	35 539	33 536	30 996	30 118
NMVOC	17 026	16 486	15 978	15 301	15 172	13 874	14 113	14 013	13 181	12 787	12 215	12 014
SO ₂	16 375	14 871	13 692	12 452	11 300	10 184	8 880	7 997	7 603	6 819	6 177	5 963

1. Introduction to the European Community greenhouse gas inventory

This report is the annual submission of the European Community (EC) to the United Nations Framework Convention on Climate Change (UNFCCC). It presents the greenhouse gas (GHG) inventory of the EC, the process and the methods used for the compilation of the EC inventory as well as GHG inventory data of the individual Member States for 1990 to 2001. The GHG inventory data of the Member States are the basis of the EC GHG inventory. The data published in this report are also the basis of the progress evaluation report of the European Commission (due in October 2003), required under Council Decision 99/296/EC for a monitoring mechanism of Community CO₂ and other greenhouse gas emissions.

This report aims to present transparent information on the process and methods used for compiling the EC GHG inventory. It addresses the relevant aspects at EC level, but does not describe particular sectoral methodologies of the Member States' GHG inventories. Detailed information on methodologies used by the Member States is available in the national Member State inventory reports, submitted separately to the UNFCCC secretariat. However, several chapters in this report compile information provided by the Member States, where additional insights can be gained. In many cases this Member State information is presented in summary overview tables.

The EC GHG inventory has been compiled according to Council Decision 99/296/EC for a monitoring mechanism of Community CO₂ and other greenhouse gas emissions ⁽²⁾ and is based on data delivered by the Member States before 4 April 2003. The EC GHG inventory is the direct sum of the 15 national inventories, except for the IPCC reference approach for CO₂ from fossil fuels. Since the data are revised and updated for all years, they replace EC data previously published, in particular, in the 2002 submission by the European Commission to the UNFCCC secretariat of the *Annual*

European Community greenhouse gas inventory and inventory report 1990–2000 (EEA, 2002a) and in the report entitled *Greenhouse gas emission trends in Europe, 1990–2000* (EEA, 2002b).

1.1. Background information on greenhouse gas inventories and climate change

The annual EC GHG inventory is required for two purposes.

First, the EC, as the only regional economic integration organisation having joined the UNFCCC as a party, has to report annually on GHG inventories within the area covered by its Member States.

Secondly, under the monitoring mechanism, the European Commission has to assess annually whether the actual and projected progress of Member States is sufficient to ensure fulfilment of the EC's commitments under the UNFCCC and the Kyoto Protocol. For this purpose, the Commission has to prepare a progress evaluation report, which has to be forwarded to the European Parliament and the Council by October each year. The annual EC inventory is an important element for the evaluation of actual progress.

The legal basis for the compilation of the EC inventory is Council Decision 99/296/EC amending Council Decision 93/389/EC for a monitoring mechanism of Community CO₂ and other greenhouse gas emissions. The purpose of this decision is to monitor all anthropogenic GHG emissions not controlled by the Montreal Protocol in the Member States and to evaluate progress towards meeting GHG reduction commitments under the UNFCCC and the Kyoto Protocol.

Under the provisions of Article 3.2 of Council Decision 99/296/EC, the Member States shall report to the Commission each year, not later than 31 December:

(2) OJ L 117, 5.5.1999, p. 35.

- their anthropogenic CO₂ emissions by sources and removals by sinks for the previous calendar year;
- final national inventory data on emissions by sources and removals by sinks for the other GHGs for the previous year but one and provisional emission data (inventories) for the previous year.

Other GHGs include the five other Kyoto Protocol GHGs: methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆). In addition, annual information on emissions of the following gases shall be provided: carbon monoxide (CO), nitrogen oxides (NO_x), non methane volatile organic compounds (NMVOCs) and sulphur oxides, in line with the reporting requirements under the UNFCCC.

The reporting requirements for the Member States under Council Decision 99/296/EC are elaborated in guidelines under this decision, in particular 'Part 1: Guidelines for Member States and EC annual inventories' (European Commission, 2000). According to the decision and these guidelines the reporting requirements are exactly the same as for the UNFCCC, regarding content and format. The EC and its Member States use the *UNFCCC guidelines on reporting and review* (document FCCC/CP/1999/7), and prepare inventory information in the common reporting format (CRF) and the 'National inventory report' that contains background information.

In accordance with UNFCCC guidelines, the EC and its Member States use the IPCC *Good practice guidance and uncertainty management in national greenhouse gas inventories* (IPCC, 2000), which is consistent with the *Revised 1996 IPCC guidelines for national greenhouse gas inventories* (IPCC, 1997). The use of this report by countries is expected to lead to higher quality inventories and more reliable estimates of the magnitude of absolute and trend uncertainties in reported GHG inventories.

1.2. A description of the institutional arrangements for inventory preparation

The main institutions involved in the compilation of the EC GHG inventory are the Member States, the European Commission — Environment DG, the

European Environment Agency (EEA) and its European Topic Centre on Air and Climate Change (ETC/ACC), Eurostat, and the Joint Research Centre (JRC). Table 1 shows the main institutions and persons involved in the compilation and submission of the EC inventory.

1.2.1. The Member States

All Member States are parties to the UNFCCC. Therefore, all Member States have to prepare individual GHG inventories in accordance with UNFCCC reporting guidelines and to submit those inventories to the Commission by 31 December every year.

Apart from submitting their national GHG inventories and inventory reports the Member States take part in the review and comment phase of the draft EC inventory report, which is sent to the Member States by 1 March each year. The purpose of circulating the draft EC inventory report is to improve the quality of the EC inventory. The Member States check their national data and information used in the EC inventory report and send updates, if necessary. In addition, they comment on the general aspects of the EC inventory report.

The Member States also take part in the Monitoring Committee established under Council Decision 99/296/EC. The purpose of the Monitoring Committee is to assist the European Commission in its tasks under Council Decision 99/296/EC.

1.2.2. The European Commission, Directorate-General for the Environment

The European Commission, Directorate-General for the Environment in consultation with the Member States has the overall responsibility for the EC inventory. The European Commission is the official receiver of the Member State national inventories and inventory reports under Council Decision 99/296/EC and the official supplier of the EC inventory and inventory report to the UNFCCC secretariat. In the actual compilation of the EC inventory and inventory report, the Environment DG is assisted by the EEA including its ETC/ACC and by Eurostat and the JRC.

The consultation between the Environment DG and the Member States takes place in the Monitoring Mechanism Committee (established under Article 8 of Council Decision 99/296/EC). The committee is

Table 1

List of institutions and experts responsible for the compilation of Member State inventories and for the preparation of the EC inventory

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Joint Research Centre (JRC)	Frank Raes Joint Research Centre, Institute for Environment and Sustainability, Climate Change Unit Via Enrico Fermi, I-21020 Ispra (VA)

composed of the representatives of the Member States and chaired by the representative of the European Commission Environment DG. Procedures within the Committee for decision-making, adoption of measures and voting are also outlined in Council Decision 99/296/EC. In order to facilitate decision making in the committee, three working groups have been established: Working Group 1 'Annual inventories', Working Group 2 'Assessment of progress (effect of policies and measures, projections)' and Working Group 3 'Emission trading'.

The objectives and tasks of Working Group 1 under the Monitoring Mechanism Committee include:

- the promotion of the timely delivery of national annual GHG inventories as required under the monitoring mechanism;
- the improvement of the quality of GHG inventories on all relevant aspects (transparency, consistency, comparability, completeness, accuracy and use of good practices);
- the exchange of practical experience on inventory preparation, on all quality aspects and on the use of national methodologies for GHG estimation;
- the evaluation of the current organisational aspects of the preparation process of the EC inventory and the preparation of proposals for improvements where needed.

1.2.3. The European Environment Agency

The European Environment Agency assists the Commission in the compilation of the annual EC inventory through the work of the ETC/ACC. The activities of the EEA ETC/ACC include:

- initial checks of Member State submissions in cooperation with Eurostat, and the JRC, up to 1 March and compilation of results from initial checks (status reports, consistency and completeness reports);
- consultation with Member States in order to clarify data and other information provided;
- preparation and circulation of the draft EC inventory and inventory report by 1 March based on Member State submissions;

- preparation of the final EC inventory and inventory report by 15 April (to be submitted by the Commission to the UNFCCC secretariat);
- assisting Member States in their reporting of GHG inventories by means of supplying software tools.

The tasks of the EEA and the ETC/ACC are facilitated by the European Environmental Information and Observation Network (EIONET), which consists of the EEA as central node (supported by European Topic Centres) and national institutions in the EEA member countries that supply and/or analyse national data on the environment (see <http://eionet.eea.eu.int/>).

1.2.4. The European Topic Centre on Air and Climate Change

The European Topic Centre on Air and Climate Change was established by a contract between the lead organisation National Institute of Public Health and the Environment — RIVM (the Netherlands) and the EEA in March 2001. The ETC/ACC involves 13 organisations and institutions in nine European countries. The technical annex for the 2003 work plan for the ETC/ACC and an implementation plan specify the specific tasks of the ETC/ACC partner organisations with regard to the preparation of the EC inventory. The Federal Environment Agency, Austria (UBA Vienna) is the task leader for the compilation of the EC annual inventory in the ETC/ACC, including all tasks mentioned above.

The EEA ETC/ACC provides software tools for Member States to compile national GHG inventories and to convert their national inventory from Corinair-SNAP source category codes into the required CRF source categories. The main software tools are CollectER, for compiling and updating national emission inventories, and reportER, for reporting the emissions in the required format, e.g. CRF. In addition, separate software tools are available to prepare estimates of emissions from agriculture and road transport. These tools are being used by several Member States. The EEA ETC/ACC adapts the tools regularly to latest changes in reporting requirements. The tools are available at <http://etc-acc.eionet.eu.int/>.

1.2.5. Eurostat

Based on Eurostat energy balance data, Eurostat compiles annually by 31 March

estimates of the EC CO₂ emissions from fossil fuels using the IPCC reference approach. Eurostat compares these estimates with national estimates of CO₂ emissions from fossil fuels prepared by Member States and provides information summarising and explaining these differences. In order to improve the consistency of Member State and Eurostat energy data, a project on harmonisation of energy balances has started between Eurostat and national statistical offices. In addition, Eurostat is leading an EU project aimed at improving estimates of GHG emissions from international aviation.

1.2.6. The Joint Research Centre

The Joint Research Centre assists in the improvement of methodologies for the land-use, land-use change and forestry (LULUCF) sector. It does so (1) by intercomparing methodologies used by the Member States for estimating emissions and removals with a focus on LULUCF and (2) by providing EU-wide estimates with various models/methods

for emissions and removals with a focus on LULUCF (including inverse modelling using measurement of ambient air concentrations of GHGs). In addition, the JRC is leading a project for improving the methodologies used for estimating GHG emissions from agriculture.

1.3. A description of the process of inventory preparation

The annual process of compilation of the EC inventory is summarised in Table 2. The Member States should submit their annual GHG inventory by 31 December each year to the European Commission Environment DG. Then, EEA ETC/ACC, Eurostat and the JRC perform initial checks of the submitted data up to 1 March. ETC/ACC transfers the nationally submitted data from the common reporting format (CRF) tables into spreadsheets. From these spreadsheets the data are transferred into the EC CRF tables and into the ETC/ACC database.

Table 2 Annual process of submission and review of Member State inventories and compilation of the EC inventory ⁽¹⁾

Element	Who	When	What
1. Submission of annual inventory by Member State	Member States	31 December annually	Anthropogenic CO ₂ emissions and CO ₂ removals by sinks, for the year n-1 Emissions by source and removals by sinks of the other GHGs Final data for the year n-2 and provisional data for the year n-1 ⁽²⁾
2. Initial check of Member State submissions	European Commission (Environment DG, Eurostat, JRC), assisted by EEA ETC/ACC	up to 1 March	Initial checks (by EEA ETC/ACC) Comparison of energy data in Member State IPCC reference approach with Eurostat energy data (by Eurostat and Member States) and comparison of Member States' and JRC's LULUCF inventory estimates
3. Compilation and circulation of draft EC inventory and inventory report	European Commission Environment DG, assisted by EEA ETC/ACC	1 March	Draft EC inventory (by EEA), based on Member States' inventories and additional information where needed Circulation of the draft EC inventory on 1 March
4. Submission of updated or additional data by Member States	Member States	up to 1 April	Updated or additional data submitted by Member States ⁽³⁾
5. Final annual EC inventory	European Commission Environment DG, assisted by EEA ETC/ACC	15 April	Submission of the final annual EC inventory to UNFCCC. This inventory will also be used to evaluate progress as part of the monitoring mechanism
6. Additional review of Member State submissions and EC inventory	European Commission (Environment DG, Eurostat, JRC), assisted by EEA ETC/ACC	June to December	Additional review aimed at improving the next annual Member States' and EC inventories In November Eurostat makes available to Member States energy balance data (1990 to inventory year)

⁽¹⁾ In accordance with Council Decision 1999/296/EC.

⁽²⁾ In accordance with Articles 3(1) and 3(2) of Council Decision 1999/296/EC.

⁽³⁾ Preferably updating is limited to the following situations: to remove major inconsistencies, to fill major gaps or to provide essential additional information. Documentation should be included describing which data are updated or are additional, compared to the submission of 31 December.

On 1 March, the draft EC GHG inventory and inventory report are circulated to the Member States for review and comment. The Member States check their national data and information used in the EC inventory report and send updates, if necessary, and review the EC inventory report by 1 April. This procedure should assure the timely submission of the EC GHG inventory and inventory report to the UNFCCC secretariat and it should guarantee that the EC submission to the UNFCCC secretariat is consistent with the Member State UNFCCC submissions.

The final EC GHG inventory and inventory report is prepared by the EEA ETC/ACC by 15 April for submission to the UNFCCC secretariat. In late April the inventory and the inventory report are published on the EEA web site (<http://www.eea.eu.int>) and the data are made available through the EEA data warehouse (<http://dataservice.eea.eu.int/dataservice>). In addition, the EC inventory report is published by the EEA as a printed report, with a CD-ROM including the data.

1.4. A general description of methodologies and data sources used

The inventory is compiled in accordance with the recommendations for inventories set out in the UNFCCC 'Guidelines for the preparation of national communications by parties included in Annex 1 to the Convention, Part 1: UNFCCC reporting guidelines on annual inventories', to the extent possible⁽³⁾. In addition, the *Revised IPCC 1996 guidelines for national greenhouse gas inventories* have been applied and also the *IPCC Good practice guidance*, where appropriate and feasible. At EC level, Council Decision 99/296/EC and the guidelines thereunder have been used for the compilation of the EC GHG inventory.

The EC greenhouse gas inventory is compiled on the basis of the inventories of the 15 Member States. The reference approach is calculated for the EC on the basis of Eurostat energy data (see Chapter 3.5) and the key source analysis (Chapter 1.5) is separately performed at EC level.

Since Member States use different national methodologies, background activity data or emission factors in accordance with IPCC guidelines, these methodologies are reflected in the EC GHG inventory data. In general, no additional methodological information can be provided at EC level except summaries of methodologies used by Member States.

However, in some areas possibilities of quality improvement were defined for the estimation at Member State level, and work was started in these areas including energy background data, emissions from international bunkers, emissions and removals from LUCF, and emissions from agriculture.

The EC CRF Table Summary 3 in Annex 2 provides information on methodologies and emission factors used by the Member States. These tables have been compiled on the basis of the information provided by the Member States in their CRF Tables Summary 3. The sector-specific chapters list the methodologies and emission factors used by the Member States for each EC key source. Annex 5 includes the CRF Tables Summary 3 for those Member States that submitted these tables in 2002.

1.5. A description of key source categories

A key source analysis has been carried out according to the Tier 1 method (quantitative approach) described in IPCC (2000). A key source category is defined as an emission source that has a significant influence on a country's GHG inventory in terms of the absolute level of emissions, the trend in emissions, or both. The basis of the analysis is IPCC (2000), but the source categories adopted for the analysis at EC level are more aggregated than those suggested in IPCC (2000) because of lack of data at a more disaggregated level.

In addition to the key source analysis at EC level, the Member States provide a national key source analysis which can differ from the assessment at EC level. The EC key source analysis is not intended to replace key source analysis by Member States. The key source analysis at EC level is carried out to identify those source categories for which overviews of Member States' methodologies, emission factors and quality estimates are provided.

(3) The UNFCCC guidelines were revised in 2002 (FCCC/CP/2002/8, 28 March 2003). Parties should start using the revised guidelines for reporting the annual inventories due in 2004. However, the structure of the NIR as included in the revised guidelines was already used for the EC inventory report 2003, in order to make the report more transparent.

Table 3 EC GHG source categories identified as key sources (emissions in Gg of CO₂ equivalents)

GREENHOUSE GAS SOURCE CATEGORIES	Gas	Base year	2001	Absolute change	% change	Level assessment %	Cumulative total %
		(Gg)					
1.A.1. Energy industries	CO ₂	1 144 434	1 119 301	- 25 133	- 2	27.2	27.2
1.A.3. Transport	CO ₂	695 003	833 925	138 922	20	20.3	47.5
1.A.4. Other sectors	CO ₂	635 096	655 763	20 667	3	16.0	63.5
1.A.2. Manufacturing industries and construction	CO ₂	642 348	585 160	- 57 189	- 9	14.2	77.8
4.D. Agricultural soils	N ₂ O	214 489	196 818	- 17 670	- 8	4.8	82.5
4.A. Enteric fermentation	CH ₄	144 091	131 631	- 12 460	- 9	3.2	85.7
2.A. Mineral products	CO ₂	106 934	105 952	- 982	- 1	2.6	88.3
6.A. Solid waste disposal on land	CH ₄	110 982	80 295	- 30 687	- 28	2.0	90.3
2.B. Chemical industry	N ₂ O	106 096	49 167	- 56 929	- 54	1.2	91.5
4.B. Manure management	CH ₄	45 172	45 268	97	0	1.1	92.6
2 F Consumption of halocarbons and SF ₆	HFC	6 167	31 383	25 216	409	0.8	93.3
1.B.2. Oil and natural gas	CH ₄	32 969	28 338	- 4 631	- 14	0.7	94.0
1.A.3. Transport	N ₂ O	11 660	26 361	14 701	126	0.6	94.7
2.C. Metal production	CO ₂	25 702	23 856	- 1 847	- 7	0.6	95.3
4.B. Manure management	N ₂ O	23 495	21 562	- 1 933	- 8	0.5	95.8
1.B.2. Oil and natural gas	CO ₂	17 247	16 377	- 870	- 5	0.4	96.2
1.B.1. Solid fuels	CH ₄	48 510	15 277	- 33 233	- 69	0.4	96.5
2 E Production of halocarbons and SF ₆	HFC	32 373	11 957	- 20 416	- 63	0.3	96.8
2.B. Chemical industry	CO ₂	12 884	10 769	- 2 116	- 16	0.3	97.1
1.B.1. Solid fuels	CO ₂	9 283	8 081	- 1 202	- 13	0.2	97.3
1.A.4. Other sectors	CH ₄	10 453	7 739	- 2 713	- 26	0.2	97.5
1.A.5. Other	CO ₂	20 076	7 307	- 12 770	- 64	0.2	97.7
2 F Consumption of halocarbons and SF ₆	SF ₆	9 617	6 543	- 3 074	- 32	0.2	97.8
6.B. Waste-water handling	N ₂ O	6 492	5 579	- 913	- 14	0.1	98.0
2 C Metal production	PFC	5 637	3 100	- 2 537	- 45	0.1	98.0
4.D. Agricultural soils	CO ₂	3 208	1 946	- 1 262	- 39	0.0	98.1
2.G. Other	CO ₂	1 111	1 295	184	17	0.0	98.1
6.D. Other	CO ₂	881	420	- 461	- 52	0.0	98.1

To identify key source categories of the EC, the following procedure was applied.

1. Starting point for the key source identification for this report was the CRF Table Summary 1.A of the EC GHG inventory. All source categories where GHG emissions occur were listed, at the most disaggregated level available at EC level and split by gas. This way, a list of 68 source categories was identified.
2. For the base year only a level assessment was carried out. For all years starting from 1991 a level and a trend assessment was performed. Annex 1 shows the key sources identified in the level and trend assessments for all years from the base year to 2001.

3. This procedure resulted in the identification of 28 key source categories for the EC for 2001. The EC key sources are listed in Table 3 and ranked according to their level contribution to total EC GHG emissions in 2001. They cover 98.1 % of total EC GHG emissions in 2001.

In Chapters 3 to 9 for each key source an overview table is presented which includes the Member States' contributions to the EC key source in terms of level and trend, and information on methodologies, emission factors, completeness and qualitative uncertainty estimates.

Quality control activities related to the EC inventory at the UBA Vienna

Table 4

Main types of checks	Check report	Checks
Initial checks of Member State submissions	Status report	Complete status report form for each Member States' submission
	Consistency and completeness report (1)	Check deviations in time-series of +/- 10 % annually and +/- 50 % over the whole time period
		Check time-series against previous submissions (document deviation +/- 5 %)
		Check sub-categories sum
		Check information availability in those CRF tables that are needed for the compilation of the EC inventory
Check consistency between NIR and CRF		
Checks during the preparation of the EC inventory	Preparation report	Check that known data gaps that result in incomplete source category emission estimates are documented
		Check that Member State submissions using the same input data (e.g. energy consumption, animal population data) report comparable values (i.e. analogous in magnitude) for the data (in case that these activity data are reported at EC level)
		Document any further findings and procedures applied
		Specify exact data source (e.g. are data taken from Table 1.A or Table 10)
Checks before the final submission of the CRF	CRF tables	Confirm that estimates are reported for all source categories and for all years from the appropriate base year to the period of the current inventory
		Check that emissions data are correctly (1) aggregated from lower reporting levels to higher reporting levels when preparing summaries and (2) transcribed between different intermediate sheets
		Check that the number of significant digits or decimal places for common parameters, conversion factors, emission factors, or activity data are consistent across source categories; total emissions should also be reported consistently (in terms of significant digits or decimal places) across source categories
		Inventory report
		Check the inventory report (layout, consistency, tables and figures, references, general format)

(1) The consistency and completeness reports were sent to the Member States on 1 March and are available from the EEA on request.

1.6. Information on the quality assurance and quality control plan

The EC GHG inventory is based on the annual inventories of the Member States. Therefore, the quality of the EC inventory depends on the quality of the Member States' inventories, the quality assurance and quality control (QA/QC) procedures of the Member States and the quality of the compilation process of the EC inventory.

1.6.1. Quality assurance and quality control of the European Community inventory

The initial checks of Member State submissions are an essential component of the annual QA/QC procedure at EC level. The initial checks include two elements; checking the completeness of the Member

States' CRF tables and checking the consistency of Member States GHG data.

The checks of completeness of Member State submissions are carried out by the ETC/ACC by using a similar status report form as used by the UNFCCC secretariat. The completed status reports are made available to Member States (through the EIONET and the circulation on 1 March); then Member States can check the status reports and update information, if needed. The status reports of the Member State submissions as by 4 April 2003 are included in Annex 3 of this report.

The consistency check of Member States' data primarily aims at the identification of main problems in time-series or sub-category sums. In addition, the ETC/ACC identifies problems by comparison with the previous year's inventory submission of the Member

States and checks the availability of the CRF tables needed for the compilation of the EC inventory. The results of these checks are documented in the consistency and completeness report and are made available to the Member States, in order to obtain, if needed, revised emission estimates or additional information before 1 April.

After the initial checks of the emission data, the ETC/ACC transfers the national data from the CRF tables into spreadsheets and into the ETC/ACC database on emissions of GHGs and air pollutants. The version of the data received by the ETC/ACC are numbered, in order to be traced back to their source. The ETC/ACC database is a relational database (MS Access) and maintained and managed by UBA Vienna. A number of further checks are carried out during the compilation of the EC inventory and before submitting the final EC GHG inventory and inventory report.

Sector specific checks and activities to improve the quality of the EC inventory are performed by Eurostat in the energy sector (see Chapters 3.3 and 3.6) and by the JRC in the agriculture and LUCF sectors (see Chapters 6.3 and 7.2).

The circulation of the draft EC inventory and inventory report on 1 March to the Member States for review and comment is also an element to improve the quality of the EC inventory and inventory report. The Member States check their national data and information used in the EC inventory report and send updates, if necessary, and review the EC inventory report. This procedure should assure the timely submission of the EC GHG inventory and inventory report to the UNFCCC secretariat and it should guarantee that the EC submission to the UNFCCC secretariat is consistent with the Member States' UNFCCC submissions.

Finally, also the detailed analysis of GHG emission trends of the EC and each EC Member State after the submission of the EC inventory to the UNFCCC contributes to the improvement of the quality of the EC GHG inventory. This analysis is carried out in the annual EC GHG trend report (see EEA, 2002b); the report identifies sectoral indicators, for socioeconomic driving forces of greenhouse gas emissions, by using data from Eurostat or from Member States' detailed inventories. In addition, it compares and analyses Member States' emission trends in the EC key sources and provides main explanations, either socioeconomic developments or policies and measures, for these trends in some Member States.

1.6.2. Overview of quality assurance and quality control procedures in place at Member State level

The following Table 5 gives an overview of QA/QC procedures in place at Member State level. The information is taken from the latest available Member States' national inventory reports.

1.7. General uncertainty evaluation

The CRF Table 7 in Annex 2 shows information on completeness and quality of GHG emissions for the EC key sources. These estimates are based on the information provided by the Member States in their CRF Tables 7. The overview tables in Chapters 3 to 9 provide this information for each EC key source.

Table 6 gives an overview of information provided by Member States on uncertainty estimates in their latest available national inventory reports and presents summarised results of these estimates. The overview table provides general information on uncertainty estimates of the Member States and quantified uncertainty estimates at total gas level, if available.

