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Annual European Community greenhouse gas inventory 1990–2004 and inventory report 2006

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European Environment Agency

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Executive summary

ES.1 Background information on greenhouse gas inventories and climate change

The European Community (EC), 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 of the compilation of the EC inventory is Council Decision No 280/2004/EC concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol ([1]). The purpose of this decision is to: (1) monitor all anthropogenic GHG emissions covered by the Kyoto Protocol in the Member States; (2) evaluate progress towards meeting GHG reduction commitments under the UNFCCC and the Kyoto Protocol; (3) implement the UNFCCC and the Kyoto Protocol as regards national programmes, greenhouse gas inventories, national systems and registries of the Community and its Member States, and the relevant procedures under the Kyoto Protocol; (4) ensure the timeliness, completeness, accuracy, consistency, comparability and transparency of reporting by the Community and its Member States to the UNFCCC Secretariat.

The EC GHG inventory is compiled on the basis of the inventories of the EC Member States for EU-15 and EU-25. It is the direct sum of the national inventories. For EU-15 energy data from Eurostat is used for the reference approach for CO_2 emissions from fossil fuels, developed by the Intergovernmental Panel on Climate Change (IPCC). The main institutions involved in the compilation of the EC GHG inventory are the Member States, the European Commission (DG ENV), the European Environment Agency (EEA) and its European Topic Centre on Air and Climate Change (ETC/ACC), Eurostat, and the Joint Research Centre (JRC).

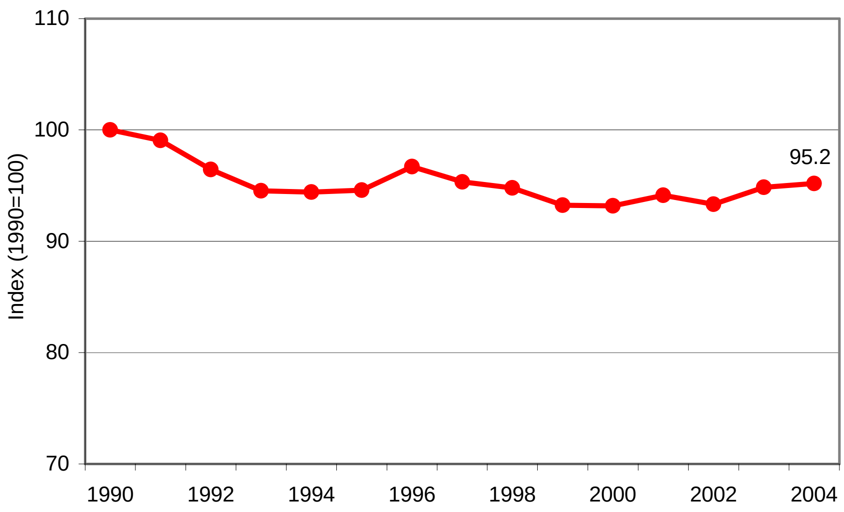
The process of compiling the EC GHG inventory is as follows: Member States submit their annual GHG inventories by 15 January each year to the European Commission, DG Environment. Then, the EEA and it's ETC/ACC, Eurostat and JRC perform initial checks on the submitted data. The draft EC GHG inventory and inventory report are circulated to Member States for reviewing and commenting by 28 February. Member States check their national data and information used in the EC GHG inventory report, send updates, if necessary, and review the EC inventory report itself by 15 March. The final EC GHG inventory report are prepared by the EEA and ETC/ACC by 15 April for submission by the European Commission to the UNFCCC Secretariat; a resubmission is prepared by 27 May, if needed.

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

EU-25: Total GHG emissions, without emissions and removals by Land Use, Land Use Change and Forestry (LULUCF), in the EU-25 decreased by 4.8 % between 1990 and 2004 (Figure ES.1). Greenhouse gas emissions increased by 0.4 % (+18 million tonnes) between 2003 and 2004.

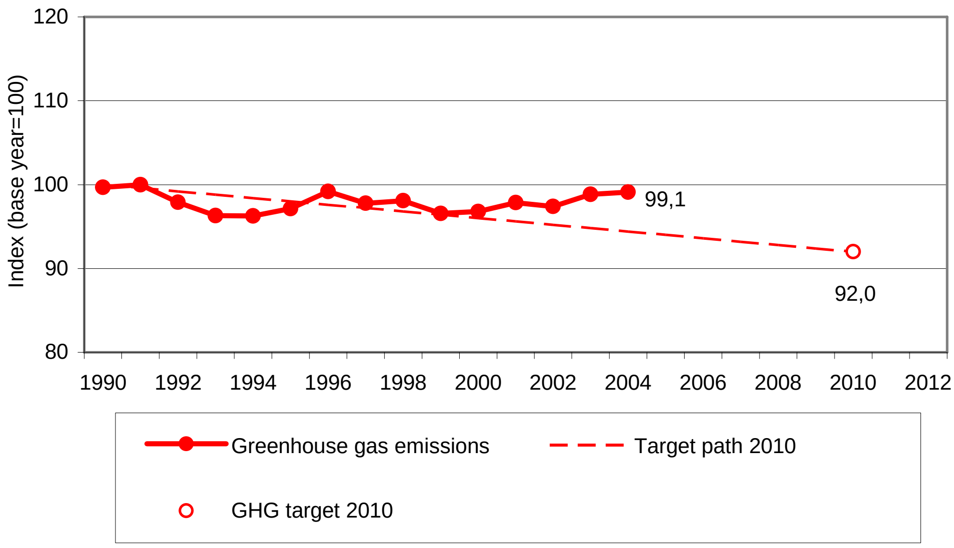
([1]) OJ L 49, 19.2.2004, p. 1. Note that Council Decision No 280/2004/EC entered into force in March 2004. Therefore, the compilation of the inventory report 2004 started under the previous Council Decision 1999/296/EC.

Figure ES.1 EU-25 GHG emissions 1990–2004 (excl. LULUCF)



EU-15: In 2004 total GHG emissions in the EU-15, without LULUCF, were 0.6 % (24 million tonnes CO_2 equivalents) below 1990. Compared to the base year[1], emissions in 2004 were 0.9 % or 38 million tonnes CO_2 equivalents lower. Under the Kyoto Protocol, the EC has agreed to reduce its GHG emissions by 8 % by 2008–12, from base year levels. Assuming a linear target path from 1990 to 2010, total EU-15 GHG emissions were 4.7 index points above this target path in 2004 (Figure ES.2).

Figure ES.2 EU-15 GHG emissions 1990–2004 compared with target for 2008–12 (excl. LULUCF)



Notes: The linear target path is not intended as an approximation of past and future emission trends. It provides a measure of how close the EU-15 emissions in 2004 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 EU-15 with its GHG targets in 2008–12, but aims at evaluating overall EU-15 GHG emissions in 2003. The unit is index points with base year emissions being 100.

GHG emission data for the EU-15 as a whole do not include emissions and removals from LULUCF. In addition, no adjustments for temperature variations or electricity trade are considered.

[1] For EU-15 the base year for CO_2, CH_4 and N_2O is 1990; for the fluorinated gases 13 Member States have indicated to select 1995 as the base year, whereas Austria and France have chosen 1990. As the EC inventory is the sum of Member States' inventories, the EC base year estimates for fluorinated gas emissions are the sum of 1995 emissions for 13 Member States and 1990 emissions for Austria and France.

The index on the y axis refers to the base year (1995 for fluorinated gases for all Member States except Austria and France, 1990 for fluorinated gases for Austria and France and for all other gases). This means that the value for 1990 needs not to be exactly 100.

Compared to 2003, EU-15 GHG emissions increased by 0.3% or 11.5 million tonnes CO_2 equivalents in 2004.

The increase in GHG emissions 2003-2004 was mainly due to:

- Higher CO_2 emissions from road transport (+11.7 million tonnes or +1,5 %),
- Higher CO_2 emissions from iron and steel production (+8.4 million tonnes or +5.4 % for both energy and process related emissions),
- Higher CO_2 emissions from oil refining (+3.8 million tonnes or +3.3 %) and
- Higher HFCs emissions from refrigeration and air conditioning (+3.7 million tonnes CO_2 equivalents or +12.1 %).

In road transportation the substantial increase of CO_2 from diesel oil consumption (+22.7 million tonnes or +5 %) was only partly offset by the decrease of CO_2 from gasoline consumption (-10.4 million tonnes or -3.2 %).

Substantial decreases in GHG emissions took place in a number of source categories between 2003-2004:

- CO_2 emissions from households and services (-9.2 million tonnes or -1.4 %),
- CH_4 from landfills (-3.8 million tonnes CO_2 equivalents or -4.3 %),
- CH_4 from coal mining and handling (-3.2 million tonnes CO_2 equivalents or -16.5 %) and
- CO_2 from electricity and heat production (-3.2 million tonnes or -0.3 %).

The reduction in CO_2 emissions from electricity and heat production between 2003 and 2004 is a net result of opposing trends: whereas power production increased by 2 % in line with increasing electricity demand within the EU-15, a shift of fuel use in thermal power stations from coal (-1 %) and oil (-14 %) to gas (+9 %) and biomass (+13 %) in combination with increased use of wind power (+24 %), hydro power (+4%) and nuclear power (+1 %) contributed to emission decreases from electricity and heat production.

Table ES.1 shows that between 2003 and 2004, Spain and Italy saw the largest emission increases in absolute terms (+19.7 million tonnes CO_2 equivalents and +5.1 million tonnes CO_2 equivalents respectively). On the positive side, 2004 saw emission reductions from Germany (-9.1 million tonnes CO_2 equivalents), Denmark (-6.0 million tonnes CO_2 equivalents), and Finland (-4.2 million tonnes CO_2 equivalents):

- Spanish emission increases mainly occurred in CO_2 from electricity and heat production (+ 8.9 million tonnes), CO_2 from energy consumption in other manufacturing industry (+3.4 million tonnes), CO_2 from road transport (+3.3 million tonnes) and CO_2 from iron and steel production (+ 2.2 million tonnes, both energy and process related emissions). The strong increase from electricity and heat production reflects a strong increase of thermal electricity production partly due to low hydro power generation.

- In Italy CO_2 emissions increased mostly from oil refining (+2.4 million tonnes) and from road transport (+2.0 million tonnes).

- The German emission reductions occurred primarily in CO_2 from households and services (-9.1 million tonnes) and CO_2 from public electricity and heat production (-3.9 million tonnes), whereas CO_2 emissions from iron and steel production increased by 5.4 million tonnes.

- Danish and Finnish emission reductions are mainly due to CO_2 from electricity and heat production (-6.0 and –3.7 million tonnes respectively) which reflects higher hydro power production in the Nordic electricity market.

In 2004, 12 Member States (including Cyprus and Malta, which do not have a Kyoto target) had GHG emissions above base year levels whereas the remaining 13 Member States had emissions below base year levels.

Table ES.1 Greenhouse gas emissions in CO_2 equivalents (excl. LULUCF) and Kyoto Protocol targets for 2008–12

MEMBER STATE	Base year [1] (million tonnes)	2004 (million tonnes)	Change 2003–2004 (million tonnes)	Change 2003–2004 (%)	Change base year–2004 (%)	Targets 2008–12 under Kyoto Protocol and "EU burden sharing" (%)
Austria	78.9	91.3	-1.2	-1.3%	15.7%	-13.0%
Belgium	146.9	147.9	0.3	0.2%	0.7%	-7.5%
Cyprus [2]	6.0	*8.9*	-0.3	-3.0%	48.2%	-
Czech Republic	196.3	147.1	-0.5	-0.3%	-25.1%	-8.0%
Denmark	69.3	68.1	-6.0	-8.1%	-1.8%	-21.0%
Estonia	42.6	21.3	0.1	0.7%	-50.0%	-8.0%
Finland	71.1	81.4	-4.2	-4.9%	14.5%	0.0%
France	567.1	562.6	1.5	0.3%	-0.8%	0.0%
Germany	1230.0	1015.3	-9.1	-0.9%	-17.5%	-21.0%
Greece	111.1	137.6	0.3	0.3%	23.9%	25.0%
Hungary	122.2	83.1	-0.2	-0.2%	-32.0%	-6.0%
Ireland	55.8	68.5	0.1	0.1%	22.7%	13.0%
Italy	518.9	582.5	5.1	0.9%	12.3%	-6.5%
Latvia	25.9	10.7	0.0	0.4%	-58.5%	-8.0%
Lithuania	50.9	20.3	3.1	17.9%	-60.1%	-8.0%
Luxembourg	12.7	12.7	1.3	11.3%	0.3%	-28.0%
Malta [2]	2.2	*3.2*	0.1	4.2%	45.9%	-
Netherlands	214.3	217.8	2.5	1.1%	1.6%	-6.0%
Poland	565.3	386.4	3.7	1.0%	-31.6%	-6.0%
Portugal	60.0	84.5	0.9	1.0%	41.0%	27.0%
Slovakia	73.2	51.0	-0.1	-0.1%	-30.3%	-8.0%
Slovenia	20.2	20.1	0.4	2.0%	-0.8%	-8.0%
Spain	289.4	427.9	19.7	4.8%	47.9%	15.0%
Sweden	72.5	69.9	-1.1	-1.5%	-3.6%	4.0%
United Kingdom	767.9	659.3	1.3	0.2%	-14.1%	-12.5%
EU-15	**4265.7**	**4227.4**	**11.5**	**0.3%**	**-0.9%**	**-8.0%**

(1) For EU-15 the base year for CO_2, CH_4 and N_2O is 1990; for the fluorinated gases 13 Member States have indicated to select 1995 as the base year, whereas Austria and France have chosen 1990. As the EC inventory is the sum of Member States' inventories, the EC base year estimates for fluorinated gas emissions are the sum of 1995 emissions for 13 Member States and 1990 emissions for Austria and France.

(2) Cyprus and Malta did not provide GHG emission estimates for 2004, therefore the data provided in this table is based on gap filling (see Chapter 1.8.2.).

Note: Malta and Cyprus do not have Kyoto targets.

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

EU-25: Table ES.2 gives an overview of the main trends in EU-25 GHG emissions and removals for 1990–2004. The most important GHG by far is CO_2, accounting for 83 % of total EU-25 emissions in 2004. In 2004, EU-25 CO_2 emissions, without LULUCF, were 4 116 Tg CO_2 equivalents, which was 0,9 % below 1990 levels. Compared to 2003, CO_2 emissions increased by 0.4 %.

Table ES.2 Overview of EU-25 GHG emissions and removals from 1990 to 2004 in CO_2 equivalents (Tg)

GREENHOUSE GAS EMISSIONS	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Net CO_2 emissions/removals	3,856	3,779	3,687	3,603	3,590	3,601	3,690	3,644	3,656	3,592	3,611	3,641	3,614	3,740	3,763
CO_2 emissions (without LULUCF)	4,153	4,134	4,024	3,947	3,940	3,944	4,049	3,987	3,991	3,949	3,960	4,033	4,011	4,100	4,116
CH_4	543	532	519	512	500	497	488	476	467	453	442	423	412	402	392
N_2O	482	464	450	433	441	442	450	450	427	411	411	406	395	394	404
HFCs	28	28	29	30	34	41	47	53	55	48	47	47	49	54	55
PFCs	19	17	15	14	13	12	12	11	10	10	8	8	9	7	6
SF_6	11	11	12	13	14	16	15	14	13	11	11	10	10	9	9
Total (with net CO_2 emissions/removals)	**4,939**	**4,832**	**4,712**	**4,604**	**4,592**	**4,609**	**4,702**	**4,647**	**4,627**	**4,525**	**4,530**	**4,534**	**4,489**	**4,606**	**4,630**
Total (without CO2 from LULUCF)	**5,236**	**5,186**	**5,049**	**4,948**	**4,942**	**4,952**	**5,062**	**4,991**	**4,963**	**4,882**	**4,879**	**4,927**	**4,885**	**4,966**	**4,984**
Total (without LULUCF)	**5,231**	**5,181**	**5,045**	**4,944**	**4,938**	**4,948**	**5,058**	**4,986**	**4,958**	**4,878**	**4,874**	**4,923**	**4,882**	**4,961**	**4,980**

EU-15: Table ES.3 gives an overview of the main trends in EU-15 GHG emissions and removals for 1990–2004. Also in the EU-15 the most important GHG is CO_2, also accounting for 83 % of total EU-15 emissions in 2004. In 2004, EU-15 CO_2 emissions, without LULUCF, were 3 506 Tg CO_2 equivalents, which was 4.4% above 1990 levels. Compared to 2003, CO_2 emissions increased by 0.6 %. The largest four key sources account for 80 % of total CO_2 emissions in 2004. The main reason for increases between 1990 and 2004 was growing road transport demand. The large increase in road transport-related CO_2 emissions was only partly offset by reductions in energy-related emissions from manufacturing industries and from manufacture of solid fuels.

Table ES.3 Overview of EU-15 GHG emissions and removals from 1990 to 2004 in CO_2 equivalents (Tg)

GREENHOUSE GAS EMISSIONS	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Net CO_2 emissions/removals	3,147	3,147	3,125	3,069	3,008	2,997	3,039	3,104	3,057	3,096	3,062	3,098	3,135	3,120	3,202	3,215
CO_2 emissions (without LULUCF)	3,357	3,357	3,382	3,308	3,255	3,252	3,283	3,362	3,311	3,354	3,331	3,355	3,420	3,416	3,485	3,506
CH_4	429	429	426	419	417	406	404	400	389	380	369	359	348	338	328	319
N_2O	414	414	406	399	385	392	393	401	400	378	356	355	348	340	340	340
HFCs	41	28	28	29	30	34	41	47	53	54	47	46	45	47	51	52
PFCs	14	17	15	13	12	12	11	11	10	9	9	7	7	8	7	5
SF_6	15	11	11	12	13	14	15	15	13	13	11	11	10	9	9	9
Total (with net CO_2 emissions/removals)	**4,060**	**4,047**	**4,011**	**3,941**	**3,865**	**3,855**	**3,904**	**3,977**	**3,921**	**3,930**	**3,853**	**3,875**	**3,892**	**3,863**	**3,937**	**3,941**
Total (without CO2 from LULUCF)	**4,270**	**4,257**	**4,269**	**4,181**	**4,112**	**4,110**	**4,148**	**4,235**	**4,175**	**4,188**	**4,122**	**4,133**	**4,177**	**4,158**	**4,220**	**4,232**
Total (without LULUCF)	**4,266**	**4,252**	**4,264**	**4,176**	**4,107**	**4,106**	**4,144**	**4,231**	**4,171**	**4,184**	**4,119**	**4,129**	**4,173**	**4,155**	**4,216**	**4,227**

The increase of CO_2 emissions was compensated by decreases in CH_4 and N_2O in the same period: CH_4 decreased by 110 Tg CO_2 equivalents and N_2O by 74 Tg CO_2 equivalents. The main reasons for declining CH_4 emissions were reductions in solid waste disposal on land, the decline of coal-mining and falling cattle population. The main reason for large N_2O emissions cuts were reduction measures in the adipic acid production. Fluorinated gas emissions are subject to two opposing trends. While HFCs from consumption of halocarbons showed large increases between 1990 and 2004 (mainly due to the replacement of ozone depleting substances), HFC emissions from production of halocarbons decreased substantially.

ES.4 Summary of emissions and removals by main source category

EU-25: Table ES.4 gives an overview of EU-25 GHG emissions in the main source categories for 1990–2004. The most important sector by far is 'Energy' (which includes transport) accounting for 80 % of total EU-25 emissions in 2004. The second largest sector is 'Agriculture' (9 %), followed by Industrial processes' (8 %).

Table ES.4 Overview of EU-25 GHG emissions in the main source and sink categories 1990 to 2004 in CO_2 equivalents (Tg)

GHG SOURCE AND SINK	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1. Energy	4,062	4,058	3,947	3,883	3,853	3,853	3,969	3,893	3,892	3,852	3,850	3,931	3,907	3,990	3,995
2. Industrial Processes	431	406	395	379	404	418	416	429	404	367	375	366	360	370	379
3. Solvent and Other Product Use	11	11	11	10	10	10	10	10	10	10	10	10	9	10	10
4. Agriculture	524	503	488	473	472	472	474	474	473	476	471	463	457	451	458
5. Land-Use, Land-Use Change and Forest	-291	-350	-332	-340	-346	-339	-356	-339	-331	-352	-344	-389	-393	-355	-349
6. Waste	199	199	200	195	194	191	184	177	176	168	164	149	144	138	134
7. Other	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Total (with net CO_2 emissions/removals)	**4,939**	**4,832**	**4,712**	**4,604**	**4,592**	**4,609**	**4,702**	**4,647**	**4,627**	**4,525**	**4,530**	**4,534**	**4,489**	**4,606**	**4,630**
Total (without LULUCF)	**5,231**	**5,181**	**5,045**	**4,944**	**4,938**	**4,948**	**5,058**	**4,986**	**4,958**	**4,878**	**4,874**	**4,923**	**4,882**	**4,961**	**4,980**

EU-15: Table ES.5 gives an overview of EU-15 GHG emissions in the main seven sectors for 1990–2004. The emissions from the largest sector 'Energy' (which includes transport), with an 80 % share of the total emissions, increased by 122 Tg CO_2 equivalents (3.8 %). This increase was offset by decreases in all other source categories: emissions from 'Industrial processes' decreased by 47 Tg CO_2 equivalents (–12.5 %), emissions from 'Agriculture' by 43 Tg CO_2 equivalents (–10 %), emissions from 'Waste' by 55 Tg CO_2 equivalents (–33 %) and emissions from 'Solvent and other product use' by 2 Tg CO_2 equivalents (–20 %).

Table ES.5 Overview of EU-15 GHG emissions in the main source and sink categories 1990 to 2004 in CO_2 equivalents (Tg)

GHG SOURCE AND SINK	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1. Energy	3,261	3,261	3,297	3,228	3,180	3,157	3,183	3,270	3,208	3,249	3,229	3,242	3,312	3,306	3,371	3,383
2. Industrial Processes	392	378	364	352	340	363	375	374	384	360	325	329	321	319	325	331
3. Solvent and Other Product Use	10	10	10	10	9	9	9	9	9	9	9	9	9	9	8	8
4. Agriculture	435	435	425	419	411	412	414	418	418	418	417	413	405	399	395	393
5. Land-Use, Land-Use Change and Forest	-205	-205	-253	-235	-242	-251	-240	-254	-250	-254	-266	-253	-282	-292	-279	-286
6. Waste	163	163	165	164	163	161	158	155	148	143	135	131	123	118	113	109
7. Other	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Total (with net CO_2 emissions/removals)	**4,060**	**4,047**	**4,011**	**3,941**	**3,865**	**3,855**	**3,904**	**3,977**	**3,921**	**3,930**	**3,853**	**3,875**	**3,892**	**3,863**	**3,937**	**3,941**
Total (without LULUCF)	**4,266**	**4,252**	**4,264**	**4,176**	**4,107**	**4,106**	**4,144**	**4,231**	**4,171**	**4,184**	**4,119**	**4,129**	**4,173**	**4,155**	**4,216**	**4,227**

ES.5 Summary of the emission trends by EU Member States

Table ES.6 gives an overview of Member States' contributions to the EC GHG emissions for 1990–2004. Member States show large variations in GHG emission trends.

Table ES.6 Overview of Member States' contributions to EC GHG emissions excluding LULUCF from 1990 to 2004 in CO_2 equivalents (Tg)

Member State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Austria	79	83	76	76	77	80	84	83	83	81	81	85	87	93	91
Belgium	146	149	147	146	151	152	156	148	153	147	147	147	145	148	148
Cyprus	6	6	7	7	7	7	8	8	8	8	9	8	9	9	9
Czech Republic	196	183	166	160	154	154	156	160	150	142	149	149	144	148	147
Denmark	69	80	73	76	79	76	90	80	76	73	68	70	69	74	68
Estonia	43	40	30	23	24	22	23	23	21	19	19	19	19	21	21
Finland	71	69	68	69	75	71	77	76	72	72	70	75	78	86	81
France	567	589	582	557	553	562	578	570	585	568	561	562	556	561	563
Germany	1,226	1,182	1,131	1,118	1,100	1,095	1,116	1,080	1,054	1,023	1,023	1,035	1,019	1,024	1,015
Greece	109	108	109	109	112	113	117	122	127	127	132	133	133	137	138
Hungary	103	95	85	85	85	84	86	84	84	84	81	84	81	83	83
Ireland	56	56	56	56	58	59	61	64	66	67	69	71	69	68	68
Italy	520	521	519	513	505	533	526	532	543	549	555	561	562	577	583
Latvia	26	23	19	16	14	12	12	12	11	11	10	11	11	11	11
Lithuania	51	47	44	40	36	33	29	25	22	21	21	20	20	17	20
Luxembourg	13	13	13	13	13	10	10	9	8	9	10	10	11	11	13
Malta	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3
Netherlands	213	218	217	222	222	225	233	227	227	215	215	216	215	215	218
Poland	460	438	440	430	440	417	437	427	404	402	386	383	370	383	386
Portugal	60	62	66	65	67	71	69	72	77	85	82	84	88	84	85
Slovakia	73	63	59	55	52	53	54	54	52	51	49	52	51	51	51
Slovenia	18	17	17	18	18	19	19	20	19	19	19	20	20	20	20
Spain	287	293	301	290	306	318	311	331	342	370	384	385	402	408	428
Sweden	72	73	73	72	75	74	78	73	73	70	68	69	70	71	70
United Kingdom	764	769	744	725	714	704	727	704	698	663	664	671	652	658	659
EU25	**5,231**	**5,181**	**5,045**	**4,944**	**4,938**	**4,948**	**5,058**	**4,986**	**4,958**	**4,878**	**4,874**	**4,923**	**4,882**	**4,961**	**4,980**
EU15	**4,252**	**4,264**	**4,176**	**4,107**	**4,106**	**4,144**	**4,231**	**4,171**	**4,184**	**4,119**	**4,129**	**4,173**	**4,155**	**4,216**	**4,227**

Note: For some countries the data provided in this table is based on gap filling (see Chapter 1.8.2 for details.).

The overall EC GHG emission trend is dominated by the two largest emitters Germany and the United Kingdom, accounting for about one third of total EU-25 GHG emissions. These two Member States achieved total GHG emission reductions of 316 million tonnes compared to 1990.

The main reasons for the favourable trend in Germany are increasing efficiency in power and heating plants and the economic restructuring of the five new *Länder* after the German reunification. The reduction of GHG emissions in the United Kingdom was primarily the result of liberalising energy markets and the subsequent fuel switches from oil and coal to gas in electricity production and N_2O emission reduction measures in the adipic acid production.

Italy and France are the third and fourth largest emitters with a shares of 12 % and 11 % respectively. Italy's GHG emissions were about 12% above 1990 levels in 2004. Italian GHG emissions increased since 1990 primarily from road transport, electricity and heat production and petrol-refining. France's emissions were 1 % below 1990 levels in 2004. In France, large reductions were achieved in N_2O emissions from the adipic acid production, but CO_2 emissions from road transport increased considerably between 1990 and 2004.

Spain and Poland are the fifth and sixth largest emitters in the EU-25 each accounting for about 9 % and 8 % of total EU-25 GHG emissions respectively. Spain increased emissions by 48 % between 1990 and 2004. This was largely due to emission increases from road transport, electricity and heat production, and manufacturing industries. Poland decreased GHG emissions by 16 % between 1990 and 2004 (-32 % since the base year, which is 1988 in the case of Poland). Main factors for decreasing emissions in Poland — as for other new Member States — was the decline of energy inefficient heavy industry and the overall restructuring of the economy in the late 1980s and early 1990s. The notable exception was transport (especially road transport) where emissions increased.

ES.6 Information on Indirect Greenhouse Gas Emissions for EU-15

Emissions of CO, NO_x, NMVOC and SO_2 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 ES.7 shows the total indirect GHG and SO_2 emissions in the EU-15 between 1990–2004. All emissions were reduced significantly from 1990 levels: the largest reduction was achieved in SO_2 (– 70 %) followed by CO (–50 %) NMVOC (– 42 %) and NO_x (– 31 %).

Table ES.7 Overview of EU-15 indirect GHG and SO_2 emissions for 1990–2004 (Gg)

GREENHOUSE GAS EMISSIONS	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
	(Gg)														
NOx	13,386	13,096	12,866	12,292	11,943	11,692	11,414	10,966	10,730	10,420	10,093	9,865	9,561	9,436	9,188
CO	51,339	49,067	46,863	44,570	41,990	40,156	38,840	37,077	35,579	33,522	30,999	29,744	27,761	26,843	25,466
NMVOC	15,348	14,719	14,352	13,663	13,191	12,733	12,166	12,000	11,509	11,075	10,330	9,979	9,504	9,169	8,955
SO2	16,535	14,906	13,728	12,473	11,289	9,986	8,932	8,200	7,645	6,795	6,075	5,873	5,662	5,217	5,022

1 Introduction to the EC 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 EC Member States for 1990 to 2004. 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, required under Council Decision No 280/2004/EC concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol.

This report aims to present transparent information on the process and methods of 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 inventory reports of the Member States, which are included in Annex 12. Note that all Member States' submissions (CRF tables and inventory reports), which are included in Annex 12 and made available at the EEA website, are considered to be part of the EC submission. Several chapters in this report refer to 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 greenhouse gas inventory has been compiled under Council Decision No 280/2004/EC concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol ([3]).The emissions compiled in the EC GHG inventory are the sum of the respective emissions in the respective 15 or 25 national inventories, except for the IPCC reference approach for CO_2 from fossil fuels. Since the data are revised and updated for all years, they replace EC data previously published, in particular, in the 2005 submission by the European Commission to the UNFCCC Secretariat of the *Annual European Community greenhouse gas inventory 1990–2003 and inventory report 2005* (EEA, 2005a) and in the report entitled *Greenhouse gas emission trends and projections in Europe 2005* (EEA, 2005b).

This inventory report includes data for the EU-15 and for the EU-25 Member States. The EU-15 Member States are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom. The ten new Member States are Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia. Most chapters and annexes of this report refer to EU-15 only, i.e. chapters 3-10 and annexes 1,2,4-10. Chapters 1 and 2 and also annexes 11 and 12 refer to the EU-25 where relevant (for more detail see Section 1.8.5). This means that all the detailed information provided in previous reports for the EU-15 is also available in this report. In addition, basic information on data availability, QA/QC, uncertainty estimates, completeness and emission trends are provided for the EU-25.

1.1 Background information on greenhouse gas inventories and climate change

The annual EC GHG inventory is required for two purposes.

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

([3]) OJ L 49, 19.2.2004, p. 1.

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. The annual EC inventory is the basis for the evaluation of actual progress.

The legal basis of the compilation of the EC inventory is Council Decision No 280/2004/EC concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol ([4]). The purpose of this decision is to: (1) monitor all anthropogenic GHG emissions covered by the Kyoto Protocol in the Member States; (2) evaluate progress towards meeting GHG reduction commitments under the UNFCCC and the Kyoto Protocol; (3) implement the UNFCCC and the Kyoto Protocol as regards national programmes, greenhouse gas inventories, national systems and registries of the Community and its Member States, and the relevant procedures under the Kyoto Protocol; (4) ensure the timeliness, completeness, accuracy, consistency, comparability and transparency of reporting by the Community and its Member States to the UNFCCC Secretariat.

Under the provisions of Article 3.1 of Council Decision No 280/2004/EC, the Member States shall determine and report to the Commission by 15 January each year (year X) *inter alia*:

- their anthropogenic emissions of greenhouse gases listed in Annex A to the Kyoto Protocol (carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride SF_6)) during the year before last (X – 2);
- provisional data on their emissions of carbon monoxide (CO), sulphur dioxide (SO_2), nitrogen oxides (NO_x) and volatile organic compounds (VOCs) during the year before last (year X – 2), together with final data for the year three-years previous (year X – 3);
- their anthropogenic greenhouse gas emissions by sources and removals of carbon dioxide by sinks resulting from land-use, land-use change and forestry during the year before last (year X – 2);
- information with regard to the accounting of emissions and removals from land-use, land-use change and forestry, in accordance with Article 3(3) and, where a Member State decides to make use of it, Article 3(4) of the Kyoto Protocol, and the relevant decisions thereunder, for the years between 1990 and the year before last (year X – 2);
- any changes to the information referred to in points (1) to (4) relating to the years between 1990 and the year three-years previous (year X – 3);
- the elements of the national inventory report necessary for the preparation of the Community greenhouse gas inventory report, such as information on the Member State's quality assurance/quality control plan, a general uncertainty evaluation, a general assessment of completeness, and information on recalculations performed.

The reporting requirements for the Member States under Council Decision 280/2004/EC are elaborated in the Commission Decision 2005/166/EC laying down rules implementing Decision 280/2004/EC of the European Parliament and of the Council concerning a mechanism for monitor-ing Community greenhouse gas emissions and for implementing the Kyoto Protocol ([5]). According to the Council decision and the Commission decision 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/2002/8), 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,

([4]) OJ L 49, 19.2.2004, p. 1.
([5]) OJ L 55, 1.3.2005, p. 57.

1997). The use of IPCC (2000) 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

Figure 1.1 shows the inventory system of the European Community. The DG Environment of the European Commission is responsible for preparing the inventory of the European Community (EC) while each Member State is responsible for the preparation of its own inventory which is the basic input for the inventory of the European Community ([6]). DG Environment is supported in the establishment of the inventory by the following main institutions: the European Environment Agency (EEA) and its European Topic Centre on Air and Climate Change (ETC/ACC) as well as the following other DGs of the European Commission: Eurostat, and the Joint Research Centre (JRC) ([7]).