Overview of QA/QC procedures in place at Member State level as at 1 April 2003
(mainly excerpts from Member States' national inventory reports 2002 and 2003)

Table 5

	Short description of the QA/QC procedures in place extracted from Member States' national inventory reports	Source
Austria	The Austrian Federal Environment Agency as the responsible body for compiling the national GHG emissions inventory is currently implementing a quality management following EN 45000, a series of European standards similar to the ISO 9000 series. The Federal Environment Agency has decided to implement a quality management system based on the European standard EN 45004, which specifies general criteria for the operation of various types of bodies performing inspections. The full implementation of the system was foreseen for June 2001, the accreditation of the Federal Environment Agency as inspection body according to EN 45004 is foreseen for 2003. The QA/QC system which is currently implemented at the Federal Environment Agency is fully compatible with the requirements of the IPCC's <i>Good practice guidance</i> (IPCC, 2000).	Federal Environment Agency — Austria (2001)
Denmark	In the preparation of Denmark's annual emission inventories normal and common Quality Control procedures are performed. Work on quality assurance and documentation is carried out as a result of the UNFCCC's in-depth-reviews, latest resulting in the report 'Report of the individual review of the greenhouse gas inventory of Denmark submitted in the year 2001'. Work to improve QA/QC procedures in preparing the Danish emission inventories is included in a planned project to implement GPG and improve reporting as a consequence of the Kyoto Protocol.	National Environmental Research Institute (2002)
Finland	The quality management system for the national GHG inventory is currently under development and will be implemented in the inventory of 2002 emissions. Statistics Finland as the national inventory agency will coordinate the project. The expert institutes participating in the inventory are presently building up quality systems for the inventories in their areas of expertise. The annually reported CRF tables are archived both at the Finnish Environment Institute and Statistics Finland. The method descriptions together with documents of the original data sources are archived at the Finnish Environment Institute with the exception of confidential activity data in the energy sector that are archived at Statistics Finland. The present inventory of 2001 emissions is not verified by a third party but in the interministerial working group.	Ministry of the Environment (2003a)
France	All actions concerning the improvement of QA/QC will be reinforced, in particular by the adaptation of QA/QC instruments and procedures, extended consultation with experts in different fields, the ISO 9001 certification of the institution compiling the inventory, etc.	Citepa (2001)
Ireland	Ireland has not yet developed formal QA/QC systems on the scale recommended by the IPCC <i>Good practice guidance</i> . The inventory preparation process employed in Ireland does incorporate a number of activities that may be regarded as fundamental elements of quality control. The emission estimates for the most important source sectors (energy and agriculture) are produced in three computational systems simultaneously. Firstly, simple spreadsheets are used to undertake a considerable amount of preparatory calculations and to subsequently derive the emissions estimates by combining activity data and emission factors at the most appropriate level of disaggregation. Conversion to IPCC source categories is part of this process. Secondly, the greenhouse gas emission estimates are derived by the CollectER software, as part of a much wider range of emission inventories stored in the database. Thirdly, the IPCC software is used to produce emissions in the major source categories because the results may be directly imported into the CRF file, providing a convenient starting point in the preparation of the annual CRF. This duplication provides rigorous internal checking of the calculation process and it ensures that there is consistency of application regarding units, aggregation, inputs that are common to several source categories and, in the case of energy, the inclusion of emission estimates supplied by contributing bodies. Simple comparison of source category totals at IPCC Level 1 or Level 2 and at the national scale provides convenient completeness checks and immediate identification of gross errors or omissions.	Environmental Protection Agency (2002)
Netherlands	In 1997, the quality assurance system ISO 9001 was introduced to ascertain the quality of the monitoring process related to the pollutant emission register (PER). All procedural activities by the Inspectorate for Environmental Protection of the Ministry of Housing, Spatial Planning and the Environment (VROM/HIMH), the Netherlands Organisation for Applied Scientific Research (TNO) and the National Institute of Public Health and Environment (RIVM) are subject to this quality control as well as the maintenance of the PER database by RIVM. However, the activities of actual data collection and emission calculations by the task groups are not yet part of the formal ISO quality assurance programme. A number of external reviews have been conducted regarding GHG emission data in recent years, although the contents of the PER as a whole is not subjected to regular external reviews. An inventory improvement programme was started with the creation of the working group on emission monitoring of GHGs (WEB). In 2001, the WEB started a two-phase project, to develop a QA/QC system for the Dutch NIR/CRF process which is in line with the QA/QC guidelines from the UNFCCC and the IPCC. The first phase evaluated existing practices; the second phase is directed to develop and implement the QA/QC system itself and started in 2002.	Olivier, J.G.J., Brandes, L.J., Peters, J.A.H.W. and Coenen, P.W.H.G. (2002)
Sweden	Sweden has begun an initial quality assurance (QA), but the QA/QC plan is not fully adopted yet. Apart from the UNFCCC's in-depth reviews and individual reviews on the inventories resulting in the 'Report of the individual review of the GHG inventory of Sweden submitted in the year 2001', quality assurance (QA) with independent review of the inventories has partly been made in 2002 and will be further developed in 2003 and 2004. The IPCC has developed guidance on good practice, which also includes good practice guidance on QA/QC. For some parts of the Swedish emission inventories the good practice has been implemented, except for QA. Sweden will during the next years improve its emission inventories and will include further elaboration of how formal QA/QC procedures could be implemented upon the full adoption of the IPCC's <i>Good practice guidance</i> .	Swedish Environmental Protection Agency (2003)
United Kingdom	The UK QA/QC system complies with the Tier 1 procedures outlined in the <i>Good practice guidance</i> (IPCC, 2000). Plans are under way to develop the system and extend the range of activities so that the system complies with Tier 2. A detailed QA/QC activities schedule until 2004 is presented including external peer reviews for key sources. The inventory has been subject to ISO 9000 since 1994 and is liable to audit by Lloyds and the AEAT internal QA auditors. The national atmospheric emissions inventory has been audited favourably by Lloyds on two occasions in the last four years. The emphasis of these audits was on authorisation of personnel to work on inventories, document control, data tracking and spreadsheet checking. As part of the inventory management structure there is a nominated officer responsible for the QA/QC system — the QA/QC Coordinator. Special QA/QC activities undertaken in 2000–02 included verification of the inventory, revision of halocarbon estimates, expert peer review of fuel combustion sources of carbon dioxide, revision of estimates of methane emissions from landfill, in-depth review of the UK national inventory by the UNFCCC, September 2002, review of the estimation of emissions from aviation in the UK greenhouse gas inventory and compliance check of the current UK national inventory report structure to the proposed requirements of the UNFCCC.	National Environmental Technology Centre (2002, 2003)

Table 6	Overview of uncertainty estimates available from Member States (mainly excerpts from Member States' national inventory reports)					Source
	Uncertainty estimates extracted from Member States' national inventory reports					Source
Austria	Uncertainty analysis including systematic and random uncertainty was carried out for CO ₂ , CH ₄ and N ₂ O for 1990 and 1997. The results of the calculations are as follows:					Federal Environment Agency — Austria (2001)
	Total uncertainty	CO ₂	CH ₄	N ₂ O	Total GHG emissions (excluding fluorinated gases)	
	1990	2.3 %	48.3 %	89.6 %	9.8 %	
	1997	2.1 %	47.4 %	85.9 %	8.9 %	
Denmark	The national inventory report refers to Denmark's second national communication where the uncertainty of NMVOC, CH ₄ and N ₂ O is assumed to be the highest (perhaps with an uncertainty factor 2). The uncertainty of CO and NO _x inventories is assumed to be less than 30 to 40 % and the uncertainty of CO ₂ may be as low as 1 to 2 %. Applying the methodology mentioned in Annex 1 of the reporting instructions of the <i>Revised 1996 IPCC guidelines for national GHG inventories</i> these estimates lead to an overall uncertainty of the GHG emissions in CO ₂ equivalents of +/- 23 %. This estimate does not take into account the 35 % uncertainty of the GWP-factors. Sensitivity analysis shows that it is the huge uncertainty of N ₂ O emissions from agricultural soils, which are the key factor for overall uncertainty of the Danish GHG inventory. Work is under way to implement uncertainty according to GPG. The results of this work are expected to be included in the Danish NIR 2004.					National Environmental Research Institute (2002)
Finland	In 2001 inventory, the uncertainty assessment was performed for the first time using the Monte Carlo simulation (Tier 2 method). The uncertainties in the input parameters were estimated using the IPCC default uncertainties, expert elicitation, domestic and international literature and available measurement data. A separate report on the uncertainty estimates (Monni and Syri, 2003) will be published in 2003. According to the calculations, the uncertainty estimates for 2001 were as follows:					Ministry of the Environment (2003a)
	Total GHGs	CO ₂	CH ₄	N ₂ O	Fluorinated gases	
	- 5/+ 6 %	- 4/+ 6 %	- 19/+ 20 %	- 33/+ 40 %	- 53/+ 32 %	
	The share of CO ₂ emissions from fuel combustion, which has low uncertainties, is large in Finland, thus resulting in a rather low total inventory uncertainty, though some input parameters in other emission categories have very large uncertainties.					
France	Work is under way for estimating uncertainties of GHG emissions according to the <i>Good practice guidance</i> (IPCC, 2000). The uncertainties of CO ₂ and SO ₂ from energy use are assumed to be less than 5 %.					Citepa (2001)
Germany	The report states that partly emission uncertainties are considerable. This is due to uncertainties of activity data and emission factors and — to a much lesser extent — to a lack of information on emission-causing activities. In general, the uncertainty of combustion-related emissions is considerably lower than uncertainty of non-combustion-related emissions. The uncertainties are estimated to be higher for emissions after 1999 because they have to be considered as preliminary estimates. For qualitative estimates of emission uncertainties the report refers to the relevant CRF tables.					Bericht 2002 der Bundesrepublik Deutschland (2002)
Ireland	The Tier 1 method provided by IPCC (2000) has been used to make an uncertainty estimate of the Irish inventory time-series for 1990 to 2000. This analysis results in an overall uncertainty of approximately 11 % in the 2000 inventory of greenhouse gases and a trend uncertainty of 5 % for the period 1990 to 2000. This outcome is determined largely by the uncertainty in the estimate of N ₂ O emissions from agricultural soils, where an emission factor uncertainty of 100 % is assumed in order to complete the analysis. This highlights the need for more reliable data on this particular emission source in Ireland. Two thirds of total Irish emissions, i.e. the proportion contributed by CO ₂ , are estimated to have an uncertainty of less than 2 %. When CH ₄ is included, bringing the proportion up to 85 %, the total uncertainty remains less than 4 %, even though there are large uncertainties assigned to the CH ₄ emission factors in most source categories. However, it is the influence of N ₂ O that leads to a substantial uncertainty in total emissions. This influence is not as large in the case of the trend, due to the modest change in emissions of N ₂ O from 1990 to 2000 and the relatively small share of this gas in total emissions. The impact of HFC, PFC and SF ₆ on inventory uncertainty in 2000 is negligible because these gases account for less than 1 % of total emissions.					Environmental Protection Agency (2002)
Netherlands	The Netherlands estimated uncertainty in annual emissions and in emission trends by applying the IPCC Tier 1 uncertainty approach at the level of the IPCC list of possible key sources. The results of the uncertainty estimates for 2000 CO ₂ equivalent emissions is as follows:					Olivier, J.G.J., Brandes, L.J., Peters, J.A.H.W. and Coenen, P.W.H.G. (2002)
	Total GHGs	CO ₂	CH ₄	N ₂ O	HFCs PFCs SF ₆	
	± 4 %	± 3 %	± 25 %	± 50 %	± 50 % ± 50 % ± 50 %	
	The results of the uncertainty estimates for the trend 1990–2000 CO ₂ equivalent emissions is as follows:					
	Total GHGs	CO ₂	CH ₄	N ₂ O	Fluorinated gases	
	± 3 %	± 3 %	± 7 %	± 12 %	± 11 %	
Spain	The Spanish report mentions that the assessment of uncertainty (estimation of emission quality) is shown in Table 7 of the CRF using the quality codes H (high), M (medium), and L (low). This ordinal classification of quality is only a first stage in the analysis of the uncertainty associated with the inventory estimations. Work is now in progress for the implementation of a quantitative estimation of uncertainty in accordance with the approach recommended by the IPCC (2000).					Ministry of the Environment (2003b)

	Uncertainty estimates extracted from Member States' national inventory reports	Source																								
Sweden	The uncertainty in reported emissions arises from the uncertainty in the activity data, uncertainty in emission factors and uncertainty arising from whether all (major) sources of emissions are included in the inventory. For most sectors Swedish official statistics are used as activity data, except for industrial processes, emissions from F-gases and for solvent use where information comes from the industries annual environmental reports. Used emission factors originate either from measurements from existing Swedish plants or from comparable European installations, where IPCC default emission factors are not used. In 2003 validation of uncertainties for the emission estimates will be started. It is assumed that the uncertainty is largest for the inventories of CH ₄ and N ₂ O, perhaps with an uncertainty factor of 2, for NMVOC, which have been recalculated possibly in the order of 50 %, while the uncertainty on the CO, SO ₂ and NO _x inventories is assumed to be less than 30 to 40 % and the uncertainty with the CO ₂ may be as low as 1 to 2 %.	Swedish Environmental Protection Agency (2003)																								
United Kingdom	Quantitative estimates of the uncertainties in the emissions were calculated by using Monte Carlo simulation. This corresponds to the IPCC Tier 2 approach discussed in the <i>Good practice guidance</i> (IPCC, 2000). The results for the United Kingdom are as follows (calculated as 2s/E where s is the standard deviation and E is the mean, calculated in the simulation): <table border="1" data-bbox="268 589 1353 790"> <thead> <tr> <th></th> <th>Total GHGs</th> <th>CO₂</th> <th>CH₄</th> <th>N₂O</th> <th>HFCs</th> <th>PFCs</th> <th>SF₆</th> </tr> </thead> <tbody> <tr> <td>Emissions 2001 (%)</td> <td>13</td> <td>2.2</td> <td>14</td> <td>204</td> <td>25</td> <td>19</td> <td>13</td> </tr> <tr> <td>Range of likely percentage change (2001 and 1990)</td> <td>- 15/- 10</td> <td>- 6.9/- 4.2</td> <td>- 49/- 31</td> <td>- 73/- 17</td> <td>- 47/9</td> <td>- 76/- 59</td> <td>103/192</td> </tr> </tbody> </table> <p>The Tier 1 approach based on the error propagation equations suggests an uncertainty of 17 % in the combined GWP total emissions in 2001. The analysis also estimates an uncertainty of 2 % in the trend between 1990 and 2000.</p>		Total GHGs	CO ₂	CH ₄	N ₂ O	HFCs	PFCs	SF ₆	Emissions 2001 (%)	13	2.2	14	204	25	19	13	Range of likely percentage change (2001 and 1990)	- 15/- 10	- 6.9/- 4.2	- 49/- 31	- 73/- 17	- 47/9	- 76/- 59	103/192	National Environmental Technology Centre (2003)
	Total GHGs	CO ₂	CH ₄	N ₂ O	HFCs	PFCs	SF ₆																			
Emissions 2001 (%)	13	2.2	14	204	25	19	13																			
Range of likely percentage change (2001 and 1990)	- 15/- 10	- 6.9/- 4.2	- 49/- 31	- 73/- 17	- 47/9	- 76/- 59	103/192																			

1.8. General assessment of the completeness

1.8.1. Completeness of Member State submissions

The EC GHG inventory is compiled on the basis of the inventories of the 15 Member States. Therefore, the completeness of the EC inventory depends on the completeness of the Member State submissions.

Table 7 summarises timeliness and completeness of the Member State submissions as at 4 April 2003. It shows that nine Member States submitted their GHG inventories in time to the European

Commission, i.e. by 31 December 2002.

Eleven Member States submitted all or almost all tables (i.e. more than 90 %) of the CRF tables for 1990–2001. All Member States provided information on fluorinated gases, but there are still some data gaps in the time-series 1990 to 2001. The completeness of national submissions with regard to individual CRF tables in the 2003 submission can be found in the status reports in Annex 3. In addition, Member State information on the completeness of their emission estimates at source level can be seen from the overview tables in Chapters 3 to 8 and in the CRF Tables 7 of the Member States in Annex 5.

Table 7

Date of submissions (updates submitted), years covered and CRF tables available from Member States at 4 April 2003

Member State	Submission dates	Latest data available	Years covered	CRF tables (1)
Austria	30 Dec. 2002	2001	1990–2001	All
Belgium	23 Dec. 2002	2001	1990–2001	Summary tables, sectoral report tables
	31 March 2003	2001	1990–2001	All
Denmark	27 Dec. 2002	2001	1990–2001	All
	31 March 2003	2001	1990–2001	All
	4 April 2003	2001	1990–2001	All
Finland	12 Dec. 2002	2001	1990–2001	All
	28 March 2003	2001	1990–2001	All
France	30 Dec. 2002	2001	1990–2001	All
Germany	31 Jan. 2003	2001	1990–2001	All
	1 April 2003	2001	1990–2001	All
Greece	31 March 2003	2001	2001	All, except Trend Table 10
Ireland	23 Dec. 2002	2001	1990–2001	Full CRF only for 2001; no fluorinated gases for 2001
	28 March 2003	2001	1990–2001	All
Italy	31 March 2003	2001	1990–2001	Full CRF only for 2001
Luxembourg	15 Jan. 2003	2001	2001	Summary Table 1A, Summary Report 3, Overview Table 7
Netherlands	17 Dec. 2002	2001	1990–2001	All
	28 Feb. 2003	2001	1990–2001	All
	28 March 2003	2001	1990–2001	All
Portugal	31 March 2003/ 4 April 2003	2001	1990–2001	All
Spain	14 Feb. 2003	2001	1990–2001	All
	31 March 2003	2001	1990–2001	All
Sweden	20 Dec. 2002	2001	1990–2001	All
	31 March 2003	2001	1990–2001	All
United Kingdom	24 Dec. 2002	2001	1990–2001	All
	31 March 2003	2001	1990–2001	All

(1) All = all or almost all (more than approximately 90 %) of the CRF tables (see Annex 3 for more detail).

Table 8 shows the availability of Member States' national inventory reports and/or additional inventory information and a short

characterisation of the information provided for the 2003 submission.

National inventory reports and additional information available from Member States as at 5 April 2003

Table 8

Member State	2002	2003	Characterisation of the report 2003
Austria	—	Federal Environment Agency — Austria (2002)	Short report including methodological changes with regard to the previous submission and emission trends
Belgium	—	—	
Denmark	National Environmental Research Institute (2002)	—	
Finland	Ministry of the Environment (2002a)	Ministry of the Environment (2002b, 2003a)	National inventory report including general information on the inventory, emission trends, sector- and source-specific methodological information, recalculations and inventory improvements
France	Citepa (2001)	—	
Germany	Bericht 2001 der Bundesrepublik Deutschland (2001)	Bericht 2002 der Bundesrepublik Deutschland (2002)	Short report including mainly information on emission trends, projections, and policies and measures
Greece	—	—	
Ireland	Environmental Protection Agency (2002)	—	
Italy	—	—	
Luxembourg	—	—	
Netherlands	Olivier, J.G.J, Brandes, L.J., Peters, J.A.H.W. and Coenen, P.W.H.G. (2002)	Olivier, J.G.J, Brandes, L.J., and Coenen, P.W.H.G. (2002)	Short draft national inventory report mainly including information on methodological changes
Portugal	—	—	
Spain	Ministry of the Environment (2002c)	Ministry of the Environment (2003b)	Report including information on general methodology, development of inventory principles, recalculations, emissions trends, and key source analysis
Sweden	Swedish Environmental Protection Agency (2002a)	Swedish Environmental Protection Agency (2002b, 2003)	National inventory report including general information on the inventory, sector- and source-specific methodological information, key source analysis, and future inventory improvements
United Kingdom	National Environmental Technology Centre (2002)	Goodwin (2002), National Environmental Technology Centre (2003)	Final draft national inventory report including general information on the inventory, emission trends, sector- and source-specific methodological information, methodological changes, uncertainty estimates, QA/QC, and verification

1.8.2. Data gaps and gap filling

The EC GHG inventory is compiled by using the inventory submissions of the 15 Member States. For data gaps in Member States' inventory submissions, the following procedure is applied by EEA ETC/ACC.

1. If emission data are available for previous years:

- CH₄, N₂O, HFCs, PFCs and SF₆, emissions reported for the most recent previous year are taken as an approximated estimate for the missing year;

- for CO₂ emissions of all CRF categories except Sector 1, 'Energy', also the emissions reported for the most recent previous year are taken as an approximated estimate for the missing year;
- for CO₂ emissions of CRF Sector 1, 'Energy', the latest data reported by the Member States are used and extrapolated on the basis of percentage changes of CO₂ emissions from fossil fuel combustion as estimated for more recent years by Eurostat for this Member State. The Eurostat estimates are compiled using the IPCC

Table 9 Overview of data gaps by 4 April 2003

Member State	CO ₂	CH ₄	N ₂ O	HFCs	PFCs	SF ₆
Belgium				1990–94	1990–94	1990–94
Greece						1990–2001
Ireland				1990–94	1990–94	1990–94
Luxembourg	1991–93 (¹)	1991–93	1991–93	1990–2000	1990–2000	1990–2000

(¹) Luxembourg provided total CO₂ emissions for 1991–93 but without sector and category split.

Table 10 Data gap filling for Belgium, Ireland and Luxembourg (Gg of CO₂ equivalents)

Belgium	1990	1991	1992	1993	1994	1995
HFC	339	339	339	339	339	339
PFC	0	0	0	0	0	0
SF ₆	96	96	96	96	96	96

Ireland	1990	1991	1992	1993	1994	1995
HFC	21	21	21	21	21	21
PFC	75	75	75	75	75	75
SF ₆	83	83	83	83	83	83

Luxembourg	1990	1991	1992	1993	1994	1995
HFC	43	43	43	43	43	43
PFC	0	0	0	0	0	0
SF ₆	4	4	4	4	4	4
	1996	1997	1998	1999	2000	2001
HFC	43	43	43	43	43	43
PFC	0	0	0	0	0	0
SF ₆	4	4	4	4	4	4

Luxembourg	Most recent previous year reported	Data gap filling for years		
	1990	1991	1992	1993
CH ₄	498	498	498	498
Total CO ₂ emissions without LUCF as reported by Luxembourg	10 152	9 724	9 572	9 864
Percentage change applied to CO ₂ emissions at sectoral and source category level (%)		- 4.2	- 5.7	- 2.8

Note: Values are shaded for estimates derived by gap filling.

reference approach and energy balance data provided annually by Member States.

- If emission data are not available for any year between 1990 and 2001, data gaps are not filled.

The following data gaps existed by 4 April 2003.

For the EC inventory 2003, the data gap procedure has been applied for the following Member States, years and gases (Table 10).

- For Belgium and Ireland, fluorinated gas emissions were estimated for 1990–94 on the basis of 1995 data.
- For Luxembourg, fluorinated gas emissions were estimated for 1990–2000 on the basis of 2001 data. Emissions of CO₂, CH₄ and N₂O were estimated for 1991–93 on the basis of 1990 data. For the sector split of CO₂ emissions 1991–93, which was not provided by Luxembourg, the split of 1990 was extrapolated by the percentage change of total CO₂ emissions for these years (which is available from Luxembourg).

No gaps were filled for Greece for SF₆.

1.8.3. Data basis of the European Community greenhouse gas inventory

The EC GHG inventory 2003 data consist of:

1. the GHG submissions of the Member States to the Commission in 2003 (if available, data were taken from CRF Tables Summary 1.A; in a few cases also data from CRF Tables 10 were used);
2. previous GHG submissions, in cases where Member States did not provide the complete time-series for each gas in 2003; and

3. emission estimates derived from data gap filling in cases where no data were available for a specific gas and year (used only in few cases).

Tables 11 to 14 show the data basis of the EC GHG inventory 2003. Values in white cells without a frame are data provided by Member States in 2003 in the CRF Tables Summary 1.A. Light shaded values are taken from Member States' 2003 CRF Tables 10. Framed cells indicate that the emission data have been taken from Member State submissions in previous years. Dark shaded values derive from gap filling. 'NE' (not estimated) indicates that data are not available and that no gap filling has been made.

Data basis of CO ₂ emissions excluding LUCF (Gg)												Table 11
EC Member State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Austria	60.113	63.595	58.455	59.307	59.744	62.627	66.629	66.208	66.333	65.020	64.928	69.120
Belgium	117.749	123.571	122.714	120.887	123.805	127.454	130.233	125.728	129.322	126.472	126.331	126.803
Denmark	52.659	63.383	57.563	59.928	63.919	61.130	74.556	65.209	60.050	57.279	52.764	54.355
Finland	62.459	61.062	58.662	59.164	65.459	62.676	68.123	66.832	64.594	64.065	62.283	67.692
France	395.272	419.932	412.421	392.875	388.587	394.869	408.732	403.076	425.366	412.793	407.199	411.353
Germany	1.014.439	975.769	928.081	917.989	903.792	898.758	920.871	889.597	881.384	854.741	857.968	870.762
Greece	84.336	84.230	85.774	85.847	87.479	87.644	90.163	94.668	99.419	98.626	103.727	105.875
Ireland	31.797	32.535	33.113	32.680	34.114	34.759	35.954	38.312	40.250	42.133	44.092	46.460
Italy	428.178	427.977	427.786	418.542	412.964	438.985	434.115	439.523	451.095	456.587	460.965	460.760
Luxembourg	10.152	9.724	9.572	9.864	9.547	7.078	7.098	6.086	5.179	5.432	5.399	5.482
Netherlands	159.270	167.521	165.733	167.934	168.770	172.402	180.304	168.669	173.788	170.686	173.840	179.855
Portugal	43.809	45.616	50.056	48.727	49.115	52.546	49.941	52.104	56.699	64.199	63.493	64.892
Spain	227.400	234.223	242.189	232.475	242.710	254.386	241.884	261.700	270.604	295.512	308.201	307.248
Sweden	56.489	56.762	56.003	55.677	60.304	59.031	62.464	57.623	58.775	56.649	53.766	55.269
United Kingdom	585.016	588.587	574.138	560.326	557.054	548.617	568.533	544.271	547.079	538.706	544.359	557.628
EU15	3.329.139	3.354.486	3.282.261	3.222.223	3.227.362	3.262.960	3.339.599	3.279.607	3.329.936	3.308.900	3.329.314	3.383.556

Note: Values in white cells without a frame are data provided by Member States in 2003 in the CRF Tables Summary 1.A. Light shaded values are taken from Member States' 2003 CRF Tables 10. Framed cells indicate that the emission data have been taken from Member State submissions in previous years. Dark shaded values derive from gap filling. 'NE' (not estimated) indicates that data are not available and that no gap filling has been made.

EC Member State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Austria	10.672	10.552	10.280	10.318	10.168	10.074	9.955	9.609	9.442	9.300	9.134	9.074
Belgium	11.212	11.599	11.336	11.286	11.428	11.261	11.182	11.108	11.175	10.901	10.716	10.401
Denmark	5.672	5.728	5.735	5.858	5.882	5.958	6.030	5.920	5.802	5.473	5.535	5.606
Finland	6.339	6.283	6.194	6.183	6.132	6.117	6.052	5.965	5.764	5.653	5.427	5.368
France	70.249	70.441	70.146	70.357	70.272	70.730	70.244	67.120	66.714	65.875	65.666	64.718
Germany	99.134	89.104	82.100	75.701	71.300	66.806	62.741	60.789	57.845	56.245	52.717	50.338
Greece	8.744	8.706	9.008	9.108	9.365	9.497	9.814	9.924	10.442	10.413	10.890	11.123
Ireland	11.900	12.183	12.344	12.441	12.506	12.595	12.769	12.955	12.970	12.885	12.785	12.563
Italy	38.659	39.068	37.322	36.931	37.311	37.857	37.713	37.676	37.128	36.717	36.546	36.420
Luxembourg	498	498	498	498	460	464	501	507	480	483	478	473
Netherlands	27.140	27.479	26.315	25.745	25.260	24.574	24.648	23.102	22.357	21.787	20.648	20.435
Portugal	10.124	10.127	9.983	9.700	9.962	9.997	10.031	10.133	10.206	10.654	10.689	10.788
Spain	30.286	30.562	31.609	32.004	33.080	33.758	35.426	36.453	37.698	38.089	39.317	40.329
Sweden	6.631	6.605	6.708	6.754	6.678	6.589	6.553	6.461	6.310	6.113	5.862	5.846
United Kingdom	76.885	75.904	74.303	71.316	64.882	64.292	62.748	59.557	56.397	52.567	48.781	46.105
EU15	414.145	404.840	393.880	384.199	374.686	370.569	366.408	357.279	350.730	343.154	335.189	329.588

Note: Values in white cells without a frame are data provided by Member States in 2003 in the CRF Tables Summary 1.A. Light shaded values are taken from Member States' 2003 CRF Tables 10. Framed cells indicate that the emission data have been taken from Member State submissions in previous years. Dark shaded values derive from gap filling. 'NE' (not estimated) indicates that data are not available and that no gap filling has been made.

EC Member State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Austria	5.804	6.431	5.247	6.072	6.752	6.360	6.154	6.445	6.252	6.177	6.153	5.951
Belgium	12.164	11.847	11.500	11.771	12.306	12.959	12.472	12.009	12.511	12.209	12.122	11.980
Denmark	10.843	10.737	10.068	10.193	9.976	9.903	9.758	9.343	9.382	9.314	9.090	8.749
Finland	8.340	7.868	7.280	7.448	7.562	7.762	7.797	8.015	7.856	7.715	7.105	7.095
France	94.992	94.544	93.258	91.744	92.945	94.550	95.947	96.440	89.363	83.606	81.344	80.297
Germany	87.904	83.136	84.100	80.530	77.609	78.546	80.181	75.720	62.257	59.004	59.345	60.227
Greece	10.623	10.521	10.467	10.143	10.258	9.899	10.337	10.628	10.625	10.418	11.010	10.744
Ireland	9.544	9.564	9.647	9.683	9.908	10.050	10.263	10.422	10.648	10.826	10.760	10.400
Italy	40.870	42.219	41.411	41.635	40.784	41.998	41.536	42.735	42.409	43.292	43.529	44.349
Luxembourg	208	208	208	208	214	213	216	233	236	90	94	97
Netherlands	16.544	16.807	17.950	18.663	18.313	18.178	17.946	17.786	17.629	17.367	16.659	16.067
Portugal	7.508	7.507	7.283	7.191	7.176	7.424	7.519	7.427	7.660	8.003	8.031	8.073
Spain	26.635	26.390	25.644	23.732	25.960	25.690	28.006	27.361	28.080	29.410	30.799	29.483
Sweden	9.109	8.986	8.823	8.926	9.133	8.825	9.031	8.938	9.120	8.705	8.600	8.630
United Kingdom	67.859	65.945	59.091	55.389	59.765	57.075	59.118	60.775	57.995	44.918	44.726	42.353
EU15	408.947	402.710	391.975	383.328	388.660	389.434	396.282	394.276	372.024	351.055	349.367	344.495

Note: Values in white cells without a frame are data provided by Member States in 2003 in the CRF Tables Summary 1.A. Light shaded values are taken from Member States' 2003 CRF Tables 10. Framed cells indicate that the emission data have been taken from Member State submissions in previous years. Dark shaded values derive from gap filling. 'NE' (not estimated) indicates that data are not available and that no gap filling has been made.

Data availability of actual HFC, PFC and SF₆ emissions in CO₂ equivalents (Gg)

Table 14

EC Member State		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Austria	HFC	4	6	9	12	17	546	625	718	816	870	1 033	1 033
	PFC	963	974	576	48	54	16	15	18	21	25	25	25
	SF ₆	518	683	725	823	1 033	1 175	1 246	1 148	955	730	677	677
Belgium	HFC	339	339	339	339	339	339	418	527	631	804	1 014	1 227
	PFC	0	0	0	0	0	0	0	0	0	0	0	0
	SF ₆	96	96	96	96	96	96	213	206	96	0	109	105
Denmark	HFC	0	0	4	96	141	236	371	392	489	598	705	647
	PFC	0	0	0	0	0	1	3	7	15	20	28	22
	SF ₆	43	62	89	135	122	107	61	73	59	65	59	30
Finland	HFC	0	0	0	0	7	29	77	168	245	319	502	657
	PFC	0	0	0	0	0	0	0	0	0	28	22	20
	SF ₆	94	67	37	34	35	69	72	76	53	52	51	55
France	HFC	2 252	1 510	1 067	807	821	1 645	2 532	3 445	4 105	5 173	7 334	8 290
	PFC	3 192	2 472	2 142	1 641	1 415	1 331	1 451	1 503	1 662	1 919	1 672	1 400
	SF ₆	2 195	2 216	2 238	2 262	2 288	2 314	2 330	2 330	2 271	2 109	2 096	2 101
Germany	HFC	3 510	3 547	3 677	4 950	5 178	6 360	5 768	6 356	6 979	7 280	6 630	8 130
	PFC	2 696	2 356	2 138	2 012	1 627	1 759	1 723	1 377	1 481	1 247	790	723
	SF ₆	3 896	4 350	4 876	5 401	5 808	6 633	6 359	6 274	6 038	4 414	4 018	3 325
Greece	HFC	935	1 107	908	1 638	2 209	3 369	3 916	4 194	4 053	4 156	4 281	4 410
	PFC	258	258	252	153	94	83	72	165	204	132	148	81
	SF ₆	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Ireland	HFC	21	21	21	21	21	21	58	79	104	152	190	231
	PFC	75	75	75	75	75	75	103	131	62	196	305	297
	SF ₆	83	83	83	83	83	83	101	132	91	63	52	67
Italy	HFC	351	355	359	355	482	671	449	751	1 170	1 437	1 986	2 730
	PFC	237	231	206	204	212	272	177	184	201	190	232	302
	SF ₆	333	356	358	370	416	601	683	729	605	405	493	795
Luxembourg	HFC	43	43	43	43	43	43	43	43	43	43	43	43
	PFC	0	0	0	0	0	0	0	0	0	0	0	0
	SF ₆	4	4	4	4	4	4	4	4	4	4	4	4
Netherlands	HFC	4 432	3 452	4 447	4 998	6 487	6 018	7 676	8 307	9 360	4 897	3 875	1 584
	PFC	2 432	2 437	2 099	2 118	1 890	1 867	2 042	2 154	1 728	1 444	1 526	1 456
	SF ₆	187	100	106	110	148	275	285	311	295	265	269	296
Portugal	HFC	0	0	0	0	0	0	0	2	6	19	37	62
	PFC	0	0	0	0	0	0	0	0	0	0	0	0
	SF ₆	0	0	0	0	0	5	5	5	5	6	6	7
Spain	HFC	2 403	2 179	2 763	2 258	3 458	4 645	5 197	6 126	5 809	7 164	8 171	5 288
	PFC	828	787	782	794	785	790	759	784	750	696	405	229
	SF ₆	56	61	64	67	76	94	101	122	141	185	211	212
Sweden	HFC	4	7	10	31	72	127	178	271	302	351	373	372
	PFC	440	427	414	402	390	391	351	324	309	329	270	267
	SF ₆	83	86	85	91	101	121	110	155	91	92	78	100
United Kingdom	HFC	11 374	11 859	12 346	12 905	13 814	15 205	16 384	18 377	19 958	8 186	8 861	8 678
	PFC	2 281	1 790	959	811	980	1 094	1 022	710	630	659	738	706
	SF ₆	724	776	833	889	1 061	1 133	1 271	1 263	1 485	1 501	1 642	1 762
Total	HFC	25 668	24 425	25 991	28 453	33 088	39 255	43 692	49 753	54 070	41 449	45 033	43 383
	PFC	13 403	11 808	9 643	8 258	7 523	7 679	7 717	7 358	7 063	6 885	6 163	5 527
	SF ₆	8 311	8 940	9 594	10 365	11 269	12 709	12 839	12 827	12 187	9 890	9 765	9 537

Note: Values in white cells without a frame are data provided by Member States in 2003 in the CRF Tables Summary 1.A. Light shaded values are taken from Member States' 2003 CRF Tables 10. Framed cells indicate that the emission data have been taken from Member State submissions in previous years. Dark shaded values derive from gap filling. 'NE' (not estimated) indicates that data are not available and that no gap filling has been made.

Table 15 Geographical coverage of the EC inventory

Member State	Geographical coverage
Austria	Austria
Belgium	Belgium
Denmark	Denmark (excluding Greenland and the Faroe Islands)
Finland	Finland and Åland Islands
France	France, the Overseas Departments (Guadeloupe, Martinique, French Guiana and Réunion) and the Overseas Territories (New Caledonia, Wallis and Futuna Islands, French Polynesia, Mayotte, St Pierre and Miquelon)
Germany	Germany
Greece	Greece
Ireland	Ireland
Italy	Italy
Luxembourg	Luxembourg
Netherlands	Netherlands including a 12-mile zone from the coastline and inland water bodies, emissions from offshore oil and gas production at the Netherlands' part of the continental shelf, excluded are Arube and the Netherlands Antilles
Portugal	Portugal, Madeira, Azores
Spain	Spanish part of Iberian mainland, Canary Islands, Balearic Islands, Ceuta and Melilla
Sweden	Sweden
United Kingdom	England, Scotland, Wales, Northern Ireland

Table 16 Inconsistencies between the EC 2002 submission and the sum of the Member States' 2002 submissions (Gg for 2000)

	Sum of Member States' 2002 submissions	EC 2002 submission	Difference
CO ₂	3 324 800	3 333 697	8 897
CO ₂ removals	– 180 681	– 181 437	756
CH ₄	16 275	16 282	7
N ₂ O	1 091	1 096	5

Source: UNFCCC draft synthesis and assessment report 2002.

1.8.4. Geographical coverage of the European Community inventory

Table 15 shows the geographical coverage of the Member States' national GHG inventories as submitted under the monitoring mechanism. As the Member States' national GHG inventories are used for the compilation of the EC GHG inventory, the table also shows the geographical coverage of the EC inventory.

1.9. Differences between European Community submissions and Member State submissions in 2002

In the UNFCCC draft synthesis and assessment report of the EC GHG inventory 2002, inconsistencies between the EC 2002 submission (for the 2000 inventory) and the sum of the Member State submissions for 2002 to the UNFCCC secretariat were identified.

The most important reason for these inconsistencies between the EC CRF submission and the sum of the Member State submissions in 2002 is the reporting in category 5 of CRF Table Summary 1.A. Footnote five requires parties to report net emissions (emissions — removals) from LUCF in each sub-category 5 and in the total sum of category 5. Only a single number should be placed in either the CO₂ emissions or CO₂ removals column, as appropriate. Thirteen Member States reported net removals from LUCF for 2000, two Member States (Greece and the United Kingdom) reported net CO₂ emissions. At EC level, CO₂ removals were larger than CO₂ emissions. Therefore, net removals were reported that resulted from adding the net removals of the 13 Member States and deducting the net emissions of Greece and the United Kingdom. This means that total CO₂ emissions at EC level do not include net

emissions from LUCF of Greece and the United Kingdom. (These net emissions from LUCF of Greece and the United Kingdom reduce net removals of the EC.) The sum of CO₂ emissions of the national submissions to the UNFCCC secretariat includes net emissions of Greece and the United Kingdom and therefore is higher (see Table 17). Therefore, also the sum of CO₂ removals in the national submissions to the UNFCCC is higher.

A second reason for inconsistencies are data updates of Greece, Ireland and Italy provided to the UNFCCC after 15 April 2002, which could therefore not be included in the EC inventory (which was submitted to the UNFCCC on 15 April 2002).

Table 17 shows the differences in the submissions between the EC 2002 submission and the sum of the Member States' 2002 submissions.

Breakdown of the inconsistencies between the EC 2002 submission and the sum of the Member States' 2002 submissions (Gg for 2000)

Table 17

	Total CO ₂ emissions			Net CO ₂ emissions/removals from LUCF		
	EC submission 2002	MS submission 2002	Differential	EC submission 2002	MS submission 2002	Differential
Austria	66 102	66 102	0	- 7 633	- 7 633	0
Belgium	127 040	127 040	0	- 1 823	- 1 823	0
Denmark	52 852	52 852	0	- 995	- 995	0
Finland	62 305	62 305	0	- 11 953	- 11 953	0
France	401 923	401 923	0	- 63 247	- 63 247	0
Germany	857 908	857 908	0	- 16 826	- 16 826	0
Greece	103 727	107 602	- 3 875	3 875	0	3 875
Ireland	43 815	43 925	- 110	- 6 505	- 33	- 6 473
Italy	461 822	463 381	- 1 559	- 16 444	- 16 444	0
Luxembourg	5 399	5 399	0	- 295	- 295	0
Netherlands	173 527	173 527	0	- 1 413	- 1 413	0
Portugal	63 150	63 150	0	- 4 216	- 4 216	0
Spain	306 632	306 632	0	- 29 252	- 29 252	0
Sweden	55 855	55 855	0	- 27 306	- 27 306	0
UK	542 743	546 097	- 3 354	3 354	0	3 354
EU	3 324 800	3 333 698	- 8 898	- 180 681	- 181 437	756

	Total CH ₄ emissions			Total N ₂ O emissions		
	EC submission 2002	MS submission 2002	Differential	EC submission 2002	MS submission 2002	Differential
Austria	448	448	0	8	8	0
Belgium	524	524	0	43	43	0
Denmark	274	274	0	29	29	0
Finland	187	187	0	23	23	0
France	2 871	2 871	0	248	248	0
Germany	2 885	2 885	0	194	194	0
Greece	519	518	0,5	36	36	0,0
Ireland	610	610	- 0,5	31	31	- 0,2
Italy	1 794	1 801	- 6,9	134	139	- 4,9
Luxembourg	23	23	0	0,3	0,3	0
Netherlands	983	983	0	55	55	0
Portugal	625	625	0	27	27	0
Spain	1 827	1 827	0	98	98	0
Sweden	280	280	0	22	22	0
UK	2 427	2 427	0	142	142	0
EU	16 275	16 283	- 8	1 091	1 096	- 5

Note: All values are in Gg and for the inventory year 2000. Remaining inconsistencies are due to rounding.

2. European Community greenhouse gas emission trends

This chapter presents the main GHG emission trends in the EC. First, aggregate results are described as regards total GHG emissions and progress towards fulfilling the EC Kyoto target. Then, emission trends are briefly analysed at gas and source level and a short overview of Member States' contribution to EC GHG trends is given. The EEA will provide a more detailed analysis on the EC GHG emission trends in its report *Greenhouse gas emission trends in Europe, 1990–2001*. Finally, also the trends of indirect GHG and SO₂ emissions are presented.

2.1. Aggregated greenhouse gas emission trends

Total GHG emissions without land-use change and forestry in the EC decreased between the base year and 2001 by 95.735 Gg (–2.3 %). In the Kyoto Protocol, the EC agreed to reduce its GHG emissions by 8 % by 2008–12, from 1990 levels. Assuming a linear target path from 1990 to 2010, total EC

GHG emissions were 2.1 index points above this target path in 2001 (Figure 1).

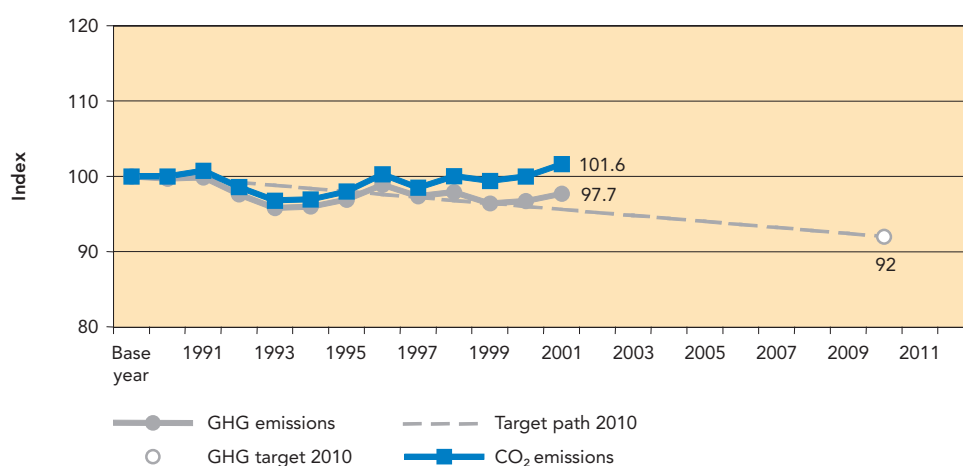
The most important GHG by far is CO₂, accounting for 82 % of total EC emissions in 2001. In 2001, EC CO₂ emissions without LUCF were 1.6 % above 1990 levels.

2.2. Greenhouse gas emission trends by gas

Table 18 gives an overview of the main trends in EC GHG emissions and removals for 1990–2001. In 2001, CO₂ emissions made up 82 % of the total GHG emissions in the EC. This was an increase of 54 417 Gg (1.6 %) compared to 1990. This increase was compensated by decreases in CH₄ and N₂O emissions in the same period: CH₄ decreased by 84 557 Gg (–20.4 %) and N₂O decreased by 64.452 Gg (–15.8 %). Fluorinated gases showed opposing trends. While HFC and SF₆ emissions increased by 17 715 Gg (69.0 %) and 1.226 Gg (14.7 %), PFC emissions decreased by 7.875 Gg (–58.8 %).

Figure 2

EC GHG emissions 1990–2001 compared with target for 2008–2012 (excluding LUCF)



Note 1: The linear target path is not intended as an approximation of past and future emission trends. It provides a measure of how close the EC emissions in 2001 are to a linear path of emissions reductions from 1990 to the Kyoto target for 2008–12, assuming that only domestic measures will be used. Therefore, it does not deliver a measure of (possible) compliance of the EC with its GHG targets in 2008–12, but aims at evaluating overall EC GHG emissions in 2001. The unit is index points with 1990 emissions being 100.

Note 2: GHG emission data for the EC as a whole do not include emissions and removals from LUCF. In addition, no adjustments for temperature variations or electricity trade are considered.

Note 3: For fluorinated gases the base year 1995 was used for all Member States, which is in line with the base year indicated so far by most Member States individually.

Overview of EC GHG emissions and removals for 1990–2001 in CO₂ equivalents (Gg)

Table 18

Greenhouse gas emissions	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
	CO ₂ equivalent (Gg)											
Net CO ₂ emissions/removals	3 137 195	3 138 005	3 080 042	3 009 213	3 026 711	3 071 406	3 139 324	3 079 282	3 138 854	3 109 487	3 148 754	3 180 074
CO ₂ emissions (without LUCF)	3 329 139	3 354 486	3 282 261	3 222 223	3 227 362	3 262 960	3 339 599	3 279 607	3 329 936	3 308 900	3 329 314	3 383 556
CH ₄	414 145	404 840	393 880	384 199	374 686	370 569	366 408	357 279	350 730	343 154	335 189	329 588
N ₂ O	408 947	402 710	391 975	383 328	388 660	389 434	396 282	394 276	372 024	351 055	349 367	344 495
HFCs	25 668	24 425	25 991	28 453	33 088	39 255	43 692	49 753	54 070	41 449	45 033	43 383
PFCs	13 403	11 808	9 643	8 258	7 523	7 679	7 717	7 358	7 063	6 885	6 163	5 527
SF ₆	8 311	8 940	9 594	10 365	11 269	12 709	12 839	12 827	12 187	9 890	9 765	9 537
Total (with net CO ₂ emissions/removals)	4 007 668	3 990 728	3 911 125	3 823 817	3 841 937	3 891 053	3 966 262	3 900 775	3 934 928	3 861 919	3 894 272	3 912 604
Total (without LUCF)	4 191 729	4 199 406	4 105 362	4 028 907	4 034 691	4 074 811	4 158 724	4 093 280	4 117 858	4 053 531	4 066 658	4 108 256

Overview of EC GHG emissions in the main source categories 1990 to 2001 in CO₂ equivalents (Gg)

Table 19

Greenhouse gas source and sink categories	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
	CO ₂ equivalent (Gg)											
1. Energy	3 309 531	3 343 140	3 273 632	3 213 816	3 206 413	3 236 580	3 315 931	3 249 818	3 299 503	3 274 547	3 288 521	3 343 702
2. Industrial processes	302 005	290 366	282 760	274 908	287 732	299 731	302 536	307 258	287 768	251 500	255 935	251 143
3. Solvent and other product use	9 559	9 469	9 258	8 860	8 827	8 857	8 872	8 939	8 974	8 936	9 039	8 771
4. Agriculture	433 768	423 311	412 802	407 912	409 350	408 989	412 257	412 354	410 496	410 097	406 816	400 225
5. Land-use change and forestry	-184 060	-208 678	-194 237	-205 090	-192 753	-183 758	-192 462	-192 506	-182 930	-191 612	-172 386	-195 652
6. Waste	134 998	131 282	125 080	121 631	120 452	118 728	117 210	113 134	109 172	106 473	104 392	102 501
7. Other	1 865	1 835	1 828	1 776	1 918	1 937	1 929	1 778	1 946	1 978	1 954	1 914

2.3. Greenhouse gas emission trends by source

Table 19 gives an overview of EC GHG emissions in the main source categories for 1990–2001. The emissions from the largest source category 'Energy', with an 81 % share of the total emissions, increased by 34 170 (1.0 %). This increase was offset by decreases in the second-, third- and fourth-largest categories: emissions from 'Agriculture' decreased by 33 543 Gg (-7.7 %), emissions from 'Industrial processes' by 50 861 Gg (-16.8 %), and emissions from 'Waste' by 32 498 Gg (-24.1 %).

2.4. Greenhouse gas emission trends by Member State

Table 20 gives an overview of the Member States' contributions to the EC GHG

emissions for 1990 to 2001. The largest emitter with a 24.2 % share of the total EC emissions in 2001 was Germany with 993 505 Gg and the smallest with a 0.15 % share was Luxembourg with 6 077 Gg.

Germany reduced its emissions significantly (-18 %) between 1990 and 2001, although the emissions increased again between 2000 and 2001 (1.2 %). Similarly, the second-largest emitter, the United Kingdom, reduced its emissions by 12 % between 1990 and 2001, though they increased between 2000 and 2001 by 1.3 %. The third-largest emitter, France, stabilised its 2001 emissions at the level of 1990, despite a 0.5 % increase compared to 2000. The smallest emitter, Luxembourg, decreased its emissions continuously from 1990 to 2001; the overall reduction from the 1990 level was 44 %.