Figure 1.1 Inventory system of the European Community

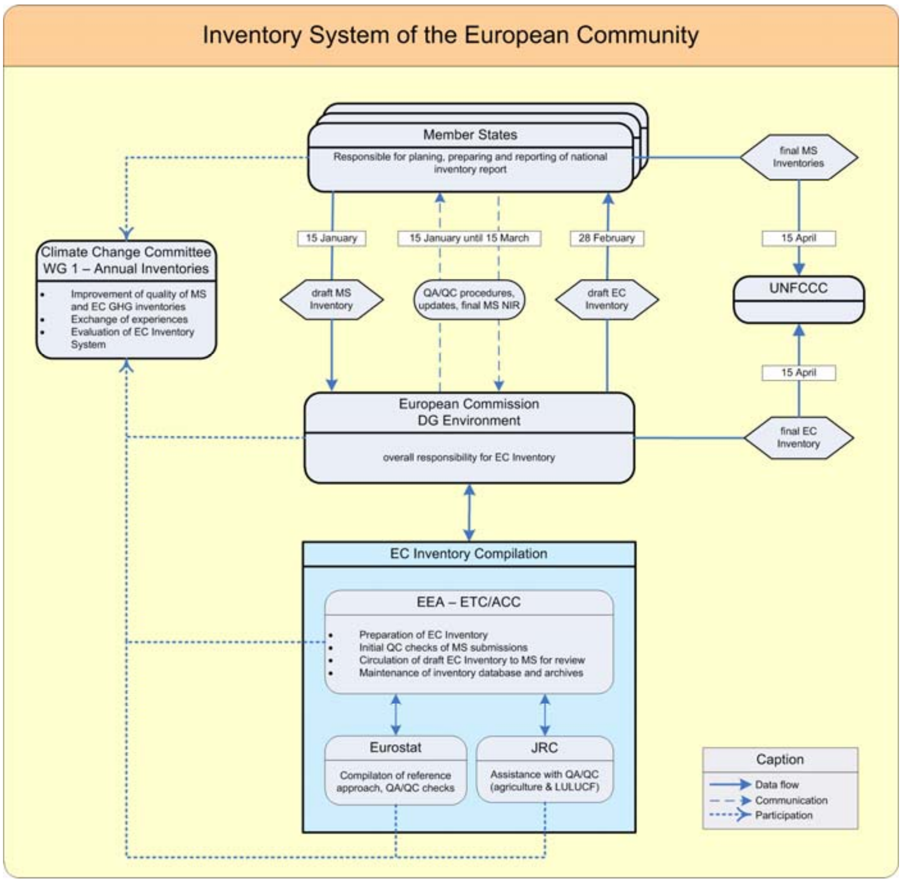


Table 1.1 shows the main institutions and persons involved in the compilation and submission of the EC inventory.

([6]) A draft Staff Working Paper laying down the Community Inventory System will be adopted soon. This paper will specify in more detail the responsibilities of the institutions involved in the preparation of the EC inventory, the preparation of the EC inventory, identification of key categories, estimation of uncertainties, recalculations, response to the UNFCCC review process and QA/QC of the EC inventory report.

([7]) The Statistical Office of the European Communities (Eurostat) and the Joint Research Centre (JRC) are DGs of the European Commission. For simplicity reasons, these institutions are referred to as 'Eurostat' and the 'JRC' in this report.

Table 1.1 List of institutions and experts responsible for the compilation of Member States' inventories and for the preparation of the EC inventory

Member State/EU institution	Contact address
Austria	Manfred Ritter Umweltbundesamt Spittelauer Laende 5, A-1090 Vienna
Belgium	Peter Wittoeck Federal Department of the Environment Pachecolaan 19 PB 5, B-1010 Brussels
Cyprus	Christos Malikkides Head, Industrial Pollution Control Section, Department of Labour Inspection Ministry of Labour and Social Insurance 12, Apellis Street, 1493 Nicosia
Czech Republic	Pavel Fott Czech Hydrometeorological Institute (CHMI) Na Sabatce 17, CZ 14306 Prague 4
Denmark	Jytte Boll Illerup Danish National Environmental Research Institute PO Box 358, DK-4000 Roskilde
Finland	Riitta Pipatti Statistics Finland PB 6 A, FIN-00022 Statistics Finland
France	Ministère de l'Ecologie et du Développement Durable (MEDD) 20 avenue de Ségur, F-75007 Paris Jean-Pierre Fontelle Centre Interprofessionel Technique d'Etudes de la Pollution Atmosphérique (CITEPA) 7 Cité Paradis, F-75010 Paris
Estonia	Jaan-Mati Punning Institute of Ecology at TPU Kevade 2, Tallinn 10137
Germany	Michael Strogies Federal Environmental Agency Bismarckplatz 1, D-14193 Berlin
Greece	Dimitra Koutendaki Institute of Environmental Research and Sustainable Development Athens, Greece
Hungary	László Gáspár Ministry of Environment and Water, department of Climate Policy Fõ u. 44-50, Budapest, 1011 Hungary
Ireland	Michael McGettigan, Paul Duffy Environmental Protection Agency Richview, Clonskeagh Road, Dublin 14, Ireland
Italy	M. Contaldi, R. de Lauretis, D. Romano National Environment Protection Agency (ANPA) Via Vitaliano Brancati 48, I-00144 Rome
Latvia	Agita Gancone Latvian Environment, Geology and Meteorology Agency Maskavas street 165, Riga, LV-1019
Lithuania	Vytautas Krusinskas Lithuanian Ministry of Environment A. Jaksto 4/9, LT 01105 Vilnius
Luxembourg	Frank Thewes Administration de l'Environment, Division Air-Bruit 16 rue Eugène Ruppert, L-2453 Luxembourg
Malta	Sharon.Micallef Malta Environment Planning Authority P.O. Box 200, Marsa GPO 01, Malta
Netherlands	Laurens Brandes Netherlands Environmental Assessment Agency PO Box 303, 3720 AH Bilthoven, The Netherlands
Poland	Krzysztof Olendrzynski Institute of Environmental Protection, National Emission Centre Kolektorska 4, 01-692 Warszawa
Portugal	Teresa Costa Pereira Direccao-Geral do Ambiente Rua da Murgueira — Bairro do Zambujal, P-2721-865 Amadora
Slovakia	Ministry of Environment SR, Department of Air Protection, director Ing. Lubomir ZIAK namestie L. Stura 1, 812 35 Bratislava
Slovenia	Tajda Mekinda Majaron Environmental Agency of the Republic of Slovenia Vojkova 1/b, SI-1000 Ljubljana
Spain	Ángleles Cristóbal

Member State/EU institution	Contact address
	Ministerio de Medio Ambiente Plaza de San Juan de la Cruz s/n, E-28071 Madrid
Sweden	Jessica Andersson Ministry of the Sustainable Development, S-103 33 Stockholm
United Kingdom	JD Watterson National Environmental Technology Centre AEA Technology, Culham, Abingdon, Oxon, OX14 3ED
European Commission	Lars Mueller European Commission, DG Environment Rue de la Loi 200, B-1049 Brussels, Belgium
European Environment Agency (EEA)	Andre Jol, Andreas Barkman European Environment Agency Kongens Nytorv 6, DK-1050 Copenhagen, Denmark
European Topic Centre on Air and Climate Change (ETC/ACC)	Bernd Gugele, Elisabeth Rigler, Manfred Ritter European Topic Centre on Air and Climate Change Umweltbundesamt Spittelauer Laende 5, A-1090 Vienna, Austria
Eurostat	Nikolaos Roubanis Statistical Office of the European Communities (Eurostat), Jean Monnet Building, L-2920 Luxembourg, Luxembourg
Joint Research Centre (JRC)	Frank Raes, Giorgio Matteucci, Adrian Leip Joint Research Centre, Institute for Environment and Sustainability, Climate Change Unit Via Enrico Fermi, I-21020 Ispra (VA), Italy

1.2.1 The Member States

All Member States are Annex I parties to the UNFCCC except Cyprus and Malta. Therefore, all Member States except Cyprus and Malta have committed themselves to prepare individual GHG inventories in accordance with UNFCCC reporting guidelines and to submit those inventories to the UNFCCC secretariat by 15 April. In addition, all Member States (including Cyprus and Malta) are required to report individual GHG inventories prepared in accordance with UNFCCC reporting guidelines to the Commission by 15 January every year under Council Decision 280/2004/EC.

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 28 February 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 Climate Change Committee established under Council Decision No 280/2004/EC. The purpose of the Climate Change Committee is to assist the European Commission in its tasks under Council Decision No 280/2004/EC.

Under Council Decision 280/2004/EC all Member States are required to establish national systems. Table 1.2 summarises the information on national systems/institutional arrangements in the EC Member States.

Table 1.2 Summaries of institutional arrangments/national systems of EC Member States

MS	Content	Source
Austria	**Administration of Austria's reporting obligations*: Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW).*** **Single national entity** (with overall responsibility for preparation of Austria's National GHG Inventory as well as the NIR): ***Umweltbundesamt*** **Legal basis of the national inventory system Austria (NISA):** main basis for NISA is the Austrian Environmental Control Act (ECA) (Umweltkontrollgesetz)(Federal Law Gazette 152/1998), which regulates responsibilities of environmental control in Austria and lists the tasks of the Umweltbundesamt as well as sets the responsibility for inventory preparation. The ECA is also the basis for the outsourcing of the "*Umweltbundesamt GmbH*" (Austrian federal environment agency ltd.) in 1999. Relevant paragraphs for NISA are para 6, 7 and 11. Thus the Umweltbundesamt (Department of Air Emissions) prepares and annually updates the Austrian air emissions inventory ("Österreichische Luftschadstoff-Inventur OLI"), which covers GHG and emissions of other air pollutants as stipulated in further reporting obligations. Responsibilities are divided by sectors between sector experts from Departments within the Umweltbundesamt. The "Inspection body for GHG inventory" within the Umweltbundesamt is responsible for the compilation of the GHG inventory. The QS is maintained relevant and current under the responsibility of the Quality Manager. The Quality Manager within the "Inspection body for GHG inventory" has irrespective of other duties defined authority and responsibility for quality assurance within the inspection body. The Quality Manager has direct access to top management. **Legal arrangements and other agreements:** Besides the ECA there are some other legal and institutional arrangements in place as basis for the national system: • Ordinance to the Austrian Emissions Trading Law ("Emissionszertifikate-Gesetz", Federal Law Gazette 46/2004) that regulates monitoring and reporting in the context of the EU Emissions Trading scheme in Austria; • Ordinance regarding Monitoring and Reporting of GHG Emissions (Verordnung des BMLFUW über die Überwachung und Berichterstattung betreffend Emissionen von Treibhaus-gasen", Federal Law Gazette 458/2004), para 15, is designed to ensure consistency of emission trading data with the NI. It states that the Umweltbundesamt has to incorporate the emission reports of the emissions trading scheme into the national GHG inventory in order to comply with requirements of the EU MM (Dec 280/2004/EC) and the UNFCCC. First data from the EU Emissions Trading scheme will be available for the year 2005; these data will be considered in the National Inventory Report 2007. • *Statistics Austria* is required by contract with the *BMLFUW* and the *Federal Ministry of Economics and Labour (BMWA)* to annually preparation the national energy balance (the contracts also cover some quality aspects)(consistent with the methodology of the OECD and is submitted annually to the IEA. The national energy balance is the most important data basis for the Austrian Air Emissions Inventory. • According to the federal statistics law (Bundesstatistikgesetz, Federal Law Gazette 163/1999), *Statistics Austria* has to prepare annually import/export statistics, production statistics and statistics on agricultural issues, which is an important data basis for calculating emissions from the sectors Industrial Processes, Solvents and Other Product Use and Agriculture. • According to the Act on Protection against Emissions from boiler plants („Emissionsschutzgesetz für Kesselanlagen", Federal Law Gazette 150/2004), para 17, each operator of an boiler plants (thermal capacity ≥ 2 MW) is obligated to report the emissions to the authority. The Umweltbundesamt can request for verification copies of these emission declarations. • The Umweltbundesamt has the possibility to obtain confidential data from *Statistics Austria* (data has to be treaten still confidential) for reporting obligations. Legal basis for this pur-pose is the "Bundesstatistikgesetz", which allows the national statistical office to provide confidential data to authorities that have a legal obligation for the processing of these data. • According to the Landfill Ordinance (Deponieverordnung, Federal Law Gazette 164/1996), operators of landfill sites have to report their activity data annually to the Umwelt-bundesamt, where they are stored in the database for solid waste disposals (Deponiedatenbank). This data is the main data basis for calculating emissions from the sector Waste. • Since 2004 there is also a reporting obligation under the Austrian Fluorinated Compounds (FC)-regulation (Industriegas-Verordnung (HFKW-FKW-SF_6-VO); Federal Law Gazette 447/2002) to the BMLFUW for users of FCs in different use: These data are used for estimating emissions from the consumption of fluorinated compounds.	Austria's National Inventory Report 2006 pp. 16, 18-21 Information according to Art. 23 Dec 2005/166/EC – Draft „Initial Report" Austria (2006) pp. 15-16

MS	Content	Source
Belgium	In the Belgian federal context, major responsibilities related to environment (like compiling GHG emissions inventories) lie with the regions. Each region implements the necessary means to establish their own emission inventory in accordance with the FCCC guidelines. The emission inventories of the three regions are subsequently combined to form the national GHG emission inventory. **Inter-ministerial Conference for the Environment (ICE)** (committee devoted to matters for which intergovernmental co-operation is required for implementing environ. policies) took a series of decisions (Dec. ICE, 07.10.1999, Dec. ICE, 06.03.2002) that clarify the role and responsibilities of different entities, as regards the preparation of the national GHG inventory. The 3 regions are responsible for delivering their GHG inventories, which are later compiled to produce the Belgian GHG inventory. The main regional institutions involved are : a) The *Department Monitoring and Research of the Flemish Environment Agency (VMM)* in the Flemish Region; b) The *Directorate General for natural resources and environment (DGRNE)* in the Walloon Region; c) The *Brussels Institute for the Management of the Environment (BIM-IBGE)* in the Brussels Capital Region. At the **federal level**, *The Directorate General Environment* of the *Federal Public Service Health, Food Chain Safety and Environment (FPS - DG Environment)* participates to the activities of *CCIEP-WG Emissions* (related to GHG inventories). It is also involved in the NI system in the capacity of National Focal Point for the climate change policy. The *Directorate General Energy* of the *Federal Public Service Economy, SMEs, Self-employed and Energy (FPS - DG Energy)* is responsible for the top-down estimation of energy-related CO_2 emissions (IPCC “reference approach” on the basis of the national energy balance). **Single national entity (SNE):** The *Interregional Cell for the Environment (CELINE - IRCEL)* ▪ Regular body of exchange of information between the regions*;* ▪ responsible for collecting the regional estimates of GHG emissions/removals; ▪ responsible for integrating the emission data from the inventories of the three regions and for compiling the national inventory. ▪ established by the Cooperation agreement of 18.05.1994 (modified by dec. 21.05.1995) about the monitoring of emissions in the atmosphere and the structuring of data. **Permanent secretariat and the National Focal Point:** ***Working group on Emissions of the Co-ordination Committee for international environmental policy (CCIEP)***: principal organ for coordinating international environmental policy (all technical aspects of the GHG inventory, organizational aspects of the preparation process, CRF-submission, other reporting requirements (like NIR), responses to the review process, forum for the process of improvement). **General responsibility for establishment, execution and monitoring of the National Climate Plan and for fulfilling the reporting:** ***The National Climate Commission*** (Co-operation agreement; composed of representatives of each party; obligations according UNFCCC and KP; approval of the inventory reports). The *Permanent secretariat of the National Climate Commission (Permanent secretariat)* assists the *National Climate Commission*. Specific activities of the *Permanent secretariat* (regarding GHG inventories) such as support to the *WG Emissions* for the preparation of the national GHG inventory, are foreseen. Because the *Permanent secretariat* is not yet in place, it is still premature to detail its possible implication in the preparation of the GHG inventory.	Belgium's National GHG Inventory (1990 – 2004) pp.6-7 Belgium's National Inventory System, 2006 pp.7-8
Cyprus		
Czech Republic	**Arrangement of institutions** co-operating on national GHG inventory is given by NI System - NIS, which was established in accordance with Dec. 280/2004/EC, Art. 4.4 **Single national entity:** *Czech Hydrometeorological Institute (CHMI)*: with overall responsibility for the national GHG inventory, founded by and under supervision of *Ministry of Environment*. Main task of CHMI is inventory management, general and crosscutting issues, QA/QC, communication with relevant UNFCCC and EU bodies etc. Official submission of national GHG Inventory is prepared by *CHMI* and approved by *Ministry of Environment*. Moreover, *Ministry of Environment* secures contacts with other relevant governmental bodies, like *Czech Statistical Office, Ministry of Industry and Trade and Ministry of Agriculture*. Sectoral inventories are prepared by sectoral compilers (sectoral experts) from sector-specialist institutions, which are coordinated and controlled by *CHMI*. Responsibilities for GHG inventory compilation from individual sectors are allocated in this way: a) *KONEKO marketing*, Praha, is responsible for the inventory compilation in the sector 1 Energy, namely for stationary sources including fugitive emissions b) *Centre for Transport Research (CDV)*, Brno, is responsible for the inventory compilation in the sector 1 Energy, namely for mobile sources c) *Czech Hydrometeorological Institute (CHMI)*, Praha, is responsible for the inventory compilation d) *Institute of Forestry Ecosystem Research (IFER)*, Jilove u Prahy, is responsible for the inventory compilation in sectors 4, 5 Agriculture and Land Use Change and Forestry e) *Charles University Environment Centre (CUEC)*, Praha, is responsible for the inventory compilation in sector 6 Waste	National green-house gas invent-tory 1990-2004. NIR 2006. p. 14

MS	Content	Source
Denmark	**Designated entity & responsible for the preparation and submission***:* National Environmental Research Institute (NERI) under the ***Danish Ministry of Environment*** NERI participates in meetings in the Conference of Parties (COP) to the UNFCCC and its subsidiary bodies, where the reporting rules are negotiated and settled. Furthermore NERI participates in the EU MM on GHG, where the guidelines and methodologies on inventories to be prepared by the EU member states are regulated. The work concerning the annual greenhouse emission inventory is carried out in co-operation with other Danish ministries, research institutes, organisations and companies**:** a) *Danish Energy Authority, The Ministry of Economic and Business Affairs:* Annual energy statistics in a format suitable for the emission inventory work and fuel use data for the LCPs. b) *Danish Environmental Protection Agency, The Ministry of the Environment:* Database on waste and emissions of the F-gases c) *Statistics Denmark, The Ministry of Economic and Business Affairs:* Statistical yearbook, Sales Statistics for manufacturing industries and agricultural statistics. d) *Danish Institute of Agricultural Sciences, The Ministry of Food, Agriculture and Fisheries*: Data on use of mineral fertiliser, feeding stuff consumption, nitrogen turnover in animals. e) *The Road Directorate, The Ministry of Transport:* Number of vehicles grouped in categories corresponding to the EU classification, mileage, trip speed. f) *Danish Centre for Forest, Landscape and Planning, The Royal Veterinary and Agricultural University:* Background data for Forestry and CO_2 uptake by forest. g) Civil Aviation Agency of Denmark, The Ministry of Transport: City-pair flight data (aircraft type and origin and destination airports) for all flights leaving major Danish airports. h) *Danish Railways, The Ministry of Transport:* Fuel related emission factors for diesel locomotives. i) *Danish companies:* Audited Green accounts and direct information gathered from producers and agency enterprises Formerly the providing of data was on a voluntary basis but more formal agreements are now being worked out.	Denmark's National Inventory Report 2006 p.26
Estonia	**National Authority for the inventory:** The current inventory report is compiled by team of researches from the *Institute of Ecology at Tallinn University and Tallinn Technical University*. Eight specialists were involved in this work. Most of them have long experience since 1993 when a new project, Estonian Country Study, was initiated within the U.S. Country Studies Program. In 1994 an *Interministerial Committee of Climate Change* was created at the Estonian Government. The Chairman of this Committee is the *Minister of the Environment* and members are from key ministries, scientists as well as representatives of NGOs. This Committee deals with the problems connected with the implementation of UN FCCC, organises monitoring of emissions of GHG, national communications etc. **Organisation:** The Ministry of the Environment organizes the practical providing of GHG inventories. Financial resources for this purpose are planned in the State Budget. Practical work has been done on the basis of contracts. The Institute of Ecology at Tallinn University is responsible for the inventories and National Communications under contract to the Ministry of the Environment in Estonia. The Institute of Ecology informs regularly the Ministry of the Environment as well as the Interministerial Committee about advances and problems. The inventory report (2006) was in practice compiled by a team of researchers from the *Institute of Ecology at Tallinn University* and *Tallinn University of Technology*.	GHG Emissions in Estonia 1990–2004 National Inventory Report p.8 Report pursuant to Art. 3(1) of Monitoring Decision 2006 Estonia p. 4

MS	Content	Source
Finland	**Responsibilities of the National Authority for Finland's GHG inventory: *Statistics Finland*** (Government resolution, 30.01.2003 on the organisation of climate policy activities of Government authorities, 2005). The national system is based on regulations concerning *Statistics Finland*, on agreement between the inventory unit and expert organisations on the production of emission estimates and reports as well as on co-operation between the responsible ministries. The National System is designed and operated to ensure the transparency, consistency, comparability, completeness, accuracy and timeliness of GHG emission inventories. The quality requirements are fulfilled by implementing consistently the inventory quality management procedures. ***Statistics Finland* as the National Authority for the inventory** • is the general authority of the official statistics of Finland and is independently responsible for GHG emission inventory preparation, reporting and submission to the UNFCCC. In its activity as the National Authority for the GHG inventory the *Statistics Finland* Act and the Statistics Act are applied. • defines the placement of the inventory functions in its working order. An advisory board of the GHG inventory set up by the *Statistics Finland* reviews the achieved quality of the inventory and decides about changes to the inventory's division of labour as agreed for the reporting sectors. In addition, the advisory board supervises longer term research and review projects related to the development of the inventory and reporting, as well as the responsibilities of international co-operation in this area (UNFCCC, IPCC, EU). The advisory board is composed of representatives from the expert organisations and the responsible Government ministries. • is in charge of the compilation of the national emission inventory and its quality management in the manner intended in the KP and bears the responsibility for the general administration of the inventory and communication with the UNFCCC, as well as publishes and archives the inventory results. • coordinates participation in reviews, . **Responsibilities of expert organisations:** Finland's inventory system includes in addition to *Statistics Finland* the expert organisations that take part in the emission calculation. With regard to this co-operation, separate agreements are made with *the Finnish Environment Institute, MTT Agrifood Research Finland* and the *Finnish Forest Research Institute*. *Statistics Finland* also acquires parts of the inventory as a purchased service. The agreements confirm the division of responsibilities recorded in so-called reporting protocols and they specify the procedures for the annual emission calculation and quality management co-ordinated by *Statistics Finland*. The reporting protocols are based on the areas of responsibility of the different expert organisations and on Finland's established practice for the preparation and compilation of the GHG emission inventory (responsibilities to reporting sectors are also defined in the protocols). **The role of responsible ministries in the national system:** The resources of the National System for the participating expert organisations are channelled through the relevant ministries' performance guidance (*Ministry of the Environment and Ministry of Agriculture and Forestry*). In addition, other ministries participating in preparation of the climate policy advance in their administrative branch (data collected in management of public administration duties can be used in the emission inventory). In accordance with the Government resolution, the ministries produce the data needed for international reporting on the content, enforcement and effects of the climate strategy. *Statistics Finland* assists in the technical preparation of the policy reporting. *Statistics Finland* compile technically the fourth National Communication for the year 2005 for the UNFCCC. Separate agreements have been made on division of responsibilities and cooperation between *Statistics Finland* and the ministries.	GHG Emissions in Finland 1990-2004 National Inventory Report to the European Union 15 January 2006 pp. 12-13
France	**Single national entity (SNE) and responsible of compiling the National Inventory System (système national d'inventaire; SNIEPA) of France: *Ministry of ecology and sustainable development (Ministère de l'Ecologie et du Développement Durable; MEDD):*** • coordinates all tasks regarding SNIEPA in particular institutional, legal procedural dispositions. • builds up and administrates a network of different institutions • is responsible for technical decision (methods, activity data, data management,…), for observing the international standards, for submitting to EU and UNFCCC • is assisted by *CITEPA (Centre Interprofessionnel Technique d'Etudes de la Pollution Atmosphérique)*. • administrates the ***Groupe de coordination et d'information sur les inventaires d'émission (GCIIE)*(** results, methodology, improvements, recommendations, research projects) The ***"Groupe de coordination et d'information sur les inventaires d'émission" (GCIIE)*** gives expert statements to different topics of SNIEPA and is composed by represents of: (1) *Mission Interministérielle à l'Effet de Serre (MIES*), directly responsible to MEDD, (2) *Ministère chargé de l'agriculture (MAP)*, especially the sections 'Service central des enquêtes et études statistiques' (SCEES), 'Direction générale de la forêt et des affaires rurales' (DGFAR), 'Direction des politiques économique et internationale' (DPEI), 'Office national des forêts' (ONF), 'Inventaire forestier national' (IFN) (3) *Ministère chargé de l'économie et de l'industrie (MINEFI*), especially the sections 'direction générale de l'INSEE', 'Direction générale de l'Energie et des Matières Premières' (DGEMP), ' Direction générale du Trésor et de la politique économique' (DGTPE), ' Direction générale des entreprises' (DGE) (4) *Ministère Ministère chargé de l'équipement, de l'urbanisme et des transports (MTETM):* especially the sections 'Direction des affaires économiques et internationales' (DAEI), 'Direction générale de l'aviation civile' (DGAC), 'Direction générale de la mer et des transports' (DGMT), 'Direction de la sécurité et de la circulation routières' (DSCR), 'Direction générale de l'urbanisme, de l'habitat et de la construction' (DGUHC), 'Centre d'études et de recherche des transports urbains' (CERTU), (5) *Ministère chargé de l'environnement (MEDD)* especially the sections 'Direction de la prévention des pollutions et des risques' (DPPR), 'Direction des études économiques et de l'évaluation environnementale' (D4E)	Inventaire des emissions de gaz à effet de serre en France au titre de la convention cadre des nations unies sur les change-ments climatiques, déc. 2005 pp.19-21

MS	Content	Source
Germany	**Single National Entity (SNE)**: ***Federal Environmental Agency (UBA), Section I 4.6*** ▪ enacted by the directive of the UBA (Hausanordnung) 11/2005 ▪ is the co-ordinating office of the National System; is charged with serving as the central point of contact and information for all participants in the National System. **Involved institutions and agencies:** (1) *Federal Environmental Agency (UBA)* • Working Gr. on Emissions Inventories: co-ordinates relevant work within the UBA and will incorporate all UBA employees who are involved in inventory preparation. • Working Gr. on Emissions Reporting: founded within "CO_2 Reduction Interministerial Work. Gr." (2002)(implementing emissions-reporting requirements within federal agencies. (2) *Federal Ministry of the Environment, Nature Conservation and Nuclear Safety (BMU)* • Coordinates interministerial discussion on central tasks in emissions inventories. Plans call for *Working Group on Emissions Reporting* to meet three times annually. • Working Group VI will focus on discussing possibilities for institutionalising the Kyoto requirements – for example via an act on implementation. (3) *Federal Ministry for Consumer Protection, Food and Agriculture (BMVEL)* and *German Federal Agricultural Research Centre (FAL)*: provides data on agriculture and forestry (relevant specialised competence)(Rahmen-Ressortvereinbarung BMELV / BMU). (4) *Länder Committee on Immission Protection (LAI):* presents German Länder. This is required for validation of the Energy Balance of Germany with the energy balances of the Länder, as well as for the process for verification of Federal and Länder emissions inventories. (5) *German Institute for Economic Research (DIW)*, which prepares the Energy Balance of Germany on behalf of the *Working Group on Energy Balances* (AGEB). (6) Involvement of *associations* and *other independent organisations* has been achieved via the sections of UBA divisions I and III; specialist departments are supported by SNE in discussion of reporting requirements and in determination of requirements for data-sharing by associations. **Agreements as well as research and development projects:** • Framework departmental agreement (02.04.2001) between *Federal Ministry of Consumer Protection, Food and Agriculture (BMVEL)* and *BMU* marked the first-ever inter-departmental agreement on co-operation in calculation of emissions (data and information exchange and the operation of a joint database on emissions from agriculture). • UFOPLAN framework: Inventory preparation has always made use of the expertise of research institutions (overarching projects on specific issues. Since UFOPLAN 2002, SNE has had a global project on updating emissions-calculation methods; individual measures for improving inventories are initiated and financed via establishment of sub-projects. • Separate budget position for the National System has been established within the UBA as of 2005 (Title 526 02, Chapter 1605, No. 4.15) for research/studies within a short-time. F**ramework conditions for inventory preparation**: establishing a Quality System for Emissions Inventories (QSE); operating the database of the UBA Central System on Emissions (CSE) (central storage of all information required for emissions calculation, main instrument for documentation and quality assurance at the data level); binding schedule.	National GHG Inventory Report 2006 pp.43-45

MS	Content	Source
Greece	**Overall responsibility for the national GHG inventory:** ***Ministry for the Environment, Physical Planning and Public Works*** *(Department of International Relations and EU Affairs)*(according to the Presidential Decree 51/1988). The Ministry is responsible for • the development and implementation of environmental policy, as well as for the provision of information concerning the state of the environment; • the co-ordination of all involved ministries, public or private organization, in relation to the implementation of the provisions of the KP (Law 3017/2002); • the official consideration and approval of the inventory prior to its submission. A committee has been set up within the Ministry, aiming at the monitoring of the inventory preparation/compilation process so as to officially consider and approve the GHG inventory prior to its submission and ensure its timely submission; • the operation of the National System and decides on the necessary arrangements to ensure compliance with relevant decisions of the COP and the COP/MOP. **Designated / Contracting party:** *National Observatory of Athens (NOA)* • has been designated by the Ministry for Environment • has the overall technical responsibility for the compilation of the NI (choice of methodology, data collection, processing and archiving, implementation of quality control procedures); • Co-operates with the following government agencies and other entities for the preparation of the inventory as those agencies and entities develop and maintain statistical data necessary for the estimation of GHG emissions / removals; co-operation is not restricted to data collection but is also concerns methodological issues as appropriate: a) *Ministry for the Environmet, Physical Planning and Public Works* (information & data: LCP, solid waste management, domestic wastewater handling practices) b) *National Statistical Service of Greece (NSSG) (*supervised by the *Ministry of Economy and Finance*, represents the main source of information for the estimation of emissions / removals from most of the IPCC source / sink categories) c) *Ministry for Development* (responsible for reporting and maintaining annual statistical data for energy consumption and production as well as for providing those data to international organizations such as the International Energy Agency (IEA), the European Statistical Service EUROSTAT, etc.) d) *Ministry of Rural Development and Food* (information and data for the main indices and parameters of the rural economy) e) *Ministry of Transport and Communication* (information and data for the vehicle fleet and its technical characteristics) f) *Civil Aviation Agency* *g) Public Power Corporation* *h) Industrial installations* (handling confidentiality issues) Further development of formal arrangements for the specification of the roles of and the co-operation between government agencies and other entities involved in the preparation of annual inventory is in progress. Additionally, procedures involving the *Ministry (Department of International Relations and EU Affairs)*, the *National Observatory of Athens* and any government agency or other entity, have been established for providing responses to any issues raised by the inventory review process.	Greece – National Inventory Report 2006 pp. 5-7 Climate Change Emission Inventory 2006 pp.3-4
Hungary	Until 1997 the inventory had been prepared by System expert Ltd. As from 1998 the background institution of the **Ministry of Environment and Water, the Directorate for Environmental Protection of the Institute for Environmental Management (KGI)** is in charge of this task. Initially the job was done by the **Air-Cleaning Protection Department (LTVO)** of the Directorate, then, as from 2003, the department was restructured into **Convention on Climate Change Department (ÉvEO)**, and has taken over this task as well. As from 1 April 2004, following a reorganisation at department level, the inventory is prepared by the **National Directorate for Environment, Nature and Water (OKTVF)**, where ÉvEO still operates within **the Directorate for Environmental Protection**. As a result of further reorganisations, as from 1 January 2005, ÉvEO ceased to exist. Some of the employees making the inventory have a decade of experience in preparing emissions inventories. The inventory of the year under review is prepared by LTVO with the assistance of colleagues working in other departments of the Directorate plus an outside expert. Agricultural data are completed by the **Research Institute for Animal Breeding and Nutrition**. As the base years comprise the average of three years, we have also created independent inventories for each year and filled in the tables of the base years with the average values thereof. The resources for inventory-making are still quite restricted. As from 2004, two full-time employees are in charge of this work, assisted by 3-4 professional desk officers part time (for 1 to 2 months annually).	Hungary - National Iventory Report for 2004 p.9