Table 20 Overview of Member States' contribution to EC GHG emissions excluding LUCF for 1990–2001 in CO₂ equivalents (Gg)

Member State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Austria	78 073	82 241	75 291	76 580	77 768	80 797	84 624	84 146	83 819	82 123	81 951	85 880
Belgium	141 216	147 107	145 641	144 038	147 636	151 773	154 182	149 243	153 403	150 054	149 943	150 169
Denmark	69 217	79 910	73 459	76 209	80 039	77 335	90 778	80 945	75 797	72 750	68 181	69 410
Finland	77 233	75 281	72 173	72 829	79 195	76 652	82 122	81 056	78 512	77 831	75 391	80 888
France	560 775	583 739	573 892	552 304	548 945	558 052	573 851	566 525	582 082	564 074	557 909	560 757
Germany	1 211 579	1 158 262	1 104 970	1 086 585	1 065 314	1 058 861	1 077 642	1 040 112	1 015 984	982 932	981 468	993 505
Greece	104 755	104 760	106 172	106 714	109 238	110 429	114 220	119 504	124 343	123 697	129 652	132 176
Ireland	53 420	54 461	55 284	54 983	56 707	57 583	59 249	62 030	64 124	66 256	68 184	70 018
Italy	508 629	510 208	507 441	498 038	492 169	520 385	514 671	521 598	532 608	538 627	543 751	545 355
Luxembourg	10 883	10 455	10 303	10 595	10 257	7 792	7 851	6 851	5 919	6 029	5 996	6 077
Netherlands	210 004	217 795	216 651	219 569	220 869	223 314	232 901	220 330	225 156	216 446	216 816	219 694
Portugal	61 441	63 251	67 322	65 617	66 253	69 972	67 496	69 670	74 577	82 880	82 256	83 823
Spain	287 609	294 203	303 051	291 330	306 069	319 363	311 373	332 546	343 082	371 057	387 104	382 789
Sweden	72 756	72 873	72 042	71 881	76 679	75 085	78 687	73 772	74 907	72 239	68 949	70 485
United Kingdom	744 139	744 862	721 671	701 635	697 555	687 417	709 075	684 952	683 543	646 537	649 107	657 232
EU15	4 191 729	4 199 406	4 105 362	4 028 907	4 034 691	4 074 811	4 158 724	4 093 280	4 117 858	4 053 531	4 066 658	4 108 256

Table 21 Overview of EC indirect GHG emissions for 1990–2001 (Gg)

Greenhouse gas emissions	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
	Gg											
NO _x	13 402	13 295	12 985	12 368	11 995	11 673	11 566	11 083	10 774	10 417	10 129	9 941
CO	50 387	48 511	46 579	44 189	41 955	40 446	39 219	37 417	35 539	33 536	30 996	30 118
NMVOG	17 026	16 486	15 978	15 301	15 172	13 874	14 113	14 013	13 181	12 787	12 215	12 014
SO ₂	16 375	14 871	13 692	12 452	11 300	10 184	8 880	7 997	7 603	6 819	6 177	5 963

2.5. Emission trends for indirect greenhouse gases and sulphur dioxide

Emissions of CO, NO_x, NMVOC and SO₂ have to be reported to the UNFCCC secretariat because they influence climate change indirectly: CO, NO_x and NMVOC are precursor substances for ozone which itself is a greenhouse gas. Sulphur emissions produce microscopic particles (aerosols) that can reflect sunlight back out into space and also affect cloud formation. Table 21 shows the total indirect GHGs and SO₂ emissions in the EC between 1990 and 2001. All emissions were reduced significantly from the 1990 levels: the largest reduction was achieved in SO₂ (– 63.6 %) followed by CO (– 40.2 %), NMVOC (– 29.4 %) and NO_x (– 25.8 %).

Table 22 shows the NO_x emissions of the Member States between 1990 and 2001. The largest emitters, the United Kingdom, Germany and France, that made up 47.9 % of the total NO_x emissions in 2001, reduced their emissions from the 1990 levels. This was counterbalanced by increases from Greece, Ireland, Spain and Portugal. All other Member States reduced their emissions.

Table 23 shows the CO emissions of the Member States between 1990 and 2001. The largest emitters, France, Italy and Germany that made up 53.8 % of the total CO emissions in 2001, reduced their emissions from the 1990 levels. This was counterbalanced by the increases from Finland and Greece. All other Member States reduced their emissions.

Overview of Member States' contribution to EC NO_x emissions for 1990–2001 (Gg)

Table 22

Member State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Austria	204	209	200	197	191	188	207	195	203	193	196	199
Belgium	337	353	364	360	365	359	349	326	341	305	326	315
Denmark	272	319	275	276	281	264	307	267	239	220	206	202
Finland	311	290	283	282	282	259	268	260	253	248	236	210
France	1 958	2 035	1 991	1 869	1 822	1 784	1 752	1 688	1 668	1 593	1 517	1 488
Germany	2 729	2 514	2 323	2 208	2 055	1 984	1 897	1 784	1 675	1 619	1 584	1 592
Greece	290	298	297	292	299	296	306	310	334	326	317	331
Ireland	116	118	129	117	114	114	118	117	120	117	123	132
Italy	1 952	2 011	2 027	1 923	1 792	1 764	1 763	1 693	1 600	1 490	1 372	1 317
Luxembourg	22	22	22	22	22	20	22	18	17	16	17	17
Netherlands	570	551	539	519	493	487	474	445	428	430	413	411
Portugal	287	303	325	319	324	337	332	339	363	385	406	399
Spain	1 259	1 302	1 334	1 307	1 330	1 343	1 307	1 346	1 344	1 401	1 420	1 393
Sweden	334	334	319	307	320	296	295	280	267	259	252	251
United Kingdom	2 763	2 637	2 558	2 371	2 306	2 178	2 168	2 016	1 923	1 815	1 742	1 687
EU15	13 402	13 295	12 985	12 368	11 995	11 673	11 566	11 083	10 774	10 417	10 129	9 941

Overview of Member States' contribution to EC CO emissions excluding LUCF for 1990–2001 (Gg)

Table 23

Member State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Austria	1 238	1 246	1 198	1 167	1 117	1 030	1 050	985	953	907	859	860
Belgium	1 265	1 286	1 326	1 305	1 232	1 188	1 215	1 045	1 168	1 050	1 099	1 028
Denmark	715	755	745	749	720	703	709	666	602	572	579	587
Finland	549	495	467	447	433	424	463	460	452	545	535	603
France	11 096	10 981	10 511	9 924	9 217	9 052	8 441	7 980	7 757	7 228	6 714	6 439
Germany	11 213	9 515	8 351	7 704	7 065	6 532	6 109	5 955	5 424	5 143	4 768	4 797
Greece	1 298	1 290	1 320	1 285	1 264	1 254	1 354	1 356	1 489	1 386	1 395	1 366
Ireland	397	391	391	347	326	301	303	308	313	281	275	270
Italy	7 863	8 024	7 968	7 769	7 573	7 796	7 341	7 211	6 346	6 072	5 207	4 965
Luxembourg	172	172	172	172	145	104	102	80	50	49	49	53
Netherlands	1 121	1 023	966	949	905	855	867	786	741	704	681	662
Portugal	1 077	1 148	1 241	1 225	1 205	1 191	1 171	1 133	1 133	1 101	1 085	1 057
Spain	3 798	3 868	3 933	3 713	3 674	3 302	3 424	3 267	3 250	2 994	2 886	2 857
Sweden	1 135	1 098	1 090	1 045	1 027	1 015	1 000	899	952	909	833	808
United Kingdom	7 450	7 219	6 900	6 389	6 053	5 700	5 671	5 285	4 907	4 596	4 031	3 765
EU15	50 387	48 511	46 579	44 189	41 955	40 446	39 219	37 417	35 539	33 536	30 996	30 118

Table 24 Overview of Member States' contribution to EC NMVOC emissions for 1990–2001 (Gg)

Member State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Austria	345	323	293	282	270	271	269	250	242	237	232	232
Belgium	322	325	331	327	316	308	294	277	286	253	255	249
Denmark	171	173	171	170	167	162	161	154	147	144	128	124
Finland	236	213	206	196	191	182	207	204	160	178	162	156
France	3 751	3 735	3 666	3 526	3 482	3 436	3 201	3 288	3 109	3 147	3 003	3 002
Germany	3 221	2 796	2 539	2 326	2 158	2 020	1 892	1 823	1 735	1 663	1 605	1 606
Greece	255	253	261	270	274	273	284	285	290	291	305	268
Ireland	106	107	110	101	103	101	107	111	113	94	85	83
Italy	2 259	2 312	2 333	2 347	2 350	2 358	2 298	2 277	1 768	1 674	1 512	1 464
Luxembourg	19	19	19	19	18	17	17	17	15	12	13	12
Netherlands	492	461	436	403	388	363	306	271	302	291	278	271
Portugal	379	408	435	442	443	464	439	500	532	484	477	485
Spain	2 546	2 528	2 455	2 309	2 499	1 549	2 344	2 374	2 450	2 473	2 436	2 422
Sweden	498	478	460	427	408	399	389	354	339	319	304	303
United Kingdom	2 425	2 357	2 263	2 154	2 104	1 971	1 905	1 830	1 693	1 527	1 419	1 337
EU15	17 026	16 486	15 978	15 301	15 172	13 874	14 113	14 013	13 181	12 787	12 215	12 014

Table 25 Overview of Member States' contribution to EC SO₂ emissions for 1990–2001 (Gg)

Member State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Austria	79	72	59	58	52	52	51	46	43	39	38	37
Belgium	353	359	354	327	281	259	256	227	216	178	170	162
Denmark	180	239	186	152	156	149	179	109	74	54	28	25
Finland	237	194	141	122	115	97	105	99	89	85	76	87
France	1 365	1 488	1 325	1 163	1 117	1 053	1 026	881	905	781	712	668
Germany	5 321	3 996	3 307	2 945	2 473	1 939	1 340	1 039	835	738	638	650
Greece	493	532	546	545	517	541	525	521	528	540	483	485
Ireland	183	180	170	161	175	161	147	166	176	157	131	126
Italy	1 652	1 550	1 404	1 305	1 274	1 217	1 137	1 035	1 039	924	758	709
Luxembourg	15	15	15	15	15	15	15	6	4	4	3	3
Netherlands	202	164	157	150	137	142	134	116	108	103	92	89
Portugal	288	283	343	308	279	318	261	265	299	315	288	310
Spain	2 181	2 166	2 136	2 007	1 954	1 805	1 578	1 745	1 610	1 617	1 516	1 424
Sweden	106	99	88	78	80	73	97	70	67	54	57	60
United Kingdom	3 719	3 535	3 461	3 115	2 676	2 365	2 030	1 671	1 609	1 229	1 188	1 127
EU15	16 375	14 871	13 692	12 452	11 300	10 184	8 880	7 997	7 603	6 819	6 177	5 963

Table 24 shows the NMVOC emissions of the Member States between 1990 and 2001. The largest emitters, France, Spain and Germany that made up 58.5 % of the total NMVOC emissions in 2001, reduced their emissions from the 1990 levels. This was counterbalanced by the increases from Greece and Portugal. All other Member States reduced their emissions.

Table 25 shows the SO₂ emissions of the Member States between 1990 and 2001. The largest emitters, Spain, the United Kingdom and Italy that made up 54.7 % of the total SO₂ emissions in 2001, reduced their emissions from the 1990 levels. This was counterbalanced by the increases from Portugal. All other Member States reduced their emissions.

3. Energy (CRF Sector 1)

This chapter starts with an overview on emission trends in CRF Sector 1, 'Energy'. Then a section on methodological issues and uncertainty presents for each EC key source an overview table which includes the Member States' contributions to the key source in terms of level and trend, and information on methodologies, emission factors, completeness and qualitative uncertainty estimates. In addition, the chapter includes sections on sector-specific QA/QC, recalculations, the reference approach and international bunkers.

3.1. Overview of sector

CRF Sector 1, 'Energy', contributes 81 % of the total GHG emissions and is thereby the largest emitting sector in the EC. The most important energy-related gas is CO₂ that makes up 79 % of the total GHG emissions.

Total GHG emissions from this sector increased by 1 % from 3 310 Tg in 1990 to 3 344 Tg in 2001 (Figure 3). In 2001, emissions increased by 1.7 % compared to 2000.

3.1. Methodological issues and uncertainties

Tables 26 to 36 present for each EC key source in CRF Sector 1 an overview of the Member States' contributions to the key source in terms of level and trend, and information on methodologies, emission factors, completeness and qualitative uncertainty estimates. Therefore, the overview tables also aim at making transparent the compilation of CRF Summary Tables 3 and CRF Table 7 of the EC submission.

EC GHG emissions for 1990-2001 from CRF Sector 1 'Energy' (Tg)

Figure 3

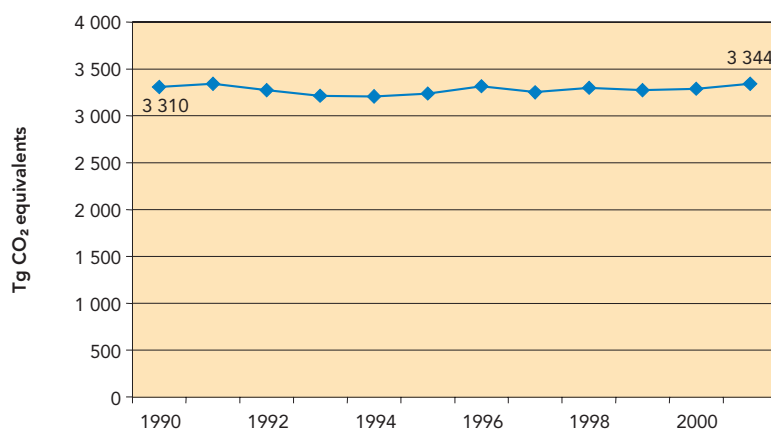


Table 26

Member States' contributions to CO₂ emissions from 1A1, 'Energy industries', and information on methods applied and quality of these emission estimates

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
Germany	412 896	345 293	30.85	31.28	CS	CS	ALL	H
United Kingdom	228 090	199 229	17.80	12.75	T2	CS	ALL	H
Italy	138 957	155 279	13.87	10.35	D, T2	CS	ALL	H
Spain	77 030	98 417	8.79	12.33	CS, C	PS, C	ALL	H
Netherlands	51 305	64 776	5.79	7.80	CS/T2	PS, CS	ALL/IE	H
France	67 636	57 487	5.14	4.63	C	CS	ALL	H
Greece	43 302	55 579	4.97	7.07	C	C, CS	ALL	
Finland	18 517	26 762	2.39	4.62	CS (T2)	CS, PS, D	ALL	H
Belgium	28 572	26 669	2.38	0.68			F	
Denmark	26 202	26 375	2.36	0.40	C	CS	ALL	H
Portugal	16 199	21 953	1.96	3.27	C, T2	C	ALL	H
Ireland	11 057	17 145	1.53	3.38	T1	PS, CS	FULL	H
Austria	13 225	14 375	1.28	0.77	C	CS	ALL	H
Sweden	10 169	9 697	0.87	0.13	CS	CS	ALL	H
Luxembourg	1 277	266	0.02	0.53	C	C	ALL	H-M
EU15	1 144 434	1 119 301	100.00	100.00	C,CS,D,T1,T2	C, CS, D, PS	ALL, IE	H, M

(¹⁾ CRF Summary Tables 3 for 2001.

(²⁾ CRF Tables 7 for 2001.

Table 27

Member States' contributions to CO₂ emissions from 1A., 'Manufacturing industries and construction', and information on methods applied and quality of these emission estimates

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
Germany	196 457	132 536	22.65	46.83	CS	CS	ALL	H
United Kingdom	94 132	90 144	15.41	4.43	T2	CS	ALL	H
France	82 620	83 514	14.27	8.32	C	CS	ALL	H
Italy	84 033	77 095	13.18	0.55	D, T2	CS	ALL	H
Spain	44 532	59 781	10.22	19.38	CS, C	PS, C	ALL	H
Netherlands	41 888	40 197	6.87	2.06	CS/T2	PS, CS		
Belgium	33 181	33 589	5.74	3.39			FULL	
Finland	14 358	13 855	2.37	0.78	CS (T2)	CS/PS/D	ALL	H
Sweden	11 567	12 695	2.17	2.18	CS	CS	ALL	H
Portugal	8 166	11 324	1.94	3.92	C, T2	C	ALL	H
Greece	9 792	10 390	1.78	1.48	C	C	ALL	
Austria	6 927	7 752	1.32	1.45	C	CS	ALL	H
Denmark	5 605	5 909	1.01	0.81	C	CS	ALL	H
Ireland	3 833	4 726	0.81	1.25	T1	PS, CS	FULL	H
Luxembourg	5 258	1 651	0.28	3.17	C	C	ALL	H-M
EU15	642 348	585 160	100.00	100.00	C,CS,D,T1,T2	C, CS, D, PS	ALL	H, M

(¹⁾ CRF Summary Tables 3 for 2001.

(²⁾ CRF Tables 7 for 2001.

Member States' contributions to CO₂ emissions from 1A3, 'Transport', and information on methods applied and quality of these emission estimates

Table 28

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
Germany	162 281	178 313	21.38	20.22	CS	CS	ALL	H
France	119 135	140 670	16.87	2.81	C/CS	C/M/CS	ALL	H
Italy	102 023	125 191	15.01	3.42	D, T2	CS	ALL	H
United Kingdom	116 753	123 165	14.77	20.86	T2	CS	ALL	H
Spain	57 497	89 341	10.71	25.08	C	C	ALL	H
Netherlands	29 122	35 608	4.27	0.82	CS/T2	CS	ALL	H
Belgium	19 610	24 162	2.90	0.78			FULL	
Greece	18 039	22 448	2.69	0.99	C	C	ALL	
Sweden	18 337	19 848	2.38	2.65	CS	CS	ALL	H
Portugal	10 701	19 077	2.29	7.69	C	C	ALL	H
Austria	12 739	18 887	2.26	4.44	M	CS	ALL	H
Finland	12 475	12 569	1.51	2.96	CS (M)	CS	ALL	H
Denmark	10 404	12 077	1.45	0.50	M/C	CS	ALL	H
Ireland	5 020	11 063	1.33	6.21	T1	CS	FULL	H
Luxembourg	870	1 504	0.18	0.57	C	C	ALL	H-M
EU15	695 003	833 925	100.00	100.00	C,CS,D,M,T1, T2	C, CS, M	ALL	H, M

(1) CRF Summary Tables 3 for 2001.

(2) CRF Tables 7 for 2001.

Member States' contribution to N₂O emissions from 1A3, 'Transport', and information on methods applied and quality of these emission estimates

Table 29

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
Germany	3 058	6 465	24.52	7.97	CS	CS	ALL	M
United Kingdom	1 348	4 457	16.91	25.00	T2/T3	D	ALL	L
France	1 626	3 959	15.02	5.03	C/CS	C/M/CS	ALL	L
Italy	1 731	3 454	13.10	8.14	D, T3	D, C	ALL	M
Spain	778	2 165	8.21	7.20	C	C	ALL	L
Austria	486	855	3.24	4.32	M	CS	ALL	M
Belgium	306	851	3.23	2.81			FULL	
Greece	515	719	2.73	7.90	C	C	ALL	
Sweden	428	706	2.68	4.66	CS	CS	ALL	L
Finland	631	693	2.63	12.99	CS (M)	CS/M	ALL	L
Netherlands	371	612	2.32	4.03	CS/T3(road); T1(rest)	CS(road)/D(rest)	ALL	L
Portugal	137	567	2.15	4.56	C	C	ALL	M
Ireland	87	414	1.57	3.86	T1	C	FULL	L
Denmark	147	393	1.49	1.10	M/C	M/C	ALL	L
Luxembourg	12	53	0.20	0.44	C	C	ALL	H-M
EU15	11 660	26 361	100.00	100.00	C, CS, D, M, T1, T2, T3	C, CS, D, M	ALL	H, L, M

(1) CRF Summary Tables 3 for 2001.

(2) CRF Tables 7 for 2001.

Table 30

Member States' contributions to CO₂ emissions from 1A4, 'Other sectors', and information on methods applied and quality of these emission estimates

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
Germany	203 439	187 893	28.65	38.60	CS	CS	ALL	H
United Kingdom	112 538	121 109	18.47	8.55	T2	CS	ALL	H
France	94 381	103 859	15.84	11.16	C	CS	ALL	H
Italy	75 664	78 120	11.91	0.01	D, T2	CS	ALL	H
Netherlands	34 185	36 134	5.51	1.46	CS/T2	CS	ALL	H
Spain	25 953	33 928	5.17	12.42	C	C	ALL	H
Belgium	27 630	30 817	4.70	3.98			F	
Austria	13 638	14 658	2.24	1.00	CS	CS	ALL	H
Ireland	9 726	10 414	1.59	0.65	T1	CS	FULL	H
Greece	5 341	9 300	1.42	6.59	C	C	ALL	
Sweden	10 597	7 757	1.18	5.55	CS	CS	ALL	H
Denmark	8 959	7 688	1.17	2.72	C	CS	ALL	H
Portugal	4 197	6 637	1.01	4.01	C, T2	C	ALL	H
Finland	7 571	6 022	0.92	3.13	CS (T2, T1)	CS/D	ALL	M
Luxembourg	1 277	1 426	0.22	0.19	C	C	ALL	H-M
EU15	635 096	655 763	100.00	100.00	C,CS,D,T1,T2	C, CS, D	ALL	H, M

(1) CRF Summary Tables 3 for 2001.

(2) CRF Tables 7 for 2001.

Table 31

Member States' contributions to CH₄ emissions from 1A4, 'Other sectors', and information on methods applied and quality of these emission estimates

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
France	3 043	2 979	38.49	21.85	CS	CS	ALL	L
United Kingdom	1 468	844	10.90	7.33	T2	CS/C/D	ALL	L
Germany	2 684	654	8.45	40.14	CS	CS	ALL	M
Spain	838	651	8.41	0.93	C	C	ALL	L
Italy	319	553	7.14	9.53	D, T2	D, C	ALL	M
Netherlands	425	429	5.54	3.43	CS/T2	CS	ALL	M
Finland	268	323	4.18	3.75	CS (T2, T1)	CS/PS	ALL	L
Portugal	349	305	3.94	1.41	C+T2	C	ALL	M
Sweden	221	237	3.07	2.23	CS	CS	ALL	M
Austria	386	217	2.81	2.07	CS	CS	ALL	L
Greece	163	208	2.69	2.62	C	C	ALL	
Denmark	81	166	2.14	3.18	C	CS/C	ALL	M
Belgium	106	114	1.47	1.06			F	
Ireland	89	50	0.65	0.46	T1	C	FULL	L
Luxembourg	12	9	0.12	0.01	C	C	ALL	H-M
EU15	10 453	7 739	100.00	100.00	C,CS,D,T1,T2	C, CS, D, PS	ALL	H, L, M

(1) CRF Summary Tables 3 for 2001.

(2) CRF Tables 7 for 2001.

Member States' contributions to CO₂ emissions from 1A5, 'Other', and information on methods applied and quality of these emission estimates

Table 32

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
United Kingdom	5 265	2 984	40.84	26.03	T2	CS	ALL	M
Germany	11 760	2 317	31.70	47.84	CS	CS	ALL	H
Finland	972	1 284	17.58	22.67	CS (T2, T1)	CS/D	ALL	M
Italy	1 041	354	4.84	0.61	D, T2	CS	ALL	H
Sweden	910	271	3.70	1.47	CS	CS	PART	L
Denmark	119	97	1.33	1.31				
Netherlands	1	0	0.00	0.01	CS/T2	CS	ALL/IE	M
Portugal	8	0	0.00	0.07	C+T2	C		
Spain	0	0	0.00	0.00	NE		IE	
France	0	0	0.00	0.00	C	CS	NO	
Greece	0	0	0.00	0.00			NO	
Belgium	0	NE	0.00	0.00			NE	
Ireland	NO	NO	0.00	0.00	NA	NA	NE	NE
Austria	0	0	0.00	0.00			NO	NO
Luxembourg	0	0	0.00	0.00	NA	NA	ALL	H-M
EU15	20 076	7 307	100.00	100.00	C,CS,D,T1,T2	C, CS, D	ALL, IE, NE, PART	H, L, M

(1) CRF Summary Tables 3 for 2001.

(2) CRF Tables 7 for 2001.

Member States' contributions to 1B1, 'Fugitive CO₂ emissions from solid fuels', and information on methods applied and quality of these emission estimates

Table 33

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
Finland	3 500	3 500	43.31	43.25	CS	CS	ALL	L
United Kingdom	3 000	2 217	27.44	37.65	T2/T3	CS	ALL	M
Spain	2 522	2 073	25.66	11.63	CS, C	PS, C	ALL	H
Sweden	253	291	3.60	6.75	CS	CS	ALL	L
Portugal	9	0	0.00	0.72	MB		ALL	H
Germany	NE	NE	0.00	0.00	NO	NO	NO	
France	0	0	0.00	0.00	C	CS	IE	H
Greece	0	0	0.00	0.00				
Denmark	0	0	0.00	0.00	NO		NO	
Italy	-	0	0.00	0.00			NO	
Belgium	0	0	0.00	0.00			P	
Ireland	NO	0	0.00	0.00	NA	NA	NO	NA
Austria	0	0	0.00	0.00			ALL	H
Netherlands	0	0	0.00	0.00	IE		IE	
Luxembourg	0	0	0.00	0.00	NA	NA	ALL	H-M
EU15	9 283	8 081	100.00	100.00	C, CS, MB, T2, T3	C, CS, PS	ALL, IE, PART	H, L, M

(1) CRF Summary Tables 3 for 2001.

(2) CRF Tables 7 for 2001.

Table 34

Member States' contributions to 1B1, 'Fugitive CH₄ emissions from solid fuels', and information on methods applied and quality of these emission estimates

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
Germany	23 945	5 852	38.31	41.85	CS	CS	ALL	L
United Kingdom	17 203	5 110	33.45	7.63	T2	CS	ALL	M
France	4 331	1 679	10.99	7.81	C	CS	ALL	M
Greece	926	1 400	9.17	27.48	T1	D	ALL	
Spain	1 789	1 057	6.92	12.24	T1	CS	ALL	M
Denmark	72	69	0.45	1.14	D	D	ALL	L
Italy	117	64	0.42	0.68	D, C	D, CS	ALL	M
Belgium	38	24	0.16	0.29			P	
Finland	21	21	0.14	0.36	CS	CS	ALL	L
Austria	0	0	0.00	0.00	C	CS	PART	L
Sweden	0	0	0.00	0.00	CS	CS	ALL	L
Portugal	66	0	0.00	0.52	C, T2	C	PART	M
Ireland	0	0	0.00	0.00	NA	NA	NO	NA
Netherlands	0	0	0.00	0.00	IE		IE	
Luxembourg	0	0	0.00	0.00	NA	NA	ALL	H-M
EU15	48 510	15 277	100.00	100.00	C,CS,D,T1,T2	C, CS, D	ALL, IE, PART	H, L, M

(¹⁾ CRF Summary Tables 3 for 2001.