MS	Content	Source
Ireland	**Responsibility for the compilation and reporting of emissions data:** ***Inventory Agency (EPA)***(established in 1992)***:*** ▪ designated by Department of the Environment Heritage and Local Government (DEHLG) ▪ EPA Agency's Office of Environmental Assessment compiles the national greenhouse gas emission inventories on behalf of DEHLG for submission ▪ EPA is required to establish and maintain databases of information on the environment and to disseminate such information to interested parties (Sections 52 EPA Act, 1992); ▪ EPA must provide, of its own volition or upon request, information and advice to Ministers of the Government in the performance of their duties (Sections 55 EPA Act, 1992); which includes making available such data and materials as are necessary to comply with Ireland's reporting obligations and commitments within the framework of international agreements. ▪ EPA performs the key inventory compilation functions including collecting data from a wide range of suppliers, selecting appropriate emission estimation methods according to IPCC guidance, compiling the inventory, undertaking QA/QC procedures and preparation of reports to the EC and UNFCCC on behalf of the Irish Government. The Agency role is expanding to cover activities related to NIS implementation. **Formal inter-institutional network:** The National Inventory System (NIS) of Ireland establishes the process of GHG inventory data compilation, and reporting as a formal inter-institutional network, clearly designating the responsibilities to the GHG inventory preparation process across *Government Departments*, *national agencies* and other *stakeholder groups*. Previously, the **EPA** has led on all GHG inventory related activities and the involvement of Government Departments and other stakeholders has been on a predominantly informal basis. The development of a *functional Inventory Review Group* to manage and support the GHG improvement process has been initiated through increased involvement of KDP contacts in the inventory compilation process. Increased in-country review mechanisms are under development. During 2005 the EPA contracted UK consultants NETCEN to undertake a scoping study to identify the essential elements and structure of a NIS for Ireland to meet the needs of Dec. 280/2004/EC and Kyoto Protocol. The report describes how institutional arrangements among the EPA, DEHLG and other stakeholders may be reorganised, extended and legally consolidated across all participating institutions to strengthen inventory capacity within the Agency and ensure that more formal and comprehensive mechanisms of data collection and processing are established for long term implementation. It is prescribed how current arrangements can be enhanced within the existing statutory framework according to a plan of action that will make the system operational by the end of 2005, thereby meeting one of the key requirements set down in Decision 280/2004/EC. The scoping report also gives recommendations on internal inventory review and a database system to facilitate more efficient data management and reporting. **Involved institutions in compiling Irish emission inventories:** ▪ energy balance statistics from *Sustainable Energy Ireland (SEI)*; ▪ agricultural statistics are obtained from the *Department of Agriculture and Food (DAF)* and from the *Central Statistics Office (CSO)*; ▪ additional inputs by contributions from *specific energy and industrial sub-sectors* and by information from some of the EPA databases.	Ireland National Inventory Report 2006 pp.5-6,10 Ireland - Report on the Determination of the Assigned Amount pp.6-8
Italy	**Responsible for the compilation of the National Air Emission Inventory:** ***Agency for the Protection of the Environment and for Technical Services (APAT)*** recognized by the competent Ministries and Administrations. In particular, as *National Reference Centre of the European Environment Agency (EEA)*, *APAT* is required to prepare the national atmospheric emission inventory in order to ensure compliance with international commitments concerning the protection of the environment. The Italian GHG inventory is compiled and updated annually by the *APAT* and officially communicated to the UNFCCC and EU, after endorsement by the *Ministry for the Environment and Territory*. Although there is not an official National System in place, different institutions responsible for statistical data flow and publication are part of a National Statistical System (SISTAN) and therefore are asked periodically to update statistics; in spite of that, problems regarding timeliness and lack of transparency still occur. In the next months, APAT, on behalf of the *Ministry for the Environment and Territory*, will draft a plan for the establishment of a robust national system (building on the base of SISTAN), with a sound legal basis at a later stage. Italy is undertaking the actions to develop a national emission inventory system, National System, which involves and attributes specific roles and responsibilities to the different institutions which should collect and communicate basic data necessarily and timely for the GHG inventory.	Italian Greenhouse Gas Inventory 1990-2003 - National Inventory Report 2005 p. 18
Latvia	**Institutions responsible for the Latvian GHG inventory:** (1) ***LEGMA*** is a governmental institution under the supervision of the *Ministry of Environment of the Republic of Latvia* and is responsible for preparing GHG inventory. Activity data, mainly collected from other institutions, is used by *LEGMA (Environment Quality Division)* to calculate emissions. (2) *Central Statistical Bureau of Latvia (CSB)* is main data supplier for the air emission inventory; *LEGMA* has signed a special agreement with CSB about supplying the necessary data. (3) The *Ministry of Agriculture (MoA)* is responsible for performing emission calculations for the LULUCF sector. Responsible institutions designated by the Ordinance of the Cabinet of Ministers No 220 approving the Climate change mitigation programme 2005 - 2010. **Schedule:** deadline (01.11.) for submitting data (activity data, description, CO_2 removals, emissions from LULUCF) to *LEGMA* for all institutions involved in NIS; only final data regarding fuel consumption was received until 30 of November when CSB prepared Energy balances for EUROSTAT according to additional agreement. For the submission of 2006 this process was done for the first time. **Workshops:** During 2005 three workshops were organized for experts from the institutions involved in NIS, explaining the procedure for preparing and submitting the necessary activity data for each sector and sub-sector, as well as providing information about quality assurance and quality control issues.	Latvia's National Iventory Report 1990 – 2004 pp.8-9

MS	Content	Source
Lithuania	**Preparation of the GHG inventory: *Air Division of the Environment Quality Department, Ministry of Environment*.** It is based on statistics collected from the following sources: a) *Statistics of Lithuania* (Statistical Yearbooks of Lithuania, sectoral yearbooks on energy balance, agriculture, commodities, natural resources and environmental protection) b) *Ministry of Environment, State Forest Survey Service* (Lithuanian Statistical Yearbook of Forestry) c) *Environmental Protection Agency (* wastewater and waste data) **Responsibility: *Environment Protection Agency (EPA)*** is a subsidiary institution of the *Ministry of Environment*. It is responsible, among others, for environmental quality monitoring, gathering and storing of environmental data and information as well as for assessment and prognosis of environmental quality. One of the main task of the *EPA* is managing, processing and reporting of information. So far the development and preparation of the GHG inventory has been the responsibility of a single person with other tasks at the *Air Division*. Reports (CRF and NIR) to the UNFCCC Secretariat were prepared with assistance of EU PHARE project EUROPEAID/112892/D/SV/LT/4 "Strengthening of institutional capacity to implement EU requirements on chemicals, GMO, IPPC and GHG". This project was implemented by national and foreign experts. The NIR contained the data on emission trends for 1990, 1998, 2001 and 2002. In 2005, this report was renewed by the data on emission trends for 2003 by experts from the *Air Division of the Department of the Environmental Quality of the Ministry of Environment*. Recently in Lithuania, the establishment of National Inventory System (NIS) is approaching its completion with finances of *Lithuanian Environment Investment Fund (LEIF)* and setting up of *NIR preparation group (Inventory Group)* which will consist of experts from various branches of economy as well as institutions of science and studies. The Group's work will be co-ordinated by the *Head of the Air Division of the Department of Environmental Quality of the Ministry of Environment* who at the same time is the country's UNFCCC focal point. The work of the Inventory Group is defined by the *Air Division of the Department of Environmental Quality of the Ministry of Environment and National Climate Change Committee*. A work performance scheme and plan have been set with Group's participants and relevant institutions as well as with required experts. Future NIR's submitted by the Group will be discussed and approved at the sittings of *National Climate Change Committee*. **Close cooperation of NIR preparation group (Inventory Group)** is anticipated with ▪ *Air Division of the Department of Environmental Quality of the Ministry of Environment*, ▪ *Institutions of branches of economy*, ▪ *Department of Statistics*. LULUCF sector: extensive use will be made of annual statistics, participation and expert appraisal of agricultural specialists and foresters, results of CORINE land-cover project, experience and knowledge of the *Institute of Ecology of Vilnius University, Laboratory of Avian Ecology, Group of Geoinformation Systems* with the aim to obtain the most exact and newest data available in Lithuania.	National GHG Emission Inventory Report of the Republic of Lithuania 2006 pp.9-10 National GHG Emission Inventory Report of the Republic of Lithuania 2005 p.9
Luxembourg	**Preparation of the GHG inventory:** if, officially, it is the *Ministry of the Environment* that is responsible for reporting the NIR/CRF to the EU and the UNFCCC Secretariat, the compilation, the maintenance and the monitoring of the national GHG inventory is actually performed by the Division *Air/Noise* of the *Environment Administration*. (law of 27 November 1980 on the setting up of an Environment Administration). This Administration, which works under the authority of the *Ministry of the Environment*, also prepares the NIR and fills the CRF. Inventories are stored both at the Administration and at the Ministry. **Collaboration with other bodies:** data used to produce the annual greenhouse gas inventories are mainly coming from information supplied directly by the operators of industrial or other activities, taken from official statistical datasets calculated by the National Statistics Office (Statec) and extracted from statistical information received from other ministries (for example Ministry for Economic Affairs for energy use). However, some of the information needed to realize the inventories is not available in Luxembourg, e.g. emission factors. In these cases, data from other European countries or from the literature were taken as default data. So far, the calculation of the inventories is done by the *Environment Administration* on its own, without other public or third-party help.	National Inventory Report 1990-2003 Luxembourg p.3
Malta		

MS	Content	Source
Netherlands	**Overall responsibility for climate change policy issues:** The *Ministry of Housing, Spatial Planning and the Environment (VROM)* is responsible for reporting the NIR/CRF to the EU and UNFCCC. The Netherlands *Environmental Assessment Agency (MNP)* has been designated agency to compile and maintain the national GHG inventory and to co-ordinate the preparation of the NIR and filling the CRF. **Responsibility for 'designing the National System':** *SenterNovem* co-ordinates the in 2001 implemented monitoring improvement programme (adapting the GHG inventory system to meet the requirements for National Systems under KP). The results of the programme are implemented in the ER as a part of the National System for the GHG inventory. NI **Entity (NIE):** *SenterNovem*, assigned by the *Ministry of VROM* (2004) with executive tasks in connection with the NIE required by the KP **Responsibility for emission estimates:** *MNP* (by order of *the ministry of VROM*) is responsible for the co-ordination of the *Pollutant Emission Register (PER)* which is in operation in The Netherlands since 1974. PER encompasses the process of data collection, data processing, registering and reporting emission data for some 170 policy-relevant compounds and compound groups that are present in the air, water and soil. The emission data are produced in an annual (project) cycle. PER is also the basis for the national GHG inventory. Outsourcing reasons are clearer definition and distinction of responsibilities as well as a concentration of tasks. **Main objective of the *ER*:** Produce an annual set of unequivocal emission data, which are up-to-date, complete, transparent, comparable, consistent and accurate. Since mid-2005 EP prepares the NIR (before done by *MNP*). Most institutes or external agencies contribute to the PER by performing calculations or submitting activity data, contribute to the NIR also. Institutes contributing to the PER: a) *MNP*, *b) CBS (Statistics Netherlands)*, *c) RIZA (Institute for Inland Water Management)* *d) TNO (Netherlands Organisation for Applied Scientific Research)* *e) SenterNovem* f) several institutes related to *Wageningen University and Research Centre (WUR).*	National Inventory Report 2006 Netherlands p.3
Poland	**Commissioned to carry the inventory:** ***National Emission Centre (NEC)*** at the *Institute of Environmental Protection* (Warsaw); since 2000, NEC has been commissioned by the *Polish Ministry of Environment - MoE* to carry out inventories for the GHGs and other air pollutants. **Collaborating with a number of individual experts as well as collaborating institutions**: a) *Central Statistical Office (GUS),* b) *Institute of Ecology of Industrial Areas (IETU)(Katowice),* c) *Institute of Automobile Transport (ITS)(Warsaw),* d) *Agency of Energy Market (ARE).*	National Inventory Report 2004 Poland p.6
Portugal	**National entity:** ***Institute for Environment (Instituto do Ambiente/Ministry for Environment and Land-Use Planning (Ministério do Ambiente e do Ordenamento do Território*** • is responsible for the overall coordination of the Portuguese inventory of air pollutants emissions; • makes an annual compilation of the Portuguese Inventory of air emissions which includes GHGs and sinks, acidifying substances as well as other pollutants; • is also responsible for the reporting obligations to the EU and the international instances; • performs all emission calculations while INVENTAR provides technical advice concerning all aspects of inventory development. **Contracting party by IA:** *a) INVENTAR (InventAr, Estudos e Projectos Unip Lda)* • to organize the inventory; • to perform emission estimates (in close collaboration with the IA) and to elaborate the National Inventory Report, as well as CRF and NFR tables; • providing technical advice concerning all aspects of inventory development methodologies, methodological improvements, sources of information and emission factors; • responsible for the elaboration of the uncertainty analysis. *b) ECOPROGRESSO, Consultores em Ambiente e Desenvolvimento,* 1. to develop and implement the Quality Control (QC) tier 2. However many other institutions and agencies contributed to the inventory process, providing activity data, sectoral expert judgement, technical support and comments.	Portuguese National Inventory Report on GHG, 1990 – 2004, draft p.4

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Slovakia	**Legal guarantor of report : *Ministry of the Environment*** and **Expert guarantor of report: *Slovak Hydrometeorological Institute*** Setting up a NI system (NIS) of emissions in compliance with the KP and CD 280/2004/EC is the priority of capacity development in Slovakia at all levels identified also as a middle-term objective (2003-2007) of the Strategy towards the Kyoto commitments. The basic characteristics of the capacity building the NIS are follows: • to define a NIS (institutions, competences), which will group the experts from all sectors according to IPCC (NFP, SNE, scientific institutions, universities, research institutes, private sector, non-governmental organisations, Statistical Office...), • to establish an independent working unit entitled the Single National Entity (SNE), which will coordinate the NIS and have competencies and responsibilities stipulated by law. The SNE will be controlled directly by NFP (MŽP SR), including financial resources, • the SNE should interlink all stakeholders at the horizontal level with regard to expert, financial, legal and information issues. The SNE should also be responsible for achieving the commitments under the UNFCCC and KP in the field of reporting, assessment and providing information to all stakeholders, administration of national databases (NEIS, IPPC – air, NEC directive, EPER), implementation of QA/QC process, accreditation and certification, organisation of „cross-country“ meetings and communication with international organisations, • to appoint experts or organisations for each IPCC sector or gas, and explicitly determine their responsibilities; to appoint a team for the work on national communications, modeling and projections of emissions (RAINS, CAFE) in the sense of keeping consistency, reproducibility and transparency, • to obtain dedicated continuous financial sources also for further improvements from the state budget for sustainable fulfilling of commitments (UNFCCC and KP) • to determine the competencies of the NIS and the operators of polluting sources, with regard to the manipulation and dissemination of information. Actually under development (already prepared Terms of Reference and allocated financial resources) the project of the *Slovak Ministry of the Environment* aimed at proposal of national integrated system of inventory and projections of GHG emissions. The project will be carried out in two phases – after the first phase focused on methodological and organisational aspects will in the second one the project aimed at proposal and implementation of required QA/QC parameters and procedures for GHG emission inventory.	Slovak Republic, Annual Report 2006 p.5
Slovenia	**Responsibility for preparing GHG inventory: *Environmental Agency of the Republic of Slovenia***. In accordance with its tasks and obligations to international institutions, the Environmental Agency is charged with making inventories of GHG emissions as well as emissions that are defined LRTAP. The Environmental Agency has increased the number of its staff. In making the inventories, the Environmental Agency cooperates with numerous other institutions and administrative bodies which relay the necessary activity data and other necessary data for making the inventories. a) *Statistical Office of the Republic of Slovenia* b) *Ministry of Environment,* c) *Ministry of Environment and Spatial Planning* d) *Slovenian Agriculture Institute:* emissions from Agriculture e) *Slovenian Forestry Institute*: sinks in the Land Use Change and Forestry sector The Environmental Agency obtains much of its data through other activities, which it performs under the Environmental Protection Act.	Slovenia's National Inventory Report 2006 pp.13-14
Spain	**Maintaining and developing the National Emissions Inventories into the Atmosphere (Inventarios Nacionales de Emisiones a la Atmósfera): *Directorate-General for Environmental Quality and Assessment at the Spanish Ministry of the Environment.*** The fulfilment of the CRF tables is effected on the basis of the pertinent data available in the National Emissions Inventories into the Atmosphere (Inventarios Nacionales de Emisiones a la Atmósfera).	GHG Emissions Inventories Report from Spain 1990-2003 p. 3
Sweden	**Overall responsibility:** *Swedish Ministry of Sustainable Development* submits the inventory report to the EC and to the UNFCCC. **Co-ordination of activities for developing the inventory report** by the *Swedish Environmental Protection Agency (Swedish EPA),* which is also responsible for the final quality control and quality assurance of the data before the report is submitted. **Consortium** called ***Swedish Environmental Emissions Data (SMED)***: composed of *Statistics Sweden*, the *Swedish Meteorological and Hydrological Institute (SMHI)*, the *Swedish Environmental Research Institute AB (IVL) (data* collection and calculations of emissions for the sectors: energy, industrial processes, solvents and other product use, agriculture, waste. The *Swedish University of Agricultural Sciences (SLU)* is involved in calculating emissions and removals for the sector Land Use, Land Use Change and Forestry (LULUCF). From the first of January 2006 *SLU* is also part of the consortium *SMED*. A national system meeting the requirements is under development and includes institutional arrangements and will be fully operational in 2006.	Sweden's National Inventory Report 2006 pp.26-27

MS	Content	Source
UK	**Single National Entity:** ***UK Government Department of Environment, Food and Rural Affairs (Defra)*** • has been confirmed in writing to the UN Executive Secretary and has overall responsibility for the UK GHG Inventory and the UK National System • carries out this function on behalf of *Her Majesty's Government and the Devolved Administrations* (Wales, Scotland and Northern Ireland). • is responsible for the institutional, legal and procedural arrangements for the national system and for the strategic development of the NI. • responsibilities administered by the *Global Atmosphere Division (GAD) in the UK Department for Environment, Food & Rural Affairs(Defra)*: coordination of expertise from across Government and management of research contracts to ensure that the UK GHG Inventory meets applicable international standards. ***Defra* has the following roles and responsibilities:** • NI System Management & Planning (Overall control of the NIS development & function; Management of contracts & delivery of GHG inventory; definition of performance criteria for NIS key organisations) • Development of legal & contractual infrastructure (Review of legal & organisational structure; implementation of legal instruments & contractual developments as required) **<u>Contracting parties :</u>** ***(1) The UK GHG Inventory Agency: National Environmental Technology Centre (NETCEN) of AEA Technology plc*** • under contract with the GAD • performs the role of *Inventory Agency* and is responsible for all aspects of NI preparation, reporting and quality management. • prepares the national atmospheric emissions inventory (NAEI) which is the core air emissions database from which the GHG inventory (GHGI) is extracted to ensure consistency in reporting across all air emissions for different reporting purposes. Included activities: collecting & processing data; selecting emission factors & estimation methods according to IPCC guidance; compiling the inventory; managing all aspects of inventory QA/QC including QC of raw data & data management tools, documentation & archiving, prioritisation of methodology & raw data improvements; carrying out uncertainty assessments; delivering the NIR on behalf of *Defra*; assisting with Art. 8 reviews. • has the following roles and responsibilities: ***(A) planning*** (co-ordination with *Defra* to deliver the NIS; review of current NIS performance & assessment of required development action; scheduling of tasks & responsibilities to deliver GHG inventory and NIS); ***<u>(B) preparation</u>*** (drafting of agreements with key data providers; review of source data & identification of developments required to improve GHG inventory data quality) **(C)** ***management:*** (documentation & archiving; dissemination of information regarding NIS to Key Data Providers; management of inventory QA/QC plans, programmes and activities) ***(D) inventory compilation*** (data acquisition, processing and reporting; delivery of NIR (including associated CRF tables) to time and quality) ***(2) LULUCF Inventory Agency: The Centre for Ecology and Hydrology (CEH)*** • under contract with the GAD • responsible for the preparation and development of the *LULUCF inventory*, including both emissions and removals of GHGs; conducts specific research in the LULUCF sector • provides finalised data to *Netcen* for inclusion within the UK GHG inventory dataset. ***(3) Agriculture Inventory Agency: The Institute for Grassland and Environmental Research (IGER):*** • under contract with Defra's Land Management Improvement Division (LMID) • is currently responsible for the preparation and development of the *agriculture inventory* as well as conducts specific research in the agriculture sector • provides finalised GHG emissions data to *Netcen* for inclusion within the UK inventory dataset.	UK GHG Inventory, 1990-2004 for submission under the UNFCCC Draft Report pp.4-9 UK GHG Inventory Report to EUMM 15th January 2006 pp. 3-5

1.2.2 The European Commission, Directorate-General for the Environment

The European Commission's DG Environment in consultation with the Member States has the overall responsibility for the EC inventory. Member States are required to submit their national inventories and inventory reports under Council Decision No 280/2004/EC to the European Commission, DG Environment; and the European Commission, DG Environment itself submits the inventory and inventory report of the EC to the UNFCCC Secretariat. In the actual compilation of the EC inventory and inventory report, the European Commission, DG Environment is assisted by the EEA including its ETC/ACC and by Eurostat and the JRC.

The consultation between the DG Environment and the Member States takes place in the Climate Change Committee established under Article 9 of Council Decision No 280/2004/EC. The Committee is composed of the representatives of the Member States and chaired by the representative of the DG Environment. Procedures within the Committee for decision-making, adoption of measures and voting are outlined in the rules of procedure, adopted in November 2003. 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 Climate Change 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 ETC/ACC include:
- initial checks of Member States' submissions in cooperation with Eurostat, and the JRC, up to 28 February 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 28 February based on Member States' 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/). The Member States are encouraged to use the central data repository under the Eionet for making available their GHG submissions to the European Commission and the ETC/ACC (see http://cdr.eionet.eu.int/).

1.2.4 The European Topic Centre on Air and Climate Change

The European Topic Centre on Air and Climate Change (ETC/ACC) was established by a contract between the lead organisation National Institute of Public Health and the Environment — RIVM (the Netherlands) and EEA in March 2001. The ETC/ACC involves 13 organisations and institutions in eight European countries. The technical annex for the 2006 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. Umweltbundesamt Austria is the task leader for the compilation of the EC annual inventory in the ETC/ACC, including all tasks mentioned above.

The 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 ETC/ACC adapts the tools regularly to the 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 CO_2 emissions from fossil fuels using the IPCC reference approach. Eurostat compares these estimates with national estimates of CO_2 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 EC project aimed at improving estimates of GHG emissions from international aviation.

1.2.6 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 inter-comparing methodologies used by the Member States for estimating emissions and removals with a focus on LULUCF and (2) by providing EC-wide estimates with various models/methods for emissions and removals with a focus on LULUCF. For this reason, methods using inverse modelling for CH_4 emissions are currently under development. In addition, the JRC is leading a project for improving the methodologies used for estimating GHG emissions from agriculture with a focus on the N_2O emissions of agriculture soils, the source contributing most to the overall uncertainty of the EC inventory.

1.3 A description of the process of inventory preparation

The annual process of compilation of the EC inventory is summarised in Table 1.3. The Member States should submit their annual GHG inventory by 15 January each year to the European Commission’s DG Environment. Then, the ETC/ACC, Eurostat and the JRC perform initial checks of the submitted data up to 28 February. The ETC/ACC transfers the nationally submitted data from the spreadsheet format of the common reporting format (CRF) tables into spreadsheets. From these spreadsheets the data is transferred into the EC CRF tables and into the ETC/ACC database. The ETC/ACC has developped a software for using the xml-files created by the new UNFCCC CRF reporter software for aggregating the EC submission (CRF aggregator). This software is currently being tested intensively in order to be ready for use for the next submission.

Table 1.3 Annual process of submission and review of Member States inventories and compilation of the EC inventory

Element	Who	When	What
1. Submission of annual greenhouse gas inventories (complete common reporting format (CRF) submission and elements of the national inventory report) by Member States under Council Decision No 280/2004/EC	Member States	15 January	Elements listed in Article 3(1) of Decision 280/2004/EC as elaborated in Articles 2 to7 in particular: • Greenhouse gas emissions by sources and removals by sinks, for the year n – 2 • And updated time series 1990- year n – 3, depending on recalculations; • Core elements of the NIR Steps taken to improve estimates in areas that were previously adjusted under Article 5.2 of the Kyoto Protocol (for reporting under the Kyoto Protocol)
2. 'Initial check' of Member States' submissions	Commission (incl. Eurostat, the JRC), assisted by the EEA	As soon as possible after receipt of Member State data, at the latest by 1 April	Initial checks and consistency checks (by EEA). Comparison of energy data provided by Member States on the basis of the IPCC Reference Approach with Eurostat energy data (by Eurostat and Member States) and check of Member States' agriculture and land use, land-use change and forestry (LULUCF) inventories by DG JRC (in consultation with Member States).
3. Compilation of draft EC inventory	Commission (incl. Eurostat, the JRC), assisted by the EEA	up to 28 February	Draft EC inventory (by EEA), based on Member States' inventories and additional information where needed.
4. Circulation of draft EC inventory	Commission (DG Environment) assisted by the EEA	28 February	Circulation of the draft EC inventory on 28 February to Member States. Member States check data.
5. Submission of updated or additional inventory data and complete national inventory reports by Member States	Member States	15 March	Updated or additional inventory data submitted by Member States (to remove inconsistencies or fill gaps) and complete final national inventory reports.
6. Estimates for data missing from a national inventory	Commission (DG Environment) assisted by EEA	31 March	The Commission prepares estimates for missing data by 31 March of the reporting year, following consultation with the Member State concerned, and communicate these to the Member States.
7. Comments from Member States regarding the Commission estimates for missing data	Member States	8 April	Member States provide comments on the Commission estimates for missing data, for consideration by the Commission.
8. Final annual EC inventory (incl. Community inventory report)	Commission (DG Environment) assisted by EEA	15 April	Submission to UNFCCC of the final annual EC inventory. This inventory will also be used to evaluate progress as part of the monitoring mechanism.
9. Circulation of initial check results of the EC submission to Member States	Commission (DG Environment) assisted by EEA	As soon as possible after receipt of initial check results	Commission circulates the initial check results of the EC submission as soon as possible after their receipt to those Member States, which are affected by the initial checks.
10. Response of relevant Member States to initial check results of the EC submission	Member States	Within one week from receipt of the findings	The Member States, for which the initial check indicated problems or inconsistencies provide their responses to the initial check to the Commission.
11. Any resubmissions by Member States in response to the UNFCCC initial checks	Member States	For each Member State, same as under the UNFCCC initial checks phase Under the Kyoto Protocol: the resubmission should be provided to the Commission	Member States provide to the Commission the resubmissions which they submit to the UNFCCC Secretariat in response to the UNFCCC initial checks. The Member States should clearly specify which parts have been revised in order to facilitate the use for the EC resubmission. As the EC resubmission also has to comply with the deadlines specified in the guidelines under Article 8 of the Kyoto Protocol, the resubmission has to be sent to the Commission earlier than the period foreseen in the guidelines under Article 8 of the

Element	Who	When	What
		within five weeks of the submission due date.	Kyoto Protocol, provided that the resubmission correct data or information that is used for the compilation of the EC inventory.
12. Submission of any other resubmission after the initial check phase	Member States	When additional resubmissions occur	Member States provide to the Commission any other resubmission (CRF or national inventory report) which they provide to the UNFCCC Secretariat after the initial check phase.

On 28 February, 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 15 March. 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 ETC/ACC by 15 April for submission to the UNFCCC Secretariat. Resubmissions of the EC GHG inventory and inventory report are prepared by 27 May, if needed. Within five weeks after 15 April, Member States should provide to the Commission any resubmission in response to the UNFCCC initial checks which affects the EC inventory, in order to guarantee that the EC resubmission to the UNFCCC Secretariat is consistent with the Member States' resubmissions. In June the inventory and the inventory report are published on the EEA website (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 General description of methodologies and data sources used

The EC 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' (FCCC/SBSTA/2004/8), to the extent possible ([8]). In addition, the *Revised IPCC 1996 guidelines for national greenhouse gas inventories* have been applied as well as the IPCC *Good practice guidance and uncertainty management in national greenhouse gas inventories*, where appropriate and feasible. In addition, for the compilation of the EC GHG inventory, Council Decision No 280/2004/EC and the Commission Decision 2005/166/EC.

The EC GHG gas inventory is compiled on the basis of the inventories of the 15 or 25 Member States. The emissions of each source category are the sum of the emissions of the respective source and sink categories of the 15 or 25 Member States. This is also valid for the base year estimate of the EU-15 GHG inventory. Table 1.4 shows the base years indicated to be used by the EC Member States.

Table 1.4 Base years used as indicated by the EC Member States

EC MS	CO_2, CH_4, N_2O	HFC, PFC, SF_6	Information source
EU-15 Member States			
Austria	1990	1990	Information according to Art. 23 of Commission Decision 2005/166/EC - Draft Initial Report, page 6
Belgium	1990	1995	Report by Belgium on the Determination of the assigned amount pursuant to article 8(1) (e) of Decision 280/2004/EC, page 1
Denmark	1990	1995	CRF 2003, Submission 2005, Table 11
Finland	1990	1995	Report to facilitate the estimation of Finland's assigned amount under the Kyoto Protocol, Draft report to the European Commission, page 8
France	1990	1990	CRF 2003, Submission 2005, Table 11
Germany	1990	1995	CRF 2003, Submission 2005, Table 11
Greece	1990	1995	Draft report on establishing assigned amount, page 11
Ireland	1990	1995	NIR 2005, page 19
Italy	1990	1995	CRF 2003, Submission 2005, Table 11
Luxembourg	1990	to be decided	

EC MS	CO_2, CH_4, N_2O	HFC, PFC, SF_6	Information source
Netherlands	1990	1995	Draft initial report of The Netherlands, page 4
Portugal	1990	1995	CRF 2004, Submission 2006, Table 11
Spain	1990	1995	CRF 2003, Submission 2005, Table 11
Sweden	1990	1995	Sweden's Initial Report under the Kyoto protocol – Calculation of Assigned Amount, page 10
United Kingdom	1990	1995	UK's report to the European Commission made under Decision 280/2004/EC of the European Parliament and of the Council of 11 February 2004 concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol, page 7
New Member States			
Cyprus	Not relevant	Not relevant	
Czech Republic	1990	1995	CRF 2003, Submission 2005, Table 11
Estonia	1990		CRF 2004, Submission 2006, Table 11
Hungary	1985-87	1985-87	CRF 1985-87, NIR 2006
Latvia	1990	1995	CRF 2003, Submission 2005, Table 11
Lithuania	1990		
Malta	Not relevant	Not relevant	
Poland	1988	1995	CRF 2003, Submission 2005, Table 11
Slovakia	1990	1995	CRF 2003, Submission 2005, Table 11
Slovenia	1986	1986	NIR 2006

Of the EU-15 Member States, currently 13 Member States have indicated to chose 1995 as the base year for fluorinated gases while Austria and France have indicated to chose 1990. Therefore, the EU-15 base year estimates for fluorinated gas emissions are the sum of 1995 emissions for 13 Member States and 1990 emissions for Austria and France. The reference approach is calculated for the EU-15 on the basis of Eurostat energy data (see Section 3.6) and the key source analysis (Section 1.5) is separately performed at EU-15 level ([9]).

Since Member States use different national methodologies, national activity data or country-specific emission factors in accordance with IPCC and UNFCCC guidelines, these methodologies are reflected in the EC GHG inventory data. The EC believes that it is consistent with the UNFCCC reporting guidelines and the IPCC good practice guidelines to use different methodologies for one source category across the EC especially if this helps to reduce uncertainty and improve consistency of the emissions data provided that each methodology is consistent with the IPCC good practice guidelines.

In general, no separate methodological information is provided at EC level except summaries of methodologies used by Member States. However, for some sectors quality improvement projects have been started with the aim of further improving estimates at Member State level. These sectors include energy background data, emissions from international bunkers, emissions and removals from LULUCF, emissions from agriculture and waste.

The EU-15 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 Table Summary 3. In addition, information on methods, activity data and emission factors was used which was provided by the Member States in accordance with Annex I of Commission Decision 2005/166/EC. Table 1.5 shows the information on methods used, emission factors and activity data as provided by the Member States in accordance with Commission Decision 2005/166/EC. In addition, also the sector-specific chapters list the methodologies and emission factors used by the Member States for each EC key source.

([9]) However, the choice of the emission calculation methodology is made at Member State level and is based on the key source analysis of each individual Member State.