(²⁾ CRF Tables 7 for 2001.

Table 35

Member States' contribution to 1B2, 'Fugitive CO₂ emissions from oil and natural gas', and information on methods applied and quality of these emission estimates

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
United Kingdom	9 138	5 658	34.55	49.63	T3	CS	ALL	H
France	4 306	4 208	25.69	1.96	C	CS	ALL	H
Spain	1 779	2 193	13.39	8.27			ALL	H
Netherlands	308	1 666	10.17	22.58	CS/T3 (>97 T1)	CS	PART	L
Italy	999	1 293	7.90	5.67	C, CS	CS	ALL	M
Denmark	240	633	3.87	6.67	C	C	ALL	L
Portugal	155	347	2.12	3.29	MB		PART	M
Austria	120	207	1.26	1.53	C, CS	CS, PS	ALL	L
Ireland	139	134	0.82	0.03	T1	CS	FULL	M
Finland	42	23	0.14	0.28	CS	PS	PART	M
Sweden	22	15	0.09	0.09	CS	CS	ALL	L
Germany	NE	NE	0.00	0.00	NE	NE	NE	
Belgium	NE	NE	0.00	0.00			P	
Luxembourg	0	0	0.00	0.00	C	C	ALL	H-M
Greece	0	0	0.00	0.00				
EU15	17 247	16 377	100.00	100.00	C, CS, MB, T1, T3	C, CS, PS	ALL, NE, PART	H, L, M

(¹⁾ CRF Summary Tables 3 for 2001.

(²⁾ CRF Tables 7 for 2001.

Member States' contributions to 1B2, 'Fugitive CH₄ emissions from oil and natural gas', and information on methods applied and quality of these emission estimates

Table 36

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
United Kingdom	10 779	8 502	30.00	18.51	T3	CS	ALL	M
Germany	7 628	7 422	26.19	21.01	CS	CS	ALL	M
Italy	6 665	5 085	17.94	15.64	C, CS	CS	ALL	H
Netherlands	3 754	2 821	9.95	9.85	CS/T1	CS	ALL	L
France	2 471	1 903	6.72	5.37	C	CS	ALL	M
Spain	584	993	3.50	11.91	CS, C	PS, C	ALL	M
Belgium	748	864	3.05	5.38			P	
Portugal	38	199	0.70	4.02	C, T2	C	PART	M
Greece	5	177	0.62	4.20	C	C	ALL	
Austria	95	126	0.44	1.09	C	CS	ALL	L
Ireland	151	103	0.36	0.64	T1	CS	FULL	M
Denmark	21	78	0.28	1.46	C	C	ALL	L
Luxembourg	28	46	0.16	0.54	C	C	ALL	H-M
Finland	4	19	0.07	0.39	CS	PS	PART	M
Sweden	0	0	0.00	0.00	CS	CS	ALL	L
EU15	32 969	28 338	100.00	100.00	C,CS,T1,T2,T3	C, CS, PS	ALL, PART	H, L, M

⁽¹⁾ CRF Summary Tables 3 for 2001.

⁽²⁾ CRF Tables 7 for 2001.

3.3. Sector-specific quality assurance and quality control

The main sector-specific QA/QC activity is the project led by Eurostat on the harmonisation of the energy data used for energy balances and CO₂ inventories. The work programme for this project foresees that Member States perform the following tasks:

- examine the energy data used by the two submissions (CRF to UNFCCC and the European Commission, DG Environment, and joint questionnaires to Eurostat and the IEA) for 1990, 1995 and 2000 and identify and explain the differences;
- establish a procedure at national level that will eliminate discrepancies in the two reporting mechanisms in future; this procedure will be agreed with Eurostat;
- provide the updated energy data in the form of annual questionnaires for the period 1990 to 2000 ensuring comparable data under the two reporting mechanisms.

At the end of 2000, the first countries co-financed to carry out this work were Denmark, Sweden, the Netherlands and

Norway. In 2001, Eurostat continued this project with the provision of grants to Austria, Germany, France and the United Kingdom. In 2002, grants were issued for Ireland, Italy and Portugal. In 2003, a call for proposals for grants will be launched to the remaining EC countries not yet participating in this project. Denmark, Sweden, Austria, the Netherlands, and the United Kingdom have already submitted the final report to Eurostat.

Following the submission of each Member State's final report, Eurostat will update information in its database and will be in the position to produce CO₂ emission figures based on the energy balances, with minimum deviation from those reported by the Member States and a full understanding of any discrepancies. This will help to improve the quality of the EC GHG inventory for Sector 1, 'Energy'.

3.4. Sector-specific recalculations

Table 37 shows that in the energy sector the largest recalculations in absolute terms were made for CO₂. However, in relative terms the recalculations of CO₂ emissions in the energy sector were below 0.5 %.

Table 37

Recalculations of total greenhouse gas emissions and recalculations of greenhouse gas emissions in CRF Sector 1, 'Energy', for 1990 and 2000 by gas (Gg and %)

	CO ₂		CH ₄		N ₂ O		HFCs		PFCs		SF ₆	
	Gg	Percent	Gg	Percent	Gg	Percent	Gg	Percent	Gg	Percent	Gg	Percent
1990												
Total emissions and removals	- 5 604	- 0.18	- 12 361	- 2.90	7 999	2.00	1 242	5.08	- 143	- 1.05	- 129	- 1.52
Energy	- 9 543	- 0.30	- 1 161	- 1.16	- 123	- 0.26	NO	NO	NO	NO	NO	NO
2000												
Total emissions and removals	4 635	0.15	- 6 581	- 1.93	11 256	3.33	4 362	- 4.76	- 683	- 9.98	810	9.05
Energy	9 928	0.31	- 1 332	- 2.15	3 184	5.79	NO	NO	NO	NO	NO	NO

3.5. Comparison between the sectoral approach and the reference approach

The IPCC reference approach for CO₂ from fossil fuels for the EC is based on Eurostat energy data (New Cronos database, October 2002 version). Energy statistics are submitted to Eurostat by Member States on an annual basis with the five joint Eurostat/IEA/UNECE questionnaires on solid fuels, oil, natural gas, electricity and heat, and renewables and wastes. On the basis of this information Eurostat compiles the annual energy balances which are used for the estimation of CO₂ emissions from fossil fuels by Member State and for the EC as a whole.

The Eurostat data for the EC IPCC reference approach includes activity data, net calorific values and carbon emission factors. In the CRF Tables 1.A(b) some fuel categories are grouped and average net calorific values are used: 'Orimulsion' is included in 'Residual fuel oil'. 'Natural gas liquids' is included in 'Crude oil'. 'Other kerosene' is included in 'Total kerosene'. 'Anthracite', 'Coking coal' and 'Other bituminous coal' are referred to in the Eurostat New Cronos database as 'Hard coal' and are included in CRF Tables 1.A(b) under 'Other bituminous coal'. 'Sub-bituminous coal' and 'Peat' are included in 'Lignite'. 'Solid biomass', 'Liquid biomass' and 'Gas biomass' is included in 'Total biomass'. For international bunkers, only fuel consumption for international navigation is available separately; data on international aviation are not estimated separately. Therefore, total CO₂ emissions as estimated with the IPCC reference approach on the basis of Eurostat data include CO₂ emissions from international aviation. For the calculation of CO₂ emissions, the IPCC default carbon emission factors adjusted for the non-oxidised fraction are used in the Eurostat New Cronos database.

The IPCC reference approach method at EC level is a three-step process.

Step 1: For each Member State, annual data on energy production, imports, exports, international bunkers (except international aviation) and stock changes are available in the Eurostat database in fuel specific units (i.e. kt (= 1 000 tonnes) for solid fuels and petroleum products, TJ for natural gas). The apparent consumption in TJ is calculated for each Member State by using country-specific average net calorific values. These net calorific values are updated annually for solid fuels together with the energy data in the New Cronos database; for petroleum products the net calorific values are kept constant. For groups of fuels average weighted net calorific values are used, which is the case for 'Other bituminous coal' and 'Lignite'.

Step 2: The EC CRF Tables 1.A(b) are calculated by adding the relevant Member State activity and emission data, as calculated under Step 1. The net calorific values provided for the EC in CRF Tables 1.A(b) are calculated from dividing apparent consumption in TJ by apparent consumption in fuel-specific units for each fuel. Therefore, these net calorific values are 'implied calorific values'; there are no fuel-specific net calorific values at EC level.

Step 3: For the calculations of carbon stored in Tables 1.A(d), Eurostat data on non-energy use of fuels are used, as reported by Member State in the joint questionnaire. For the fraction of carbon stored and carbon emission factors IPCC default values are taken (IPCC, 1997).

Table 38 shows the apparent energy consumption and CO₂ emissions from fossil fuel combustion from 1990 to 2000 as provided in Tables 1.A(b) in the annex. Total fossil fuel energy consumption increased by

Apparent EC energy consumption (TJ) and EC CO₂ emissions from fossil fuel combustion (Gg)

Table 38

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Liquid fuels	22.761.496	23.482.133	23.817.546	23.543.083	23.722.534	24.016.584	24.503.293	24.496.382	25.054.141	24.886.527	24.470.374
Solid fuels	12.561.949	11.859.600	11.056.226	10.283.864	10.133.182	9.901.371	9.783.665	9.305.916	9.295.693	8.626.103	8.945.734
Gaseous fuels	9.298.421	10.036.650	9.929.083	10.562.050	10.621.111	11.446.721	12.778.070	12.669.683	13.211.329	13.799.696	14.179.877
Total energy consumption	44.621.865	45.378.382	44.802.854	44.388.997	44.476.826	45.364.676	47.065.027	46.471.982	47.561.162	47.312.327	47.595.985
CO ₂ emissions	3.200.404	3.213.914	3.148.460	3.100.972	3.092.535	3.131.112	3.235.276	3.169.289	3.239.958	3.197.927	3.219.475

Differences between EC CO₂ emissions from fuel combustion (CRF 1A) using the IPCC reference approach (Eurostat data) and sectoral approach (Member States' data)

Table 39

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Percentage difference between reference approach (Eurostat data) and sectoral approach (MS data)	2.02	1.29	1.37	1.63	1.42	1.57	2.27	2.23	2.84	2.25	2.34
Percentage difference between reference approach (Eurostat data) and sectoral approach (MS) including emissions from international aviation	0.23	-0.45	-0.55	-0.50	-0.79	-0.71	-0.10	-0.34	0.09	-0.67	-0.73

6.7 % between 1990 and 2000, whereas CO₂ emissions from fossil fuel combustion increased by 0.6 %.

Table 39 summarises the percentage deviation of CO₂ emissions from the IPCC reference approach applied to the EC based on Eurostat data and the sectoral approach available from Member States. The main reason for this difference is that Eurostat energy data do not separate fuel combustion from international aviation. If fuel combustion from international aviation is added to the sectoral approach (from Member States), the percentage differences are much smaller.

Differences are also observed when comparing the estimates for CO₂ emissions from fossil fuels from the IPCC reference approach of the Member States with the estimates from the reference approach calculated using Eurostat energy balance data. Table 40 provides an overview by Member State on differences between the Eurostat and national reference approach for 1990 and 2000, as far as available. The differences can occur due to differences in the basic energy data or due to differences when calculating CO₂ emissions from the basic energy data.

Main reasons for diverging energy data are:

- the exclusion of fuels from international aviation in the national reference approach (in Eurostat data this exclusion is not possible);
- the use of different calorific values (CV) mainly for oil products, BKB (lignite briquettes) and patent fuels. For BKB and patent fuels, Eurostat is using the same CV for all countries which differs from the calorific values used by the Member States;
- small differences in the basic energy balance data reported by Member States to Eurostat (in the joint questionnaires) and to the Commission and the UNFCCC (in the CRF tables).

To resolve these differences Eurostat launched a project for harmonisation of the two (joint questionnaires and CRF) reporting systems of energy data and for revision of reported energy data back to 1990 (see Chapter 3.3).

Main reasons for diverging CO₂ emissions are:

- differences in the treatment of non-energy use of fossil fuels and carbon stored; and
- the use of country-specific emission factors. The Eurostat reference approach uses the IPCC default emission factors.

Table 40

Comparison between the Eurostat and the national reference approach for CO₂ from fuel combustion (CRF 1A) (4)

Austria						
1990	Eurostat reference approach		National reference approach		Percentage difference	
	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)
Liquid fossil fuels	442 065	29 594	434 126	27 381	- 1,8	- 7,5
Solid fossil fuels	169 442	16 283	168 733	13 503	- 0,4	- 17,1
Gaseous fossil fuels	219 239	11 898	219 239	11 463	0,0	- 3,7
Total	830 746	57 775	822 098	52 347	- 1,0	- 9,4
2000	Eurostat reference approach		National reference approach		Percentage difference	
	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)
Liquid fossil fuels	497 098	33 554	487 982	31 435	- 1,8	- 6,3
Solid fossil fuels	152 796	14 773	149 283	10 993	- 2,3	- 25,6
Gaseous fossil fuels	273 551	15 057	275 682	14 876	0,8	- 1,2
Total	923 446	63 383	912 947	57 305	- 1,1	- 9,6
Denmark						
1990	Eurostat reference approach		National reference approach		Percentage difference	
	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)
Liquid fossil fuels	339 472	23 752	318 411	22 426	- 6,2	- 5,6
Solid fossil fuels	218 500	20 532	254 880	24 130	16,6	17,5
Gaseous fossil fuels	76 098	4 248	76 098	4 269	0,0	0,5
Total	634 070	48 531	649 389	50 824	2,4	4,7
2000	Eurostat reference approach		National reference approach		Percentage difference	
	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)
Liquid fossil fuels	378 168	26 989	333 259	24 020	- 11,9	- 11,0
Solid fossil fuels	168 018	15 792	166 862	15 801	- 0,7	0,1
Gaseous fossil fuels	186 258	10 397	186 511	10 463	0,1	0,6
Total	732 444	53 178	686 632	50 285	- 6,3	- 5,4
Finland						
1990	Eurostat reference approach		National reference approach		Percentage difference	
	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)
Liquid fossil fuels	417 506	27 122	441 576	29 436	5,8	8,5
Solid fossil fuels	212 396	20 432	223 400	21 943	5,2	7,4
Gaseous fossil fuels	94 646	5 263	91 620	5 121	- 3,2	- 2,7
Total	724 548	52 817	756 596	56 500	4,4	7,0

(4) Minus means that Member State-based estimates are lower than the Eurostat-based estimates. Member States' data exclude emissions from international aviation.

2000	Eurostat reference approach		National reference approach		Percentage difference	
	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)
Liquid fossil fuels	391 633	26 775	393 294	26 757	0,4	- 0,1
Solid fossil fuels	211 306	20 345	217 906	21 001	3,1	3,2
Gaseous fossil fuels	143 281	7 969	143 640	7 992	0,3	0,3
Total	746 219	55 090	754 841	55 751	1,2	1,2

France						
1990	Eurostat reference approach		National reference approach		Percentage difference	
	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)
Liquid fossil fuels	3 655 354	238 450	3 533 651	220 991	- 3,3	- 7,3
Solid fossil fuels	824 313	77 749	754 302	70 353	- 8,5	- 9,5
Gaseous fossil fuels	1 030 510	55 888	1 089 913	59 174	5,8	5,9
Total	5 510 178	372 087	5 377 866	350 517	- 2,4	- 5,8
2000	Eurostat reference approach		National reference approach		Percentage difference	
	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)
Liquid fossil fuels	3 685 327	236 022	3 427 318	207 753	- 7,0	- 12,0
Solid fossil fuels	625 542	59 065	597 202	55 719	- 4,5	- 5,7
Gaseous fossil fuels	1 471 283	80 147	1 478 539	80 550	0,5	0,5
Total	5 782 152	375 234	5 503 059	344 022	- 4,8	- 8,3

Germany						
1990	Eurostat reference approach		National reference approach		Percentage difference	
	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)
Liquid fossil fuels	5 190 871	333 697	5 034 262	327 838	- 3,0	- 1,8
Solid fossil fuels	5 572 479	539 954	5 508 185	566 742	- 1,2	5,0
Gaseous fossil fuels	2 302 935	126 616	2 302 935	123 971	0,0	- 2,1
Total	13 066 285	1 000 267	12 845 382	1 018 551	- 1,7	1,8

Ireland						
1990	Eurostat reference approach		National reference approach		Percentage difference	
	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)
Liquid fossil fuels	195 789	13 739	165 588	12 323	- 15,4	- 10,3
Solid fossil fuels	148 001	14 209	147 417	14 334	- 0,4	0,9
Gaseous fossil fuels	79 289	4 055	78 586	4 318	- 0,9	6,5
Total	423 079	32 003	391 591	30 975	- 7,4	- 3,2
2000	Eurostat reference approach		National reference approach		Percentage difference	
	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)
Liquid fossil fuels	323 594	23 109	329 417	24 209	1,8	4,8
Solid fossil fuels	110 962	10 610	117 021	11 171	5,5	5,3
Gaseous fossil fuels	143 856	7 702	144 152	7 920	0,2	2,8
Total	578 413	41 421	590 590	43 300	2,1	4,5

Netherlands						
1990	Eurostat reference approach		National reference approach		Percentage difference	
	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)
Liquid fossil fuels	993 490	55 873	943 000	52 284	- 5,1	- 6,4
Solid fossil fuels	383 073	35 841	367 000	34 741	- 4,2	- 3,1
Gaseous fossil fuels	1 289 950	70 053	1 305 000	72 533	1,2	3,5
Total	2 666 513	161 767	2 615 000	159 558	- 1,9	- 1,4
2000	Eurostat reference approach		National reference approach		Percentage difference	
	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)
Liquid fossil fuels	1 165 009	69 052	1 070 000	56 585	- 8,2	- 18,1
Solid fossil fuels	334 049	31 331	332 000	31 863	- 0,6	1,7
Gaseous fossil fuels	1 453 264	78 973	1 469 000	81 662	1,1	3,4
Total	2 952 322	179 356	2 871 000	170 110	- 2,8	- 5,2

Portugal						
1990	Eurostat reference approach		National reference approach		Percentage difference	
	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)
Liquid fossil fuels	486 835	30 346	491 139	30 430	0,9	0,3
Solid fossil fuels	108 009	10 146	115 571	10 463	7,0	3,1
Gaseous fossil fuels	0	0	0	0	-	-
Total	594 844	40 492	606 709	40 892	2,0	1,0
2000	Eurostat reference approach		National reference approach		Percentage difference	
	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)
Liquid fossil fuels	632 862	40 405	651 821	41 709	3,0	3,2
Solid fossil fuels	159 227	14 936	159 649	14 390	0,3	- 3,7
Gaseous fossil fuels	85 152	4 753	98 843	5 517	16,1	16,1
Total	877 241	60 094	910 313	61 616	3,8	2,5

Spain						
1990	Eurostat reference approach		National reference approach		Percentage difference	
	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)
Liquid fossil fuels	1 885 284	123 278	1 870 202	120 742	- 0,8	- 2,1
Solid fossil fuels	790 770	74 899	795 407	78 399	0,6	4,7
Gaseous fossil fuels	208 105	11 296	212 036	11 315	1,9	0,2
Total	2 884 159	209 472	2 877 644	210 457	- 0,2	0,5
2000	Eurostat reference approach		National reference approach		Percentage difference	
	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)
Liquid fossil fuels	2 637 596	172 329	2 562 299	163 667	- 2,9	- 5,0
Solid fossil fuels	864 260	81 231	876 258	85 834	1,4	5,7
Gaseous fossil fuels	637 193	35 161	659 187	36 732	3,5	4,5
Total	4 139 049	288 721	4 097 744	286 233	- 1,0	- 0,9

Sweden						
1990	Eurostat reference approach		National reference approach		Percentage difference	
	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)
Liquid fossil fuels	599 659	38 079	628 365	40 879	4,8	7,4
Solid fossil fuels	112 065	10 687	121 965	11 170	8,8	4,5
Gaseous fossil fuels	22 126	1 235	21 536	1 217	- 2,7	- 1,5
Total	733 850	50 000	771 865	53 266	5,2	6,5
2000	Eurostat reference approach		National reference approach		Percentage difference	
	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)
Liquid fossil fuels	586 990	36 582	612 182	40 499	4,3	10,7
Solid fossil fuels	102 246	9 773	104 760	9 705	2,5	- 0,7
Gaseous fossil fuels	29 257	1 633	29 393	1 661	0,5	1,7
Total	718 494	47 987	746 335	51 865	3,9	8,1

United Kingdom						
1990	Eurostat reference approach		National reference approach		Percentage difference	
	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)
Liquid fossil fuels	3 445 693	228 294	3 263 134	214 244	- 5,3	- 6,2
Solid fossil fuels	2 614 886	245 575	2 626 382	241 511	0,4	- 1,7
Gaseous fossil fuels	1 976 219	108 101	1 976 478	113 553	0,0	5,0
Total	8 036 799	581 971	7 865 994	569 308	- 2,1	- 2,2
2000	Eurostat reference approach		National reference approach		Percentage difference	
	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)	Apparent consumption (TJ)	CO ₂ emissions (Gg)
Liquid fossil fuels	3 363 593	222 267	3 110 181	202 191	- 7,5	- 9,0
Solid fossil fuels	1 490 057	139 837	1 495 702	136 726	0,4	- 2,2
Gaseous fossil fuels	3 663 439	203 544	3 659 007	210 923	- 0,1	3,6
Total	8 517 089	565 648	8 264 890	549 840	- 3,0	- 2,8

3.6. International bunker fuels

International bunker emissions of the EC inventory are the sum of the international bunker emissions of the Member States. A project shared between the Commission (Eurostat and Environment DG), Eurocontrol and EEA has been initiated to improve the quality of the estimates of CO₂ emissions from international aviation.

In a first phase of the project, Eurocontrol, the European Organisation for the Safety of Air Navigation and responsible for the coordination of the European air traffic management system, provided Eurostat with aggregated air traffic data covering 1996–2000. Eurostat has used these data to produce estimates of fuel consumption and emissions of CO, CO₂, hydrocarbons, NO_x

and SO₂, split between domestic and international flights. Estimated fuel consumption has been compared with the figures provided in national inventories and with energy statistics for a number of European countries.

The main results of these first investigations are as follows: Estimations of fuel consumption based on European air traffic data are largely compatible with statistics on fuel sold. Similarly, the split between domestic and international fuel consumption as reported in European inventories is largely compatible with traffic-based estimates. The reasons for remaining discrepancies need to be further investigated and may include: (1) the fact that aircrafts do not refuel during every landing and take-off cycle; (2) the inclusion or non-inclusion of overseas territories in the compared data sets.

4. Industrial processes (CRF Sector 2)

This chapter starts with an overview on emission trends in CRF Sector 2, 'Industrial processes'. Then a section on methodological issues and uncertainty presents for each EC key source an overview table which includes the Member States' contributions to the key source in terms of level and trend, and information on methodologies, emission factors, completeness and qualitative uncertainty estimates. In addition, the chapter includes a section on recalculations. A section on sector-specific QA/QC is not included as such activities have not yet started in this sector.

4.1. Overview of sector

CRF Sector 2, 'Industrial processes', is the third-largest sector contributing 6 % to the total EC GHG emissions. The most important GHG from the 'Industrial processes' are CO₂

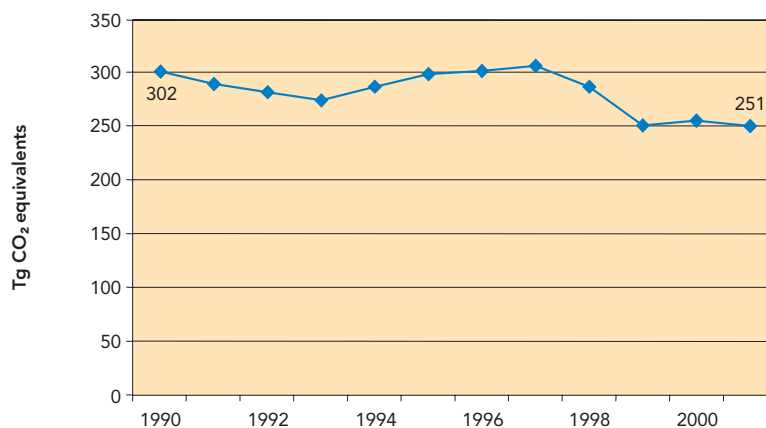
(3 % of the total GHG emissions) and N₂O (1 % of the total GHG emissions). The emissions from this sector decreased by 17 % from 302 Tg in 1990 to 251 Tg in 2001 (Figure 4). In 2001, the emissions decreased by 2 % compared to 2000.

4.2. Methodological issues and uncertainties

Tables 41 to 49 present for each EC key source in CRF Sector 2 an overview on the Member States' contributions to the key source in terms of level and trend, and information on methodologies, emission factors, completeness and qualitative uncertainty estimates. Therefore, the overview tables also aim at making transparent the compilation of CRF Summary Tables 3 and CRF Tables 7 of the EC submission.

Figure 4

EC GHG emissions for 1990–2001 from CRF Sector 2, 'Industrial processes' (Tg)



Member States' contributions to CO₂ emissions from 2A, 'Mineral products', and information on methods applied and quality of these emission estimates

Table 41

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
Germany	24 512	21 802	20.58	14.77	CS	CS	ALL	H
Italy	18 223	18 473	17.44	2.49	D	D	ALL	M
Spain	14 076	17 457	16.48	20.86	CS, C, D, T2	CS, C, D, T2	PART	H
France	14 945	12 231	11.54	15.32	C	CS	ALL	H
Greece	6 984	7 752	7.32	4.95	C	C	ALL	
United Kingdom	9 629	7 702	7.27	10.93	T2	D	PART	H
Belgium	4 569	5 875	5.54	8.01			F	
Portugal	3 426	4 330	4.09	5.56	D, C	D, C	PART	M
Austria	3 975	3 074	2.90	5.14	C, CS	CS	PART	M
Ireland	941	1 833	1.73	5.35	D	D	PART	M
Sweden	1 765	1 630	1.54	0.71	CS	CS	ALL	H
Denmark	1 005	1 464	1.38	2.78	CS	CS	ALL	M
Finland	1 175	1 042	0.98	0.73	D	PS/D	PART	H
Netherlands	1 124	805	0.76	1.83	CS/T2 (clinker)	PS, CS	ALL	M
Luxembourg	585	483	0.46	0.57	C	C	ALL	H-M
EU15	106 934	105 952	100.00	100.00	C, CS, D, T2	C, CS, D, PS, T2	ALL, PART	H, M

⁽¹⁾ CRF Summary Tables 3 for 2001.