Table 1.5 Information methods used, activity data and emission factors as reported by Member States according to Commission Decision 2005/166/EC

Information on methods used (EU-15)

EC Key source	AT	BE	DK	FI	FR	DE	GR[(A)]	IE	IT	LU	NL	PT	ES	SE	GB
1 A 1 a Public Electricity and Heat Production: Gaseous Fuels (CO_2)	T2	CS	C	T3	C	CS	C	T3	T3	C/D	T2	D	T2	T1,T2,T3	T2
1 A 1 a Public Electricity and Heat Production: Liquid Fuels (CO_2)	T2	CS	C	T3	C	CS	C	T3	T3	C/D	T2	D	T2	T1,T2,T3	T2
1 A 1 a Public Electricity and Heat Production: Other Fuels (CO_2)	T2	CS	C	T3	C	CS	NO[2]	NO	T3	C/D	T2	D	T2	T1,T2,T3	T2
1 A 1 a Public Electricity and Heat Production: Solid Fuels (CO_2)	T2	CS	C	T3	C	CS	C	T3	T3	C/D	T2	D	T2	T1,T2,T3	T2
1 A 1 a Public Electricity and Heat Production: Solid Fuels (N_2O)	T2	CS	C	T3	C	T2	C	T3	T3	C/D	T1	T2	T2	T1,T2,T3	T2
1 A 1 b Petroleum refining: Liquid Fuels (CO_2)	T2	CS	C	T3	C	CS	C	T3	T3	C/D	T2	D	T2	T1,T2,T3	T2
1 A 1 c Manufacture of Solid fuels and Other Energy Industries: Gaseous Fuels (CO_2)	T2	CS	C	T3	C	CS	C	NO	T2	C/D	T2	D	T2	NA	T2
1 A 1 c Manufacture of Solid fuels and Other Energy Industries: Solid Fuels (CO_2)	-	CS	-	T3	C	CS	C	T1	T2	C/D	NA	D	T2	T1,T2,T3 ,NA	T2
1 A 2 Manufacturing Industries and Construction: Gaseous Fuels (CO_2)	T2	C	C	T3	C	T2/ CS	NO	T1	T2	C/D	NA/T2	D	T2	T1,T2,T3 ,NA	T2
1 A 2 Manufacturing Industries and Construction: Liquid Fuels (CO_2)	T2	C	C	T3/M	C	T2/ CS	C	T1	T2	C/D	T2	D	T2, T3	T1,T2,T3	T2
1 A 2 Manufacturing Industries and Construction: Other Fuels (CO_2)	T2	C	C	T3	C	T2/ CS	C	NO	T2	C/D	NA	D	T2	T1,T2,T3 ,NA	T2
1 A 2 Manufacturing Industries and Construction: Solid Fuels (CO_2)	T2	C	C	T3	C	T2/ CS	C	T1	T2	C/D	NA/T2	D	T2	T1,T2,T3 ,NA	T2
1 A 3 a Civil Aviation: Jet Kerosene (CO_2)	CS	C, M	C	T2/B	M	T1	T2a	T2a	T1, T2a	C/D	T2	T2b	T2	T1	T3
1 A 3 b Road Transportation: Diesel oil (CO_2)	CS	C, M, CS	COPERT III	T3	M	T3	COPERT III	T1	COPPER T3	C/D	T2	D	C	T1	T3
1 A 3 b Road Transportation: Diesel oil (N_2O)	CS	C, M, CS	COPERT III	T3	M	T3	COPERT III	T3	COPPER T3	C/D	T2	T3	C	T2	T3
1 A 3 b Road Transportation: Gasoline (CO_2)	CS	C, M, CS	COPERT III	T3	M	T3	COPERT III	T1	COPPER T3	C/D	T2	D	C	T1	T3
1 A 3 b Road Transportation: Gasoline (N_2O)	CS	C, M, CS	COPERT III	T3	M	T3	COPERT III	T3	COPPER T3	C/D	T2	T3	C	T2	T3
1 A 3 b Road Transportation: Other Fuels (CO_2)	-	C, M, CS	-	T1	M	T3	COPERT III	T1	COPPER T3	C/D	NA	D	C	NO	T3
1 A 3 c Railways: Liquid Fuels (CO_2)	CS	C, M	C	T2	C	T1	C	T1	D	C/D	CS	D	T2	CS	T2
1 A 3 d Navigation: Gas/Diesel Oil (CO_2)	CS	C, M	C	T2	C	T1	C	T1	T1, T2	C/D	T2	T1	T2	T1	T2
1 A 4 a Commercial/Institutional: Gaseous Fuels (CO_2)	T2	C	C	T1	C	T2	C	T1	T2	C/D	T2	D	T2	T1,T2,T3	T2

EC Key source	AT	BE	DK	FI	FR	DE	GR[(A)]	IE	IT	LU	NL	PT	ES	SE	GB
1 A 4 a Commercial/Institutional: Liquid Fuels (CO_2)	T2	C	C	T1	C	T2	C	T1	T2	C/D	T2	D	T2	T1,T2,T3	T2
1 A 4 a Commercial/Institutional: Solid Fuels (CO_2)	T2	C	C	T1	C	T2	C	T1	T2	C/D	T2	D	T2	NA	T2
1 A 4 b Residential: Gaseous Fuels (CO_2)	T2	C	C	T1	C	T2	C	T1	T2	C/D	T2	D	T2	T1,T2,T3	T2
1 A 4 b Residential: Liquid Fuels (CO_2)	T2	C	C	T1	C	T2	C	T1	T2	C/D	T2	D	T2	T1,T2,T3	T2
1 A 4 b Residential: Solid Fuels (CO_2)	T2	C	C	T1	C	T2	C	T1	T2	C/D	NA	D	T2	NA	T2
1 A 4 c Agriculture/Forestry/Fisheries: Gaseous Fuels (CO_2)	T2	C	C	T1	C	T2	C	T1	T2	C/D	T2	D	T2	T1,T2,T3	T2
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels (CO_2)	T2	C	C	T1/T2	C	T2	C	T1	T2	C/D	T2	D	T2, T3	T1,T2,T3	T2
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels (CO_2)	T2	C	C	T1	C	T2	C	T1	T2	C/D	NA	D	T2	NA	T2
1 A 5 Other: Liquid Fuels (CO_2)	M	C	C	T1	C	-	No	NO	T2	C/D	NA	D		T1	T2,T3
1 A 5 Other: Solid Fuels (CO_2)	NO	C	C	T1	C	-	No	NO	T2	C/D	NA	D		NA	NO
1 B 1 a Coal Mining (CH_4)	C	NO	-	No	C	T2	T1	NO	T1	C/D	NA	T1	T2, CS	NA	T2
1 B 2 a Oil (CO_2)	CS	C	NA	T1	-	-	T1	NO	-	C/D	NA	M	T2	T1/NA	T2
1 B 2 b Natural gas (CH_4)	D	CS	CS	M/T1	C	CS	T1	CS	T2	C/D	CS/T3	T2	C, CS	NA	T2
1 B 2 c Venting and flaring (CO_2)	IE	CS	C	CS	-	-	T1	NO	T2	C/D	NA/T2	D	T1, T2, CS	T2/NA	T2
2 A 1 Cement Production (CO_2)	CS	CS	CS/T2	T2	C	CS	T2	D	T2	C/D	CS	T2	T2	T2	T2
2 A 2 Lime Production (CO_2)	CS	CS	D	T2	C	D	T1	D	D	C/D	NA	D	D	D	T2
2 B 1 Ammonia Production (CO_2)	CS	CS	-	NO	C	D	IE[1]	D	T2, D	C/D	T1b	D	D	NO	T2,T3
2 B 2 Nitric Acid Production (N_2O)	CS	CS	D	T2	C	CS	D	D	D	C/D	T2	D	D	T2	T2,T3
2 B 3 Adipic Acid Production (N_2O)	N	NO	-	NO	C	CS	NO	NO	D	C/D	NA	NO		NO	T2,T3
2 B 5 Other (N_2O)	N	CS	-	NO	C	-	NO	NO	D	C/D	NA/T2	D		CS	No
2 C 1 Iron and Steel Production (CO_2)	T2	CS	T2	CS	C	T2	T2	NO	D	C/D	NA/T2	T2	T2	CS/T1	T2,T3
2 C 3 Aluminium production (PFC)	T3b	NA	-	NO	C	T3	T3b	NO	T1, T2	C/D	T2	NO	T2	T2	T3
2 E PRODUCTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE (HFC)	NO	-	-	NO	-	CS	T1	NO	CS	C/D	NA/T2	NO	T1, T2	NA	T2
2 E PRODUCTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE (PFC)	NO	T2, CS	-	NO	-	-	NO	NO	CS	C/D	NA/T1	NO		NA	T2
2 F CONSUMPTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE (HFC)	CS	T2, CS	T2	T1a/T2b/T2	-	CS, T2, T2a	T2a	T1, T2, T3	T2a, CS	C/D	NA	T2a	T1, T2, D	CS/T1/NA	T1,T2,T3
2 F CONSUMPTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE (SF_6)	CS	T2, CS	T2	T1b/T3	-	T2	CS	T2	CS, T3c	C/D	NA/CS/T2	T2a	T2	T1a/T1b/NA	T1,T2
4 A 1 Cattle (CH_4)	T2	M	T2	T2	C	T2	T1	T2	T2	C/D	T2	T2	T2, CS	CS	T2
4 A 3 Sheep (CH_4)	T1	M	T2	T1	C	T1	T2	T2	T1	C/D	T1	T2	T2, CS	T1	T2
4 B 1 Cattle (CH_4)	T2	M	T2	T2	C/T1	T2/CS	T1	T2	T2	C/D	T2	T2	T2, CS	T2	T2
4 B 12 Solid Storage and Dry Lot (N_2O)	T1	D	T1	T1	C/T1	-	D	T1	D	C/D	T2	D	D, CS	T2	T2
4 B 8 Swine (CH_4)	T2	M	T2	T2	C/T1	T2/CS	T1	T1	T2	C/D	T2	T2	T2, CS	T2	T2

EC Key source	**AT**	**BE**	**DK**	**FI**	**FR**	**DE**	**GR**[(A)]	**IE**	**IT**	**LU**	**NL**	**PT**	**ES**	**SE**	**GB**
4 D 1 Direct Soil Emissions (N_2O)	T1a,b	D	D/CS	T1a	C/T1	T1	T1a,T1b[6]	T1a, T1b	D	C/D	NA/T1b/ T2	T1b	T1a, T1b, CS	T1a/T1b/ CS	T1a/T1b
4 D 2 Animal Production (N_2O)	T1b	D	D/CS	T1	C/T1	T1	D	T1a	D	C/D	T1b	T1a	T1a, T1b, CS	T2	NO
4 D 3 Indirect Emissions (N_2O)	T1a,b	D	CS/M	T1a/T1b	C/T1	T1	T1a	T1b	D	C/D	T1/T3	D	T1a, T1b, CS	CS/T1	NO
6 A 1 Managed Waste disposal on Land (CH_4)	T2	M	T2	T2	CS/T2	T2	T1	T2	T2	C/D	T2	T2	T2	T3	M
6 A 2 Unmanaged Waste Disposal Sites (CH_4)	NO	NO	-	NA	CS/T2	-	T1	T2	T2	C/D	NA	T2	T2	NO	NO
6 B 2 Domestic and Commercial Wastewater (CH_4)	D	D	D/CS	D	CS/T2	D	D	T1	D	C/D	NA/T2	D	D	NA	M
6 B 2 Domestic and Commercial Wastewater (N_2O)	CS,D	-	D/CS	D/CS	CS/T2	D	NE	T1	D	C/D	NA/T2	D	D	CS/NA	M

Information on activity data (EU-15)

EC Key source	AT	BE	DK	FI	FR	DE	GR(A)	IE	IT	LU	NL	PT	ES	SE	GB
1 A 1 a Public Electricity and Heat Production: Gaseous Fuels (CO_2)	NS, PS	PS, RS	NS/PS	PS	PS	NS/AS	NS	NS, PS	NS, PS		NS/Q	PS	PS	PS	NS
1 A 1 a Public Electricity and Heat Production: Liquid Fuels (CO_2)	NS, PS	PS, RS	NS/PS	PS	PS	NS/AS	NS	NS, PS	NS, PS		NS/Q	PS+NS	PS	PS	NS/AS
1 A 1 a Public Electricity and Heat Production: Other Fuels (CO_2)	NS, PS	PS, RS	NS/PS	PS	PS	NS/AS	NO	NO	NS, PS		NS/Q	PS	PS	PS	NS
1 A 1 a Public Electricity and Heat Production: Solid Fuels (CO_2)	NS, PS	PS, RS	NS/PS	PS	PS	NS/AS	NS	NS, PS	NS, PS		NS/Q	PS	PS	PS	NS/AS
1 A 1 a Public Electricity and Heat Production: Solid Fuels (N_2O)	NS, PS	PS, RS	NS/PS	PS	PS	NS/AS	NS	NS, PS	NS, PS		Q	PS	PS	PS	NS/AS
1 A 1 b Petroleum refining: Liquid Fuels (CO_2)	NS	RS	NS/PS	PS	PS	NS/AS	NS	NS, PS	NS, PS		NS/Q	PS	PS	PS	NS
1 A 1 c Manufacture of Solid fuels and Other Energy Industries: Gaseous Fuels (CO_2)	NS	PS, RS	NS	PS	AS/PS	NS/AS	NS	NO	NS		NS/Q	NS	PS, NS	NA	NS
1 A 1 c Manufacture of Solid fuels and Other Energy Industries: Solid Fuels (CO_2)	-	PS, RS	NO	PS	AS/PS	NS/AS	NO	NS, PS	NS		NS/Q	PS	PS, NS, AS, Q	PS/NA	NS
1 A 2 Manufacturing Industries and Construction: Gaseous Fuels (CO_2)	NS, PS	PS, RS	NS	PS	AS/PS	NS/AS	NS	NS, PS	NS		NS/Q	NS+PS	PS, NS, AS, Q	PS/NA	NS/AS
1 A 2 Manufacturing Industries and Construction: Liquid Fuels (CO_2)	NS, PS	RS	NS	PS	AS/PS	NS/AS	NS	NS, PS	NS		NS/Q	NS+PS	PS, NS, AS, Q	PS	NS/AS
1 A 2 Manufacturing Industries and Construction: Other Fuels (CO_2)	NS, PS	RS	NS	PS	AS/PS	NS/AS	NS	NO	NS		NS/Q	NS+PS	PS, AS, Q	PS/NA	NS/AS
1 A 2 Manufacturing Industries and Construction: Solid Fuels (CO_2)	NS, PS	RS	NS	PS	AS/PS	NS/AS	NS	NS, PS	NS		NS/Q	NS	PS, NS, AS, Q	PS/NA	NS/AS
1 A 3 a Civil Aviation: Jet Kerosene (CO_2)	NS	PS	NS	NS	NS	NS/AS	NS/AS[4]	NS	NS		NS	NS+AS	NS	NS	NS/AS
1 A 3 b Road Transportation: Diesel oil (CO_2)	NS	NS	NS	NS	NS	NS/AS	NS	NS	NS/AS		NS	NS	NS, Q	NS	NS/AS
1 A 3 b Road Transportation: Diesel oil (N_2O)	NS	NS	NS	NS	NS	NS/AS	NS	NS	NS/AS		NS/Q	NS+AS	NS, Q	NS	NS/AS
1 A 3 b Road Transportation: Gasoline (CO_2)	NS	NS	NS	NS	NS	NS/AS	NS	NS	NS/AS		NS	NS	NS, Q	NS	NS/AS
1 A 3 b Road Transportation: Gasoline (N_2O)	NS	NS	NS	NS	NS	NS/AS	NS	NS	NS/AS		NS/Q	NS+AS	NS, Q	NS	NS/AS
1 A 3 b Road Transportation: Other Fuels (CO_2)	-	NS	NO	NS	NS	NS/AS	NS	NS	NS/AS		NS	NS	NS, Q	NO	NS/AS
1 A 3 c Railways: Liquid Fuels (CO_2)	NS	RS	NS	NS	NS	NS/AS	NS	NS	NS		AS	NS	Q	NS	NS/AS
1 A 3 d Navigation: Gas/Diesel Oil (CO_2)	NS	RS	NS	NS	NS	NS/AS	NS	NS	NS		NS/Q	NS+AS	NS, AS	NS	NS/AS
1 A 4 a Commercial/Institutional: Gaseous Fuels (CO_2)	NS	RS	NS	NS	NS	NS/AS	NS	NS	NS		NS	NS	NS	NS	NS
1 A 4 a Commercial/Institutional: Liquid Fuels (CO_2)	NS	RS	NS	NS	NS	NS/AS	NS	NS	NS		NS	NS	NS	NS	NS/AS
1 A 4 a Commercial/Institutional: Solid Fuels (CO_2)	NS	RS	NS	NS	NS	NS/AS	NS	NS	NS		NS	NS	NS	NA	NS/AS
1 A 4 b Residential: Gaseous Fuels (CO_2)	NS	RS	NS	NS	NS	NS/AS	NS	NS	NS		NS	NS	NS	NA	NS
1 A 4 b Residential: Liquid Fuels (CO_2)	NS	RS	NS	NS	NS	NS/AS	NS	NS	NS		NS	NS	NS	NS	NS/AS
1 A 4 b Residential: Solid Fuels (CO_2)	NS	RS	NS	NS	NS	NS/AS	NS	NS	NS		NS	NS	NS	NS	NS/AS

EC Key source	AT	BE	DK	FI	FR	DE	GR[A]	IE	IT	LU	NL	PT	ES	SE	GB
1 A 4 c Agriculture/Forestry/Fisheries: Gaseous Fuels (CO_2)	NS	RS	NS	NS	NS	NS/AS	NS	NS	NS		NS/Q	NS	NS	NS	NS
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels (CO_2)	NS	RS	NS	NS	NS	NS/AS	NS	NS	NS		NS/Q	NS	NS, Q	NS	NS/AS
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels (CO_2)	NS	RS	NS	NS	NS	NS/AS	NS	NS	NS		NS/Q	NS	NS	NA	NS/AS
1 A 5 Other: Liquid Fuels (CO_2)	AS	RS	NS	NS	NS	-	NO	NO	NS		NS/Q	NS		NS	NS/AS
1 A 5 Other: Solid Fuels (CO_2)	NO	RS	NS	NS	NS	-	NO	NO	NS		NS/Q	NS	NS, AS	NA	NO
1 B 1 a Coal Mining (CH_4)	NS	NO	NO	NA	AS	AS/PS	NS	NO	NS		NA	NS	PS	NA	AS
1 B 2 a Oil (CO_2)	AS	RS	NA	PS	-	-	NS	NO	-		NA	AS+NS	PS	PS	NS
1 B 2 b Natural gas (CH_4)	AS	AS	NS	PS	PS	NS/AS	NS	NS	NS		AS	NS+AS	NS, AS, Q	NA	NS/AS
1 B 2 c Venting and flaring (CO_2)	IE	PS, AS	NS/PS	PS	-	-	NS	NO	NS		NA	PS	PS	PS	NS
2 A 1 Cement Production (CO_2)	PS	PS	PS	PS	AS	AS	PS	NS, PS	NS		Q	PS	AS, PS	PS	NS
2 A 2 Lime Production (CO_2)	PS	PS	NS	PS	AS	AS	Q/NS	NS, PS	NS		NE	NS+PS	AS	PS	NS
2 B 1 Ammonia Production (CO_2)	NS, PS	PS	NO	NA	AS	NS	IE	NS, PS	NS, PS		PS/Q	NS+PS	PS	NO	PS
2 B 2 Nitric Acid Production (N_2O)	PS	PS	PS	PS	AS	NS	NS	NS, PS	NS, PS		Q/NS	NS+PS	PS, AS	PS	PS
2 B 3 Adipic Acid Production (N_2O)	NO	NO	NO	NA	PS	PS	NO	NO	PS		NO	-		NO	PS
2 B 5 Other (N_2O)	NO	PS	NE	NA	AS/NS	-	NO	NO	NS, AS		PS/Q	NS+PS		PS	NO
2 C 1 Iron and Steel Production (CO_2)	NS	PS	PS	PS	NS	NS/AS	NS	NO	NS		PS	PS	PS; AS	PS	NS/AS
2 C 3 Aluminium production (PFC)	NS	NA	NO	NA	NS	AS	PS	NO	PS		NS	NO	PS	PS	NS
2 E PRODUCTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE (HFC)	NO	-	NO	NA	-	AS/PS	PS	NO	PS		Q	NO	PS	NA	PS
2 E PRODUCTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE (PFC)	NO	PS	NO	NA	-	-	NO	NO	PS		NA	NO		NA	PS
2 F CONSUMPTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE (HFC)	Q	AS, PS	AS/Q	Q	-	Q	Q/IS	PS, NS	AS, PS		Q	NS+AS	AS, Q	PS	NS/AS
2 F CONSUMPTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE (SF_6)	Q	AS, PS	AS/Q	Q	-	Q/AS	NS	PS, NS	AS, PS		AS	PS	AS	PS	AS
4 A 1 Cattle (CH_4)	NS	NS	NS	NS	NS	RS	NS	NS	NS		NS	NS	NS	NS	NS
4 A 3 Sheep (CH_4)	NS	NS	NS	NS	NS	RS	NS	NS	NS		NS	NS	NS	NS	NS
4 B 1 Cattle (CH_4)	NS	NS	NS	NS	NS	RS	NS	NS	NS		NS	NS	NS	NS	NS
4 B 12 Solid Storage and Dry Lot (N_2O)	NS	NS	NS	NS/AS	NS	-	NS	NS	NS		NS	NS	NS	NS	NS
4 B 8 Swine (CH_4)	NS	NS	NS	NS	NS	RS	NS	NS	NS		NS	NS	NS	NS	NS
4 D 1 Direct Soil Emissions (N_2O)	NS	NS	NS	NS/AS	NS	RS	NS/IS	NS	NS		NS	NS	NS	NS	NS
4 D 2 Animal Production (N_2O)	NS	NS, AS	NS	NS/AS	NS	RS	NS	NS	NS		NS	NS	NS	NS	NO
4 D 3 Indirect Emissions (N_2O)	NS	NS	NS	NS/AS	NS	RS	NS/IS	NS	NS		NS	NS	NS	NS	NO
6 A 1 Managed Waste disposal on Land (CH_4)	NS	RS	NS/PS	PS/NS	NS	NS	NS/Q	NS	NS		AS	NS	NS, Q	NS	AS
6 A 2 Unmanaged Waste Disposal Sites (CH_4)	NO	NO	NO	NA	NS	-	NS/Q	NS	NS		AS	NS	NS	NO	NO
6 B 2 Domestic and Commercial Wastewater (CH_4)	NS	RS	NS	NS/PS	NS	NS	NS/Q[7]	NS	NS		NS	NS	NS	NA	NS
6 B 2 Domestic and Commercial Wastewater (N_2O)	NS	-	NS	NS/PS	NS	NS	NE	NS	NS		NS	IS	NS	NS	NS

Information on emission factors (EU-15)

EC Key source	AT	BE	DK	FI	FR	DE	GR[(A)]	IE	IT	LU	NL	PT	ES	SE	GB
1 A 1 a Public Electricity and Heat Production: Gaseous Fuels (CO_2)	CS	CS, PS	CS/C	CS	CS	CS	D	PS	CS	C/D	CS	D	PS, CS	CS	CS
1 A 1 a Public Electricity and Heat Production: Liquid Fuels (CO_2)	CS	CS, PS	CS/C	CS	CS	CS	D	PS	CS	C/D	CS	D	PS, C	CS	CS
1 A 1 a Public Electricity and Heat Production: Other Fuels (CO_2)	CS(MSW)D (Ind.waste)	CS, PS	CS/C	CS	CS	CS	NO	NO	CS	C/D	CS	D	PS, CS, C	CS	CS
1 A 1 a Public Electricity and Heat Production: Solid Fuels (CO_2)	CS	CS, PS	CS/C	CS/D	CS	CS	D/CS[1]	PS	CS	C/D	CS	D	PS	CS	CS
1 A 1 a Public Electricity and Heat Production: Solid Fuels (N_2O)	CS	CS, PS	CS/C	CS	CS	CS	C	C	D	C/D	D	D	D, C, OTH	CS	CS,D,C
1 A 1 b Petroleum refining: Liquid Fuels (CO_2)	CS	CS	CS/C	CS	CS	CS	D	PS	CS	C/D	CS	D+CS	PS, C	CS	CS
1 A 1 c Manufacture of Solid fuels and Other Energy Industries: Gaseous Fuels (CO_2)	CS	CS	CS/C	CS	CS	CS	CS[3]	NO	CS	C/D	CS	CS	CS	NA	CS
1 A 1 c Manufacture of Solid fuels and Other Energy Industries: Solid Fuels (CO_2)	-	CS	-	CS	CS	CS	NO	C	CS	C/D	NA	D	PS, CS	CS, NA	CS
1 A 2 Manufacturing Industries and Construction: Gaseous Fuels (CO_2)	CS	C, CS	CS/C	CS	CS	CS	D	C	CS	C/D	NA/CS	CS	CS	CS, NA	CS
1 A 2 Manufacturing Industries and Construction: Liquid Fuels (CO_2)	CS	C, CS	CS/C	CS	CS	CS	D	C	CS	C/D	CS	D	PS, CS, C	CS	CS
1 A 2 Manufacturing Industries and Construction: Other Fuels (CO_2)	D	C, CS	CS/C	CS	CS	CS	D	NO	CS	C/D	NA	D	C	CS, NA	CS
1 A 2 Manufacturing Industries and Construction: Solid Fuels (CO_2)	CS	C, CS	CS/C	CS	CS	CS	D	C	CS	C/D	NA/CS	D	PS, CS, C	CS, NA	CS
1 A 3 a Civil Aviation: Jet Kerosene (CO_2)	CS	C	C	CS	M	CS	T2a	CS	CS	C/D	CS	D	D	CS	CS
1 A 3 b Road Transportation: Diesel oil (CO_2)	CS	C, CS	C	CS	M	CS	D	CS	CS	C/D	CS	D	C	C2	CS
1 A 3 b Road Transportation: Diesel oil (N_2O)	NS	C, CS	C	CS	M	CS	C	COPPER T3	CS	C/D	CS	C	C	CS	COPERT 3
1 A 3 b Road Transportation: Gasoline (CO_2)	CS	C, CS	C	CS	M	CS	D	CS	CS	C/D	CS	D	C	C2	CS
1 A 3 b Road Transportation: Gasoline (N_2O)	NS	C, CS	C	CS	M	CS	C	COPPER T3	CS	C/D	CS	C	C	CS	COPERT 3
1 A 3 b Road Transportation: Other Fuels (CO_2)	-	C, CS	-	CS	M	CS	D	CS	CS	C/D	NA	D	C	NO	CS
1 A 3 c Railways: Liquid Fuels (CO_2)	CS	C	C	CS	CS	CS	D	CS	CS	C/D	CS	D	C	CS	CS
1 A 3 d Navigation: Gas/Diesel Oil (CO_2)	CS	C	C	CS	CS	CS	D	CS	CS	C/D	CS	D	C	CS	CS
1 A 4 a Commercial/Institutional: Gaseous Fuels (CO_2)	CS	C	CS/C	CS	CS	CS	D	CS	CS	C/D	CS	D	CS	CS	CS
1 A 4 a Commercial/Institutional: Liquid Fuels (CO_2)	CS	C	CS/C	CS	CS	CS	D	CS	CS	C/D	CS	D	C	CS	CS
1 A 4 a Commercial/Institutional: Solid Fuels (CO_2)	CS	C	CS/C	CS	CS	CS	D	CS	CS	C/D	CS	D	C	NA	CS
1 A 4 b Residential: Gaseous Fuels (CO_2)	CS	C	CS/C/D	CS	CS	CS	D	CS	CS	C/D	CS	D	CS	CS	CS
1 A 4 b Residential: Liquid Fuels (CO_2)	CS	C	CS/C/D	CS	CS	CS	D	CS	CS	C/D	CS	D	C	CS	CS
1 A 4 b Residential: Solid Fuels (CO_2)	CS	C	CS/C/D	CS	CS	CS	D	CS	CS	C/D	NA	D	C	NA	CS
1 A 4 c Agriculture/Forestry/Fisheries: Gaseous Fuels (CO_2)	CS	C	CS/C	CS	CS	CS	D	CS	CS	C/D	CS	D	CS	CS	CS

EC Key source	AT	BE	DK	FI	FR	DE	GR(A)	IE	IT	LU	NL	PT	ES	SE	GB
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels (CO_2)	CS	C	CS/C	CS	CS	CS	D	CS	CS	C/D	CS/D	D	C	CS	CS
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels (CO_2)	CS	C	CS/C	CS	CS	CS	D	CS	CS	C/D	NA	D	C	NA	CS
1 A 5 Other: Liquid Fuels (CO_2)	CS	C	CS/C	CS	CS	-	NO	NO	CS	C/D	NA	D		CS	CS
1 A 5 Other: Solid Fuels (CO_2)	NO	C	CS/C	CS	CS	-	NO	NO	CS	C/D	NA	D		NA	NO
1 B 1 a Coal Mining (CH_4)	C	NO	-	NA	CS	CS	D	NO	D, CS	C/D	NA	D	CS	NA	CS
1 B 2 a Oil (CO_2)	CS	C	NA	D	-	-	D	NO	-	C/D	NA	CS	PS	CS/NA	CS
1 B 2 b Natural gas (CH_4)	D	CS	CS	M/D/CS	CS	CS	D	CS	CS	C/D	CS	CS	C, CS	NA	CS
1 B 2 c Venting and flaring (CO_2)	IE	CS	CS	CS	-	-	D	NO	CS	C/D	NA/PS	CS	CS	CS/D/NA	CS
2 A 1 Cement Production (CO_2)	CS	CS	PS	CS	PS	CS	CS	PS	CS, PS	C/D	PS	D	CS	PS	CS
2 A 2 Lime Production (CO_2)	CS	CS	D	CS	PS	D	D	PS	CS, PS	C/D	NA	D	D, PS	D/CS	D
2 B 1 Ammonia Production (CO_2)	CS	CS	-	NA	PS	D	IE[5]	CS, PS	C, PS	C/D	CS	PS	PS	NO	CS
2 B 2 Nitric Acid Production (N_2O)	PS	CS	PS	PS	PS	CS	D	CS, PS	D, PS	C/D	PS	PS	CS	PS	CS
2 B 3 Adipic Acid Production (N_2O)	NO	CS	-	NA	PS	D, PS	NO	NO	PS	C/D	NA	NO		NO	CS
2 B 5 Other (N_2O)	NO	CS	-	NA	PS	-	NO	NO	C, PS	C/D	NA/PS	CS		PS	NO
2 C 1 Iron and Steel Production (CO_2)	CS,D	CS	D	PS	CS	CS	CS	NO	C, CS	C/D	NA/CS	NO	PS, CS	CS/PS	CS
2 C 3 Aluminium production (PFC)	PS	NA	-	NA	PS	CS	PS	NO	PS	C/D	PS	NO	PS	CS	PS
2 E PRODUCTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE (HFC)	NO	-	-	NA	-	CS	D	NO	PS	C/D	NA/PS	NO	D, PS	NA	PS
2 E PRODUCTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE (PFC)	NO	PS	-	NA	-	-	NO	NO	PS	C/D	NA/PS	NO		NA	PS
2 F CONSUMPTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE (HFC)	CS	CS	CS	D	-	CS/D	D	CS	CS, PS	C/D	NA	D+CS	D	CS/D/NA	CS/D
2 F CONSUMPTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE (SF_6)	CS	CS	CS	D	-	CS	CS	CS	CS, PS	C/D	NA/PS/D	PS	D	D/NA	CS
4 A 1 Cattle (CH_4)	CS	CS	CS	CS	CS	CS	D	CS	D, CS	C/D	CS	CS	D, CS	CS	CS/D
4 A 3 Sheep (CH_4)	D	CS	CS	CS	D	D	CS	D	D, CS	C/D	D	CS	D, CS	D	CS/D
4 B 1 Cattle (CH_4)	CS	CS	CS	CS	CS, D	CS	D	CS	D, CS	C/D	CS	CS	D, CS	CS	CS/D
4 B 12 Solid Storage and Dry Lot (N_2O)	D, CS	D	D	D	D, CS	-	D	D	D, CS	C/D	D	D+CS	D	D	CS/D
4 B 8 Swine (CH_4)	CS	CS	CS	CS	D, CS	CS	D	D	D, CS	C/D	CS	CS	D, CS	CS	CS/D
4 D 1 Direct Soil Emissions (N_2O)	D	CS	D	D/CS	D, CS	D	D	D	D, CS	C/D	NA/CS	D+CS	D	CS/D	D
4 D 2 Animal Production (N_2O)	D	CS	D	D	D, CS	D	D	D	D, CS	C/D	CS	D+CS	D	CS	NO
4 D 3 Indirect Emissions (N_2O)	D	CS	D	D	D, CS	D	D	CS	D, CS	C/D	D	D+CS	D	D	NO
6 A 1 Managed Waste disposal on Land (CH_4)	CS	CS	CS	D/CS	CS	CS/D	D	CS	D, CS	C/D	CS	D	D, C, CS	D/SC	CS
6 A 2 Unmanaged Waste Disposal Sites (CH_4)	NO	NO	-	NA	CS	-	D	CS	D, CS	C/D	NA	D	D	NO	NO
6 B 2 Domestic and Commercial Wastewater (CH_4)	D, CS	D, CS	D/CS	CS	CS	D/ CS	D	D	D	C/D	NA/CS	D+CS	D, CS	NA	CS
6 B 2 Domestic and Commercial Wastewater (N_2O)	CS, D	-	D/CS	D	CS	D	NE	D	D	C/D	NA/D	D	D	D/NA	D

Information on methods used (new MS)

EC Key source	CY	CZ	EE	HU	LV	LT	MT	PL	SK	SI
1 A 1 a Public Electricity and Heat Production: Gaseous Fuels (CO_2)		T1		T3	T1	T2		D	SA	T1
1 A 1 a Public Electricity and Heat Production: Liquid Fuels (CO_2)		T1		T3	T1	T2		D	SA	T1
1 A 1 a Public Electricity and Heat Production: Other Fuels (CO_2)		T1		T3	T1	T2		D	SA	T1
1 A 1 a Public Electricity and Heat Production: Solid Fuels (CO_2)		T1		T3	T1	T2		D	SA	T1
1 A 1 a Public Electricity and Heat Production: Solid Fuels (N_2O)		T2		T3	T1	T2		D	SA	T1
1 A 1 b Petroleum refining: Liquid Fuels (CO_2)		T1		-	-	T2		D	SA	T1
1 A 1 c Manufacture of Solid fuels and Other Energy Industries: Gaseous Fuels (CO_2)		T1		-	T1	T2		D	SA	T1
1 A 1 c Manufacture of Solid fuels and Other Energy Industries: Solid Fuels (CO_2)		T1		-	T1	T2		D	SA	T1
1 A 2 Manufacturing Industries and Construction: Gaseous Fuels (CO_2)		T1		T2	T1			D	SA	T1
1 A 2 Manufacturing Industries and Construction: Liquid Fuels (CO_2)		T1		T2	T1			D	SA	T1
1 A 2 Manufacturing Industries and Construction: Other Fuels (CO_2)		T1		T2	T1			D	SA	T1
1 A 2 Manufacturing Industries and Construction: Solid Fuels (CO_2)		T1		T2	T1			D	SA	T1
1 A 3 a Civil Aviation: Jet Kerosene (CO_2)		T1		-	T1	T2		T2b	M	T1
1 A 3 b Road Transportation: Diesel oil (CO_2)		T1		T1c	COPERT X	T2		D	COPERT3	M
1 A 3 b Road Transportation: Diesel oil (N_2O)		T2		T1c	COPERT X	T2		T3	COPERT3	M
1 A 3 b Road Transportation: Gasoline (CO_2)		T1		T1c	COPERT X	T2		D	COPERT3	M
1 A 3 b Road Transportation: Gasoline (N_2O)		T2		T1c	COPERT X	T2		T3	COPERT3	M
1 A 3 b Road Transportation: Other Fuels (CO_2)		T1		T1c	T1	T2		D	COPERT3	-
1 A 3 c Railways: Liquid Fuels (CO_2)		T1		T1c	T1	T2		D	M	T1
1 A 3 d Navigation: Gas/Diesel Oil (CO_2)		T1		T1c	T1	T2		T1	M	-
1 A 4 a Commercial/Institutional: Gaseous Fuels (CO_2)		T1		T1	T1	T2		D	SA	T1
1 A 4 a Commercial/Institutional: Liquid Fuels (CO_2)		T1		T1	T1	T2		D	SA	T1
1 A 4 a Commercial/Institutional: Solid Fuels (CO_2)		T1		T1	T1	T2		D	SA	T1
1 A 4 b Residential: Gaseous Fuels (CO_2)		T1		T1	T1	T2		D	SA	T1
1 A 4 b Residential: Liquid Fuels (CO_2)		T1		T1	T1	T2		D	SA	T1
1 A 4 b Residential: Solid Fuels (CO_2)		T1		T1	T1	T2		D	SA	T1
1 A 4 c Agriculture/Forestry/Fisheries: Gaseous Fuels (CO_2)		T1		T1	T1	T2		D	SA	-
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels (CO_2)		T1		T1	T1	T2		D	SA	T1
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels (CO_2)		T1		T1	T1	T2		D	SA	-
1 A 5 Other: Liquid Fuels (CO_2)		T1		-	-	NE		D	SA	-
1 A 5 Other: Solid Fuels (CO_2)		T1		-	-	NE		D	SA	-
1 B 1 a Coal Mining (CH_4)		T2		T1	-	NO		T1	T1	T1
1 B 2 a Oil (CO_2)		T1		-	T1	T1		M	NO	-
1 B 2 b Natural gas (CH_4)		T1		M	Cs	T1		T2	T1	T1
1 B 2 c Venting and flaring (CO_2)		T3		-	-	T1		D	NO	-
2 A 1 Cement Production (CO_2)		T1		T3	T2	T2		T2	T1	T2
2 A 2 Lime Production (CO_2)		CS		T3	T2	T1		D	T1	D
2 B 1 Ammonia Production (CO_2)		T1		T3	-	T2		D	IE	-
2 B 2 Nitric Acid Production (N_2O)		T2		T3	-	T2		D	T1	D
2 B 3 Adipic Acid Production (N_2O)				-	-	NE		NO	T1	-
2 B 5 Other (N_2O)				-	-	NE		D	NO	-
2 C 1 Iron and Steel Production (CO_2)		T1		CS	T2	NO		T2	T1	T2

EC Key source	CY	CZ	EE	HU	LV	LT	MT	PL	SK	SI
2 C 3 Aluminium production (PFC)				-	-	NO		NO	CS	T3
2 E PRODUCTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE (HFC)		NO		-	-	-		NO	D	-
2 E PRODUCTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE (PFC)		NO		-	-	-		NO	D	-
2 F CONSUMPTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE (HFC)		T1		T1,T2,Cs	CS	-		T2a	D	T2
2 F CONSUMPTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE (SF_6)		T1		CS	CS	-		T2a	D	T2
4 A 1 Cattle (CH_4)		T2		D, T1	T1	T1		T2	T2	T2
4 A 3 Sheep (CH_4)		T1		D	T1	T1		T2	T2	T1
4 B 1 Cattle (CH_4)		T1		T1	T1	T1		T2	T2	T2
4 B 12 Solid Storage and Dry Lot (N_2O)		T1		-	T1	-		D	T1	D
4 B 8 Swine (CH_4)		T1		T1	T1	-		T2	T1	T1
4 D 1 Direct Soil Emissions (N_2O)		T1		T1a	T1/T1a	T1		T1b	T1/T2	T1,T1b
4 D 2 Animal Production (N_2O)		T1		D	T1/T2	T1		T1a	T1/T2	T1
4 D 3 Indirect Emissions (N_2O)		T1		T1a	T1	NE		D	T1/T2	T1
6 A 1 Managed Waste disposal on Land (CH_4)		T1		CS,D	T2	T1		T2	D/CS	T2
6 A 2 Unmanaged Waste Disposal Sites (CH_4)				-	-	T1		T2	D/CS	-
6 B 2 Domestic and Commercial Wastewater (CH_4)		T2		CS	D	T1		D	D/CS	D
6 B 2 Domestic and Commercial Wastewater (N_2O)				-	D	T1		D	D/CS	D

Information on activity data (new MS)

EC Key source	CY	CZ	EE	HU	LV	LT	MT	PL	SK	SI
1 A 1 a Public Electricity and Heat Production: Gaseous Fuels (CO_2)		NS		PS, NS	NS	NS		PS	PS	PS
1 A 1 a Public Electricity and Heat Production: Liquid Fuels (CO_2)		NS		PS, NS	NS	NS		PS+NS	PS	PS
1 A 1 a Public Electricity and Heat Production: Other Fuels (CO_2)		NS		PS, NS	NS	NS		PS	PS	PS
1 A 1 a Public Electricity and Heat Production: Solid Fuels (CO_2)		NS		PS, NS	NS	NS		PS	PS	PS
1 A 1 a Public Electricity and Heat Production: Solid Fuels (N_2O)		NS		PS, NS	NS	NS		PS	PS	PS
1 A 1 b Petroleum refining: Liquid Fuels (CO_2)		NS		-	-	NS		PS	PS	NS
1 A 1 c Manufacture of Solid fuels and Other Energy Industries: Gaseous Fuels (CO_2)		NS		-	NS	NS		NS	PS	NS
1 A 1 c Manufacture of Solid fuels and Other Energy Industries: Solid Fuels (CO_2)		NS		-	NS	NS		PS	PS	NS
1 A 2 Manufacturing Industries and Construction: Gaseous Fuels (CO_2)		NS		NS	NS	NS		NS+PS	PS	NS
1 A 2 Manufacturing Industries and Construction: Liquid Fuels (CO_2)		NS		NS	NS	NS		NS+PS	PS	NS
1 A 2 Manufacturing Industries and Construction: Other Fuels (CO_2)		NS		NS	NS	NS		NS+PS	PS	NS
1 A 2 Manufacturing Industries and Construction: Solid Fuels (CO_2)		NS		NS	NS	NS		NS	PS	NS
1 A 3 a Civil Aviation: Jet Kerosene (CO_2)		NS		-	Q	NS		NS+AS	AS/Q/NS/RS	NS
1 A 3 b Road Transportation: Diesel oil (CO_2)		NS		NS	NS	NS		NS	AS/Q/NS/RS	AS/NS/Q
1 A 3 b Road Transportation: Diesel oil (N_2O)		NS		NS	NS	NS		NS+AS	AS/Q/NS/RS	AS/NS/Q
1 A 3 b Road Transportation: Gasoline (CO_2)		NS		NS	NS	NS		NS	AS/Q/NS/RS	AS/NS/Q
1 A 3 b Road Transportation: Gasoline (N_2O)		NS		NS	NS	NS		NS+AS	AS/Q/NS/RS	AS/NS/Q
1 A 3 b Road Transportation: Other Fuels (CO_2)		NS		NS	NS	NS		NS	AS/Q/NS/RS	-
1 A 3 c Railways: Liquid Fuels (CO_2)		NS		NS	NS	NS		NS	AS/Q/NS/RS	NS
1 A 3 d Navigation: Gas/Diesel Oil (CO_2)		NS		NS	Q	NS		NS+AS	AS/Q/NS/RS	-
1 A 4 a Commercial/Institutional: Gaseous Fuels (CO_2)		NS		NS	NS	NS		NS	PS	NS/PS
1 A 4 a Commercial/Institutional: Liquid Fuels (CO_2)		NS		NS	NS	NS		NS	PS	NS/PS
1 A 4 a Commercial/Institutional: Solid Fuels (CO_2)		NS		NS	NS	NS		NS	PS	NS/PS
1 A 4 b Residential: Gaseous Fuels (CO_2)		NS		NS	NS	NS		NS	PS	NS/Q
1 A 4 b Residential: Liquid Fuels (CO_2)		NS		NS	NS	NS		NS	PS	NS/Q
1 A 4 b Residential: Solid Fuels (CO_2)		NS		NS	NS	NS		NS	PS	NS/Q
1 A 4 c Agriculture/Forestry/Fisheries: Gaseous Fuels (CO_2)		NS		NS	NS	NS		NS	PS	-
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels (CO_2)		NS		NS	NS	NS		NS	PS	NS/Q
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels (CO_2)		NS		NS	NS	NS		NS	PS	-
1 A 5 Other: Liquid Fuels (CO_2)		NS		-	-	NE		NS	PS	-
1 A 5 Other: Solid Fuels (CO_2)		NS		-	-	NE		NS	PS	-
1 B 1 a Coal Mining (CH_4)		NS		NS	-	NO		NS	NS/AS/PS/Q	NS/PS
1 B 2 a Oil (CO_2)		NS		-	NS	Q		NS+AS	NO	-
1 B 2 b Natural gas (CH_4)				NS, PS	PS	Q		NS+AS	NS/AS/PS/Q	NS/PS/AS
1 B 2 c Venting and flaring (CO_2)				-	-	Q		PS	NO	-
2 A 1 Cement Production (CO_2)		NS		PS	PS	PS		PS	NS/PS	PS
2 A 2 Lime Production (CO_2)		NS		PS	PS	NS		NS+PS	NS/PS	PS
2 B 1 Ammonia Production (CO_2)		NS		PS	-	PS		NS+PS	IE	-
2 B 2 Nitric Acid Production (N_2O)		NS/PS		PS	-	PS		NS+PS	PS	PS
2 B 3 Adipic Acid Production (N_2O)		NO		-	-	NE		-	PS	-
2 B 5 Other (N_2O)		NO		-	-	NE		NS+PS	NO	-
2 C 1 Iron and Steel Production (CO_2)		NS		AS	PS	NO		PS	PS	PS

EC Key source	CY	CZ	EE	HU	LV	LT	MT	PL	SK	SI
2 C 3 Aluminium production (PFC)		NO		-	-	NO		NO	PS	PS
2 E PRODUCTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE (HFC)		NO		-	-	-		NO	Q	-
2 E PRODUCTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE (PFC)		NO		-	-	NO		NO	Q	-
2 F CONSUMPTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE (HFC)		Q		Q	Q	Q		NS+AS	Q	AS/Q
2 F CONSUMPTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE (SF_6)		Q		Q	Q	NE		PS	Q	Q
4 A 1 Cattle (CH_4)		NS		NS	NS	NS		NS	NS/AS	NS/AS
4 A 3 Sheep (CH_4)		NS		NS	NS	NS		NS	NS/AS	NS
4 B 1 Cattle (CH_4)		NS		NS	NS	NS		NS	NS/AS	NS/AS
4 B 12 Solid Storage and Dry Lot (N_2O)		NS		-	NS	-		NS	NS/AS	NS/AS
4 B 8 Swine (CH_4)		NS		NS	NS	-		NS	NS/AS	NS/AS
4 D 1 Direct Soil Emissions (N_2O)		NS		NS	NS	NE		NS	NS	NS/AS
4 D 2 Animal Production (N_2O)		NS		NS	NS	NS		NS	NS	NS/AS
4 D 3 Indirect Emissions (N_2O)		NS		NS	NS	NE		NS	NS	NS/AS
6 A 1 Managed Waste disposal on Land (CH_4)		NS		NS	NS	NS		NS	NS	Q/PS
6 A 2 Unmanaged Waste Disposal Sites (CH_4)		NO		-	-	NS		NS	NS	-
6 B 2 Domestic and Commercial Wastewater (CH_4)		NS		NS	NS	NS		NS	NS/PS	NS/AS/PS
6 B 2 Domestic and Commercial Wastewater (N_2O)				-	NS	Q		IS	NS/PS	IS

Information on emission factors (new MS)

EC Key source	CY	CZ	EE	HU	LV	LT	MT	PL	SK	SI
1 A 1 a Public Electricity and Heat Production: Gaseous Fuels (CO_2)		D		D	CS	CS		D	D/CS	CS
1 A 1 a Public Electricity and Heat Production: Liquid Fuels (CO_2)		D		D	CS	CS		D	D/CS	D
1 A 1 a Public Electricity and Heat Production: Other Fuels (CO_2)		D		D	CS	CS		D	D/CS	D
1 A 1 a Public Electricity and Heat Production: Solid Fuels (CO_2)		D		D, PS	CS	CS		D	D/CS	CS/D
1 A 1 a Public Electricity and Heat Production: Solid Fuels (N_2O)		CS		CS, C	D	CS		D	D	D
1 A 1 b Petroleum refining: Liquid Fuels (CO_2)		D		-	-	CS		D+CS	D/CS	D
1 A 1 c Manufacture of Solid fuels and Other Energy Industries: Gaseous Fuels (CO_2)		D		-	CS	CS		CS	D/CS	CS
1 A 1 c Manufacture of Solid fuels and Other Energy Industries: Solid Fuels (CO_2)		D		-	CS	CS		D	D/CS	D
1 A 2 Manufacturing Industries and Construction: Gaseous Fuels (CO_2)		D		D	CS	-		CS	D/CS	CS
1 A 2 Manufacturing Industries and Construction: Liquid Fuels (CO_2)		D		D	CS	-		D	D/CS	D
1 A 2 Manufacturing Industries and Construction: Other Fuels (CO_2)		D		D	CS	-		D	D/CS	D
1 A 2 Manufacturing Industries and Construction: Solid Fuels (CO_2)		D		D	CS	-		D	D/CS	D
1 A 3 a Civil Aviation: Jet Kerosene (CO_2)		D		-	D	CS		D	C	D
1 A 3 b Road Transportation: Diesel oil (CO_2)		D		D	D	CS		D	C	CS/D
1 A 3 b Road Transportation: Diesel oil (N_2O)		CS		CS, C	D	CS		C	C	CS/D
1 A 3 b Road Transportation: Gasoline (CO_2)		D		D	D	CS		D	C	CS/D
1 A 3 b Road Transportation: Gasoline (N_2O)		CS		CS, C	D	CS		C	C	CS/D
1 A 3 b Road Transportation: Other Fuels (CO_2)		D		D	D	CS		D	C	-
1 A 3 c Railways: Liquid Fuels (CO_2)		D		D	D	CS		D	C	D
1 A 3 d Navigation: Gas/Diesel Oil (CO_2)		D		D	D	CS		D	C	-
1 A 4 a Commercial/Institutional: Gaseous Fuels (CO_2)		D		D	CS	CS		D	D/CS	CS
1 A 4 a Commercial/Institutional: Liquid Fuels (CO_2)		D		D	CS	CS		D	D/CS	D
1 A 4 a Commercial/Institutional: Solid Fuels (CO_2)		D		D	CS	CS		D	D/CS	D
1 A 4 b Residential: Gaseous Fuels (CO_2)		D		D	CS	CS		D	D/CS	CS
1 A 4 b Residential: Liquid Fuels (CO_2)		D		D	CS	CS		D	D/CS	D
1 A 4 b Residential: Solid Fuels (CO_2)		D		D	CS	CS		D	D/CS	D
1 A 4 c Agriculture/Forestry/Fisheries: Gaseous Fuels (CO_2)		D		D	CS	CS		D	D/CS	-
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels (CO_2)		D		D	CS	CS		D	D/CS	D
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels (CO_2)		D		D	CS	CS		D	D/CS	-
1 A 5 Other: Liquid Fuels (CO_2)		D		-	-	NE		D	D/CS	-
1 A 5 Other: Solid Fuels (CO_2)		D		-	-	NE		D	D/CS	-
1 B 1 a Coal Mining (CH_4)		CS		CS	-	NO		D	CS	CS
1 B 2 a Oil (CO_2)				-	D	D		CS	NO	-
1 B 2 b Natural gas (CH_4)		CS		CS	PS	D		CS	D/CS	CS/D
1 B 2 c Venting and flaring (CO_2)				-	-	D		CS	NO	-
2 A 1 Cement Production (CO_2)		D		D, CS	PS	PS		D	D	CS
2 A 2 Lime Production (CO_2)		-		D	PS	D		D	D	D
2 B 1 Ammonia Production (CO_2)		CS		D	-	PS		PS	IE	-
2 B 2 Nitric Acid Production (N_2O)		PS		PS, D	-	PS		PS	PS	D
2 B 3 Adipic Acid Production (N_2O)				-	-	NE		NO	PS	-
2 B 5 Other (N_2O)				-	-	NE		CS	NO	-
2 C 1 Iron and Steel Production (CO_2)		D		CS, D	PS	NO		PS	D	PS

EC Key source	CY	CZ	EE	HU	LV	LT	MT	PL	SK	SI
2 C 3 Aluminium production (PFC)				-	-	NO		NO	CS	PS
2 E PRODUCTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE (HFC)		NO		-	-	NO		NO	D/CS	-
2 E PRODUCTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE (PFC)		NO		-	-	NO		NO	D/CS	-
2 F CONSUMPTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE (HFC)		-		D, CS	CS	D		D+CS	D/CS	D
2 F CONSUMPTION OF HALOCARBONS AND SULPHUR HEXAFLUORIDE (SF_6)		-		CS	CS	NE		PS	D/CS	CS
4 A 1 Cattle (CH_4)		CS		CS, D	D	D		CS	D/CS	CS
4 A 3 Sheep (CH_4)		Tier 1		CS	D	D		CS	D/CS	D
4 B 1 Cattle (CH_4)		Tier 1		CS	D	D		CS	D/CS	CS
4 B 12 Solid Storage and Dry Lot (N_2O)		D		D	D/CS	-		D+CS	D/CS	D
4 B 8 Swine (CH_4)		Tier 1		CS	D	-		CS	D/CS	CS
4 D 1 Direct Soil Emissions (N_2O)		D		D	D	D		D+CS	D/CS	D
4 D 2 Animal Production (N_2O)		D		D	D/CS	D		D+CS	D/CS	D
4 D 3 Indirect Emissions (N_2O)		D		D	D	NE		D+CS	D/CS	D
6 A 1 Managed Waste disposal on Land (CH_4)		CS		CS, D	D	D		D	D	D
6 A 2 Unmanaged Waste Disposal Sites (CH_4)		NO		-	-	D		D	D	-
6 B 2 Domestic and Commercial Wastewater (CH_4)		CS		CS	D	D		D+CS	D/CS	D
6 B 2 Domestic and Commercial Wastewater (N_2O)				-	D	D		D	D/CS	D

Annex 12 includes the CRF Table Summary 3 for those Member States that submitted these tables in 2005. Detailed information on methodologies used by the Member States is available in the Member States national inventory reports, which are included in Annex 12. Note that all Member States' submissions (CRF tables and national inventory reports), which are included in Annex 12 and made available at the EEA website, are considered to be part of the EC submission.

Internal consistency of the EU-15 CRF tables

There are some consistency problems when compiling the EC CRF tables (i.e. the sum of sub-categories is not equal to the category total) in those categories where Member States have difficulties to allocate emissions to the sub-categories. This often is due to confidentiality issues and mainly refers to the source categories 2.E and 2.F. Member States use notation keys like IE or C if they cannot provide an emission estimate for a certain sub-category. At Member State level, the use of the notation keys makes transparent the reason for not providing emission estimates. However, at EU-15 level, the sub-category emission value is the sum of Member States emission values and the information of the notation keys used by some Member States is lost in the EU-15 CRF submission. In order to make this more transparent, Annexes 4-10 of this report include the CRF tables for the sectors for each EU-15 Member State. However, due to reallocation of some sources this year the EC CRF tables are fully consistent. The following overview lists the procedures applied (and marked in yellow in the respective annexes):

Energy:

• Table 1:	- the sum of 1A2 was included in 1A2f when a MS reports only notation keys
• Table 1.A(a): • Table 1B1: • Table 1C:	- for some Member States additional information provided by the Member States during the consultation process was used; in some cases information provided in the old CRF format was adapted for use in the CRF Reporter software.

Industrial processes

• Table 2(I):	- the sum of 2B was included in 2B5 when a MS reports only notation keys - the sum of 2E was included in 2E1 when a MS reports only notation keys - the sum of 2F was included in 2F9 when a MS reports only notation keys
• Table 2(II):	- This table was made consistent for those MS who reported notation keys or did not report this table. In these cases emissions were transferred into columns 'unspecified mix of …'.
• Table 2.(I): • Table 2(I).A-G: • Table 2.(II):	- for some Member States additional information provided by the Member States during the consultation process was used; in some cases information provided in the old CRF format was adapted for use in the CRF Reporter software.

Solvent use

• Table 3	- the sum of 3D was included in 3D5 when a MS reports only notation keys

Agriculture

• Table 4	- the sum of 4D was included in 4D4 when a MS reports only notation keys - NOx emissions from 4B and 4D were included in 4G - SO2 emissions from 4F were included in 4G - CH4 removals are missing the CRF tables because CRF Reporter software does not allow entry of negative emissions in this source category
• Table 4.A: • Table 4.B(a): • Table 4.B(b): • Table 4D:	- for some Member States additional information provided by the Member States during the consultation process was used; in some cases information provided in the old CRF format was adapted for use in the CRF Reporter software.

LULUCF

• Table 5	CH4 and N2O emissions of 5D were included in sector 5G, because the CRF Reporter software does not allow CH4 and N2O emissions under 5D NMVOC and SO2 emissions from 5G were included in sector 7 'Other' because the CRF Reporter does not allow entry of these emissions in sector 5

Waste

• Table 6.A: • Table 6.B: • Table 6.C:	- for some Member States additional information provided by the Member States during the consultation process was used; in some cases information provided in the old CRF format was adapted for use in the CRF Reporter software.

1.5 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.

In addition to the key source analysis at EU-15 level, every Member State provides a national key source analysis which is independent from the assessment at EU-15 level. The EU-15 key source analysis is not intended to replace the key source analysis by Member States. The key source analysis at EU-15 level is carried out to identify those source categories for which overviews of Member States' methodologies, emission factors, quality estimates and emission trends are provided in this report. In addition, the EU-15 key source analysis helps identifying those categories that should receive special attention with regard to QA/QC at EC level. The Member States use their key source analysis for improving the quality of emission estimates at Member State level.

To identify key source categories of the EU-15, the following procedure was applied:

- Starting point for the key source identification for this report were the CRF sectoral report tables and sectoral background data tables (for energy), i.e. CRF Tables 1A(a), 2(I), 3, 4, 6 of the EU-15 GHG inventory. All source categories where GHG emissions occur were listed, at the most disaggregated level available at EU-15 level and split by gas.

- A level assessment was carried out for all years between the base year and 2004 and a trend assessment was performed for the base year to 2004.

- This procedure resulted in the identification of 79 key source categories for the EU-15. The EU-15 key sources are listed in Table 1.6; the calculations are included in Annex 1. The key sources cover 96.7 % of total EU-15 GHG emissions in 2004.

In Chapters 3 to 9 for each key source overview tables are presented which include the Member States' contributions to the EU-15 key source in terms of level and trend.

Table 1.6 EU-15 GHG source categories identified as key sources (emissions in Gg of CO_2 equivalents)

Source category	Base year	2004
1 A 1 a Public Electricity and Heat Production: Gaseous Fuels (CO_2)	60,480	215,797
1 A 1 a Public Electricity and Heat Production: Liquid Fuels (CO_2)	124,690	77,745
1 A 1 a Public Electricity and Heat Production: Other Fuels (CO_2)	13,218	27,359
1 A 1 a Public Electricity and Heat Production: Solid Fuels (CO_2)	750,061	687,329
1 A 1 a Public Electricity and Heat Production: Solid Fuels (N_2O)	8,359	8,418
1 A 1 b Petroleum refining: Gaseous Fuels (CO_2)	3,678	7,208
1 A 1 b Petroleum refining: Liquid Fuels (CO_2)	98,604	114,085
1 A 1 b Petroleum refining: Solid Fuels (CO_2)	3,586	900
1 A 1 c Manufacture of Solid fuels and Other Energy Industries: Gaseous Fuels (CO_2)	16,398	23,101
1 A 1 c Manufacture of Solid fuels and Other Energy Industries: Solid Fuels (CO_2)	72,805	31,554
1 A 2 a Iron and Steel: Gaseous Fuels (CO_2)	16,305	20,740
1 A 2 a Iron and Steel: Liquid Fuels (CO_2)	7,253	5,047
1 A 2 a Iron and Steel: Solid Fuels (CO_2)	91,253	75,127
1 A 2 b Non-Ferous Metals: Gaseous Fuels (CO_2)	2,400	4,573
1 A 2 b Non-Ferous Metals: Solid Fuels (CO_2)	4,141	1,458
1 A 2 c Chemicals: Gaseous Fuels (CO_2)	27,771	30,935
1 A 2 c Chemicals: Liquid Fuels (CO_2)	30,803	19,491
1 A 2 c Chemicals: Other Fuels (CO_2)	3,456	9,193
1 A 2 c Chemicals: Solid Fuels (CO_2)	8,204	4,129
1 A 2 d Pulp, Paper and Print: Gaseous Fuels (CO_2)	10,574	18,317
1 A 2 d Pulp, Paper and Print: Liquid Fuels (CO_2)	9,593	6,416
1 A 2 d Pulp, Paper and Print: Solid Fuels (CO_2)	3,423	1,230
1 A 2 e Food Processing, Beverages and Tobacco: Gaseous Fuels (CO_2)	12,707	23,841
1 A 2 e Food Processing, Beverages and Tobacco: Liquid Fuels (CO_2)	15,359	13,866
1 A 2 e Food Processing, Beverages and Tobacco: Solid Fuels (CO_2)	5,136	1,882
1 A 2 f Other: Gaseous Fuels (CO_2)	105,104	143,613
1 A 2 f Other: Liquid Fuels (CO_2)	126,193	117,409
1 A 2 f Other: Solid Fuels (CO_2)	119,585	44,245
1 A 3 a Civil Aviation: Jet Kerosene (CO_2)	17,315	23,022

Source category	Base year	2004
1 A 3 b Road Transportation: Diesel oil (CO_2)	265,972	476,294
1 A 3 b Road Transportation: Diesel oil (N_2O)	4,147	9,796
1 A 3 b Road Transportation: Gasoline (CO_2)	363,108	317,471
1 A 3 b Road Transportation: Gasoline (N_2O)	2,724	11,135
1 A 3 b Road Transportation: LPG (CO_2)	7,313	5,831
1 A 3 c Railways: Liquid Fuels (CO_2)	8,275	6,386
1 A 3 d Navigation: Gas/Diesel Oil (CO_2)	12,426	12,201
1 A 3 d Navigation: Residual Oil (CO_2)	5,704	7,277
1 A 4 a Commercial/Institutional: Gaseous Fuels (CO_2)	59,130	101,861
1 A 4 a Commercial/Institutional: Liquid Fuels (CO_2)	73,881	60,374
1 A 4 a Commercial/Institutional: Solid Fuels (CO_2)	27,603	1,797
1 A 4 b Residential: Biomass (CH_4)	6,237	5,835
1 A 4 b Residential: Gaseous Fuels (CO_2)	161,893	248,057
1 A 4 b Residential: Liquid Fuels (CO_2)	169,679	159,807
1 A 4 b Residential: Solid Fuels (CO_2)	74,526	11,520
1 A 4 c Agriculture/Forestry/Fisheries: Gaseous Fuels (CO_2)	9,723	10,227
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels (CO_2)	57,198	52,606
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels (CO_2)	4,066	585
1 A 5 a Stationary: Solid Fuels (CO_2)	4,667	41
1 A 5 b Mobile: Liquid Fuels (CO_2)	13,612	6,153
1 B 1 a Coal Mining: (CH_4)	43,278	14442
1 B 2 a Oil: (CO_2)	9,330	8,545
1 B 2 b Natural gas: (CH_4)	25,665	21555
1 B 2 c Venting and flaring: (CO_2)	6,505	5,837
2 A 1 Cement Production: (CO_2)	79,905	83,946
2 A 2 Lime Production: (CO_2)	17,355	18,327
2 A 3 Limestone and Dolomite Use: (CO_2)	5,932	7,347
2 B 1 Ammonia Production: (CO_2)	17,599	16,322
2 B 2 Nitric Acid Production: (N_2O)	36,979	31078
2 B 3 Adipic Acid Production: (N_2O)	63,326	13697
2 B 5 Other: (CO_2)	8,408	12,473
2 B 5 Other: (N_2O)	4,707	1815
2 C 1 Iron and Steel Production: (CO_2)	71,912	64,482
2 C 3 Aluminium production: (PFC)	9,414	2,618
2 E 1 By-product Emissions: (HFC)	33,863	4,592
2 F 1 Refrigeration and Air Conditioning Equipment : (HFC)	2,078	34,334
2 F 4 Aerosols/ Metered Dose Inhalers: (HFC)	805	7,200
2 F 9 Other: (SF_6)	7,053	2758
4 A 1 Cattle: (CH_4)	113,874	101669
4 A 3 Sheep: (CH_4)	16,063	14504
4 B 1 Cattle: (CH_4)	23,192	20385
4 B 13 Solid Storage and Dry Lot: (N_2O)	23,829	20868
4 B 8 Swine: (CH_4)	18,332	20911
4 D 1 Direct Soil Emissions: (N_2O)	115,782	102766
4 D 2 Pasture, Range and Paddock Manure: (N_2O)	28,644	26077
4 D 3 Indirect Emissions: (N_2O)	80,193	69381
6 A 1 Managed Waste disposal on Land: (CH_4)	118,494	72254
6 A 2 Unmanaged Waste Disposal Sites: (CH_4)	13,108	8221
6 B 2 Domestic and Commercial Wastewater: (CH_4)	9,024	6341
6 B 2 Domestic and Commercial Wastewater: (N_2O)	8,192	8583

1.6 Information on the quality assurance and quality control plan

The EC GHG inventory is based on the annual inventories of the EC 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. The EC Member States and also the European Community as a whole are currently implementing QA/QC procedures in order to comply with the IPCC good practice guidance.

1.6.1 Quality assurance and quality control of the European Community inventory

The EC QA/QC programme describes the quality objectives and the inventory quality assurance and quality control plan for the EC GHG inventory including responsibilities and the time schedule for the performance of the QA/QC procedures: Definitions of quality assurance, quality control and related terms used are those provided in IPCC Good Practice Guidance and Uncertainty Management in

National Greenhouse Gas Inventories and Guidelines for National Systems under the Kyoto Protocol. The EC QA/QC programme will be reviewed annually and modified or updated as appropriate.

The European Commission (Directorate General for Environment) is responsible for coordinating QA/QC activities for the EC inventory and ensures that the objectives of the QA/QC programme are implemented and the QA/QC plan is developed. The European Environment Agency (EEA) is responsible for the annual implementation of QA/QC procedures for the EC inventory.

The overall objectives of the EC QA/QC programme are:

- to provide an EC inventory of greenhouse gas emissions and removals consistent with the sum of Member States' inventories of greenhouse gas emissions and removals,
- to establish appropriate QA/QC procedures at EC level in order to comply with requirements under the UNFCCC and the Kyoto Protocol,
- to contribute to the improvement of quality of Member States' inventories and
- to provide assistance for the implementation of national QA/QC programmes.

A number of specific objectives have been elaborated in order to ensure that the EC GHG inventory complies with the UNFCCC inventory principles of transparency, completeness, consistency, comparability, accuracy and timeliness.

In the QA/QC plan quality control procedures before and during the compilation of the EC GHG inventory are listed. In addition, QA procedures, procedures for documentation and archiving, the time schedules for QA/QC procedures and the provisions related to the inventory improvement plan are included.

Based on the EC QA/QC programme a quality management manual was developed which includes all specific details of the QA/QC procedures (in particular checklists and forms). The structure of the EC quality management manual has been developed on the basis of the Austrian quality management manual. The reason for using the Austrian manual as a template for the EC manual is that the EC GHG inventory is compiled by Umweltbundesamt Austria and the implementation of the annual QA/QC procedures are coordinated by Umweltbundesamt Austria. By using the Austrian quality manual as a template for the EC quality manual the EC can benefit from the experience made during the set-up of the Austrian quality management system which is accredited under ISO 1720: procedures and documents from the Austrian system have been taken and adapted according to the need of the EC quality management system.

The EC quality management manual is structured along three main processes (management processes, inventory compilation processes, supporting processes) of the quality management system (See Table 1.7).