⁽²⁾ CRF Tables 7 for 2001.

Member States' contributions to CO₂ emissions from 2B, 'Chemical industry', and information on methods applied and quality of these emission estimates

Table 42

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
France	3 029	2 649	24.60	3.61	C	CS	ALL	H
Germany	2 190	1 811	16.82	0.60	CS	CS	ALL	H
Belgium	778	1 562	14.50	28.02			F	
United Kingdom	1 358	1 373	12.75	7.31	T1	CS	ALL	H
Ireland	989	1 037	9.63	6.48	D, T1a	D	PART	M
Italy	2 237	694	6.45	36.14	D	D, C, CS	ALL	M
Spain	673	603	5.60	1.25	C, D	C, D	ALL	H
Portugal	633	507	4.70	0.69	MB, D, C	D, C	ALL	H
Austria	424	462	4.29	3.33	C	PS	PART	M
Sweden	104	71	0.66	0.50	CS	CS	ALL	H
Greece	470	0	0.00	12.07	C	C	ALL	
Netherlands	0	0	0.00	0.00	CS/IE	PS/CS	ALL	M
Finland	0	0	0.00	0.00	NO	NO	NE	NE
Denmark	0	0	0.00	0.00				
Luxembourg	0	0	0.00	0.00	C	C	ALL	H-M
EU15	12 884	10 769	100.00	100.00	C, CS, D, MB, T1, T1a	C, CS, D, PS	ALL, NE, PART	H, L, M

⁽¹⁾ CRF Summary Tables 3 for 2001.

⁽²⁾ CRF Tables 7 for 2001.

Table 43

Member States' contributions to N₂O emissions from 2B, 'Chemical industry', and information on methods applied and quality of these emission estimates

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
France	24 347	11 338	23.06	0.20	C	CS/PS	ALL	M
Italy	7 252	8 874	18.05	20.59	D	D, CS	ALL	M
Germany	25 547	6 632	13.49	19.45	CS	CS	ALL	M
Netherlands	7 554	6 564	13.35	11.44	CS/T2	PS	CS	L
United Kingdom	29 270	5 386	10.95	30.55	PS	CS	ALL	M
Belgium	3 559	4 031	8.20	8.90			F	
Spain	2 884	2 044	4.16	2.64	C	CS, C	ALL	M
Finland	1 595	1 260	2.56	1.94	D	PS	ALL	L
Austria	907	786	1.60	1.37	C	PS	PART	M
Portugal	603	606	1.23	1.22	D, C	D, C	ALL	M
Ireland	1 035	584	1.19	0.39	D	CS	PART	L
Greece	713	567	1.15	0.88	C	C	ALL	
Sweden	829	495	1.01	0.41	C	CS	ALL	H
Denmark	0	0	0.00	0.00				
Luxembourg	0	0	0.00	0.00	C	C	ALL	H-M
EU15	106 096	49 167	100.00	100.00	C, CS, D, PS, T2	C, CS, D, PS	ALL, PART	H, L, M

(¹⁾ CRF Summary Tables 3 for 2001.

(²⁾ CRF Tables 7 for 2001.

Table 44

Member States' contribution to CO₂ emissions from 2C, 'Metal production', and information on methods applied and quality of these emission estimates

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
Austria	8 461	9 245	38.75	28.09	C	CS, PS	PART	M
France	4 559	2 892	12.12	27.02	C	CS	ALL	H
Sweden	2 445	2 808	11.77	10.87	CS	CS	ALL	H
United Kingdom	3 161	2 738	11.48	3.95	T2	CS	ALL	H
Spain	1 579	1 947	8.16	9.72	C	C	ALL	H
Italy	1 804	1 585	6.64	1.81	D, C	D, C, CS	ALL	M
Belgium	1 671	1 391	5.83	3.24			F	
Germany	904	797	3.34	0.86	CS	CS	ALL	H
Greece	232	251	1.05	0.72	C	C	ALL	
Luxembourg	850	139	0.58	13.12	C	C	ALL	H-M
Portugal	35	62	0.26	0.60	D+C	D+C	ALL	H
Netherlands	0	0	0.00	0.00	CS/IE	PS, CS	ALL	M
Denmark	0	0	0.00	0.00				
Finland	0	0	0.00	0.00	NO	NO	IE	IE
Ireland	0	0	0.00	0.00	NA	NA	NO	NA
EU15	25 702	23 856	100.00	100.00	C, CS, D, T2	C, CS, D, PS	ALL, IE, PART	H, M

(¹⁾ CRF Summary Tables 3 for 2001.

(²⁾ CRF Tables 7 for 2001.

Member States' contributions to PFC emissions from 2C, 'Metal production', and information on methods applied and quality of these emission estimates

Table 45

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
Netherlands	2 398	1 320	42.59	37.06	CS/T2/T3b	PS	NO	
France	2 290	584	18.84	1.32			ALL	H
Germany	2 486	372	11.98	15.67	T3a	T3a	ALL	H
Sweden	440	259	8.36	7.72	T2	CS	ALL	H
United Kingdom	2 031	225	7.24	17.09	T2/PS	CS	ALL	M
Spain	828	176	5.66	2.42	NO		ALL	H
Italy	-	83	2.69	4.53	D, T1	CS	ALL	M
Greece	258	81	2.62	0.69			ALL	
Austria	937	0	0.00	13.50			NO	NO
Portugal	0	0	0.00	0.00	D	D	PART	L
Denmark	0	0	0.00	0.00				
Belgium	0	0	0.00	0.00				
Finland	0	0	0.00	0.00	NO	NO	NO	NO
Ireland	0	0	0.00	0.00	NA	NA	NO	NA
Luxembourg	-	-	0.00	0.00				
EU15	11 668	3 100	100.00	100.00	CS, D, PS, T1, T2, T3a, T3b	CS, D, PS, T3a	ALL, PART	H, L, M

(1) CRF Summary Tables 3 for 2001.

(2) CRF Tables 7 for 2001.

Member States' contributions to HFC emissions from 2E, 'Production of halocarbons and SF₆', and information on methods applied and quality of these emission estimates

Table 46

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
Greece	935	3 744	31.31	31.96	T1	D		
United Kingdom	11 373	3 176	26.56	22.20	T2/PS	CS	ALL	H
Spain	2 403	2 993	25.03	17.83	D, CS, T2	D, PS, T2	ALL	H
Netherlands	4 432	641	5.36	14.43	CS/T2	PS	ALL	M
France	2 230	282	2.36	7.65	CS	CS	ALL	M
Italy	-	22	0.19	0.22	CS	CS	ALL	M
Germany	3 510	1 098	0.00	5.71	T1	T1	ALL	H
Denmark	0	0	0.00	0.00	NO		NO	
Belgium	0	0	0.00	0.00			F	
Finland	0	0	0.00	0.00	NO	NO	NO	NO
Portugal	0	0	0.00	0.00			ALL	H
Ireland	0	0	0.00	0.00	NA	NA	NO	NA
Austria	0	0	0.00	0.00			NO	NO
Sweden	NO	0	0.00	0.00	NO	NO	NO	NO
Luxembourg	-	-	0.00	0.00	NA	NA		
EU15	24 883	11 957	100.00	100.00	CS, D, PS, T1, T2	CS, D, PS, T1, T2	ALL	H, M

(1) CRF Summary Tables 3 for 2001.

(2) CRF Tables 7 for 2001.

Table 47

Member States' contributions to HFC emissions from 2F, 'Consumption of halocarbons and SF₆', and information on methods applied and quality of these emission estimates

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
France	23	8 008	25.52	11.28	CS/T2	CS	ALL	M
Germany	NE	7 032	22.41	12.81	T2	T2	ALL	H
United Kingdom	1	5 502	17.53	9.92	T2	D/CS	ALL	H
Italy	-	2 708	8.63	4.93	D, T2	CS	PART	M
Spain	0	2 295	7.31	4.18	D, CS, T2	D, PS, T2	ALL	L
Belgium	339	1 227	3.91	47.39			F	
Austria	4	1 033	3.29	1.34	CS	CS	PART	M
Netherlands	0	943	3.00	1.72	M, CS/T2	CS	ALL	M
Greece	0	666	2.12	1.21			PART	
Finland	0	657	2.09	1.19	T2, T1a & T1b	D	ALL	M
Denmark	0	647	2.06	1.18	M/CS	CS	ALL	M
Sweden	4	372	1.19	0.11	T2	CS, D	ALL/ PART	M
Ireland	21	231	0.74	2.61	NA	NA	FULL	M
Portugal	0	62	0.20	0.11	D	D	PART	L
Luxembourg	-	-	0.00	0.00	C	C		
EU15	390	31 383	100.00	100.00	C, CS, D, M, T1a, T1b, T2	C, CS, D, PS, T2	ALL, PART	H, L, M

(¹⁾ CRF Summary Tables 3 for 2001.

(²⁾ CRF Tables 7 for 2001.

Table 48

Member States' contributions to SF₆ emissions from 2F, 'Consumption of halocarbons and SF₆', and information on methods applied and quality of these emission estimates

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
Germany	3 728	2 741	41.89	40.57	CS/T2/T1	CS/T2/T1	ALL	H
United Kingdom	246	997	15.24	21.19	T2	CS	ALL	H
France	1 060	966	14.76	6.07	CS/T2	CS	ALL	M
Austria	264	669	10.23	11.01	CS	CS	PART	M
Italy	-	345	5.27	10.09	D, T3c	CS	ALL	M
Netherlands	187	296	4.53	2.61	T2/T3b	PS/CS/D	PART	L
Spain	56	212	3.24	4.40	CS, T2	CS, T2	All	M
Belgium	96	105	1.61	0.02			F	
Ireland	83	67	1.02	0.74	NA	NA	FULL	M
Finland	94	55	0.84	1.45	T2, T1a & T1b	D	ALL	M
Sweden	83	53	0.80	1.16	T2	CS	ALL	M
Denmark	12	30	0.47	0.50	M/CS	CS	ALL	M
Portugal	0	7	0.10	0.19	D	CS	PART	H
Greece	0	0	0.00	0.00			NE	
Luxembourg	-	-	0.00	0.00	C	C		
EU15	5 910	6 543	100.00	100.00	C, CS, D, M, T1, T1a, T1b, T2, T3b, T3c	C, CS, D, PS, T1, T2	ALL, NE, PART	H, L, M

(¹⁾ CRF Summary Tables 3 for 2001.

(²⁾ CRF Tables 7 for 2001.

Member States' contributions to CO₂ emissions from 2G, 'Other', and information on methods applied and quality of these emission estimates

Table 49

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
Belgium	654	976	75.39	50.00			P	
Netherlands	457	319	24.61	50.00	CS	PS/CS	ALL	H
Germany	NO	NO	0.00	0.00	NO	NO	NO	
France	0	0	0.00	0.00			NO	
United Kingdom	0	0	0.00	0.00				
Spain	0	0	0.00	0.00	NO		NO	
Italy	-	0	0.00	0.00			NO	
Austria	0	0	0.00	0.00			NO	NO
Denmark	0	0	0.00	0.00				
Greece	0	0	0.00	0.00			NO	
Finland	0	0	0.00	0.00			NO	NO
Sweden	0	0	0.00	0.00	CS	CS	ALL	M
Portugal	0	0	0.00	0.00				
Ireland	NO	NO	0.00	0.00	NA	NA	NE	NE
Luxembourg	0	0	0.00	0.00	NA	NA	ALL	H-M
EU15	1 111	1 295	100.00	100.00	CS	CS, PS	ALL, NE, PART	H, M

(¹⁾ CRF Summary Tables 3 for 2001.

(²⁾ CRF Tables 7 for 2001.

Table 50 provides an overview of emission allocations in iron and steel production and in cement production for those Member States which provided the relevant information.

Energy and process related CO₂ emissions reported in IPCC categories 1A2a, 1A2f, 2A1 and 2C1 (iron and steel industry and cement industry)

Table 50

	Member State reporting	Member State explanation	Information source
Austria			
Iron and steel industry	Member State reports emissions from 1A2a and 2C1	The emission declaration of the iron and steel industry includes emissions of all activities of this sector which are allocated under SNAP 040202. The standard transformation of SNAP to IPCC allocates the emissions to sector 2C1	Table 1, Table 2(l) and Table 9 (CRF_2002_2001)
Cement industry	Member State reports emissions from 2A1	Emissions of cement industry are reported as total emissions and not for the different fuel types	Table 2(l) and Table 9 (CRF_2002_2001)
Belgium			
Iron and steel industry	Member State reports emissions from 1A2a and 2C1	No specific explanation available	Table 1 and Table 2(l) (CRF2001BELG_2003)
Cement industry	Member State reports emissions from 2A1	No specific explanation available	Table 2(l) (CRF2001BELG_2003)
Denmark			
Iron and steel industry	Member State reports that emissions from 1A2a and 2C1 are IE and 0 respectively	Danish energy statistics states energy consumption of manufacturing industry as a whole. Thus all energy consumption of 1A2 is included in 1A2f	Table 1, Table 2(l) and Table 9 (April 2003_DK2001_UN2)
Cement industry	Member State reports emissions from 2A1	Danish energy statistics states energy consumption of manufacturing industry as a whole. Thus all energy consumption of 1A2 is included in 1A2f	Table 2(l) and Table 9 (April 2003_DK2001_UN2)
Finland			

	Member State reporting	Member State explanation	Information source
Iron and steel industry	Member State reports emissions from 1A2a and that CO ₂ emissions from 2C1 are included elsewhere (IE)	CO ₂ emissions from C1, 'Iron and steel production', have been included in 1A2a, 'Iron and steel'. The calculation method gives more accurate total CO ₂ emissions (no double-counting, completeness) compared to more or less arbitrary allocation of coke and BF gases between energy use and process use	Table 1, Table 2(I) and Table 9 (Fi01un03)
Cement industry	Member State reports emissions from 2A1	No specific explanation available	Table 2(I) (Fi01un03)
France			
Iron and steel industry	Member State reports emissions from 1A2a and 2C1	No specific explanation available	Table 1 and Table 2(I) (CRF_France_01)
Cement industry	Member State reports emissions from 2A1	No specific explanation available	Table 2(I) (CRF_France_01)
Germany			
Iron and steel industry	Member State reports that emissions from 1A2a are included elsewhere (IE) and that emissions from 2C1 are not estimated (NE)	No specific explanation available	Table 1 and Table 2(I).A-G (Germany — 2002 — 2001)
Cement industry	Member State reports emissions from 2A1	No specific explanation available	Table 2(I) (Germany — 2002 — 2001)
Greece			
Iron and steel industry	Member State reports emissions from 1A2a and that emissions from 2C1 are 0	No specific explanation available	Table 1 and Table 2(I) (Greece — Submission 2003 — 2001)
Cement industry	Member State reports emissions from 2A1	No specific explanation available	Table 2(I) (Greece — Submission 2003 — 2001)
Ireland			
Iron and steel industry	Member State reports emissions from 1A2a and that emissions from 2C1 are not occurring (NO)	No specific explanation available	Table 1 and Table 2(I).A-G (CRF2001_2003_IE)
Cement industry	Member State reports emissions from 2A1	No specific explanation available	Table 2(I) (CRF2001_2003_IE)
Italy			
Iron and steel industry	Member State reports emissions from 1A2a and 2C1	CO ₂ emissions from pig iron, sinter and coke production are not relevant and considered in the combustion processes	Table 1 and Table 2(I).A-G (CRF-ITA2001)
Cement industry	Member State reports emissions from 2A1	No specific explanation available	Table 2(I) (CRF-ITA2001)
Luxembourg			
Iron and steel industry	Reporting not detailed enough	No specific explanation available	No sectoral (background) tables available
Cement industry	Reporting not detailed enough	No specific explanation available	No sectoral (background) tables available
Netherlands			
Iron and steel industry	Member State reports emissions from 1A2a and that emissions from 2C1 are IE	IE in C, 'Metal production', and in D, 'Other production', are allocated under 1A2, 'Manufacturing industries and construction'	Table 1 and Table 2(I) A-G (Netherlands — Submission 2003 v 2.0 — 2001)
Cement industry	Member State reports emissions from 2A1	No specific explanation available	Table 2(I) (Netherlands — Submission 2003 v 2.0 — 2001)
Portugal			
Iron and steel industry	Member State reports emissions from 1A2a and 2C1	No specific explanation available	Table 1 and Table 2(I) (Portugal-2003-2001_v3)
Cement industry	Member State reports emissions from 2A1	No specific explanation available	Table 2(I) (Portugal-2003-2001_v3)
Spain			

	Member State reporting	Member State explanation	Information source
Iron and steel industry	Member State reports emissions from 1A2a and 2C1	No specific explanation available	Table 1 and Table 2(I) (Year 2001 — common reporting format V1.01)
Cement industry	Member State reports emissions from 2A1	No specific explanation available	Table 2(I) (Year 2001 — common reporting format V1.01)
Sweden			
Iron and steel industry	Member State reports emissions from 1A2a and 2C1	No specific explanation available	Table 1 and Table 2(I) (SE-2003-2001)
Cement industry	Member State reports emissions from 2A1	No specific explanation available	Table 2(I) (SE-2003-2001)
United Kingdom			
Iron and steel industry	Member State reports emissions from 1A2a and 2C1	Emissions from blast furnace gas used for energy are reported in 1A2	Table 1 and Table 2(I) A-G (common_reporting_form at_v1.01_uk_2003_01)
Cement industry	Member State reports emissions from 2A1	More specific explanation available in National Environmental Technology Centre (2003)	Table 2(I) (common_reporting_form at_v1.01_uk_2003_01)

Recalculations of total greenhouse gas emissions and recalculations of greenhouse gas emissions in CRF Sector 2, 'Industrial processes', for 1990 and 2000 by gas (Gg and %)

Table 51

1990	CO ₂		CH ₄		N ₂ O		HFCs		PFCs		SF ₆	
	Gg	percent	Gg	percent	Gg	percent	Gg	percent	Gg	percent	Gg	percent
Total emissions and removals	- 5 604	- 0.18	- 12 361	- 2.90	7 999	2.00	1 242	5.08	- 143	- 1.05	- 129	- 1.52
Industrial Processes	- 4 953	- 3.24	- 3	- 0.50	950	0.90	1 242	5.08	- 143	- 1.05	- 129	- 1.52
2000												
Total emissions and removals	4 635	0.15	- 6 581	- 1.93	11 256	3.33	4 362	- 4.76	- 683	- 9.98	810	9.05
Industrial Processes	- 5 820	- 3.87	- 24	- 5.20	3 355	7.22	4 362	- 4.76	- 683	- 9.98	810	9.05

4.3. Sector-specific recalculations

Table 51 shows that in the industrial processes sector the largest recalculations in absolute terms were made for CO₂. In relative terms, the largest recalculations were made for N₂O emissions in 2000.

5. Solvent and other product use (CRF Sector 3)

This chapter provides two short sections on emission trends and on recalculations in CRF Sector 3, 'Solvent and other product use'. No section on methodological issues and uncertainty is included in this chapter because the sector does not contain an EC key source ⁽⁵⁾. Neither is a section on sector-specific QA/QC included as no such activities are performed in this sector.

5.1. Overview of sector

CRF Sector 3, 'Solvent and other product use', contributes less than 1 % of the total EC

GHG emissions. The most important GHG from 'Solvent and other product use' is CO₂ (0.13 % of the total GHG emissions). The emissions from this sector decreased by 8 % from 10 Tg in 1990 to 9 Tg in 2001 (Figure 5). In 2001, the emissions decreased by 3 % compared to 2000.

5.2. Sector-specific recalculations

Table 52 shows that in the solvent sector only minor recalculations were made (in particular in absolute terms).

Figure 5 EC GHG emissions for 1990–2001 from CRF Sector 3, 'Solvent and other product use' (Tg)

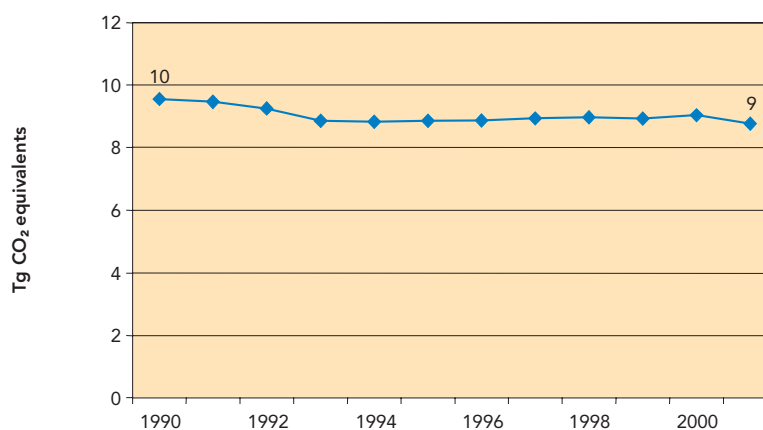


Table 52

Recalculations of total greenhouse gas emissions and recalculations of greenhouse gas emissions in CRF Sector 3, 'Solvent and other product use', for 1990 and 2000 by gas (Gg and %)

1990	CO ₂		CH ₄		N ₂ O		HFCs		PFCs		SF ₆	
	Gg	Percent	Gg	Percent	Gg	Percent	Gg	Percent	Gg	Percent	Gg	Percent
Total emissions and removals	-5 604	-0.18	-12 361	-2.90	7 999	2.00	1 242	5.08	-143	-1.05	-129	-1.52
Solvent and other product use	342	5.97	0	0.00	152	4.56	NO	NO	NO	NO	NO	NO
2000												
Total emissions and removals	4 635	0.15	-6 581	-1.93	11 256	3.33	4 362	-4.76	-683	-9.98	810	9.05
Solvent and other product use	212	3.96	0	0.00	31	0.90	NO	NO	NO	NO	NO	NO

(5) In this report, overview tables on methodologies and on uncertainties are only presented for the EC key sources as identified in Chapter 1.5. For information on sector-specific methods used by the Member States see the Member State submissions.

6. Agriculture (CRF Sector 4)

This chapter starts with an overview on emission trends in CRF Sector 4, 'Agriculture'. Then a section on methodological issues and uncertainty presents for each EC key source an overview table which includes the Member States' contributions to the key source in terms of level and trend, and information on methodologies, emission factors, completeness and qualitative uncertainty estimates. In addition, the chapter provides information on sector-specific QA/QC and on recalculations.

6.1. Overview of the sector

CRF Sector 4, 'Agriculture', contributes 10 % of the total EC GHG emissions, making it the second-largest sector after the 'Energy' sector. The most important GHGs from 'Agriculture' are N₂O (5 % of the total

emissions) and CH₄ (4 % of the total GHG emissions). Total emissions from this sector decreased by 8 % from 434 Tg in 1990 to 400 Tg in 2001 (Figure 6). In 2001, emissions decreased by 2 % compared to 2000.

6.2. Methodological issues and uncertainties

Tables 53 to 57 present for each EC key source in CRF Sector 3 an overview on the Member States' contributions to the key source in terms of level and trend, and information on methodologies, emission factors, completeness and qualitative uncertainty estimates. Therefore, the overview tables also aim at making transparent the compilation of CRF Summary Tables 3 and CRF Tables 7 of the EC submission.

EC GHG emissions for 1990–2001 from CRF Sector 4, 'Agriculture' (Tg)

Figure 6

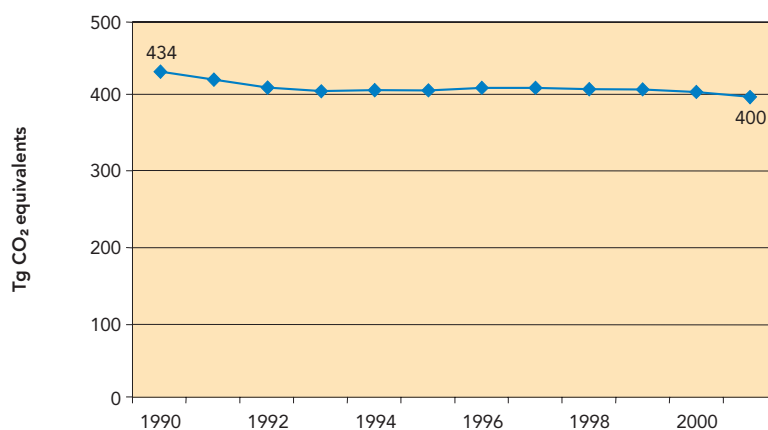


Table 53

Member States' contributions to CH₄ emissions from 4A, 'Enteric fermentation', and information on methods applied and quality of these emission estimates

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
France	30 854	29 324	22.28	8.87	C	CS	ALL	M
Germany	28 037	20 952	15.92	36.32	C/D	C/D	ALL	H
United Kingdom	19 122	17 074	12.97	3.07	T2	D/CS	ALL	M
Spain	12 651	14 607	11.10	23.76	CS, T1, T2	T1, T2	ALL	M
Italy	13 625	12 781	9.71	2.60	D, T1, T2	D, CS	ALL	H
Ireland	9 180	9 677	7.35	10.06	D	CS, D	FULL	M
Netherlands	8 439	6 766	5.14	7.35	cattle 90: T2; rest: T1	cattle: CS; rest: D	ALL	M
Belgium	4 617	4 205	3.19	0.10			F	
Austria	3 555	3 150	2.39	0.76	T1, T2	D, CS	ALL	M
Greece	2 976	3 000	2.28	2.20	T1	D	ALL	
Sweden	3 027	2 875	2.18	0.86	T1, CS	D, CS	ALL	H
Denmark	3 189	2 747	2.09	1.29	T1/T2	CS	ALL	H
Portugal	2 606	2 581	1.96	1.57	T1	D	ALL	M
Finland	1 868	1 565	1.19	1.11	T1, T2	CS/D	ALL	M
Luxembourg	346	328	0.25	0.09	C	C	ALL	M
EU15	144 091	131 631	100.00	100.00	C, CS, D, T1, T2	C, CS, D, T1, T2	ALL	H, M

(¹⁾ CRF Summary Tables 3 for 2001.