Table 1.7 Structure of the EC quality management manual

Chapter		**Chapter description**
Management processes		
ETC 01	EC inventory system	Describes the organisation and responsibilities within the EC GHG inventory system
ETC 02	QA/QC programme	Describes the preparation and evaluation of the EC QA/QC programme by the European Commission
ETC 03	Quality management system	Describes the responsibilities and the structure of the quality management system and gives an overview of the forms and checklists used
ETC 04	Quality management evaluation	Describes the evaluation of the status and effectiveness of the quality management system
ETC 05	Correction and prevention	Describes the procedures for the correction and prevention of mistakes that occur in the EC inventory
ETC 06	Information technology systems	Describes the information technology systems used such as CIRCA, Reportnet and the systems set up at Umweltbundesamt Austria
ETC 07	External communication	Describes the communication with Member States and other persons and institutions
Inventory compilation processes		
ETC 08	QC MS submissions	Describes the quality control activities performed on the GHG inventories

		submitted by the EC Member States
ETC 09	QC EC inventory compilation	Describes the quality control activities performed during the compilation of the EC GHG inventory including checks of database integrity
ETC 10	QC EC inventory report	Describes the checks carried out during and after the compilation of the EC GHG inventory report
Supporting processes		
ETC 11	Documents	Describes the production, change, proofreading, release and archiving of quality management documents
ETC 12	Documentation and archiving	Describes the procedure for preparing documentation and archiving

The quality checks performed during inventory compilation process are the central part of the quality manual. Quality checks are made at three levels:

Quality control MS submissions

The QC activities of MS submissions include two elements; checking the completeness of the Member States CRF tables and checking the consistency of Member States GHG data. The com-pleteness checks of Member States' submissions are carried out by EEA/ETC-ACC by using a similar status report form as used by the UNFCCC Secretariat. The completed status reports are sent to Member States by 28 February; then Member States can check the status reports and update information, if needed. The status reports of the Member States' submissions are included in Annex 3 of this report.

The consistency checks of Member States data primarily aim at identifying main problems in time series or sub-category sums. For the time series checks the algorithms of the UNFCCC secretariat are used. In addition, the ETC/ACC identifies problems by comparison with the previous year's in-ventory 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 also sent to the Member States by 28 February, in order to obtain, if needed, revised emission estimates or additional information.

For the sectors energy, industrial processes, agriculture, LULUCF and waste sector-specific checks are performed by the sector experts and documented in sector-specific checklists. In addition, sector experts receive the results of checks with the UNFCCC outlier tool before they are sent to the Member States. The main findings of the sector specific checklists are transferred to/also documented in the consistency and completeness reports.

The checks mentioned above are performed for EU-15 Member States' submissions. For the new Member States limited initial checks are performed: the status reports are completed entirely, whereas in the consistency and completeness report only limited checks are performed.

For every updated inventory submission provided by the MS limited follow-up checks are performed: the status reports are completed entirely, whereas in the consistency and completeness report only limited checks are performed. In addition it is checked if issues identified in the status reports and in the consistency and completeness reports (initial checks), which are relevant for the EC inventory (report) have been clarified by the MS. If this is not the case MS are contacted for clarification.

Quality control EC inventory compilation

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 GHG and air pollutants. The version of the data received by 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 Umweltbundesamt Austria.

As the EC GHG gas inventory is compiled on the basis of the inventories of the EC Member States, the focus of the quality control checks performed during the compilation of the EC GHG inventory lays on checking if the correct MS data are used, if the data can be summed-up (same units are used) and that the summing-up is correct. Finally, the consistency and the completeness of the EC GHG inventory is checked. All the checks are carried out for the original submission by 15 April each year and for any resubmission. Two checklists are used for this purpose: 'Inventory preparation/consistency' and 'Data file integrity'.

Quality checks EC inventory report

The checks carried out during and after the compilation of the EC GHG inventory report are specified in the checklist 'EC inventory report'. They cover a.o. checks of data consistency between the inventory and the inventory report, data consistency between the tables and the text, but also checks of the layout.

The circulation of the draft EC inventory and inventory report on 28 February to the EC Member States for reviewing and commenting also aims 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 also contributes to improving the quality of the EC GHG inventory. This analysis is carried out in the annual EC GHG trend and projections report (see EEA, 2005b); 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

As the EC GHG inventory is based on the annual inventories of the EC Member States, the quality of the EC inventory depends on the quality of the Member States' inventories and their QA/QC procedures. The following Table 1.8 gives an overview of QA/QC procedures in place at Member State level. The information is taken from the Member State national inventory reports 2005 and 2006.

Table 1.8 Overview of quality assurance and quality control procedures in place at Member State level (NIR descriptions)

MS	Description of the national QA/QC activities	Source
Austria	A quality management system (QMS) has been designed to contribute to the objectives of GPG (transparency, consistency, comparability, completeness and confidence in national inventories of emissions estimates). The QMS is based on the International Standard ISO 17020. This standard covers the functions of bodies whose work includes the assessments of conformity, and the subsequent reporting of results of conformity assessment to clients and, when required, to supervisory authorities. In the case of greenhouse gas emissions inventories, inspection covers (i) data collection (emission data and/or of data which are used to estimate emissions e.g. activity data, emission factors, conversion factors), (ii) the application of appropriate methodologies (IPCC, CORINAIR and country specific methodologies) to estimate emissions, (iii) the compilation of the emissions inventory and (iv) the assessment of conformity with national emissions reduction targets. The QMS ensures that all requirements of a Type A inspection body as stipulated in ISO 17020 are met, including independence, impartiality and integrity. After having been effectively implemented during the development of the UNFCCC submission 2004, the accreditation audit of the Umweltbundesamt as Inspection body for GHG Inventories took place in 2005. The Umweltbundesamt is accredited as inspection body (Id.No. 241) in accordance with the Austrian Accreditation Law (AkkG), Federal Law Gazette (FLG) No. 468/1992, last amended by FLG I No. 85/2002, by decree of the Minister of Economics and Labour, No. BMWA-92.715/0036-I/12/2005 (issued 19.01.2006, valid from 23.12.2005). The requirements of EN ISO/IEC (Type A) are fulfilled. During the year 2005 QA/QC activities were focused on finalizing and updating the QMS system and preparing for the accreditation audit. QA/QC procedures comply with the recommendations of IPCC-GPG chapter 8 on Quality Assurance and Quality Control. Priority is given to key sources. For all sources, fundamental checks such as completeness of estimates, time series consistencies, data transcription and documentation are performed. For key sources, activity data, emission factors, emissions and uncertainty analysis are assessed using the Tier 1 checklist. In addition, where applicable Tier 2 QC procedures are employed. Special attention is given to documentation, archiving and reporting. A system of standard operating procedures (SOPs) ensures agreed standards as well as transparency within (i) the inventory compilation process (ii) supporting processes (e.g. archiving) and (iii) management processes (e.g. annual management reviews, internal audits, regular training of personnel, error prevention).	Austria's National Inventory Report 2006 Submission under the EC MM (2006) p. 33-38

MS	Description of the national QA/QC activities	Source
Belgium	The Working Group on ‘Emissions’ of the Co-ordination Committee for International Environmental Policy (CCIEP) has conducted intern quality insurance and QC work by continuously exchanging information about methodologies used and estimated results. Feedback is given and extra controls are made by persons responsible for compiling the emission inventory of greenhouse gases. As a consequence this all gives extra checks of the regional emission inventories as well. Following the IPCC GPG and Uncertainty Management in National GHG inventories, QC procedures (Tier 1) will be implemented to check the inventory on selected sets of data and processes. In a first approach, the key sources categories will be checked over their input data, their parameters and their calculations. In this view, several technical meetings are conducted since 2003 with the three regions to identify for each sector on which level the GPG has to be implemented and to devise a work programme until the next submission. Specific activities relating to improvements of the inventory and QA/QC carried out were: (a) Audits: Independent audits of the GHG inventories of the regions and the national inventory have started in the course of 2002 (b) Internal QC: Several technical meetings, which are part of the CCIEP-WG Emissions were conducted in the course of 2003 to check if the IPCC GPG were followed in the different regions. (c) Reviews: In September 2003 an Expert Review Team of UNFCCC (d) Peer-review: In the beginning of 2005 first contacts about carrying out a cross-country review of some parts of the GHG emission inventories in Belgium and the Netherlands. *Regional level - QA/QC in Flanders:* (1) *within the VMM:* The responsable persons for the international reporting obligations within the service Emission Inventory Air are converting the Flemish emission data into CRF-tables. VMM has conducted a study to implement a QA/QC. The system setted up in 2004, a complete development of the system as well as a first internal review become operational in the course of 2005, full implementation for all sectors and on the most detailed level is expected in the course of 2006. The quality system set up in Flanders is completely based on ISO 9001:2000. (2) *within the VITO:* The procedures to prepare the Flemish energy balance are also part of a certified ISO9001 system (certificate no. 08376-2003-AQ-ROT-BELCERT). This certificate is currently applicable to the development & implementation of complete evaluation methods and management concepts for the sustainable use of materials, energy and environment, including the electronic distribution of information on energy and environmental information (EMIS). *Regional level - QA/QC in Wallonia* (1) In Wallonia, the inventory is conducted by the Air Cell (part of General Directorate for Natural Resources and Environment (DGRNE). An ISO 9001 certification is foreseen for the DGRNE. The manual of the management system of the DGRNE includes a description of EMAS procedures (DGRNE is certified EMAS march 2004) as well as ISO 9001 procedures. An ISO 9000 certification is also foreseen for the Air Cell in the next years. Air emissions inventories will be one of the products and services of the Air Cell that will be formalised in the procedures. (2) Concerning the measures used to determine country-specific emission factors, it can be mentioned that in Wallonia, before performing any air emissions measure, all the laboratories must first be agreed by ISSEP, which conducts a review of material and methodologies used and check the compliance with the requirements of a legal decree. (3) The energy balance is established on behalf of the DGTRE by ICEDD (Institut de Conseil et d’Etudes en Développement Durable; certified ISO 9001 for internal procedures). *Regional level - QA/QC in Brussels Capital Region* (1) In the Brussels region, the energy balance is established by an independent institute, ICEDD (Institut de Conseil et d’Etudes en Développement Durable), who is certified ISO 9001 for its internal procedures. It is important to stress that the emissions from energy consumption constitutes nearly all the emissions of this urban environment. (2) Each submission is checked with the previous ones. (3) A check of all the CRF-tables is internally operated by two responsible of the climate strategy.	Belgium’s GHG Inventory (1990-2004) submitted under UNFCCC-NIR 2006 pp. 14-15 Belgium's National Inventory System, January 2006, pp. 38-43
Cyprus	—	-
Czech Republic	Establishing QA/QC plan preparation is one of significant obligations following from NIS. The plan is now under development and it has not been completed yet. Elaboration of QA/QC plan reflects the institutional arrangements: each institution should elaborate their own system of QA/QC procedures including designation of a responsible QA/QC expert for each sector. Sectoral QA/QC plans are integral parts of overall NIS QA/QC plan, which is put together by the NIS manager. *QC procedures:* Parts of these procedures are carried out by sectoral compilers (SC) and parts by the NIS manager. SC are concentrated more on activity data and sector-specific methods used, the NIS manager checks mostly appropriate use of methodology, carries out a trend analysis and compares data from other possible sources. Both sectoral and overall inventory compilers exploit the new CRF Reporter’s automatic control. When sectoral inventory is forwarded to the CHMI, this step is accompanied by a detailed check by the NIS manager. These all procedures correspond mainly to Tier 1 QC approach in accordance with GPG. Tier 2 approach is used only is some special cases so far. It is e.g. partly used in the transport sub-sector, where activity data based on energy statistics (provided by experts from KONECO company) are combined with activity data based on transport statistics (CDV). Appropriate usage of EFs is discussed in a similar way. *QA procedures:* A thorough review of the draft GHG estimates regularly takes place in December by experts from Slovak Hydrometeorological Institute, responsible for Slovak GHG inventory preparation. In this way methods used in the Czech Republic are compared with those applied in Slovakia. The draft inventory may be also checked or reviewed as a part of the approval process by Ministry of Environment. These procedures are also recorded and archived. Results of this review, together with findings of review process accomplished by international review team arranged by UNFCCC, are utilized in the process of inventory planning for the next years. Relevant findings are analyzed by the NIS manager in co-operation with sectoral compilers to eliminate possible gaps and imperfections.	Ministry of the Environment of the Czech Republic - Reporting under Article 3.1 of the Decision No 280/2004/EC pp. 2-3

MS	Description of the national QA/QC activities	Source
Denmark	The implementing plan for a QC/QA for GHG emission inventories is performed by the Danish National Environmental Research Institute NERI. The plan is in accordance with the GPG. The ISO 9000 standards are also used as important input for the plan. In the preparation of Denmark's annual emission inventory several quality control (QC) procedures are carried out already as described in GPG chapters 3-8. The QA/QC plan will improve these activities in the future. In the preparation of Denmark's annual emission inventory several QC procedures have been carried out. The Danish Tier 1 QC includes: • a check of time series of the CRF and SNAP source categories as they are found in the Corinair databases. Considerable trends and changes are checked and explained; • a comparison to inventory of the previous year on the level of the categories of the CRF as well as on SNAP source categories. Any major changes are checked, verified, etc.; • total emissions when aggregated to CRF source categories are compared to totals based on SNAP source categories (control of data transfer); • a manual log table has been introduced into the emission databases to collect information about recalculations. Apart from the UNFCCC's in-depth-reviews, QA with independent review s of the inventories has been carried out for energy and transport. In 2005 priority sources listings will be used to secure implementation of the full quality scheme on the most relevant sources. Verification in relation to other countries is undertaken for priority sources during the first part of the year 2005.	Denmark's National Inventory Report 2006 p. 34-43 Denmark's National Inventory 2005 p. 26
Estonia	Estonia has not implemented a general QA/QC or verification plan. Nevertheless, several checks have been made. During the last 10 years Estonia has made great efforts in all directions, including those aimed at increasing the reliability of statistical data. The quality of data on the emissions for different years and sectors is variable. It is not possible to quantify the margin of error and the estimates are mainly expert assessments. By the expert estimates, and quantifications uncertainties are based on the methods given by the IPCC GPG in National GHG Inventories General (Tier 1) QC procedures were applied to all categories as following: • Activity data were compiled and gross-checked. • The default factors were used. • All units were checked	GHG Emissions in Estonia 1990–2004 National Inventory Report to UNFCCC, p. 11 Estonia Report pursuant to Art.3(1) of EC MM 2006
Finland	A general QA/QC programme including the quality objectives and QA/QC plan is available for the Finnish GHG inventory at national inventory level. A QMS is an integrated part of the national system. The principles and elements of the QMS are congruent both with international agreements and guidelines concerning GHG inventories and with the ISO 9001:2000 standard; certification is under consideration. As the SNE, Statistics Finland bears the responsibility and has the resources for the co-ordination of the QM measures for the partners of the national system and for the QM of GHG inventory at national level. The expert organisations contributing to the production of emission or removal estimates are responsible for the quality of their own inventory calculations. The quality of the inventory is ensured in the course of the compilation and reporting, that consists of four stages: planning, preparation, evaluation and improvement. The QM of inventory is a continuous process that starts from the consideration of the inventory principles. The setting of concrete annual quality objectives is based on this consideration. Next step is elaboration of the QA/QC plan and implementing the appropriate QC measures focused on meeting the quality objectives set and fulfilling the requirements. In addition, the QA procedures are planned and implemented. In the improvement phase of the inventory, conclusions are made on the basis of the realised QA/QC process and its results. A clear set of documents is produced on the different work phases of the inventory. The documentation ensures the transparency of the inventory (enable external evaluation of the inventory; replication. A quality manual of the national GHG inventory system including guidelines, annual plans, templates, documentation of methodologies and work processes and checklists of QA/QC procedures is in preparation and will be in place by the end of 2005. Quality objectives Statistics Finland, in collaboration with the expert organisations responsible for the inventory calculation sectors, sets yearly quality objectives for the whole inventory at the inventory planning stage and designs the QC procedures needed for achieving these objectives. In addition, the expert organisations set their own, sector and/or category specified quality objectives and prepare their QC plans. The quality objectives and QC plans are archived in the GHG extranet available to all parties of Finlands GHG inventory system. So far, there is no definition for quality objectives in the IPCC or UNFCCC guidelines. The definition above used in the Finland's GHG inventory system is also applied in the EU's system for monitoring GHG emissions. • QC plan: The measures aiming at attainment of quality objectives are recorded on the level of the whole inventory and in the calculation areas as QC plans, which specify the actions, the schedules for the actions and the responsibilities. The inventory unit compiles of the whole inventory level QC plan. The expert institutions prepare of a QC plan in their respective calculation sectors. The QC plans are archived in the GHG extranet available to all parties of Finland.s greenhouse gas evaluation system. The QC plans are written in Finnish. • QA plan: In the inventory quality management during 2005 attention has been especially given to setting concrete quality objectives and preparing QC plans. QA procedures are planned and developed in 2005. The implementation will largely take place in 2006 within the scope allowed by the resources. The focus of the development quality management will shift to QA procedures so that they will be in use in 2006. The goal of the inventory QA procedures is to verify that quality objectives are met, to ensure that the inventory represents the best possible estimate of emissions and sinks given the current state of scientific knowledge and the data and resources available, and to support the effectiveness of the QC programme. The planned inventory QA system comprises actions which differ from one another in their viewpoints and timings: internal self-evaluations, peer reviews, audits, data verifications, system reviews by an independent party and international reviews of inventories.	GHG Emissions in Finland 1990-2004 National Inventory Report to the EU 2006 pp. 18-22

MS	Description of the national QA/QC activities	Source
France	The national system of emission inventory is established by integrating the usual criteria applicable to quality systems (Systèmes de Management de la Qualité, SMQ). The CITEPA, which has the responsibility of carry out the technical level the national emission inventories set up such a system based on the ISO9001- version 2000. This provision is confirmed by the certificate issued by the AFAQ in 2004. The realization of the national emission inventories is covered by the SMQ through several specific processes set down in the quality manual unpublished. Within this framework, several processes relating to QA/QC of the inventories are integrated in the various processes and procedures implemented, corresponding to the various phases and actions. The objectives of QA/QC are in accordance with the requirements formulated within international framework. The quality control is integrated in the various phases of the processes and procedures. CITEPA, responsible for the technical coordination and the compilation of the inventory, is in charge of the quality control and defines the QA/QC activity plan.	Inventaire des emissions de gaz a effet de Serre en France au titre de la CCNUCC pp. 32-34
Germany	The National System institutions, in addition to the SNE, include the Quality System of Emissions Inventories (QSE), which is currently being established for management of quality monitoring and assurance, and the ***Central System of Emissions*** (CSE), a central, national database for emissions calculation and reporting. Since 2002, the SNE has been working to develop and implement a QC/QA system. A research project was providing scientific support for the UBA in implementing requirements from GPG. The QSE should serve to meet the requirements of the IPCC, and it should make allowance for the national situation in Germany and for the internal structures and procedures of the UBA. Procedures for QC/QA measures in the CSE are oriented to the emissions-reporting process. At the same time, quality must be directly linked with the various steps in the inventory process. For the first time a systematic evaluation of all inventory data has been made in 2002. Research project 202 42 266 (UBA, 2004), which is aimed at implementing the GPG requirements in inventory preparation as well as the compiling the QSE manual (UBA, unpublished 2005) and determining the pertinent uncertainties. Pursuant to the IPCC GPG requirements, the necessary QC/QA measures for emissions reporting should be summarised in a QC/QA plan. By carrying out QC/QA measures, the UBA, along with other NaSE participants, can identify improvement measures with regard to emissions reporting and to the QSE. Where improvement measures can be easily and promptly carried out, correction takes place right away. Any more time-consuming and complex improvement measures for the inventories, and all improvement measures for the QSE, are first reported by the responsible experts to the Single National Entity, which then summarises them within the improvement plan. The international QA/QC requirements of the German inventory system "Nationale System Emissionsinventare" (NaSE) are implemented since the completion of the QSE manual. This manual is binding to the UBA. The QSE will be used to introduce the necessary QC/QA measures for the entire process of emissions reporting. Execution, description and documentation of QC/QA measures take place largely in conjunction with the relevant inventory contributions. To this end, a documentation system was developed that represents all such measures and related actions in an integrated manner tailoured to the specific parties and tasks concerned. In 2005 the Umweltbundesamt implemented this systematically QC with the NaSE team for the first time but only QC/QA measures pursuant to Tier 1 are considered. Parts of the pertinent improvement plan will be taken over in the binding inventory plan with fixed deathliness and responsibilities.	Berichterstattung unter der UNFCCC 2006 - Nationaler Inventarbericht z. deutschen Treib-hausgasinventar 1990 - 2004 p. 64 pp. 538-542
Greece	In this framework, National Observatory of Athens (NOA), in close co-operation with the Ministry for Environment, Physical Planning and Public Works (MEPPPW), has developed an inventory QA/QC system that is being implemented since April 2004. The system is based on the ISO 9001:2000 standard and its quality objectives, as stated in the quality management handbook (Compliance with the IPCC guidelines and the UNFCCC reporting guidelines while estimating and reporting emissions/removals; continuous improvement of GHG emissions/removals estimates; timely submission of necessary information in compliance with relevant requirements defined in international conventions, protocols and agreements.) The QA/QC system developed covers the following processes: • QA/QC system management, comprising all activities which are necessary for the management and control of the inventory agency (to ensure the accomplishment of the quality objectives). • QC that is directly related to the estimation of emissions. The process includes activities related to (a) data inquiry, collection and documentation, (b) methodological choices in accordance with IPCC GPG, (c) QC checks for data from secondary sources and (d) record keeping. • Archiving of inventory information, comprising activities related to centralised archiving of inventory information and the compilation of the national inventory report. • QA, comprising activities related to the different levels of review processes including the review of input data from experts if necessary, and comments from the public. • Estimation of uncertainties, defining procedures for estimating and documenting uncertainty estimates per source / sink category and for the whole inventory. • Inventory improvement, that is related to the preparation and the justification of any recalculations made. The implementation of the plan started in April 2004 and the first internal review was carried out in June 2004, following procedures and manuals (available only in Greek) developed by in house staff and outside consultants. QA/QC activities since April 2004 were focused on the improvement of the archiving of information and the development of a long term improvement plan. A second internal review was carried out in June 2005 focused on the evaluation of the progress made in relation to the centralised archiving of information.	Greece – National Inventory Report 2006 pp.20-23 Greece Climate Change Emission Inven-tory 2006 pp. 16-17
Hungary	The expert groups of the inventory agency do not have any QA accreditation. In the former Directorate only the laboratories acquired such qualifications. On the other hand, our experts have been constructing national databases (for emissions and pollution) for many years and have been participating in compiling such databases, and they also possess "expert licences" issued by the Ministry, which can only be obtained by employees having the necessary experience and reliability. For the preparation of an inventory of appropriate quality we multiple-checked certain data used for the inventory (e.g., factory and industry association), from time to time we arrived at similar results by using several methods. We controlled the results by comparing time series, as the availability of the entire time series provided us with this opportunity. Corrections were made according to UNFCCC review reports. When collecting data several sources declared that they had a QA system in place. However we obtained actual information on the reliability of data from a few places only.	Hungary - National Inventory Report for 2004 p.1-6

MS	Description of the national QA/QC activities	Source
Ireland	Ireland has not yet developed formal QA and QC (QA/QC) systems on the scale recommended by the IPCC good practice guidance but the inventory preparation process incorporates a number of activities that may be regarded as fundamental elements of quality control. This duplication given by the use of a number of calculation systems provides rigorous internal checking of the general 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 the Energy sector, the inclusion of emissions estimates supplied by several external 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. The EPA will take responsibility for the management of the QA/QC system developed for the NIS during 2005, and has begun to implement rigorous QA/QC procedures that include: (a) Clearly defined requirements concerning the scope, quality and time-series of raw data used by the EPA GHG inventory team, and clearer guidance to Key Data Providers (KDPs). (b) Data Supply Agreements also aim to improve the timeliness of raw data provision to the EPA, and encourage greater integration of KDPs in the review and improvement process. (c) The EPA has implemented an improved system for the logging and annotation of inventory data processing systems and spreadsheets, to improve the transparency of emission estimations and enable the system to be more flexible and inclusive for new staff. This also includes a more consistent and rigorous system for documentation and archiving of GHG inventory information. (d) The development of a functional Inventory Review Group to manage and support the GHG improvement process has been initiated through increased involvement of KDP contacts in the inventory compilation process. Increased in-country review mechanisms are under development. In early 2005, Ireland commissioned a project with UK consultants to establish formal QA/QC procedures in emission inventories that would meet the needs of the UNFCCC reporting requirements. The project developed a QA/QC system including a documented QA/QC plan and procedures along with a QA/QC manual. The manual provides a general overview to the QA/QC system and guidance on the application of the plan and procedures. The QA/QC plan identifies the specific data quality objectives related to the principles of transparency, consistency, completeness, comparability and accuracy required for Ireland's national inventory and provides specific guidance and documentation forms and templates for the practical implementation of QA/QC procedures. The QA/QC procedures cover such elements as data selection and acquisition, data processing and reporting so that the international requirements under the Kyoto Protocol and Decision 280/2004/EC are met. The manual provides guidance and templates for appropriate quality checking, documentation and traceability, the selection of source data and calculation methodologies and peer review and expert review of inventory data and outlines the annual requirements of a continuous improvement system for the inventory. The inventory agency has used the 2006 reporting cycle to begin to implement the basic elements of the new approach to QA/QC. This involves the allocation of responsibilities linked to the national and the use of a template spreadsheet system to record the establishment and maintenance of general inventory checking and management activities covering the overall compilation process, as well as the undertaking of specific annual activities and any necessary periodic activities in response to specific events or outcomes in inventory reporting and review. The system facilitates record keeping related to the chain of activities from data capture, through emissions calculations and checking, to archiving and the identification of improvements.	Ireland National Inventory Report 2006 pp.13-14 Ireland - Report on the Determination of the Assigned Amount, p. 7
Italy	A specific QA/QC system is being developed in the framework of the establishment of the Nat. System, but QA/QC techniques and different verification procedures are already applied as part of the inventory estimation process. The inventory quality has improved over the years and further investigations are planned for relevant sectors (contribution to CO_2eq_{total} emissions / high uncertainty). In addition to *routine* control activities related to completeness, consistency in the time series and correctness in the sum of sub-categories, specific QC activities regard the accurate check of figures and documentation of those cases where methodological and data changes result in recalculations. Particular attention is also paid to the archiving and storing of all inventory data, supporting information, inventory records as well as all the reference documents. Data entries are checked several times during the compilation of the inventory; special attention is paid to sources which show significant changes. Final checks involve a consistency check on the whole time series. When revisions of estimation methodologies are applied, emissions are recalculated for the entire time series as a matter of course. All the information used for the inventory compilation is traceable back to its source. The inventory is composed by spreadsheets to calculate emission estimates; activity data and emission factors as well as methodologies are referenced to their data sources, while all information and documentation are stored at the Agency so as to be consulted whenever needed. After each reporting cycle, all database files, spreadsheets and electronic documents are archived and documentation and estimates could be consulted during the new year inventory compilation. QA procedures regard some verification activities of the inventory as a whole and at sectoral level. Drawbacks derive from the communication of data to different institutions and/or at local level. In order to verify of the effectiveness of policies and measures undertaken by Italy to reduce GHG emissions, a study was carried out by Ecofys. In this framework an independent review and checks on emission levels were carried out (also controls on transparency and consistency of methodological approaches). The quality of the inventory is also improved by (A) organisation and participation in sector specific workshops; (B) follow-up processes set up in the framework of WGI; (C) international reviews and centralised review by the UNFCC Secretariat; (D) establishment of national expert panels (specifically, in road transport, land use change and forestry and energy production sectors). Specific activities relating to improvements of the inventory and QA/QC carried out in the last year were: • *waste sector emissions review* • *Solvent and Other Product Use* • *Energy Balance Verification* • *Road Transport Emissions Review.* • *MeditAIRaneo Project.* • Data from the Italian Pollutant Emission Register (EPER) • At the national level: meetings with industry representatives • *Local inventories*. (top-down approach for preparation of local inventories Further improvements (in 2005) will concern: (A) analysis of sectoral industrial data (Italian Emission Trading Scheme database); (B) on-going work jointly with industrial association (solvent and other product use sector); (C) revision of factors and parameters for estimation of CH_4 emissions (enteric fermentation) taking into consideration the results from MediterAIRaneo project.	Italian GHG Inventory 1990-2003, NIR 2005, pp. 23 -24

MS	Description of the national QA/QC activities	Source
Latvia	The work for QA and QC (QA/QC) according to the IPCC GPG is started up. Quality assurance and quality control (QA/QC) according to the IPCC GPG (2002) LEGMA plan to implement during 2006. Institutions and experts which are involved in the NIS (data submission) are informed about QA/QC procedures (activity data documentation). Generally for quality assurance and control we take into account how many activity data were available, how many were covered in emission calculation regarding methodology as well as how many assumptions and experts view were used	Latvia's National Inventory Report 2006 p.16
Lithuania	A Quality Assurance/ Quality Control system still has to be put into place. The necessary improvements will be built into the development of future inventories.	National GHG Emission Inventory Report of Lithuania 2006 p. 27
Luxem-bourg	Luxembourg has not yet developed a fully operational QA/QC system.	National Inventory Report 1990-2003 p.3
Malta	—	-
Netherlands	As part of its National System, The Netherlands developed and implemented a QA/QC programme, which is one of the results of the national inventory improvement programme. The QA/QC activities generally aim at a high quality output of the Emission Register (ER) and the National System, taking into account the ISO 9001/2000 certification of MNP and the international QA/QC requirements (IPPC GPG). This programme includes quality objectives for the National System, the QA/QC plan and a time schedule for implementation of the activities. It will updated annually as part of a yearly 'evaluation and improvement cycle' for inventory and national system and be held available for review: • Work plan describes: tasks and responsibilities of parties involved in the ER process; products and the time schedule; emission estimation methods; The annual work plan also describes the general QC activities to be performed by the Task Forces before the annual database is fixed. The work plan furthermore consists of an inventory and QA/QC improvement programme; • The responsibility for the quality of data in annual environmental reports lies with the companies. Data validation is the responsibility of the competent authorities. It is the responsibility of the ER involved institutes to judge whether or not to use the validated data of individual companies to assess the national total emissions; • agreements/covenants between MNP (ER) and institutes involved in the annual ER process. In general, it is agreed that by accepting the annual work plan, the involved institutes commit themselves to deliver capacity for the products specified in the work plan. The role and responsibility of each institute has been described (and agreed upon) in the context of the ER work plan; • specific procedures to fulfil the QA/QC requirements as prescribed by the UNFCCC and Kyoto Protocol. General agreements on these procedures are described in the QA/QC programme as part of the National System. The specific procedures and agreements are planned and described in the QA/QC plan and the annual ER work plan: (A) QC on data input and data processing; as part of the annual process towards trend analysis and fixation of the database after approval of the involved institutions; (B) Documentation of consistency, completeness, correctness of the CRF data. Documentation is obliged for changes in the historical dataset or in the emission trend that exceed 5% at sector level and 0,5% at the national total level; (C) Peer reviews of CRF and NIR; Public review; Mutual reviews; (D) Audits; (E) Archiving and documentation; (F) Every institution is responsible for QA/QC aspects related to reports based on the annually fixed database; • evaluation and improvement: people involved in the annual inventory work, are invited once every year to evaluate the process. In this review, the results of any internal and external review and evaluation are taken into account. The results are used for the annual update of the QA/QC programme (including the improvement programme) and the annual work plan. • source-specific QC: Comparison of emissions with independent data sources was one of the study topics in the inventory improvement programme. Because it seemed not possible to reduce uncertainties by independent verification (measurements) considerably, at least not at the national scale, this issue received less priority. In the context of a large research programme in The Netherlands on climate change, the issue is studied again at the moment. The main issues for the QA/QC activities are: • inventory improvement programme: improvement of quality of methods and data has been finalized in 09/2005; methods, activity data and EF were assessed, and adapted where necessary; • elaboration and implementation of monitoring protocols (improvement of transparency). This involved assessing and, where necessary, redefining processes and methodologies, procedures, tasks, roles and responsibilities with regard to inventories of GHG. Transparent descriptions and procedures are described in protocols, and in process descriptions for other relevant tasks NS. • performing general QC checks. • QA by following activities: peer and public review; results of former UNFCCC reviews (country review 2004); Synthesis and Assessment report of last year; intra-EU mutual collaborative review (with Belgium, 2005). The mutual review further recommended to more integrated and systematic use of IEF analyses as extra QC tool.	National Inventory Report 2006 Netherlands pp. 1-8 – 1-10