(²⁾ CRF Tables 7 for 2001.

Table 54

Member States' contributions to CH₄ emissions from 4B, 'Manure management', and information on methods applied and quality of these emission estimates

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
France	14 851	14 336	31.67	9.82	CS/T2	T2	ALL	M
Spain	6 221	8 570	18.93	42.00	CS, T1, T2	T1, T2	ALL	M
Germany	5 653	4 442	9.81	22.01	C/D	C/D	ALL	H
Italy	4 013	3 946	8.72	1.35	D, T1, T2	D, CS	ALL	H
Portugal	3 464	3 098	6.84	6.72	T2	D (CS)	ALL	M
Belgium	2 385	2 581	5.70	3.45			F	
United Kingdom	2 329	2 121	4.68	3.84	T2	D/CS	ALL	M
Netherlands	2 173	1 856	4.10	5.78	CS/T2	CS (=D,corrected)	ALL	L
Ireland	1 261	1 396	3.08	2.37	D	CS, D	FULL	M
Austria	867	910	2.01	0.73	T1, T2	D, CS	ALL	M
Denmark	900	884	1.95	0.31	T2	CS	ALL	M
Greece	497	490	1.08	0.14	T1	D	ALL	
Sweden	336	411	0.91	1.35	T1, T2	D, CS	ALL	H
Finland	199	204	0.45	0.09	T2	CS/D	ALL	M
Luxembourg	24	23	0.05	0.03	C	C	ALL	M
EU15	45 172	45 268	100.00	100.00	C,CS,D,T1,T2	C,CS,D,T1,T2	ALL	H, L, M

(¹⁾ CRF Summary Tables 3 for 2001.

(²⁾ CRF Tables 7 for 2001.

Member States' contributions to N₂O emissions from 4B, 'Manure management', and information on methods applied and quality of these emission estimates

Table 55

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
Germany	8 190	6 454	29.93	40.66	C/D	C/D	ALL	H
Italy	3 846	4 213	19.54	26.18	D	D, CS	ALL	H
France	3 074	2 937	13.62	4.43	T2	T2	ALL	M
Spain	1 632	1 614	7.49	4.47	CS, D	D	ALL	M
United Kingdom	1 514	1 379	6.39	0.40	T1	D/CS	ALL	M
Portugal	1 127	1 212	5.62	6.80	T2	D (CS)	ALL	M
Austria	748	709	3.29	0.86			NE	NE
Ireland	627	684	3.17	4.15	D	CS, D	FULL	M
Sweden	741	554	2.57	4.81	T1, T2	D, CS	ALL	M
Belgium	474	484	2.24	1.85			F	
Denmark	462	442	2.05	0.67			ALL	M
Finland	554	400	1.86	4.13	D	D/CS	ALL	L
Greece	301	291	1.35	0.55	T1	D	ALL	
Netherlands	205	189	0.88	0.05	CS	CS	ALL	L
Luxembourg	0	0	0.00	0.00			ALL	M
EU15	23 495	21 562	100.00	100.00	C,CS,D,T1,T2	C, CS, D, T2	ALL, NE	H, L, M

(1) CRF Summary Tables 3 for 2001.

(2) CRF Tables 7 for 2001.

Member States' contributions to CO₂ emissions from 4D, 'Agricultural soils', and information on methods applied and quality of these emission estimates

Table 56

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
Finland	3 208	1 946	100.00	0.00	D	D/CS	ALL	L
France	0	0	0.00	0.00			NO	
Germany	NE	NE	0.00	0.00	NE	NE	NE	
United Kingdom	IE	IE	0.00	0.00	IE	IE		
Italy	-	0	0.00	0.00			NO	
Spain	0	0	0.00	0.00	NO		NO	
Denmark	0	0	0.00	0.00	NE		NE	
Netherlands	NE	NE	0.00	0.00	NE		NE	
Ireland	IE	IE	0.00	0.00	NA	NA	IE	NA
Greece	-	0	0.00	0.00				
Belgium	0	0	0.00	0.00			P	
Portugal	NE	NE	0.00	0.00				
Sweden	IE	IE	0.00	0.00			IE	
Austria	0	0	0.00	0.00			NE	NE
Luxembourg	0	0	0.00	0.00	C	C	ALL	M
EU15	3 208	1 946	100.00	100.00	C, D	C, D, CS	ALL, IE, NE, PART	L, M

(1) CRF Summary Tables 3 for 2001.

(2) CRF Tables 7 for 2001.

Table 57

Member States' contributions to N₂O emissions from 4D, 'Agricultural soils', and information on methods applied and quality of these emission estimates

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
France	55 802	51 611	26.22	2.74	T2	T2	ALL	L
Germany	39 800	33 386	16.96	21.16	CS	CS	ALL	H
United Kingdom	30 353	25 807	13.11	13.80	T1a/T1b	D	ALL	L
Italy	19 736	20 026	10.17	12.93	D	D, CS	ALL	H
Spain	16 277	17 532	8.91	17.52	CS, D	CS, D	ALL	L
Denmark	9 797	7 477	3.80	10.21	CS/M	CS/M	ALL	M
Ireland	6 870	7 414	3.77	7.49	D	CS, D	FULL	M
Netherlands	6 674	6 978	3.55	5.76	CS/T1b (D&I)	CS	ALL	L
Greece	6 501	6 031	3.06	0.44	T1	D	ALL	
Sweden	5 428	5 027	2.55	0.31	D, C	CS	ALL	M
Belgium	5 074	4 730	2.40	0.50			F	
Portugal	4 791	4 634	2.35	1.60	D	D	ALL	M
Finland	4 269	3 336	1.69	3.93	D	D/CS	ALL	L
Austria	2 970	2 831	1.44	0.71	T1	D	ALL	M
Luxembourg	146	0	0.00	0.90	C	C	ALL	M
EU15	214 489	196 818	100.00	100.00	C, CS, D, M, T1a, T1b, T2	C, CS, D, M, T2	ALL	H, L, M

(¹⁾ CRF Summary Tables 3 for 2001.

(²⁾ CRF Tables 7 for 2001.

6.3. Sector-specific quality assurance and quality control

The main sector-specific QA/QC activity is the project lead by the JRC on comparison of methods used by Member States for emission calculations and emission projections in the agricultural sector. As a first activity under this project, a workshop on 'Inventories and projections of greenhouse gas emissions from agriculture' was held at the European Environment Agency in February 2003.

The workshop focused on the emissions of methane (CH₄) and nitrous oxide (N₂O) induced by activities in the agricultural sector, not considering changes of carbon stocks in agricultural soils, but including emissions of ammonia (NH₃). The consideration of ammonia emissions allows the validation of the N₂O emission sources and it further strengthens the link between greenhouse gas and air pollutant emission inventories reported under the UNFCCC, the EC GHG monitoring mechanism, the UNECE Long-Range Transboundary Air

Pollution Convention, and the EU national emission ceiling directive.

Objectives of the workshop were to compare the Member States' methodologies and to identify and explain the main differences. The longer term objective is to further improve the methods used for inventories and projections in the different Member States and to identify how national and common agricultural policies could be integrated in EU-wide emission scenarios. The workshop will be followed by a project led by the JRC to improve the quality of national Member State GHG emissions from agriculture and a project by the EEA ETC/ACC to improve reporting of GHG emission projections.

6.4. Sector-specific recalculations

Table 58 shows that in the agriculture sector the largest recalculations in absolute and relative terms were made for CH₄. Also N₂O emissions were recalculated by more than 2 % in both years 1990 and 2000.

Recalculations of total greenhouse gas emissions and recalculations of greenhouse gas emissions in CRF Sector 4, 'Agriculture', for 1990 and 2000 by gas (Gg and %)

Table 58

1990	CO ₂		CH ₄		N ₂ O		HFCs		PFCs		SF ₆	
	Gg	Percent	Gg	Percent	Gg	Percent	Gg	Percent	Gg	Percent	Gg	Percent
Total emissions and removals	- 5 604	- 0.18	- 12 361	- 2.90	7 999	2.00	1 242	5.08	- 143	- 1.05	- 129	- 1.52
Agriculture	- 7	- 0.21	10 948	6.04	6 483	2.80	NO	NO	NO	NO	NO	NO
2000												
Total emissions and removals	4 635	0.15	- 6 581	- 1.93	11 256	3.33	4 362	- 4.76	- 683	- 9.98	810	9.05
Agriculture	- 22	- 1.09	11 658	6.93	5 645	2.58	NO	NO	NO	NO	NO	NO

7. Land-use change and forestry (CRF Sector 5)

This chapter starts with an overview on emission removal trends in CRF Sector 5, 'Land-use change and forestry'. No section on methodological issues and uncertainty is included in this chapter because the sector does not contain an EC key source ⁽⁶⁾. In addition, information on sector-specific QA/QC and on recalculations is provided.

7.1. Overview of sector

CRF Sector 5, 'LUCF', is both a source and a sink of GHG emissions. In 2001, net GHG emissions from LUCF (emissions minus removals) were – 196 Tg in the EC (Figure 7), which was – 5 % of total EC GHG emissions. They decreased by 6 % from 1990 to 2001 and by 13.5 % from 2000 to 2001. Net GHG emissions from LUCF have been below 1990 levels for the past decade except in 1995, 1998 and 2000.

7.2. Sector-specific quality assurance and quality control

Emissions and removals from LUCF of the EC are the sum of the Member States' emissions and removals. In accordance with IPCC guidelines, Member States use different methodologies, including data collection

methods and frequencies, definitions and conversion factors in the estimation of LUCF data.

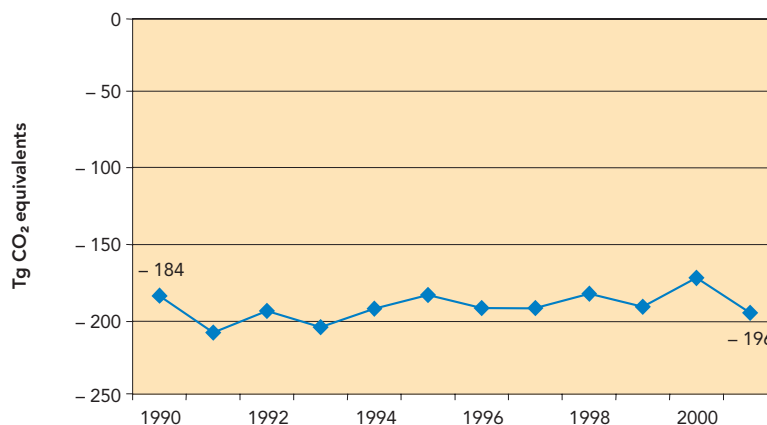
The EU initiated an action under the intergovernmental framework for European cooperation in the field of scientific and technical research (COST E21) entitled 'Contribution of forests and forestry to mitigate greenhouse effects' with the objective of exchanging experience and knowledge to improve the quality of GHG inventory compilation for forests in Europe.

In addition, the JRC is working with the Member States on a separate complementary project to facilitate the comparability of LUCF estimates. In 2002, the following activities to compare and improve methodologies on the calculations of emissions and removals from LUCF within EU Member States have started.

As a first step, in February 2002 a workshop was organised by the JRC on the LUCF reporting, particularly dedicated to carbon emissions and removals in forests. During this workshop, for the LUCF category 5A the following parameters were recognised to be relevant factors contributing to differences in

Figure 7

EC net GHG emissions (emissions minus removals) for 1990–2001 from CRF Sector 5, 'LUCF' (Tg)



(6) In this report, overview tables on methodologies and on uncertainties are only presented for the EC key sources as identified in Chapter 1.5. In accordance with the IPCC (2000), the LUCF sector is not included in the key source analysis. For information on sector-specific methods used by the Member States see Member State submissions in Annex 5.

reporting between Member States and to the overall uncertainties of the GHG inventories of the sector:

- definition of forest and forest area in the Member States' national forest inventories (NFI) and components included in the reporting;
- expansion factors from wood volume to (total) carbon mass;
- inclusion of belowground biomass/growth;
- data sources for wood harvest and estimation of soil carbon.

One of the outcomes of the workshop was the set-up of a pilot project with a limited number of Member States to identify differences in reporting of land-use, land-use change and forestry to the UNFCCC, and to propose and test possibilities to improve the comparability and quality of inventory data. The main focus of this pilot project is steered upon carbon reporting in IPCC category 5A (changes in forest and other woody biomass stocks), but other categories of the LUCF sector will also be considered (particularly forest soils). The following Member States volunteered for participation in the project: Austria, Denmark, Finland, Italy, Sweden and United Kingdom, while Spain and Ireland participated as 'observers'.

In December 2002, a workshop was held under this pilot project. The main outcomes as regards main differences identified and possible improvements are as follows.

Identification of differences:

- forest definitions;
- biomass expansion factors (BEFs) (different components are included under

'stem volume', the BEF is different for stocks and growth);

- the local use and export/import of wood and the effective reliability of harvest/market statistics.

Possible improvements:

- homogenous forest definitions, compatible with FAO and maintaining consistencies with past national inventories, were discussed;
- Member State reports should include more detailed information on what is included in the BEFs;
- a reliability check of BEFs should be performed. In this respect, a common effort was envisaged. The situation will improve in the future when results from research and inventory efforts will become available (e.g. Finnish work on BEF, 2002–04);
- the database of wood densities for European tree species should be updated, with country-specific recent data (wood industry can be a data source);
- efforts should be concentrated on whole mineral soil and peat carbon stocks including the forest floor, as well as on land areas/land-use types/land management measures where more rapid and reliably detectable changes can be expected.

7.3. Sector-specific recalculations

Table 59 shows that in the LUCF sector the large recalculations in absolute terms were made for CO₂ in 1990.

Recalculations of total greenhouse gas emissions and recalculations of net greenhouse gas emissions in CRF Sector 5, 'LUCF', for 1990 and 2000 by gas (Gg and %)

Table 59

1990	CO ₂		CH ₄		N ₂ O		HFCs		PFCs		SF ₆	
	Gg	Percent	Gg	Percent	Gg	Percent	Gg	Percent	Gg	Percent	Gg	Percent
Total emissions and removals	-5 604	-0.18	-12 361	-2.90	7 999	2.00	1 242	5.08	-143	-1.05	-129	-1.52
LUCF (net)	7 060	-3.55	-41	-1.82	-120	-2.08	NO	NO	NO	NO	NO	NO
2000												
Total emissions and removals	4 635	0.15	-6 581	-1.93	11 256	3.33	4 362	-4.76	-683	-9.98	810	9.05
LUCF (net)	121	-0.07	-81	-3.18	-235	-3.97	NO	NO	NO	NO	NO	NO

8. Waste (CRF Sector 6)

This chapter starts with an overview on emission trends in CRF Sector 6, 'Waste'. Then a section on methodological issues and uncertainty presents for each EC key source an overview table which includes the Member States' contributions to the key source in terms of level and trend, and information on methodologies, emission factors, completeness and qualitative uncertainty estimates. In addition, the chapter includes information on recalculations. A section on sector-specific QA/QC is not included as such activities have not yet started in this sector.

8.1. Overview of sector

CRF Sector 6, 'Waste', is the fourth-largest sector in the EC, contributing with CH₄ some 2 % of the total GHG emissions in the EC.

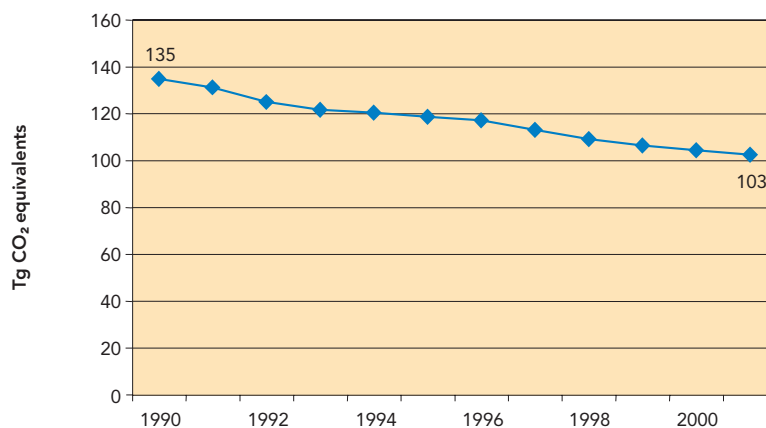
Both CO₂ and N₂O contribute less than 1 % to the total GHG emissions. Total emissions from 'Waste' have been decreasing by 24 % from 135 Tg in 1990 to 103 Tg in 2001 (Figure 8). In 2001, emissions decreased by 1.8 % compared to 2000.

8.2. Methodological issues and uncertainties

Tables 60 to 62 present for each EC key source in CRF Sector 6 an overview on Member States' contributions to the key source in terms of level and trend, and information on methodologies, emission factors, completeness and qualitative uncertainty estimates. Therefore, the overview tables also aim at making transparent the compilation of CRF Summary Tables 3 and CRF Tables 7 of the EC submission.

Figure 8

EC GHG emissions for 1990–2001 from CRF Sector 6, 'Waste' (Tg)



Member States' contributions to CH₄ emissions from 6A, 'Solid waste disposal on land', and information on methods applied and quality of these emission estimates

Table 60

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
Spain	5 391	10 485	13.06	18.49	T2	CS, T2	ALL	M
Germany	28 285	10 252	12.77	28.67	T1	CS	T1	M
United Kingdom	23 760	10 231	12.74	19.54	M	CS	ALL	L
France	10 461	10 067	12.54	7.01	CS/T2	CS/T2	ALL	M
Italy	9 526	9 556	11.90	7.48	D, T2	D, CS	ALL	M
Netherlands	11 802	8 181	10.19	1.01	M, CS, T2	CS	ALL	M
Greece	2 811	5 039	6.28	8.44	T1	D	ALL	
Austria	4 929	3 842	4.79	0.78	CS	CS	ALL	L
Portugal	2 422	3 511	4.37	4.94	T2	T2+CS	ALL	M
Finland	3 679	2 901	3.61	0.67	T2	D/CS	ALL	M
Sweden	2 554	1 972	2.46	0.35	T2	D, CS	ALL	M
Belgium	2 829	1 767	2.20	0.79			P	
Ireland	1 158	1 276	1.59	1.23	T2	CS, D	FULL	M
Denmark	1 310	1 168	1.45	0.62	CS/M	CS/M	ALL	M
Luxembourg	64	48	0.06	0.00	C	C	ALL	M
EU15	110 982	80 295	100.00	100.00	C, CS, D, M, T1, T2	C, CS, D, M, T2	ALL, PART	L, M

(1) CRF Summary Tables 3 for 2001.

(2) CRF Tables 7 for 2001.

Member States' contributions to N₂O emissions from 6B, 'Waste-water handling', and information on methods applied and quality of these emission estimates

Table 61

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
United Kingdom	1 033	1 110	19.89	10.58	T1	D	PART	L
France	1 130	1 094	19.60	5.84	CS/T2	CS/T2	ALL	L
Spain	1 002	1 085	19.45	10.67			ALL	L
Italy	968	986	17.67	7.35	D	C, CS	ALL	M
Portugal	448	565	10.13	8.59	D	D	ALL	L
Netherlands	126	194	3.47	4.09	CS/T2	CS	ALL	L
Sweden	195	146	2.62	1.04			NE	
Finland	141	110	1.97	0.54	CS	CS	ALL	L
Belgium	71	102	1.83	1.96			P	
Germany	1 290	93	1.67	48.42	CS	CS	CS	L
Ireland	60	66	1.18	0.67	NA	NA	PART	M
Austria	22	24	0.43	0.24	T1	D, CS	ALL	L
Luxembourg	6	6	0.10	0.01	C	C	ALL	M
Denmark	0	0	0.00	0.00	NE		NE	
Greece	0	0	0.00	0.00			NE	
EU15	6 492	5 579	100.00	100.00	C,CS,D,T1,T2	C, CS, D, T2	ALL, NE, PART	L, M

(1) CRF Summary Tables 3 for 2001.

(2) CRF Tables 7 for 2001.

Table 62

Member States' contributions to CO₂ emissions from 6D, 'Other', and information on methods applied and quality of these emission estimates

Member State	GHG emissions in 1990 (Gg CO ₂ equivalents)	GHG emissions in 2001 (Gg CO ₂ equivalents)	Contribution to level %	Contribution to trend %	Methods applied ¹⁾	EF ¹⁾	Estimate ²⁾	Quality ²⁾
Netherlands	881	350	83.26	50.00	CS	CS	ALL	M
Belgium	0	70	16.74	50.00			P	
Germany	NO	NO	0.00	0.00	NO	NO	NO	
France	0	0	0.00	0.00			ALL	L
United Kingdom	0	0	0.00	0.00			NO	
Spain	0	0	0.00	0.00	NO		NO	
Italy	-	0	0.00	0.00			NO	
Austria	0	0	0.00	0.00			NE	NE
Denmark	0	0	0.00	0.00				
Greece	0	0	0.00	0.00			NO	
Finland	0	0	0.00	0.00			NO	NO
Sweden	NE	NE	0.00	0.00				
Portugal	0	0	0.00	0.00	T2	T2+CS	ALL	M
Ireland	NO	0	0.00	0.00	NA	NA	NE	NE
Luxembourg	0	0	0.00	0.00	C	C	ALL	M
EU15	881	420	100.00	100.00	C, CS, T2	C, CS, T2	ALL, NE, PART	L, M

(¹⁾ CRF Summary Tables 3 for 2001.

(²⁾ CRF Tables 7 for 2001.

Table 63

Recalculations of total greenhouse gas emissions and recalculations of greenhouse gas emissions in CRF Sector 6, 'Waste', for 1990 and 2000 by gas (Gg and %)

1990	CO ₂		CH ₄		N ₂ O		HFCs		PFCs		SF ₆	
	Gg	Percent	Gg	Percent	Gg	Percent	Gg	Percent	Gg	Percent	Gg	Percent
Total emissions and removals	- 5 604	- 0.18	- 12 361	- 2.90	7 999	2.00	1 242	5.08	- 143	- 1.05	- 129	- 1.52
Waste	1 496	23.71	- 22 104	- 15.54	658	10.35	NO	NO	NO	NO	NO	NO
2000												
Total emissions and removals	4 635	0.15	- 6 581	- 1.93	11 256	3.33	4 362	- 4.76	- 683	- 9.98	810	9.05
Waste	216	3.36	- 16 802	- 15.50	- 724	- 10.52	NO	NO	NO	NO	NO	NO

8.3. Sector-specific recalculations

Table 63 shows that in the waste sector large recalculations were made for CH₄ in absolute and relative terms. For both 1990 and 2000,

CH₄ emissions from waste as provided in this submission are more than 15 % lower than the values provided in the previous submission.

9. Other (CRF Sector 7)

This chapter provides two short sections on emission trends and on recalculations in CRF Sector 7, 'Other'. No section on methodological issues and uncertainty is included in this chapter because the sector does not contain an EC key source ⁽⁷⁾. Neither is a section on sector-specific QA/QC included as no such activities are performed in this sector.

9.1. Overview of sector

CRF Sector 7, 'Other', is the smallest sector contributing 0.05 % to overall EC GHG

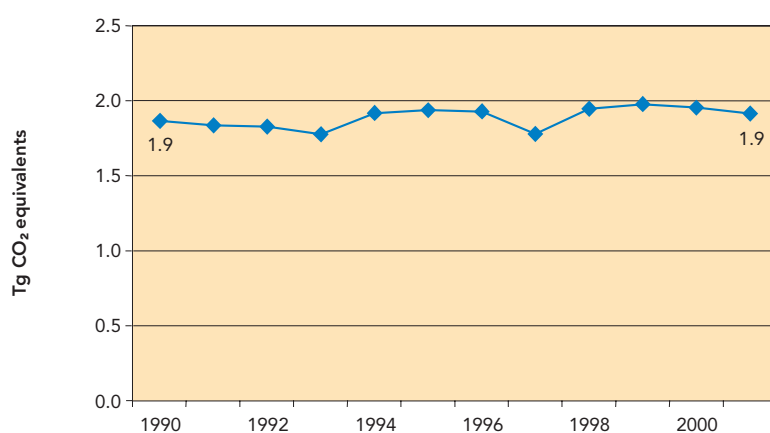
emissions. The most important gases from the CRF Sector 7, 'Other', are N₂O (0.03 % of the total GHG emissions) and CO₂ (0.02 % of the total GHG emissions). Total emissions from 'Other' have slightly increased since 1990 (Figure 9).

9.2. Sector-specific recalculations

Table 64 shows that in CRF Sector 7, 'Other', only minor recalculations were made for 1990 and 2000.

EC GHG emissions for 1990–2001 from CRF Sector 7, 'Other' (Tg)

Figure 9



Recalculations of total greenhouse gas emissions and recalculations of greenhouse gas emissions in CRF Sector 7, 'Other', for 1990 and 2000 by gas (Gg and %)

Table 64

1990	CO ₂		CH ₄		N ₂ O		HFCs		PFCs		SF ₆	
	Gg	Percent	Gg	Percent	Gg	Percent	Gg	Percent	Gg	Percent	Gg	Percent
Total emissions and removals	-5 604	-0.18	-12 361	-2.90	7 999	2.00	1 242	5.08	-143	-1.05	-129	-1.52
Other	0	0.03	0	-0.62	0	0.00	NO	NO	NO	NO	NO	NO
2000												
Total emissions and removals	4 635	0.15	-6 581	-1.93	11 256	3.33	4 362	-4.76	-683	-9.98	810	9.05
Other	0	0.06	0	0.72	0	0.00	NO	NO	NO	NO	NO	NO

(7) In this report, overview tables on methodologies and on uncertainties are only presented for the EC key sources as identified in Chapter 1.5. For information on sector-specific methods used by the Member States see Member State submissions.

10. Recalculations and improvements

10.1. Explanations and justifications for recalculations

Table 65 provides an overview of the main reasons for recalculating emissions in 1990 for each Member State which provided the relevant information. For each Member State

those three sources have been identified which had the largest recalculations in absolute terms. In addition, all recalculations of more than 1 000 Gg are presented. For more detailed explanatory information on recalculations see the information provided in the Member State submissions in Annex 5.

Table 65 Main recalculations in the Member States for 1990 and Member States' explanations for recalculations given in the CRF or the inventory report

	Absolute difference between latest and previous submission used for the EC inventory (Gg CO ₂ equivalents)	Member States' explanation for recalculation	Information source of reasons for recalculations
Austria			
Total emissions excluding LUCF	685		
N ₂ O from 4D agricultural soils	1 946	New study: for the first time direct emissions and indirect emissions as well as emissions from nitrogen input through grazing animal excreta have been estimated	Federal Environment Agency — Austria (2002)
CO ₂ from 1A2 manufacturing industries	– 1 523	Revision of the energy balance. The new energy balance also allowed to remove some double counting	Federal Environment Agency — Austria (2002)
CO ₂ from 1A1 energy industries	– 1 171	Revision of the energy balance. The new energy balance also allowed to remove some double counting	Federal Environment Agency — Austria (2002)
Belgium			
Total emissions excluding LUCF	– 1 909		
N ₂ O from 4B manure management	– 1 426	No information available	No information available
CO ₂ from 1A4 other sectors	– 375	No information available	No information available
CH ₄ from 6A solid waste disposal on land	– 359	No information available	No information available
Denmark			
Total emissions excluding LUCF	– 215		
CH ₄ from 1B2 oil and natural gas	– 172	Emission factors and activity data changed according to new knowledge	CRF Table 8(b) (April2003_DK1990_U N4)
CH ₄ from 1A4 other sectors	– 46	Emission factors of some fuels have been changed. Consistency of factors has been improved	CRF Table 8(b) (April2003_DK1990_U N4)
CH ₄ from 4A enteric fermentation	37	Changes in activity data: horses on small farms and on riding schools have been included	CRF Table 8(b) (April2003_DK1990_U N4)
Finland			
Total emissions excluding LUCF	140		
CH ₄ from 6B waste-water handling	117	Changes in activity data: population is used also; uncollected waste water included	CRF Table 8(b) (Fi90UN03)
N ₂ O from 4D agricultural soils	– 104	Changes in activity data: N fraction in crop residue corrected	CRF Table 8(b) (Fi90UN03)
CH ₄ from 4A enteric fermentation	44	Changes in activity data: reindeer added	CRF Table 8(b) (Fi90UN03)

	Absolute difference between latest and previous submission used for the EC inventory (Gg CO ₂ equivalents)	Member States' explanation for recalculation	Information source of reasons for recalculations
France			
Total emissions excluding LUCF	8 970		
CH ₄ from 4B manure management	11 333	IPCC emission factors are used instead of country-specific emission factors; livestock updated since 1990 after Agreste revision; addition of piglet stocks (20 to 50 kg)	CRF Table 8(b) (CRF_France_01)
CH ₄ from 6A solid waste disposal on land	- 7 358	Calculation parameters updated since 1990	CRF Table 8(b) (CRF_France_01)
N ₂ O from 4D agricultural soils	3 827	Livestock updated since 1990 after Agreste revision; addition of N ₂ O emissions resulting from NO _x and NH ₃ deposition since 1990; sewage sludge as fertiliser has been added since 1990	CRF Table 8(b) (CRF_France_01)
CO ₂ from 1A2 manufacturing industries	- 2 304	New methodology applied to calculate CO ₂ emissions since 1990 for primary lead production and primary zinc production; review of consumption since 1990 after modification of French statistics for industry combustion plants and other mobile sources and machinery in industry; consumption updated since 1990 for some activities; for cement works, waste substitution is now included in energy consumption	CRF Table 8(b) (CRF_France_01)
CO ₂ from 1A1 energy industries	2 144	Waste incineration plant with energy recovery transferred from category 6C to 1A1a for CRF	CRF Table 8(b) (CRF_France_01)
CO ₂ from 2A mineral products	1 333	Review of CO ₂ emission factors since 1990 because of a mistake	CRF Table 8(b) (CRF_France_01)
Germany			
Total emissions excluding LUCF	- 11 186		
CH ₄ from 6A solid waste disposal on land	- 10 393	No information available	No information available
N ₂ O from 4B manure management	- 9 581	No information available	No information available
N ₂ O from 4D agricultural soils	8 874	No information available	No information available
CH ₄ from 1B1 solid fuels	- 1 822	No information available	No information available
Greece			
Total emissions excluding LUCF	0	No information available	No information available
Ireland			
Total emissions excluding LUCF	- 10		
CH ₄ from 6A solid waste disposal on land	- 622	Improved historical time-series of the amount of solid waste disposed in landfills and for the corresponding DOC in solid wastes based on further development of the national waste database and other sources. The fraction of DOC dissimilated has been revised from 0.7 to 0.6, in line with GPG	CRF Table 8(b) (CRF1990_2003_IE)
N ₂ O from 4D agricultural soils	425	(1) Revision of input N excretion due to recalculated livestock populations. (2) Fertiliser N data revised to three-year average for period ending in the inventory year. (3) Minor modifications to fractions FracGASF and FracGASM for the same reasons as they are taken from NH ₃ inventory. (4) Value of 0.1 adopted for FracLEACH. (5) Emission estimates of N ₂ O have been included for N-fixing crops and crop residues	CRF Table 8(b) (CRF1990_2003_IE)
CH ₄ from 4A enteric fermentation	- 325	Changes in activity data: all important livestock populations have been recalculated on the basis of three-year average ending in the inventory year and taking into account some minor revisions to published agricultural statistics	CRF Table 8(b) (CRF1990_2003_IE)

	Absolute difference between latest and previous submission used for the EC inventory (Gg CO ₂ equivalents)	Member States' explanation for recalculation	Information source of reasons for recalculations
Italy			
Total emissions excluding LUCF	– 13 504		
CO ₂ from 2A mineral products	– 5 970	No information available	No information available
CO ₂ from 1A1 energy industries	– 3 970	No information available	No information available
CO ₂ from 1A2 manufacturing industries	– 2 875	No information available	No information available
Luxembourg			
Total emissions excluding LUCF	47		
HFC and SF ₆ emissions	47	Gap filling	See Chapter 1.8.2
Netherlands			
Total emissions excluding LUCF	– 337		
CO ₂ from 1A4 other sectors	– 458	Change in source allocation (see 6.D. and 1.A.1)	CRF Table 8(b) (Netherlands — Submission 2003 v 2.0 — 1990)
CO ₂ from 6D other	381	Errors from previous submission eliminated. Emissions from combustion of fossil fuels in waste sector were identified and placed in 1.A.1 and 1.A.4. Some emissions were previous year placed in the wrong sector. Identification of biomass as fuel was improved leading to less CO ₂ emissions.	CRF Table 8(b) (Netherlands — Submission 2003 v 2.0 — 1990)
CO ₂ from 1A1 energy industries	– 208	Change in source allocation (see 6.D. and 1.A.4)	CRF Table 8(b) (Netherlands — Submission 2003 v 2.0 — 1990)
Portugal			
Total emissions excluding LUCF	– 3 665		
CH ₄ from 6A solid waste disposal on land	– 3 128	Change in method (industrial waste): change from default method Tier 1 to FOD method Tier 2. Change in activity data (time-series revised): population, waste collection rates. New time-series estimated for municipal and industrial waste disposed on land, based on per capita MSW generation rates	CRF Table 8(b) (Portugal-2003-1990_v3)
CO ₂ from 1A2 manufacturing industries	– 631	CO ₂ emissions factors revised. Change in activity data: energy data statistics revised by the Portuguese Energy Authority	CRF Table 8(b) (Portugal-2003-1990_v3)
CO ₂ from 1A4 other sectors	576	CO ₂ emissions factors revised. Change in activity data: energy data statistics revised by the Portuguese Energy Authority	CRF Table 8(b) (Portugal-2003-1990_v3)
Spain			
Total emissions excluding LUCF	1 181		
CH ₄ from 4B manure management	393	Emission factor sheep, goats and pigs age categories: The ages of certain categories of animals (sheep, goats, pigs) have been changed and this has led to a change in the factor for the excretion of N for some categories in these species. Activity data extensive–intensive pig husbandry: It has been separated into two different censuses for pig herds: one for extensive grazing and another for intensive grazing. This implies a variation in the percentage per province and type of animals in meadow grazing (extensive), thus leading to a variation in the emissions from dung treatments (both CH ₄ and N ₂ O). Activity data sheep and goat age categories: Some of the age categories of sheep and goat herds in the census have been revised. This has resulted in a larger number of restocking lambs and fewer lambs slaughtered. Activity data poultry heads: The algorithm for the calculation of the number of heads of poultry has been revised in accordance with the proposal from the MAPA, thus leading to an increase in their number	CRF Table 8(b) (Year 1990 — common reporting format V1.01)

	Absolute difference between latest and previous submission used for the EC inventory (Gg CO ₂ equivalents)	Member States' explanation for recalculation	Information source of reasons for recalculations
CO ₂ from 1A1 energy industries	313	Emission factor petroleum refining: In the course of the 2002 data verification process the LHV values for refinery gas from one refinery plant have been revised upwards (by around 15 %) as they appeared with abnormally low values for the period 1990–93. Additional reporting in petroleum refining: The new inventory edition has incorporated the installations for the petrochemical part of one petroleum refinery that was not included in the previous submission	CRF Table 8(b) (Year 1990 — common reporting format V1.01)
N ₂ O from 4D agricultural soils	254	Emission factor: The Fracgasm parameter (fraction of N emitted as NO _x or NH ₃) was amended and it has been decided to calculate it on the basis of the emission factors of NH ₃ and NO _x instead of taking a default value. Activity data crop surface and production: At the date of the close of the previous year, only the Ministry of Agriculture (MAPA) yearbooks up to 1996 were available. A new yearbook has since appeared for 1998 (the one for 1997 has not yet been published) and so the data have been reviewed in the light of this new publication. For subsequent years, the data provided by the MAPA advanced statistical database. Activity data organic crop fertilisation: In view of the difficulties of obtaining a consistent series of historic data for organic crop fertilisation with the data from the successive MAPA good farming practices documents, it has been decided to take the 1997 good farming practices for the set of years 1990–2001 included in this inventory.	CRF Table 8(b) (Year 1990 — common reporting format V1.01)
Sweden			
Total emissions excluding LUCF	2 190		
N ₂ O from 4D agricultural soils	1 637	Emission factors for a few sources updated. Minor corrections in some of the activity data	CRF Table 8(b) (SE-2003-1990)
CO ₂ from 1A5 other	826	Emissions from military use has been separated from transport sector	CRF Table 8(b) (SE-2003-1990)
CO ₂ from 1A3 transport	– 400	New method and new emission factors	CRF Table 8(b) (SE-2003-1990)
United Kingdom			
Total emissions excluding LUCF	1 647		
CO ₂ from 6C waste incineration	1 140	Changes in emission factors and activity data: Environment Agency data. New source: waste incineration of chemicals	CRF Table 8(b) (common_reporting_format_v1.01_uk_2003_90)
CO ₂ from 1A3 transport	172	Revisions to vehicle fuel consumption	CRF Table 8(b) (common_reporting_format_v1.01_uk_2003_90)
CH ₄ from 6A solid waste disposal on land	303	Changes in emission factors: model used to estimate CH ₄ emissions updated. Changes in activity data: estimates of solid waste disposed to land updated	CRF Table 8(b) (common_reporting_format_v1.01_uk_2003_90)

Table 66

**Overview of recalculations of EC total GHG emissions
(difference between latest submission and previous submission in Gg CO₂ equivalents and %)**

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total CO ₂ equivalent emissions including LUCF (absolute)	- 8 996	- 11 161	- 6 595	4 828	1 795	1 438	8 251	7 714	12 853	11 719	7 186
Total CO ₂ equivalent emissions including LUCF (percent)	- 0.22	- 0.28	- 0.17	0.13	0.05	0.04	0.21	0.20	0.33	0.30	0.18
Total CO ₂ equivalent emissions excluding LUCF (absolute)	- 15 895	- 17 918	- 13 048	- 1 582	- 4 684	- 4 942	1 849	1 174	6 298	5 334	7 381
Total CO ₂ equivalent emissions excluding LUCF (percent)	- 0.38	- 0.42	- 0.32	- 0.04	- 0.12	- 0.12	0.04	0.03	0.15	0.13	0.18

Table 67

**Recalculations for the EC key source categories for 1990 and 2000
(difference between latest submission and previous submission in Gg of CO₂ equivalents and %)**

Greenhouse gas source categories	Gas	Recalculations 1990		Recalculations 2000	
		(Gg CO ₂ equivalents)	(%)	(Gg CO ₂ equivalents)	(%)
1.A.1. Energy industries	CO ₂	- 2 579	- 0.22	10 514	0.96
1.A.2. Manufacturing industries	CO ₂	- 7 384	- 1.14	- 3 765	- 0.63
1.A.3. Transport	CO ₂	236	0.03	652	0.08
1.A.3. Transport	N ₂ O	- 21	- 0.18	1 152	4.86
1.A.4. Other sectors	CO ₂	- 847	- 0.13	1 760	0.28
1.A.4. Other sectors	CH ₄	- 55	- 0.52	3	0.04
1.A.5. Other	CO ₂	645	3.32	535	7.54
1.B.1. Solid fuels	CO ₂	0	0.00	- 334	- 4.13
1.B.1. Solid fuels	CH ₄	- 1 800	- 3.58	- 1 606	- 7.80
1.B.2. Oil and natural gas	CO ₂	387	2.29	567	3.70
1.B.2. Oil and natural gas	CH ₄	540	1.66	174	0.62
2.A. Mineral products	CO ₂	- 5 003	- 4.47	- 3 533	- 3.18
2.B. Chemical industry	CO ₂	156	1.22	- 355	- 3.19
2.B. Chemical industry	N ₂ O	970	0.92	3 355	7.23
2.C. Metal production	CO ₂	39	0.15	- 48	- 0.20
2.C. Metal production	PFC	- 157	- 1.33	- 973	- 21.08
2.E. Production of halocarbons and SF ₆	HFC	3 510	16.42	641	3.65
2.F. Consumption of halocarbons and SF ₆	HFC	28	7.87	- 4 921	- 16.56
2.F. Consumption of halocarbons and SF ₆	SF ₆	- 131	- 2.17	- 45	- 0.65
2.G. Other	CO ₂	- 140	- 11.20	- 1 882	- 60.03
4.A. Enteric fermentation	CH ₄	100	0.07	879	0.67
4.B. Manure management	CH ₄	12 077	36.49	11 957	36.10
4.B. Manure management	N ₂ O	- 9 962	- 29.77	- 7 751	- 26.64
4.D. Agricultural soils	CO ₂	- 7	- 0.21	- 22	- 1.09
4.D. Agricultural soils	N ₂ O	16 446	8.30	13 374	7.05
6.A. Solid waste disposal on land	CH ₄	- 22 034	- 16.56	- 16 712	- 16.94
6.B. Waste-water handling	N ₂ O	860	15.26	- 457	- 7.58
6.D. Other	CO ₂	381	76.07	- 32	- 7.15

10.2. Implications for emission levels

Table 66 provides the differences in total EC GHG emissions between the latest submission and the previous submission in absolute and relative terms. The table shows that due to recalculations, total EC 1990

GHG emissions excluding LUCF have decreased in the latest submission compared to the previous submission by 15 895 Gg (- 0.38 %). In contrast to this, EC GHG emissions for 2000 have increased by 7 381 Gg (+ 0.18 %) due to recalculations.

**Contribution of Member States to EC recalculations of total GHG emissions excluding LUCF for 1990–2000
(difference between latest submission and previous submission Gg of CO₂ equivalents)**

Table 68

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Austria	685	927	398	1 810	1 608	2 191	4 673	2 827	4 360	2 392	2 196
Belgium	- 1 909	- 1 335	- 1 710	- 1 699	- 2 015	- 1 770	- 1 619	- 1 684	- 793	- 1 148	- 1 987
Denmark	- 144	- 247	- 133	- 122	- 112	- 44	- 158	- 161	- 184	- 166	- 324
Finland	140	471	805	1 161	1 443	1 484	1 586	1 678	1 679	1 700	1 432
France	8 970	9 466	10 652	11 314	11 693	10 962	11 125	12 856	15 110	15 522	15 610
Germany	- 11 186	- 10 751	- 11 057	- 9 234	- 8 815	- 12 320	- 6 715	- 8 042	- 10 491	- 10 887	- 9 952
Greece	0	0	0	0	0	0	0	0	0	0	0
Ireland	- 10	365	572	513	341	338	401	735	471	981	1 907
Italy	- 13 504	- 12 855	- 12 057	- 8 912	- 8 326	- 7 720	- 7 116	- 4 256	- 3 782	- 892	287
Luxembourg	47	- 925	- 901	- 759	- 2 405	47	47	47	47	47	47
Netherlands	- 337	- 3 733	- 1 864	- 1 103	- 1 738	- 294	- 1 314	- 3 621	- 1 377	- 1 381	- 100
Portugal	- 3 665	- 3 688	- 2 845	- 3 194	- 2 862	- 3 327	- 4 176	- 4 130	- 3 203	- 2 725	- 2 444
Spain	1 181	632	278	3 692	1 397	1 229	474	1 378	1 152	137	1 117
Sweden	2 190	1 933	2 916	2 698	3 045	2 342	2 265	2 347	2 362	1 734	- 408
UK	1 647	1 821	1 899	2 252	2 063	1 943	2 376	1 200	946	23	1
EU15	- 15 895	- 17 918	- 13 048	- 1 582	- 4 684	- 4 942	1 849	1 174	6 298	5 334	7 381

**Contribution of Member States to EC recalculations of total GHG emissions excluding LUCF for 1990–2000
(difference between latest submission and previous submission %)**

Table 69

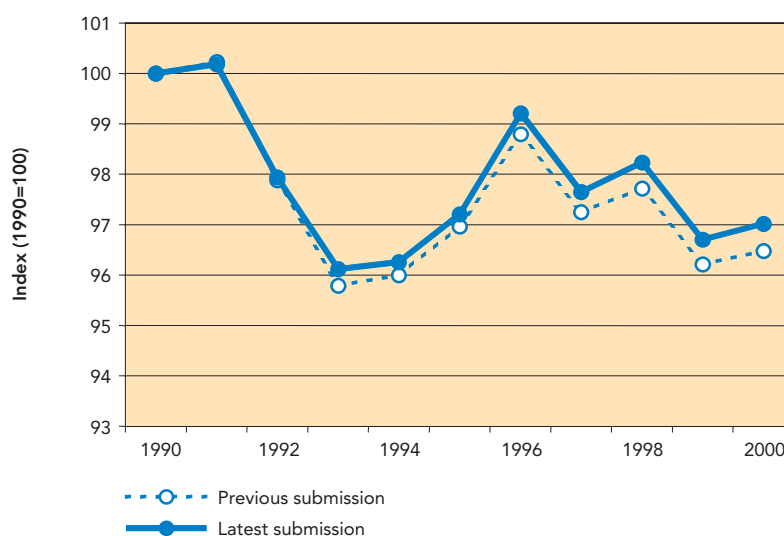
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Austria	0.89	1.14	0.53	2.42	2.11	2.79	5.85	3.48	5.49	3.00	2.75
Belgium	- 1.33	- 0.90	- 1.16	- 1.17	- 1.35	- 1.15	- 1.04	- 1.12	- 0.51	- 0.76	- 1.31
Denmark	- 0.21	- 0.31	- 0.18	- 0.16	- 0.14	- 0.06	- 0.17	- 0.20	- 0.24	- 0.23	- 0.47
Finland	0.18	0.63	1.13	1.62	1.86	1.97	1.97	2.11	2.19	2.23	1.94
France	1.63	1.65	1.89	2.09	2.18	2.00	1.98	2.32	2.66	2.83	2.88
Germany	- 0.91	- 0.92	- 0.99	- 0.84	- 0.82	- 1.15	- 0.62	- 0.77	- 1.02	- 1.10	- 1.00
Greece	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ireland	- 0.02	0.68	1.05	0.94	0.60	0.59	0.68	1.20	0.74	1.50	2.88
Italy	- 2.59	- 2.46	- 2.32	- 1.76	- 1.66	- 1.46	- 1.36	- 0.81	- 0.70	- 0.17	0.05
Luxembourg	0.43	- 8.13	- 8.05	- 6.68	- 18.99	0.60	0.60	0.68	0.79	0.78	0.78
Netherlands	- 0.16	- 1.69	- 0.85	- 0.50	- 0.78	- 0.13	- 0.56	- 1.62	- 0.61	- 0.63	- 0.05
Portugal	- 5.63	- 5.51	- 4.06	- 4.64	- 4.14	- 4.54	- 5.83	- 5.60	- 4.12	- 3.18	- 2.89
Spain	0.41	0.22	0.09	1.28	0.46	0.39	0.15	0.42	0.34	0.04	0.29
Sweden	3.10	2.72	4.22	3.90	4.14	3.22	2.96	3.29	3.26	2.46	- 0.59
UK	0.22	0.25	0.26	0.32	0.30	0.28	0.34	0.18	0.14	0.00	0.00
EU15	- 0.38	- 0.42	- 0.32	- 0.04	- 0.12	- 0.12	0.04	0.03	0.15	0.13	0.18

Table 67 provides an overview of recalculations for the EC key source categories for 1990 and 2000 (see Chapter 4.8 for information on identification of EC key sources). The table shows that the largest recalculations in absolute terms were made in the key source categories CH₄ from 6A, 'Solid waste disposal on land', N₂O from 4D, 'Agricultural soils', and CH₄ from 4B, 'Manure management'.

Table 68 and Table 69 give an overview of absolute and percentage changes of Member States' emissions due to recalculations for 1990 and 2000. Large recalculations in absolute terms were made by France, Germany and Italy (early-1990s). In relative terms, the highest recalculations were made by Portugal.

Figure 10

Comparison of EC GHG emission trends for 1990–2000 (excluding LUCF) of the latest and the previous submission



10.3. Implications for emission trends, including series consistency

Figure 10 shows that due to the recalculations the emission trend in the EC has changed slightly. Due to the fact that the 1990 emission have been reduced in the latest submission compared to the previous submission and the 2000 emissions have been increased, the trend for 1990–2000 has also changed. In the previous submission the trend of greenhouse gas emissions excluding LUCF between 1990 and 2000 was – 3.5 %. In the latest submission this trend has changed to – 3 %.

10.4. Recalculations, including in response to the review process, and planned improvements to the inventory

Several activities are ongoing at EC level with a view to improving the EC GHG inventory system.

- A proposal for an EU ‘Greenhouse gas inventory system’ under the Kyoto Protocol has been drafted and discussed in the Monitoring Committee under Council Decision 99/296/EC.
- In 2003, the legal basis of the compilation of the EC inventory and the EC inventory

system (Council Decision 99/296/EC) will be revised in order to be fully in accordance with the Kyoto Protocol and the Marrakech Accords of November 2001 and additional implementation provisions will be elaborated.

- A number of sector-specific QA/QC activities will continue: Eurostat is working with national statistical offices on harmonisation of energy balance data (see Chapter 3.3). In addition, Eurostat is involved in an EU project aimed at improving estimates of emissions from international aviation (see Chapter 3.6). The JRC is working with Member States on the quality improvement of estimates of emissions and removals from LUCF and from agriculture (see Chapters 7.2 and 6.3 respectively). In addition, the QA/QC activities performed during the compilation process of the EC inventory will be further extended.
- The EEA/ETC will gradually extend and adapt the ETC database in close cooperation with the UNFCCC secretariat in order to include the detailed sectoral emission data submitted by the Member States and in order to further extend the EC CRF submission by compiling the relevant sectoral tables at EU level.

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Units and abbreviations

t	1 tonne (metric) = 1 megagram (Mg) = 10 ⁶ g
Mg	1 megagram = 10 ⁶ g = 1 tonne (t)
Gg	1 gigagram = 10 ⁹ g = 1 kilotonne (kt)
Tg	1 teragram = 10 ¹² g = 1 megatonne (Mt)
TJ	1 terajoule
BKB	lignite briquettes
CH ₄	methane
CO ₂	carbon dioxide
COP	conference of the parties
CRF	common reporting format
CV	calorific value
EC	European Community
EEA	European Environment Agency
EIONET	European Environmental Information and Observation Network
ETC/ACC	European Topic Centre on Air and Climate Change
EU	European Union
GHG	greenhouse gas
GPG	good practice guidance
GWP	global warming potential
HFCs	hydrofluorocarbons
JRC	Joint Research Centre
F-gases	fluorinated gases (HFCs, PFCs, SF ₆)
IE	included elsewhere
IPCC	Intergovernmental Panel on Climate Change
KP	Kyoto Protocol
LUCF	land-use change and forestry

LULUCF	land-use, land-use change and forestry
N ₂ O	nitrous oxide
NA	not applicable
NE	not estimated
NIR	national inventory report
NO	not occurring
PFCs	perfluorocarbons
QA/QC	quality assurance and quality control
RIVM	National Institute of Public Health and the Environment (the Netherlands)
SF ₆	sulphur hexafluoride
UBA Vienna	Federal Environment Agency Austria
UNFCCC	United Nations Framework Convention on Climate Change

European Environment Agency

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