MS	Description of the national QA/QC activities	Source
Poland	Poland has not yet implemented a formal QA/QC procedure, including verification plan, for the national emission inventory. However, several checks are routinely carried out to eliminate possible errors. The calculated emissions figures for a given year, are compared to the respective figures from previous years (time series), and outliers are scrutinized in more detail or in other words an extended QA/QC is carried out for doubtful figures. The first draft of the inventory in form of IPCC tables and draft CRF, is usually produced 12-14 months after the end of the given year depending primarily on the availability of required activity data. During the following several weeks, extensive checks are done in form of consultations with data providers. The consultations cover both correctness of data and their proper interpretation. Wherever possible various different datasets are used for comparison purposes. Here the most important institutional sources include: Central Statistical Office, Agency for Energy Market, and a number of collaborating individual experts and institutions. After the checking period is completed, the final CRF is prepared together with the accompanying report.	Polands National Iventory Report 2006 pp. 12-13
Portugal	A plan for QA/QC has been developed and applied to this year's submission. The Institute for Environment is the SNE for the QA/QC system of the inventory. The conceptualization of QA/QC and the application of QC Tier2 procedures, have been done under an external consultancy with Ecoprogresso. The QA/QC system is an integral part of the National System for the Inventory by Sources and Removal by Sinks of Air Pollutants (SNIERPA), which was created by the March, 17th Resolution of the Council of Ministers nr. 68/2005, and includes three technical instruments: (A) QC and QA System (SCGQ); (B) Methodological Development Programme (PDIV); (C) Integrated Management System (SIGA). The SCGQ is composed of a QA/QC progamme and a procedures Manual. The first schedules the application of the general (QC1) and specific (QC2), QA/QC procedures, described in detail in the Manual. The procedures were defined according to IPCC GPG (2000) and adapted to the specifc National Inventory (INERPA) characteristics. The QC system requires the elaboretion of a report of the application of QA/QC procedures to the inventory. QC Tier 1 checks were generally applied by the inventory team who produces and compiles the national inventory. The conclusions of the QC Tier2 procedures – "QC Tier 2 procedures INERPA 2005 - final report is available for consultation. *Further developments:* In the next submission, the QC2 procedures will be applied to the remaining key sources, as well as to the ones previously analyzed but remain methodologically relevant. The SNIERPA includes the following elements: • Methodological Development Programme (Programa de Desenvolvimento Metodológico -PDM), • Control and Quality Assurance System (Sistema de Controlo e Garantia de Qualidade - SCGQ) and • Integrated IT System for the Management of the SNIERPA (Sistema Integrado para a Gestão Automatizada do SNIERPA - SIGA). Two SNIERPA instruments ensure, technically and methodologically, the inventory accuracy, completeness and credibility: the Methodological Development Programme (PDM) and the Control and Quality Assurance System (SCGQ).	Portuguese NIR on GHGs 1990- 2004 Portuguese Report based on Art. 8, Dec N.º 280/2004/EC and for Implementing the Kyoto Protocol pp. 6-10 Portuguese NIR on GHGs 1990– 2003 p. 8 – 12
Slovakia	Actually the National Inventory System (NIS) is under development (already prepared Terms of Reference and allocated financial resources) project of the Slovak Ministry of the Environment aimed at proposal of national integrated system of inventory and projections of GHG emissions. The project will be carried out in two phases – after the first phase focused on methodological and organisational aspects will in the second one the project aimed at proposal and implementation of required QA/QC parameters and procedures for GHG emission inventory.	Slovak Republic, Annual Report 2006 p.5
Slovenia	The Republic of Slovenia has not yet fully developed a formal Quality Assurance and Quality Control plan as recommended by IPCC Good Practice Guidelines (IPCC 2000). Activities for developing the plan are under way however a Manual of Procedures has already been elaborated and used for the 2005 submission. In spite of the missing QA/QC plan, certain data control procedures covered by the Manual of Procedures are already in use in developing inventories. The items verified are input data at the level of sectoral activity data, the appropriateness of chosen emission factors, the applied methodology as well as intermediate and final calculations of emissions where deviations between real life emission factors and factors as calculated from the CRF table are reviewed, too.	Slovenia's National Inventory Report 2006 p. 21
Spain	No information was provided on QA/QC procedures	NIR 2005

MS	Description of the national QA/QC activities	Source
Sweden	The Swedish Environmental Protection Agency (EPA) is responsible for the QA/QC plan for the inventory (Ordinance (2005:626)). The current system complies with the Tier 1 procedures outlined in the IPCC GPG (2000) The structure of the system complies with the PDCA cycle (Plan, Do, Check, Act), which is an adopted model for how systematic quality and environmental management activity is to be undertaken according to international standards to ensure that quality is maintained and developed.. A quality system as part of the National System has been developed and will be fully operational from January 2006. The national GHG emissions are compiled by the Swedish Environmental Emission Data (SMED). Other con-tractors are also involved in the inventory preparations process. The QA/QC plan consists of quality procedures and checklists specified for each reporting CRF-code (or group of codes). The plan is updated annually and lists all QC steps that must be undertaken during inventory work (Tier 1 and where appropriate Tier 2). The QA/QC plan also includes descriptions of roles and responsibilities, of databases and models and documented procedures for uncertainty and key source analysis, as well as procedures for handling and responding to UNFCCC´s review of the Swedish inventory. The QA/QC plan handles follow-up and improvement by procedures of non-conformity reporting and collection of improvement needs from all stages of the annual inventory cycle. This results in a planning document, which is used as a basis for planning and selecting further actions to improve the inventory. ▪ Inventory planning: (A) Requirements, decisions and guidelines; (B) Quality objectives and activity plans (Quality plans, Key Source analysis, Estimations of uncertainty) ▪ Preparation of the inventory: (A) Training, awareness and skills; (B) Calculation of emissions and removals of GHGs ▪ Inventory checking: (A) QC; (B) QA; (C) International peer review; (D) Deviations, corrective and preventive measures ▪ Follow-up and continuous improvement of the inventory	Sweden's National Inventory Report 2006 pp. 35; 297-303
United Kingdom	The National Atmospheric Emissions Inventory and the UK Greenhouse Gas Inventory are compiled and maintained by the National Environmental Technology Centre (Netcen), part of AEA Technology plc. The data compilation and reporting for some source sectors of the UK inventory are performed by other contractors (i.e. IGER compile the agriculture sector, CEH compile the land use, land use change and forestry sector), but Netcen is responsible for co-ordinating inventory-wide QA/QC activities. UK emission estimates are prepared via a central database of activity data and emission factors, from which the UK emissions are extracted and reported in CRF format. The QC within this system has evolved over many years. Numerous stages of QA/QC procedures are built into the data processing system. These include checks before data are entered into the national database of GHG emissions, and when data are extracted from the database. The database contains activity data and emission factors for all the sources necessary to construct the UK GHG inventory. The system incorporates the following activities, which are carried out each year as the inventory is compiled: (1) Documentation, (2) Database, (3) Checking, (4) Recalculation (5) Uncertainties (6) Archiving. The system complies with the Tier 1 procedures outlined in Table 8.1 of the IPCCC GPG. A review of the QA/QC procedures was carried out in 2001. The Inventory has been subject to ISO 9000 since 1994 (it is now subject to BS EN ISO 9001:2000) and is audited by Lloyds and the AEA Technology internal QA auditors. The NAEI has been audited favourably by Lloyds on three occasions in the last ten years. The emphasis of these audits was on authorisation of personnel to work on inventories, document control, data tracking and spreadsheet checking, and project management. As part of the Inventory management structure there is a nominated officer responsible for the QA/QC system – the QA/QC Co-ordinator. The National Environmental Technology Centre is currently accredited to BS EN ISO 9001:2000, and was last audited in May 2003 by Lloyds.Review of QA/QC Provisions & Engagement with Key Data Provider Organisations: During 2005, UK Defra has focussed on the implementation of provisions to meet the requirements of EU Decision 280/2004/EC on a mechanism for monitoring Community greenhouse gas emissions, and for implementing Kyoto Protocol quality and reporting requirements. In addition to the strengthening of legal provisions, Defra and Netcen have reviewed existing arrangements of major data providers regarding QA/QC of source data, and the timeliness and format of data delivered to the UK GHG inventory. Through a programme of stakeholder workshops, meetings and email & telephone contacts, information on the development of the UK National Inventory System was disseminated to key data providers and information pertaining to current QA/QC provisions within those organisations was elicited for review. During the latest inventory cycle, meetings have been held between Netcen and several key organisations to develop the UK National Inventory System and discuss specific quality issues and data sources. The programme of stakeholder meetings is ongoing, with meetings planned with UKOOA (the trade association that represents the UK offshore oil & gas industry) and the newly formed businesses that operate within the UK gas supply market, following the division of UK Transco. The programme of UK inventory improvement will be reviewed by the UK GHG Inventory Steering Group Committee during 2006 and in light of UNFCCC ERT feedback and other inputs, inventory QA/QC priorities and improvements will be derived. Specific sectors that are proposed for review during the next inventory cycle include: • GHG emissions from waste water treatment, following a change to the reporting system of UK water companies to integrate GHG emission estimates into their annual reporting requirements; • GHG emission estimates of the UKOOA dataset of emissions from the offshore oil & gas industry are to be reviewed via a formal audit of their revised EEMS reporting system during early 2006.	UK GHG Invent-ory 1990 to 2004 pp. 21- 29

Table 1.9 gives an overview of QA/QC procedures in place at Member State level on the basis of information collected for the ‘Workshop on quality control and quality assurance of greenhouse gas inventories and the establishment of national inventory systems’ which was held in September 2004 in Copenhagen. It shows that a number of QA/QC procedures are already in place in the EC Member States. Generally, the implementation of QA/QC procedures is more advanced in the EU-15 than in the new Member States.

Table 1.9 Overview of quality assurance and quality control procedures in place at Member State level

Activity	Austria	Belgium	Cyprus	Czech Republic	Denmark	Estonia
QA/QC coordinator designated	yes	No		No	Yes	
Quality objectives established	integrated in QMS (improvement plan), not as an extra document	Partial		No		
QA/QC plan in place	yes	Partial		No	No	
QC procedures in place	yes	Informal		Preparing	Partial	
Tier 1	yes			Preparing	Partial	
All key sources checked?	yes	No		No	Partial	
Checklists used?	yes	No		No	Yes	
Electronic/ automated checks used?	yes	No (manual)		No	Yes	
Tier 2	partial	No		No	Partial	
Emission data	yes (where possible)	No		No	Partial	
Sectors/gas	mainly energy, recalculations	No		No	Energy / CO_2	
QC checks of country-specific emission factors?	yes (where possible)	No		No	Partial / Energy	
Activity data	yes (where possible)	No		Partial by Czech Statistical Office		
Sectors	mainly transport, f-gases, solvents	No		No		
Uncertainty estimates	for all KS, for some non-KS	Yes		No		
QC in outside agencies?	partial	Partial		No		
QA procedures in place	partial	No		No	Partial	
Expert peer reviews	no	No		No (apart from UNFCCC review)	Stationary combustion	
Audits	yes (2nd party)	Yes		No	No	
Verification of emissions	partial	No		Partial	No	
Sectors/gas	transport, f-gases, solvents (verification of activity data)			F-gases, data from Custom Office and F-gas users		
Comparisons with other inventories	no			Partial, CO_2 emissions database REZZO1 and data for NAP		
QA/QC manual in place	yes	No		No	No	
Quality management system in place	ISO 17020 (Formal accreditation is foreseen for early 2006)	No		CHMI adaptation of ISO 9000		

Activity	Finland	France	Germany	Greece	Hungary
QA/QC coordinator designated	Yes	Yes	Sept 2004	yes	**No**
Quality objectives established	Yes	Integrated in QMS and elaborated by a national committee led by french ministry in charge of environment	Yes	yes	**No**
QA/QC plan in place	Yes	Yes	Sept 2004	partial	**Yes**
QC procedures in place	Yes	Yes		yes	**partial**
Tier 1	Yes	Yes	2005	yes	**yes**
All key sources checked?	Yes	Yes	2005	yes	**yes**
Checklists used?	Yes	Yes	2005	yes	
Electronic/ automated checks used?	Yes	Yes	2005	No (manually)	
Tier 2	Partial	Partial	Partial (review findings)	no	**yes**
Emission data	Partial	yes (where possible)	Partial (review findings)	no	**yes**
Sectors/gas	Energy / CO_2 Industrial processes / F-gases	Mainly energy and manufacturing industry sectors	Partial (review findings)	no	**Mainly energy and manufacturing industry and agricultural sectors**
QC checks of country-specific emission factors?	Yes Partly	Yes (where possible)	Partial (review findings)	partial	**yes**
Activity data	Partial	yes (where possible)	Partial (review findings)	no	**partial**
Sectors	Energy, Industrial processes (under development), F-gases	Mainly energy and manufacturing industry sectors	Partial (review findings)	no	
Uncertainty estimates	Yes	Yes	Partial	yes (Tier 1 methodology)	**Partial(Tier 1)**
QC in outside agencies?	Yes	Partial	Planned	no	**no**
QA procedures in place	Partial (under development)	Partial	No	yes	**no**
Expert peer reviews	Yes (Not all sectors; periodically)	By a national committee led by french ministry in charge of environment and by sectors experts	Yes	No (apart from UNFCCC review)	**no**
Audits	Partial	No	Yes	no	**no**
Verification of emissions	Partial	Partial	Partial	no	**partial**
Sectors/gas	Energy (CH_4, N_2O), also other	Mainly energy and transports (verification of activity data/ CO_2)	CO_2	no	
Comparisons with other inventories	Partial	No	Partial	no	**yes**
QA/QC manual in place	In preparation	Yes	Sept 2004	yes	**NO**
Quality management system in place	Country specific QMS (ISO 9001 -certification under consideration)	ISO 9001 (AFAQ n° 22708)	Country specific, Sept 2004	ISO 9001:2000	**NO**

Activity	Ireland	Italy	Latvia	Lithuania	Luxembourg	Malta	Netherlands
QA/QC coordinator designated	yes	yes	NO		No		'Yes' (official arrangements still under preparation)
Quality objectives established	yes	yes	YES		No		Partially, further elaboration for next NIR
QA/QC plan in place	yes	yes (internal)	YES		No		Yes, further detailing and upgrading for next NIR Improvement programme in progress.
QC procedures in place	yes	yes (internal)	In preparation		No		Yes. Upgrading is finalized in 2005
Tier 1	yes	yes	PARTLY		No		
All key sources checked?	yes	yes	PARTLY		No		Yes (new protocols)
Checklists used?	yes	yes	PARTLY		No		Yes
Electronic/ automated checks used?	Partial	Partial	PARTLY		No		Yes (consistency, completeness)
Tier 2	Part	yes	PARTLY		No		Partial
Emission data	Part	yes	PARTLY		No		Partial
Sectors/gas	ETS installations/CO_2 and agriculture/CH_4	all	PARTLY		No		Energy / CO_2 and CH_4 Agriculture/CH_4 and N_2O Industrial Processes/ N_2O and F-gas Waste / CH_4
QC checks of country-specific emission factors?	Yes (ETS/CO_2 and Ag/CH_4)	yes	PARTLY		No		Yes
Activity data	Part	yes	PARTLY		No		Partial
Sectors	Part	all	PARTLY		No		Energy, industry, agriculture, waste
Uncertainty estimates	Tier 1 only	partial	PARTLY		No		Yes, tier 1
QC in outside agencies?	Yes (separate from inventory QC)	yes	PARTLY		Partial		Upgrade ongoing
QA procedures in place	Yes	no	In preparation		No		Yes
Expert peer reviews	no	Partial (some sectors)	NO		No		Yes
Audits	Planned for 2006	no	NO		No		Under consideration
Verification of emissions	yes	yes	NO		No		Planned, if data available
Sectors/gas	ETS installations/CO_2 and agriculture/CH_4	Industry, transport, agriculture, waste	NO		No		Agriculture/CH_4 Energy/CO_2
Comparisons with other inventories	No	yes	PARTLY		Yes		Planned
QA/QC manual in place	yes	draft	In preparation		No		Update in preparation
Quality management system in place	yes	no	In preparation		No		Changes/update in preparation as result of organisational changes in PER

Activity	Poland	Portugal	Slovak Republic	Slovenia	Spain	Sweden	UK
QA/QC coordinator designated	No	No	No	No	No	Yes	Yes
Quality objectives established	No	According to IPCC guidelines	No	Yes	Being discussed, not formally adopted	Yes	Yes
QA/QC plan in place	No	In implementation	No	Yes	In preparation	Yes	Yes
QC procedures in place	Partial	Partial	Partial	Partial	Partial		Yes
Tier 1	Yes	Partial	Partial	Yes	Partial	Yes	Yes
All key sources checked?	No	Partial	No	Yes	Yes	Yes	Yes
Checklists used?	No	No (in implementation)	No	No	Existing checklists to be extended	Yes	Yes
Electronic/ automated checks used?	Calculation checks, analyzing data trend (flagging suspected data)	No (in implementation)	No	No	Most automated, some manual	Yes	Yes
Tier 2	No	Partial	No	Partial	Limited implementation	Partial	Partial
Emission data	No	Partial	No	Partial	Order of magnitude checks, time series outliers checks	Partial	
Sectors/gas	No	Industry/CO_2	No	Energy / CO_2		Partial	
QC checks of country-specific emission factors?	Based on national studies	Partial	Yes	Yes		Partial	
Activity data	No	Partial	Partial, Statistical Office	Partial	Limited implementation	Partial	
Sectors	No	Agriculture	Energy	Energy / industrial processes		Partial	
Uncertainty estimates	At progress for 2002 GHG inventory	Qualitative	Yes	No	No	Yes	Yes
QC in outside agencies?	Partial	No	Partial	No	Being checked	Yes	Currently verifying
QA procedures in place	No	Yes	No	No	Limited implementation	Yes	Yes
Expert peer reviews	No	Yes	No	No		Yes	Yes
Audits	No	No	No	No		No	Yes
Verification of emissions	Partial		Partial	No	No	Yes	partial
Sectors/gas	-----		F-gases, energy	-			CH_4, N_2O, HFCs
Comparisons with other inventories	Comparing to inventories of countries with similar characteristics of fuels use, economy or population		Yes	-			No
QA/QC manual in place	No	In implementation	No	Yes	No	Yes	Yes
Quality management system in place	No	In implementation in the Institute for Environment	No	ISO 9001	No	ISO 14001	ISO 9001

1.6.3 *Further improvement of the QA/QC procedures*

One of the most important activities for improving the quality of national and EC GHG inventories is the organisation of workshops and expert meetings under the EC GHG Monitoring Mechanism. In September 2004 a 'Workshop on quality control and quality assurance of greenhouse gas inventories and the establishment of national inventory systems' was organised. The Workshop facilitated the exchange of experience of Member States in the implementation of Quality Control (QC) and - Assurance (QA) procedures and the implementation of the National Inventory System. The workshop brought together experts from 17 Member States, the European Commission (DG ENV, JRC), EEA, ETC/ACC and an observer from the UNFCCC secretariat. For details of the workshop see the workshop report available on the website of the ETA/ACC:
http://air-climate.eionet.eu.int/docs/meetings/040902_GHG_MM_QAQC_WS/meeting040902.html

A number of other workshops and expert meetings have been organised in recent years with a focus on sector-specific quality improvements. Table 1.10 lists the most important workshops.

Table 1.10 Overview of workshops and expert meetings orgaised under the EC GHG Monitoring Mechamism

Workshop/expert meeting	Date and venue
Workshop on data consistency between National GHG inventories and reporting under the EU ETS	9-10 February 2006, EEA, Copenhagen, Denmark
Training workshop on the use of CRF Reporter for the experts of the European Community	12-13 September 2005, EEA, Copenhagen, Denmark
EU workshop on uncertainties in greenhouse gas inventories	5-6 September 2005, Helsinki, Finland
Workshop on Inventories and projections of greenhouse gas emissions from waste	2-3 May 2005, EEA, Copenhagen, Denmark
Expert meeting on improving the quality of. greenhouse gas emission inventories for category 4D	21-22 October 2004, JRC, Ispra, Italy
Workshop on quality control and quality assurance of greenhouse gas inventories and the establishment of national inventory systems	2-3 September 2004, EEA, Copenhagen, Denmark
Workshop on emissions of greenhouse gases from aviation and navigation	17-18 May 2004, EEA, Copenhagen, Denmark
Enlargement Training Workshop on Emission Inventory Improvement and Uncertainty Assessment	27-28 November 2003, JRC, Ispra, Italy
2003/06/24 Workshop on energy balances and energy related GHG emision inventories	24-25 June 2003, EEA, Copenhagen, Denmark
Workshop on Inventories and Projections of GHG and Ammonia Emissions from Agriculture	27-28 February 2003, EEA, Copenhagen, Denmark

All the workshop reports are available at the website of the EEA/ETC-ACC: http://air-climate.eionet.eu.int/meetings/past_html

1.7 Uncertainty evaluation

By 27 May 2006 Tier 1 uncertainty analyses were available from 13 EU-15 Member States. These Member States cover about 94 % of total EU-15 GHG emissions in 2004. Table 1.11 shows the availability of Table 6.1 of the Tier 1 uncertainty analysis. For nine Member States Tier 1 uncertainty analyses were available for 2004, for three Member States the latest year available was 2003, for Spain it is 2002. Most Member States cover all source categories in their uncertainty estimates.

Table 1.11: Availability of Table 6.1 of the Tier 1 uncertainty analysis as of 15 April 2005 (excluding LULUCF)

Member State	Year	Coverage	Member State	Year	Coverage
Austria	2004	96%	Ireland	2004	100%
Belgium	2003	100%	Italy	2003	100%
Denmark	2004	100%	Netherlands	2004	100%
Finland	2004	100%	Spain	2002	100%
France	2004	100%	Sweden	2004	100%
Germany	2003	100%	United Kingdom	2004	100%
Greece	2004	99%			

The EU-15 Tier 1 uncertainty analysis was made on basis of the Tier 1 uncertainty estimates of the Member States. Uncertainties were estimated for six sectors 'Stationary fuel combustion', 'Transport', 'Fugitive emissions', Industrial processes', 'Agriculture' and 'Waste'. Within these sectors the available MS uncertainty estimates were grouped by source categories. Then for each source category a range of uncertainty estimates was calculated: the lower bound of the range was calculated by assuming that all uncertainty estimates within a source category are uncorrelated; the upper bound of estimates was calculated by assuming that all uncertainty estimates within a source category are correlated. Then a single uncertainty estimate was calculated for each source category based on the assumption that MS uncertainty estimates are correlated if they use Tier 1 methods and/or default emission factors. After having calculated the uncertainty estimates for each source category, the uncertainty estimates for the sectors and for total GHG emissions were calculated.

Estimation of trend uncertainty: The EC uncertainty estimate is rather complicated due to potential correlations between MS uncertainties. Therefore, an analytical method, which allows more flexibility than IPCC Tier 1, was compiled.

Trend in MS n category x was defined as

$$Trend_{n,x} = E_{n,x}(t)-E_{n,x}(0) \qquad (1)$$

Where E(t) denotes emissions in the latest inventory year and E(0) emissions in the base year.

Variance for each MS and source category was calculated by using the perceptual uncertainty estimates reported by MS, and assuming normal distributions. Uncertainties in trends of different MS and source categories were then calculated using first order approximation of error propagation.

The assumptions of correlation between years (0 and t) and between different MS are important for the estimation of trend uncertainty. However, there is not enough information about strengths of different correlations. Effect of correlation was tested both with the analytical method developed, and by using MC simulation, where Normal distribution was used in all the cases to ensure comparability with analytical estimates. Table 1.12 presents an example of such comparison. The source category chosen for the example is 4D, N_2O emissions from agricultural soils, as this category has a major effect on inventory uncertainty in most MS. Both the effects of correlations between years and between Member States were tested.

Table 1.12: Trend uncertainty for EU-15 emissions of N_2O from agricultural soils by using different assumptions of correlation estimated using Monte Carlo simulation

Years correlate	MS correlate	Trend uncertainty
YES	YES	-27 to +26
YES	NO	±13
NO	YES	-294 to +292
NO	NO	-116 to +115

Note: "YES" denotes full correlation between years or Member States. Trend uncertainty is presented as percentage points.

The results of the comparison revealed that assumption on correlation between years has much larger effect on trend uncertainty than the assumption on correlation between MS. In the IPCC GPG 2000, it is suggested to assume that emission factors between years are fully correlated, and activity data are independent. However, in the EC uncertainty estimate, it is assumed that activity data uncertainties also correlate to some extent between years, because typically the same data collection methods are used each year. Therefore, for simplicity, in EC uncertainty estimate it was decided to assume that emissions between years are fully correlated, even though this may underestimate trend uncertainty to some extent.

In the example in Table A, uncertainty decreased when correlation between MS was added to the correlation between years. However, this is not always the case; in another example considering EU-15 MS estimates for 1A1a CO_2, uncertainty was ±0.2% when it was assumed that years correlate and MS estimates are independent. When a correlation between MS was added, the uncertainty decreased to ±0.1%.

Correlation between MS is difficult to quantify, especially in case of trend uncertainty, where correlation between different MS in different years should also be quantified. Furthermore, effect of correlation on uncertainty (increasing or decreasing) depends on the direction and magnitude of trend for each MS and each source category. Therefore, a simple conservative assumption cannot be made. Therefore, for simplicity, it was assumed in trend uncertainty estimate that MS are independent[10].

In general, the caveats of the method used are the same as in IPCC Tier 1, i.e. the result gives the most reliable results when uncertainties are small, and it assumes normal distributions even though this cannot actually be the case when uncertainties are >100%. However, these issues do not seem to have any major effect on the results, as can be seen from Table 1.13, where waste sector uncertainties are presented both with analytical method and Monte Carlo simulation. When uncertainty increases, also the difference between the two methods increases.

Table 1.13: Comparison of trend uncertainty estimates for EU-15 Waste Sector using the modified Tier 1 method and Monte Carlo simulation (Tier 2). Trend uncertainty is presented as percentage points

Sector	GHG	Tier 1	Tier 2
6A. Landfills	CH_4	±12	±12
6B. Wastewater	CH_4	±27	-28 to +27
6B. Wastewater	N_2O	±9	±9
6C. Waste incineration	CO_2	±7	±7
6C. Waste incineration	CH_4	±23	-23 to +24
6C. Waste incineration	N_2O	±18	±18
Waste Other	CH_4	±990	-976 to +993
Total Waste Sector		±11	±11

Note: Trend uncertainty is presented as percentage points.

Furthermore, trend uncertainty was calculated as in Equation 1, and the resulting confidence intervals were divided by base year estimate (best estimate) to obtain the relative change. The results would have been somewhat different, if trend uncertainty were calculated as in Equation 2:

$$Trend_{n,x} = [E_{n,x}(t)-E_{n,x}(0)]/ E_{n,x}(0) \qquad (2)$$

However, the effect of the choice between Eq 1 and 2 depends also on the direction and magnitude of trend in different MS, and without further consideration it cannot be stated whether choice of Eq 1 yielded a conservative estimate or not.

Lack of knowledge of different correlations, and many assumptions make the interpretation of EC trend uncertainty difficult, and therefore it should not be compared with uncertainty estimates of other countries. However, trend uncertainty calculations are internally consistent, and therefore the results can be used e.g. to assess which categories are the most important sources of trend uncertainty in the EC inventory.

Table 1.14 shows the main results of the uncertainty analysis for the EU-15. The lowest level uncertainty estimates are for stationary fuel combustion (2 %) and transport (3 %), the highest estimates are for agriculture (41 % - 104 %). For agriculture a range of level uncertainties is provided depending on the assumption on N_2O emissions from soils. The lower bound assumes that all MS uncertainty estimates of N_2O from agricultural soils are uncorrelated, the upper bound assumes that all uncertainty estimates are correlated. Overall level uncertainty estimates of all EU-15 GHG emissions is calculated to be between 4 % and 11 %.

With regard to trend uncertainty estimates the lowest uncertainty estimates are for stationary fuel combustion and transport (+/- 1 percentage point each), the highest estimates are for agriculture (6-14 percentage points). Overall trend uncertainty of all EU-15 GHG emissions is estimated to be between 1 and 2 percentage points.

More detailed uncertainty estimates for the source categories are provided in Chapters 3-8.

[10] When the correlation assumptions were simplified, IPCC Tier 1 method could also have been used

Table 1.14: Tier 1 uncertainty estimates of EU-15 GHG emissions

Source category	Gas	Emissions 1990	Emissions 2004 1)	Emission trends 1990-2004	Emissions for which MS uncertainty estimates are available 2)	Share of emissions for which MS uncertainty estimates are available	Level uncertainty estimates based on MS uncertainty estimates	Trend uncertainty estimates based on MS uncertainty estimates
Fuel combustion stationary	all	2,463,129	2,440,840	-1%	2,357,162	97%	2%	1
Transport	all	701,677	884,432	26%	833,522	94%	3%	1
Fugitive emissions	all	95,764	57,659	-40%	53,116	92%	11%	8
Industrial processes	all	378,334	330,924	-13%	251,700	76%	8%	5
Agriculture	all	435,412	392,521	-10%	402,155	102%	41% - 104%	6 - 14
Waste	all	163,446	108,866	-33%	90,072	83%	18%	11
Total	**all**	**4,251,799**	**4,227,386**	**-1%**	**3,987,727**	**94%**	**4% - 11%**	**1 - 2**

Note: Emissions are in Gg CO_2 equivalents; trend uncertainty is presented as percentage points.

1) The sum of the source category emissions may not be the total sector emissions because uncertainty estimates are not available for all source categories.

2) Includes for some countries 2003 data and for Spain 2002 data

In September 2005 a workshop on uncertainties in greenhouse gas inventories was organised in Helsinki (Finland). The aim of the workshop was to share information and experience on uncertainty assessment, to discuss needs for further guidance, and to improve comparability of uncertainty estimates across different Member States. The main objectives were to help Member States to compile/improve uncertainty estimates and to help develop the uncertainty assessment of the EC inventory. The workshop brought together experts from 16 Member States, the European Commission (DG ENV, JRC), ETC-ACC, as well as from Norway and Russia. UNFCCC secretariat sent their statement in a written form to the workshop. The workshop produced recommendations on the following topics: a) EC Uncertainty assessment and implications on Member State uncertainty assessment and b) Uncertainty assessment at Member State level (see workshop report http://air-climate.eionet.eu.int/meetings/past_html).

The relevant recommendations with regard to the EC uncertainty assessment and implications on MS uncertainty assessment were:

1. Level of detail of EC uncertainty assessment

- Aggregation of the EC uncertainty should be made to the level where most MS can be combined

2. Method and assumptions to be used to combine uncertainties at the EC level

- Tier 1 is appropriate for EC estimate, but Tier 2 can be used for certain categories and for trend
- No gap filling of uncertainties should be made
- "Rule" for correlations between MS in different sectors: default methods correlate unless there is a good reason to assume uncorrelated data

3. Improving EC uncertainty estimate

- Trend and LULUCF uncertainty should be included (feedback from the UNFCCC review process). These could not be included because of significant gaps in Member States' information.
- In EC uncertainty estimate, data provided by MS will be used taking into account MS contributions to the total uncertainty
- Feedback from EC to MS is important - e.g. are uncertainty estimates low or high compared to other MS and related to problems with EC inventory compilation.

4. Timing of EC uncertainty estimate

- Recent year estimate and 1990 estimate needed next year
- Uncertainty estimate of the EC will be carried out annually - information from MS should be available

Table 1.15 gives an overview of information provided by Member States on uncertainty estimates in their national inventory reports 2003, 2004, 2005 or 2006 and presents summarised results of these estimates. The table includes information from 18 Member States. From the remaining Member States, either a national inventory report was available, which did not include quantitative uncertainty analysis, or no national inventory report was available at all.

Table 1.15 Overview of uncertainty estimates available from Member States (from Member States' national inventory reports 2003, 2004, 2005 and 2006)

Member State	Austria		Belgium		Cyprus		Czech		Denmark		Estonia		Finland		France		Germany	
Citation	Austrian NIR 2006, p. 39-43		Belgian NIR 2006, p. 15-		No NIR provided		Czech NIR 2006, p. 22-		Danish NIR 2006 p. 53-		No information		Finnish NIR 2006 p. 24-26, Annex 1 (Table A)		French NIR 2006,		German NIR 2006, p. 67-	
Method used	Tier 1, Tier 2		Tier 1				Tier 1		Tier 1				Tier 1, Tier 2		Tier 1, Tier 2		Tier 1	
Documentation available in NIR (according to Table 6.1 of GPG)	Yes		Yes				Yes: Table 1.3		Yes				Yes: Annex 1 (Table A)		Yes		Yes: Annex [Anhang] 7 (not according to	
Years and sectors included	Tier 1: base year and 2004 - Key sources		2003-All sectors				1990, 2004 - All sources		1990, 2004 - The sources				1990, 2004 – All sectors		1990, 2004) – Tier 1 all		1990, 2002 - nearly	
Uncertainty (%)	Tier 1	Tier 2	Tier 1	Tier 2			Tier 1	Tier 2	Tier 1	Tier 2	Tier 1	Tier 2	Tier 1	Tier 2	Tier 1	Tier 2	Tier 1	Tier 2
CO_2	Base year: 0,9% 2004: 0,9%	1990: 2,3% 1997: 2,1	1,9%	-					2,3%					+/- 40% (with LULUCF) +/- 3% (without LULUCF)	-	-	-	-
CH_4	Base year: 13,1% 2004: 11,6%	1990: 48,3% 1997: 47,4%	24,0%	-					23%					+/- 22%	-	-	-	-
N_2O	Base year: 24,6% 2004: 26,8%	1990: 89,6% 1997: 85,9%	27,0%	-					40%					-30 to +130%	-	-	-	-
F-gases	Base year: 33,5% 2004: 32,8%	-	100	-					48%					-10 to +20%	-	-	-	-
Total	Base year: 2,42% 2004: 1,81%	1990: 9,8% 1997: 8,9%	7,5%	-			7,0%		5,2%					+/-30% (with LULUCF) -5 to +6% (without LULUCF)	21%	-	5,60%	-
Uncertainty in trend (%)	Tier 1	Tier 2	Tier 1	Tier 2			Tier 1	Tier 2	Tier 1	Tier 2			Tier 1	Tier 2	Tier 1	Tier 2	Tier 1	Tier 2
CO_2	-	-	-	-					1,9%				-	-	-	-	-	-
CH_4	-	-	-	-					10,4%				-	-	-	-	-	-
N_2O	-	-	-	-					11%				-	-	-	-	-	-
F-gases	-	-	-	-					58%				-	-	-	-	-	-
Total	2,97%	-	2,7%	-			2,9%		2,1%					-160 to +270% (with LULUCF) -90 to +70% (without LULUCF)	3,90%	-	4,30%	-

Member State	Greece		Hungary	Ireland		Italy		Latvia		Lithuania		Luxembour		Malta		Netherlands	
Citation	Greek Short-NIR 2006, p. 17-18.		Hungarian NIR 2006, p. 15 to 16	Irish NIR 2006, p. 14-		Italian NIR 2004, p. 18,		Latvian NIR 2006, p. 16.		Lithuanian NIR 2006		Luxembourg NIR 2006		No NIR provided		Dutch NIR 2006, p. 1-12	
Method used	Tier 1		Tier 1?	Tier 1		Tier 1		Tier 1								Tier 1	
Documentation available in NIR (according to Table 6.1 of GPG)	No			Yes: Table 1.4		Yes (Table A1.2)		Yes		No		No				Partially (Annex 7)	
Years and sectors included	1990, 2004 - All sources			1990, 2004 – All sources		1990, 2002 – All sources		1990-2004, All sources								1990/95, 2004 – All sources	
Uncertainty (%)	Tier 1	Tier 2	Tier 1?	Tier 1	Tier 2	Tier 1	Tier 2	Tier 1	Tier 2	Tier 1	Tier 2	Tier 1	Tier 2	Tier 1	Tier 2	Tier 1	Tier 2
CO_2	3,7% (witout LULUCF) 5% (with LULUCF)	-	+/- 2 to 4%	1,2	-	-	-	4								2,7%	-
CH_4	32,9%	-	+/- 15 to 25%	2,13	-	-	-	16								16,20%	-
N_2O	103,5%	-	+/- 80 to 90%	6,19	-	-	-	27								35,50%	-
F-gases	113,7%	-		0,1	-	-	-									20,30%	-
Total	11,3% (without LUCF)	-	< 10 %	6,66%	-	2,5%	-	5								5%	-
Uncertainty in trend (%)	Tier 1	Tier 2		Tier 1	Tier 2	Tier 1	Tier 2	Tier 1								Tier 1	Tier 2
CO_2	-	-		1,8	-	-	-	2								+/- 3%	-
CH_4	-	-		1,8	-	-	-	2								+/- 12%	-
N_2O	-	-		2,3	-	-	-	8								+/- 15%	-
F-gases	-	-		0,2	-	-	-									+/- 8%	-
Total	9,7%	-		3,4	-	2,4%	-	12								+/- 3%	-

Member State	Poland		Portugal		Slovakia		Slovenia		Spain		Sweden		United Kingdom	
Citation	Polnish NIR 2006, p. 13, Annex 5, 6		Portuguese NIR 2006, p.		Slovakian NIR 2006, p.		Sovenian NIR 2006, p. 21, Annex		Spanish NIR 2005, p.46-55		Swedish NIR 2006, p. 37-		UK NIR 2006, p. 78, Annex 7	
Method used	Tier 1						Tier 1		Tier 1		Tier 1		Tier 1, Tier 2	
Documentation available in NIR (according to Table 6.1 of GPG)	Partially		No		No		No, partially		Yes: Table 5.5.2 and 5.5.3		Partially (Annex 2)		Yes: Tables in Annex 7 (no composite table on references	
Years and sectors included	1998-2004 - All sources						1986, 2002, 2003		2001, 2002 (from year		1990 and 2004 for all		1990, 2004 – All sources	
Uncertainty (%)	Tier 1	Tier 2	Tier 1	Tier 2	Tier 1	Tier 2	Tier 1	Tier 2	Tier 1	Tier 2	Tier 1	Tier 2	Tier 1	Tier 2
CO_2	7,5%								-	-	2,3%	-	2,00%	
CH_4	20,9%								-	-	2,1%	-	19% (2004) 25% (1990)	
N_2O	47,7%								-	-	5,0%	-	221%	
F-gases	HFC 46,5% PFC 20% SF6 150%									-	0,3%	-	HFC 21 PFCs 13 SF6 16	
Total							1986: 12% 2002: 13,1% 2003: 12%		2001 +/- 17% 2002 +/- 15.8%	-	5,8%	-	14%	
Uncertainty in trend (%)					Tier 1	Tier 2	Tier 1		Tier 1	Tier 2	Tier 1	Tier 2	Tier 1	Tier 2
CO_2									-	-	-	-	3-8%	-
CH_4									-	-	-	-	37%(2204) 62% (1990)	-
N_2O									-	-	-	-	19-76%	-
F-gases									-	-	-	-	HFC 22%, PFCs 75%, SF6 9%	-
Total			13,3				2002: 4% 2003: 3%		2001 +/- 2.65% 2002 +/- 3.95%	-	-	-	14%	-

1.8 General assessment of the completeness

1.8.1 Completeness of Member States' submissions

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

Table 1.16 summarises timeliness and completeness of the Member States' submissions on 27 May 2006. It shows that GHG inventories for 2004 were submitted by 23 Member States. The complete time series was provided by 21 Member States. 20 Member States submitted all or almost all tables (i.e. more than 90 %) of the CRF tables for 1990–2004. The new LULUCF tables are available for 22 Member States. The completeness of national submissions with regard to individual CRF tables in the 2004 submission can be found in the status reports in Annex 3. In addition, EU-15 Member State information on the completeness of their emission estimates at source level can be seen from Table 1.16 and Table 1.17 below and in the overview tables in Chapters 3 to 8 which are based on the CRF Table 7 of the Member States.

Table 1.16 Date of latest submission or update, years covered and CRF tables available from Member States by 27 May 2006

MS	Submission dates	Latest data available	Years covered	CRF Tables[1)]	CRF format	New LULUCF tables
Austria	13 Jan 2006	2004	1990-2004	All	New	1990-2004
	16 Mar 2006	2004	1990-2004	All	New	1990-2004
	13 Apr 2006	2004	1990-2004	All	New	1990-2004
Belgium	16 Jan 2006	2004	1990-2004	All	Old	-
	15 Mar 2006	2004	1990-2004	All	Old	1990-2004
	3 May 2006	2004	1990-2004	All	Old	-
Cyprus	-	-	-	-	-	-
Czech Republic	12 Jan 2006	2004	2004	All	New	2004
	14 Apr 2006	2004	1990-2004	All	New	1990-2004
Denmark	13 Jan 2006	2004	1990-2004	All	Old	1990-2004
	15 Mar 2006	2004	1990-2004	All	New	1990-2004
	12 Apr 2006	2004	1990-2004	All	New	1990-2004
Estonia	13 Jan 2006	2004	2004	All	Old	2004
	12 Apr 2006	2004	2004	All	Old	2004
Finland	12 Jan 2006	2004	1990-2004	All	New	1990-2004
	15 Mar 2006	2004	1990-2004	All	New	1990-2004
	31 Mar 2006	2004	1990-2004	All	New	1990-2004
	6 Apr 2006	2004	1990-2004	All	New	1990-2004
France	13 Jan 2006	2004	1990-2004	Summary tables	Old	-
	16 Mar 2006	2004	1990-2004	All	Old	-
	5 Apr 2006	2004	1990-2004	LULUCF	New	1990-2004
	20 Apr 2006	2004	1990-2004	All	Old	1990-2004
Germany	6 Mar 2006	2004	1990-2004	All	Old	1990-2004
	13 Apr 2006	2004	1990-2004	All	Old	1990-2004
Greece	18 Jan 2006	2004	1990-2004	All	New	1990-2004
	15 Mar 2006	2004	1990-2004	All	New	1990-2004
Hungary	12 Jan 2006	2004	1985-2004	Full CRF only for 2004	New	2004
	16 Mar 2006	2004	1985-1988, 1990-2004	All	New	1985-1988, 1990-2004

MS	Submission dates	Latest data available	Years covered	CRF Tables[1)]	CRF format	New LULUCF tables
Ireland	18 Jan 2006	2004	1990-2004	All	New	1990-2004
	23 Jan 2006	2004	1990-2004	All	New	1990-2004
	16 Mar 2006	2004	1990-2004	All	New	1990-2004
	13 Apr 2006	2004	1990-2004	All	New	1990-2004
Italy	7 Apr 2006	2004	1990-2004	LULUCF	Old	1990-2004
	10 Apr 2006	2004	1990-2004	All	Old	-
	18 Apr 2006	2004	1990-2004	All	New	1990-2004
Latvia	13 Jan 2006	2004	1990-2004	All	New	1990-2004
	15 Mar 2006	2004	1990-2004	All	New	1990-2004
	13 Apr 2006	2004	1990-2004	All	New	1990-2004
Lithuania	16 Jan 2006	2004	1990, 1998, 2001-2004	Full CRF only for 2004	New	2004
	14 Mar 2006	2004	1990, 1998, 2001-2004	Full CRF only for 2004	New	2004
Luxembourg	6 Feb 2006	2003	1990-2003	Limited	Old	-
	17 Mar 2006	2004	1990-2004	Limited	Old	-
	22 May 2006	2004	1990-2004	Limited	Old	-
Malta	-	-	-	-	-	-
Netherlands	16 Jan 2006	2004	1990-2004	All	New	1990-2004
	15 Mar 2006	2004	1990-2004	All	New	1990-2004
	6 Apr 2006	2004	1990-2004	All	New	1990-2004
	14 Apr 2006	2004	1990-2004	All	New	1990-2004
Poland	29 Mar 2006	2004	2000-2004	Full CRF only for 2004	New	2004
Portugal	9 Feb 2006	2004	1990-2004	All	Old	1990-2004
	15 Mar 2006	2004	1990-2004	All	Old	-
	16 Mar 2006	2004	1990-2004	All	Old	1990-2004
	8 May 2006	2004	1990-2004	All	Old	1990-2004
Slovakia	14 Jan 2006	2004	1990-2004	Full CRF only for 2004	New	2004
	8 Mar 2003	2004	1990-2004	Full CRF only for 2004	New	2004
Slovenia	13 Jan 2006	2004	1986, 1990-2004	All	New	1986, 1990-2004
	15 Mar 2006	2004	1986, 1990-2004	All	New	1986, 1990-2004
	5 May 2006	2004	1986, 1990-2004	All	New	1986, 1990-2004
Spain	12 Apr 2006	2004	1990-2004	All	New	1990-2004
Sweden	13 Jan 2006	2004	1990-2004	All (Database)	New	1990-2004
	3 Feb 2006	2004	1990-2004	All	New	1990-2004
	12 Apr 2006	2004	1990-2004	All	New	1990-2004
United Kingdom	15 Jan 2006	2004	1990-2004	Emission totals		
	31 Jan 2006	2004	1990-2004	All	New	1990-2004
	15 Mar 2006	2004	1990-2004	All	New	1990-2004
	3 Apr 2006	2004	1990-2004	All	New	1990-2004
	13 Apr 2006	2004	1990-2004	All	New	1990-2004

([1]) All = all or almost all (approx. more than 90 %) of the CRF tables; Limited = Sectoral Report Tables, Table 1A(a), Summary 1.A, Summary 3 (see Annex 3 for more details).

Table 1.17 shows the availability of Member States' national inventory reports or additional inventory information and a short characterisation of the 2006 report. The column 'Report structure 2006' indicates whether the Member States used the UNFCCC structure of national inventory report ([11]).

([11]) FCCC/CP/2002/8.

Table 1.17 National inventory reports or additional information available from Member States as by 8 April

Member State	2006	References	Report structure 2006[12]	Characterisation of the 2006 report
Austria	Umweltbundesamt (2006)	Umweltbundesamt 2006. *Austria's national inventory report 2006. Submission under the EC Monitoring Mechanism*. Vienna, 2006	Yes	National inventory report including general information on the inventory, emission trends, sector and source-specific methodological information and data sources, QA/QC activities, key source analysis, uncertainty evaluation, recalculations and inventory improvements.
Belgium	Directorate General Environment (2006)	DG Environment 2006. *Belgium's Greenhouse Gas Inventory (1990-2004). National Inventory Report. Submitted under the UNFCCC.* April 2006	Yes	National inventory report including general information on the inventory, emission trends, sector and source-specific methodological information and data sources, QA/QC activities, key source analysis, uncertainty evaluation, recalculations and inventory improvements.
Cyprus				[NIR not yet submitted]
Cezch-Republic	Czech Hydrometeorological Institute (2006)	Czech Hydrometeorological Institute 2006. *National Greenhouse Gas Inventory Report of the Czech Republic, NIR; Reported Inventory 2004.* Prague, April 2006	Yes	National inventory report including general information on the inventory, emission trends, sector and source-specific methodological information and data sources, QA/QC activities and recalculations, key source analysis, uncertainty evaluation, recalculations and inventory improvements
Denmark	National Environmental Research Institute (2006)	National Environmental Research Institute 2006. *Denmark's National Inventory Report 2006. Submitted under the UNFCCC 1990-2004.* March 2006	Yes	National inventory report including general information on the inventory, emission trends, sector and source-specific methodological information and data sources, QA/QC activities and recalculations, key source analysis, uncertainty evaluation, recalculations and inventory improvements.
Estonia	Ministry of Environment (2005)	Ministry of Environment 2005. *Greenhouse Gas Emissions in Estonia 1990-2004. National Inventory report to the UNFCCC Secretariat.* Tallinn, 2005	Yes	National inventory report including general information on the inventory, emission trends, key source analysis and sector and source specific methodological information. Uncertainty evaluation and QA/QC activities and recalculations are only partly done.
Finland	Statistics Finland (2006)	Statistics Finland 2006. *Greenhouse Gas Emissions in Finland 1990-2004. National Inventory Report to the European Commission.* January 2006.	Yes	National inventory report including general information on the inventory, emission trends, sector and source-specific methodological information and data sources, QA/QC activities, key source categories, uncertainty evaluation, recalculations and inventory improvements.
France	Ministere de l'Ecologie et du Development Durable (2005)	Ministere de l'Ecologie et du Development Durable, 2005. *Inventaire des émissions de gaz à effet de serre en France au titre de la Convention Cadre des Nations Unies sur les Changements Climatiques.* December 2005	Yes	National inventory report including general information on the inventory, emission trends, sector and source-specific methodological information and data sources, QA/QC activities, key source analysis, uncertainty analysis, recalculations and inventory improvements
Germany	Umweltbundesamt (2006)	Umweltbundesamt 2006. *Berichterstattung unter der Klimarahmenkonvention der Vereinten Nationen 2006. Nationaler Inventarbericht zum Nationalen Treibhausgasinventar 1990-2004.* Dessau, Februar 2006	Yes	National inventory report including general information on the inventory, emission trends, sector and source-specific methodological information and data sources, QA/QC activities, key source analysis, uncertainty analysis, recalculations and inventory improvements.
Greece	Minstry for the Environment, Physical Planning and Public Work (2006)	Ministry for Environment, Physical Planning and Public Work 2006. *Climate Change Emissions Inventory-Information under Article 3(1) of the Decision 289/2004/EC.* January 2006	Yes	National inventory report including general information on the inventory, emission trends, sector and source specific methodological information and data sources, QA/QC activities, key source analysis, uncertainty evaluation, recalculations and inventory improvements.
Hungary	Ministry for Environment and Water (2006)	Ministry for Environment and Water 2006. *National Inventory Report for 2004. Hungary.* Budapest, January 2006	Yes	National inventory report including general information on the inventory, emission trends, sector and source specific methodological information and data sources, recalculations, inventory improvements, uncertainty analysis, QA/QC and key source analysis.

([12]) as in the revised UNFCCC reporting guidelines adopted by Decision 18/CP.8.2

Member State	2006	References	Report structure 2006[12]	Characterisation of the 2006 report
Ireland	Environmental Protection Agency (2006)	Environmental Protection Agency 2006. *Ireland - National Inventory Report 2006, Greenhouse Gas Emissions 1990-2004 Reported to the United Nations Framework Convention on Climate Change.* 2006	Yes	National inventory report including general information on the inventory, emission trends, sector and source-specific methodological information and data sources, QA/QC activities, key source analysis, uncertainty evaluation, recalculations and inventory improvements.
Italy				[NIR not yet submitted]
Luxembourg	2006	*Luxembourg, National Inventory Report 1990-2003*. Luxembourg, January 2006	Yes	National Inventory report including general information on inventory, emission trends and some sector and source specific information. First NIR submitted, improvements therefore not applicable.
Latvia	Latvian Environment, Geology and Meteorology Agency (2006)	Latvian Environment, Geology and Meteorology Agency (2006). *Latvia's National Inventory Report 1990-2004. Submitted to the European Commission under the Decision No 280/2004/EC.* January 2006	Yes	National inventory report including general information on the inventory, emission trends, sector and source-specific methodological information and data sources, QA/QC activities, key source analysis, uncertainty evaluation, recalculations and inventory improvements.
Lithuania		*National Greenhouse Gas Emission Inventory Report of the Republic of Lithuania (Reported Inventory 2004).* Vilnius, 2006	Yes	National inventory report including general information on the inventory, emission trends, sector and source specific methodological information and data sources, key source analysis, uncertainty evaluation and inventory improvements.
Malta				[NIR not yet submitted]
Netherlands	Netherlands Ministry of Spatial Planning, Housing and the Environment 2006	Netherlands Ministry of Spatial Planning, Housing and the Environment 2006, *Greenhouse Gas Emissions in the Netherlands 1990-2004, National Inventory Report 2006*	Yes	National inventory report including general information on the inventory, emission trends, sector and source-specific methodological information and data sources, QA/QC activities, key source analysis, uncertainty evaluation, recalculations and inventory improvements.
Poland	Ministry of Environment 2006.	Ministry of Environment 2006. *National Inventory Report 2004, Poland.* February 2006	No	National inventory report including general information on the inventory, emission trends, sector and source-specific methodological information and data sources, QA/QC activities, key source analysis, uncertainty evaluation and recalculations.
Portugal	Institute for the Environment (2006)	Institute for the Environment, 2006. *Portuguese National Inventory Report on Greenhouse Gases, 1990-2004, Submitted under the United Framework Convention on Climate Change.* 2006	Yes	National inventory report including general information on the inventory, emission trends, sector and source-specific methodological information and data sources, QA/QC activities, key source analysis, uncertainty evaluation, recalculations and improvements.
Slovakia				[NIR not yet submitted]
Slovenia	Environmental Agency of the Republic of Slovenia (2006)	Environmental Agency of the Republic of Slovenia 2006. *Slovenia's National Inventory Report 2006, Submission under the UNFCCC 2006.* Ljubljana, March 2006	Yes	National inventory report including general information on the inventory, emission trends, sector and source-specific methodological information and data sources, QA/QC activities, key source analysis, uncertainty evaluation, recalculations and inventory improvements.
Spain				[NIR not yet submitted]
Sweden	Swedish Environmental Protection Agency (2005)	Swedish Environmental Protection Agency 2005. *Sweden's National Inventory Report 2006 – Submitted under the United Nations Framework Convention.* 2005	Yes	National inventory report including general information on the inventory, emission trends, sector and source-specific methodological information and data sources, QA/QC activities, key source analysis, uncertainty evaluation, recalculations and inventory improvements.
United Kingdom	UK GHG Inventory Agency (2006)	UK GHG Inventory Agency, 2006. *UK Greenhouse Gas Inventory 1990 to 2004: Annual Report for submission under the Framework Convention on Climate Change* April 2006	Yes	National inventory report including general information on the inventory, emission trends, sector and source-specific methodological information and data sources, QA/QC activities, key source analysis, uncertainty evaluation, recalculations and inventory improvements.

The following tables refer to EU-15 only. Table 1.18 compiles the characterisation of the 2006 NIRs of Member States as well as the findings from the individual review of Member States' inventories conducted by the UNFCCC Secretariat in 2005 and compares those findings with the NIRs submitted in 2006 by Member States. This analysis intends to increase information on completeness of methodological descriptions, underlying data and key parts of the inventory submission by Member States that form the basis of the EC submission.

Table 1.18 Characterisation of Member States' national inventory reports 2005 and changes in 2006

Member State	Characterisation of the report in the 2005 UNFCCC inventory review	Changes to the report in 2006 in response to the review
Austria	**UNFCCC Status and Review report 2005:** The organization of chapters in the NIR follows the structure as outlined in the revised UNFCCC reporting guidelines (decision 18/CP.8). However, some of the information required in the annexes is not provided, e.g. tables 6.1 and 6.2 of the IPCC good practice guidance**.** Austria's submission is in a very good order. Clear and detailed information is provided in the NIR. Some issues, mainly concerning time series consistencies are identified by the ERT. (para 7) FCCC/ARR/2005/AUT	Several improvements in response to the UNFCCC review 2005 have been made, including the inclusion of table 6.1 in the Annexes.
Belgium	**UNFCCC Status and Review report 2005**: The organization of the NIR, in general, follows the structure as outlined in the revised UNFCCC reporting guidelines (decision 18/CP.8). However, the Executive Summary and some of the required sub-chapters and annexes (e.g. tables 6.1 and 6.2 of the IPCC good practice guidance, and methodological information relevant for the energy sector) are not provided. The NIR discusses quality assurance/quality control (QA/QC) but as yet the Party has no QA/QC plan; this will be a very useful development given the significant challenges in integrating the different methodological approaches as between Flanders, Wallonia and Brussels. (para 6) FCCC/ARR/2005/BEL	Work on the QA/QC system is ongoing.
Denmark	**UNFCCC Status and Review report 2005:** The organization of the NIR follows the structure outlined in the revised UNFCCC reporting guidelines adopted by decision 18/CP.8. The inventory is generally complete, except of the LULUCF chapter, where some estimates are missing and methodological development is underway. (para 6) FCCC/ARR/2005/DNK	Several improvements and recalculations have been made. Especially in the LULUCF sector, where mineral soils from cropland, grasland and wetland are for the first time included in the inventory.
Finland	**UNFCCC Status and Review report 2005:** The organization of the NIR follows the structure as outlined in the revised UNFCCC reporting guidelines (decision 18/CP.8). NIR and CRF are largely complete and transparent. More detailed explanations should be provided in some sectoral sections. An improved estimation of non-energy fuel use has not been done so far and should be resolved in the 2006 submission. (FCCC/ARR/2005/FIN, para 6)	Improvements have been taken place in different sectors. Many recalculations because of updated data or new emission factors have been done.
France	**UNFCCC Status and Review report 2005:** The organization of the NIR, in general, follows the outline of the revised UNFCCC reporting guidelines (decision 18/CP.8). However, the report only provides summary information on the methodologies for all sectors. France's NIR is concise and well-structured in terms of chapters, sections and paragraphs. However, in many places explanations of why particular emission factors have been used or why specific recalculations have been performed are not provided. The complete and final OMINEA report should be submitted together with the NIR to the UNCCC secretariat. (FCCC/ARR/2005/FRA, para 8).	The OMINEA report has been updated.
Germany	**UNFCCC status and Review report 2005:** The organization of the chapters in the NIR follows the structure as outlined in the revised UNFCCC reporting guidelines adopted by decision 18/CP.8. The NIR provides clear and detailed information on the methods applied, the activity data (AD) and the emission factors (EFs) used. The German submission is therefore generally very transparent and well organized, and almost all necessary information is provided. A number of details could, however, be further improved. (para 6) FCCC/ARR/2005/DEU	Work on inventory improvement is still ongoing, especially with regard to the complete implementation of the IPCC Good Practice Guidance.
Greece	**UNFCCC status and Review report 2005:** The organization of chapters in the NIR in general follows the structure as outlined in the revised UNFCCC reporting guidelines (decision 18/CP.8). However, some of the recommended annexes are not provided. The ERT noted that the NIR could be improved by the inclusion of additional explanations on data and choices of methodologies, and that the inventory would benefit from the use of higher-tier (tier 2) methods for some key categories. However, it recognizes that the Greek inventory team is aware of these deficiencies and is currently examining how best to address them. The NIR and the CRF	Greece improved its inventory submission. Tier 2 methods have been applied for most key categories and completeness has also been improved.

Member State	Characterisation of the report in the 2005 UNFCCC inventory review	Changes to the report in 2006 in response to the review
	tables are for the most part consistent. The ERT also noted that the Greek inventory, while showing improvement, still suffers from a lack of recent data (see table 1.8 in the NIR, which indicates that almost all the estimates for the year 2003 are provisional or only partial). (para 6) FCCC/ARR/2005/GRC	
Ireland	**UNFCCC status and Review report 2005:** The organization of the NIR does not follow the structure as outlined in the revised UNFCCC reporting guidelines (decision 18/CP.8). The NIR contains information on key sources, recalculations, QA/QC, uncertainties, trends, completeness and planned improvements. The inventory is generally transparent and comprehensive. Some emission categories are not included in the inventory and some key categories are estimated on the basis of the tier1 methodology. Data for the LULUCF sector have not been estimated and reported. The establishment of QA/QC activities is planned. (para 7) FCCC/ARR/2005/IRL	The majority of the recommendations in the 2003 review report have been implemented, e.g. development of an inventory report in line with the UNFCCC reporting guidelines and complete coverage of the LULUCF sector. Much work was done to apply more appropriate methods and emission factors. Previously reported inventories from 1990-2003 have been recalculated.
Italy	**UNFCCC status and review report 2005:** The Italian inventory is fairly complete, consistent and transparent, and is in a process of continuous improvement year by year. The national inventory report (NIR) is detailed and well documented, with the exception of certain categories, especially those for which country-specific methodologies and emission factors (EFs) are used, and these need further documentation.(para 4,9) FCCC/ARR/2005/ITA	[Updated NIR not yet submitted]
Luxembourg	**UNFCCC status report 2005:** An NIR has not been submitted in 2005.	NIR submitted, but many gaps remain
Netherlands	**UNFCCC status and review report 2005:** The organization of chapters in the NIR follows the structure as outlined in the revised UNFCCC reporting guidelines (decision 18/CP.8). The Netherlands inventory is on an advanced stage of development. Some data from industrial processes sector is reported as confidential. The ERT recommends that more can be done to facilitate an assessment of estimates of such sources. (para 7) FCCC/ARR/2005/NLD	Some missing sources from the industrial processes sector are included in this submission.
Portugal	**UNFCCC review report 2005:** In general the NIR is transparent and comprehensive. A well functioning institutional and QA/QC system have been developed. The CRF and the NIR include sufficient information for a thorough review of the methodologies and assumptions used. However, the structure of the NIR is not fully consistent with the structure outlined in the revised UNFCCC reporting guidelines. Some emissions sources are not included in the inventory. (para 6) FCCC/ARR/2005/PRT	In order to make the inventory internal consistend recalculations of the entire time series took place. Changes of methodologies, source coverages or scope of the data are reflected in this recalculations.
Spain	**UNFCCC status and review report 2005:** The organization of the NIR does not follow the structure as outlined in the revised UNFCCC reporting guidelines (decision 18/CP.8). The NIR contains information on methodologies used, inventory principles, trends and recalculations, uncertainty analysis and key sources, and discussion of key sources under each IPCC sector including information on activity data and factors used in the calculation of estimates. The inventory is largely complete apart from the LUCF sector, which only has estimates for category 5.A Changes in Forest and Other Woody Biomass Stocks. The emissions estimates and trends are reasonable but in many cases are not transparent, either methodologically or in the activity data (AD), emission factors (EFs) or other parameters used. There appears to be a continuing need to improve coordination between the agencies which provide the data used for the estimation of emissions. The NIR should make more obvious the use of key category and uncertainty analyses for methodological choice and in the Party's strategy for improving its emissions estimates.(para 8) FCCC/ARR/2005/ESP	[Updated NIR not yet submitted]
Sweden	**UNFCCC status and review report 2005:** The organization of the NIR, in general, follows the structure as outlined in the revised UNFCCC reporting guidelines (decision 18/CP.8). However, some of the recommended annexes are not provided (e.g., tables 6.1 and 6.2 of the IPCC good practice guidance). The ERT notes that the NIR is very good, but could be improved somewhat with additional explanations about data and methodological choices and a more detailed analysis of factors underlying the trends. (para 6,7) FCCC/ARR/2005/SWE	In response to the review more information on recalculations and quality assurance and transparent explanations on uncertainty estimates for activity data, emission factors etc. is included in the NIR.
United Kingdom	**UNFCCC status and review report 2005:** The organization of the chapters in the NIR follows the structure outlined in the revised UNFCCC reporting guidelines (decision 18/CP.8). In general, both the NIR and the	Most of the questions on transparency and consistency were

Member State	Characterisation of the report in the 2005 UNFCCC inventory review	Changes to the report in 2006 in response to the review
	CRF are largely complete and transparent. The ERT noted some minor questions of transparency and consistency, which are described in the sectoral sections of this report. It is evident that the inventory system of the United Kingdom is seeking to address many of the questions raised by previous review reports.	addressed.

Table 1.19 provides an overview regarding incomplete estimation of source categories and completeness of geographical coverage as reported by Member States as far as this information was provided. The table also indicates briefly the reasons why certain source categories were not estimated. Since this overview table reflects the level of completeness of the underlying inventories, it represents an aggregate guide to the completeness of the EC inventory.

Table 1.19 Overview of completeness as reported by Member States in CRF Table 9 and in the 2005 NIR

Member State	Summary of information on completeness in Member States' NIRs and CRF Table 9 (NE)
Austria	**Completeness by emission sources:** CRF 2.B.4: CH_4 emissions from carbide production are not estimated. **Completeness by geographical coverage:** Complete territory covered.
Belgium	Table 9.is not filled in. No information on completeness presented in the NIR.
Denmark	**Completeness by emission sources:** CRF 2.D.2: Emission estimates for CO_2 emissions from Food and Drink are under development. CRF 5.B.1 peatland for horticultural use not estimated CRF 6.B.1: CH_4 emissions from Industrial wastewater use have not been estimated due to lack of data. **Geographical coverage:** The submission is for the Kingdom of Denmark, including Greenland and the Faroe Islands as annexed tables.
Finland	**Completeness by emission sources:** CRF 2.A.5: CO_2 emissions from asphalt roofing are not estimated due to missing activity data and emission factors. CRF B.2; C.2 Changes in carbon stock have not been estimated due to missing area data or missing methodologies. CRF 6.B.1: N_2O emissions from industrial wastewater handling are not estimated due to lack of default methodology. CRF 6.B.2.1: N_2O emissions from domestic and commercial wastewater are estimated to be nearly cero and therefore negligible. **Completeness by geographical coverage:** The inventory includes emissions from the autonomic territory of Åland (Ahvenanmaa). Information on the specified emissions for the territory of Åland estimated by the Finnish Environment Institute will be available at the website http://www.environment.fi>state of the environment>air>Finland's GHG emissions by the end of March 2006.
France	**Completeness by emission sources:** CRF 2.C not estimated Tables 5(I), 5(II) not filled in. No information in NIR or CRF tables on completeness by emission sources. No estimates of potential emissions from fluorinated gases (HFCs, PFCs, SF_6). **Completeness by geographical coverage:** The inventory covers emissions from mainland France as well as all overseas departements and territories with the exception of not inhabitated regions where human induced emissions are negligible.
Germany	**Completeness by emission sources:** CRF 2.A.5 and 2.A.6: CO_2 emissions from asphalt roofing and road paving with asphalt not estimated, but methods are in preparation. CRF 4: CH_4 emissions from manure management and enteric fermentation not estimated for mules and asses as German statistics do no provide the number of animals CRF 5: Table 9 is not filled in..
Greece	**Completeness by emission sources:** CRF 1.B.1.b: CO_2, N_2O and CH_4 emissions not estimated for Fugitive emissions CRF 2.A.5, 2.A.6: CO_2 emissions from asphalt roofing and road-paving not estimated. CRF 5. D.1,2; E.1,2; F1,.2: Carbon stock changes are not reported. CRF 6.B.1: CH_4 and N_2O emissions from industrial waste water not estimated. No estimates of potential emissions from fluorinated gases (HFCs, PFCs, SF_6). **Completeness by geographical coverage:** complete territory covered.
Ireland	CRF 1.B.2.A.4-6: CO_2 emissions are not estimated as no activity data is available or emissions are considered as negligible. CRF 2.A.5, 6: CO_2 not estimated due to missing data. CRF 2.D.2: CO_2 emissions from Food and drink production are not available due to missing activity data, are also considered as negligible. CRF 3.D.1: N_2O emissions from the use of anaestheesia not estimated. D2: CO_2 emissions not estimated due to missing data. CRF 5.E.1; Carbon stock changes are not reported.
Italy	CRF 1.A.2: CO_2, N_2O and CH_4 emissions from Manufacturing Industries and Construction - Pulp, paper and

Member State	Summary of information on completeness in Member States' NIRs and CRF Table 9 (NE)
	print, Biomass are not estimated as no information is available. CRF 2: Potential PFC emissions have not been estimated. CRF 5.E.1; E.2.1; E.2.2, E.2.3: CO_2 emissions from net carbon stock change in organic matter not estimated due to lack of data.
Luxembourg	Table 9 is not provided in CRFs. No information on completeness in the NIR. Notation keys in CRF tables not used correctly therefore it is not possible to indicate completeness.
Netherlands	CRF 1.B.2.A.3,5,6: CH_4 and CO_2 emissions from transport, distribution of oil products and others not estimated, negligible amount CRF 2.A.2,5,6: CO_2 emissions from lime production, asphalt roofing and road paving with asphalt not estimated CRF 5.B.1not estimated, tables 5(I), 5(II), 5(III) not estimated. CRF 6.B.1: CH_4 emissions from industrial wastewater not estimated, no data available, negligible amount. CRF 6.B.1; 2.1: N_2O emissions from industrial and domestic and comercial wastewater not estimated, considered minor. **Completeness by geographical coverage:** The territory of the Netherlands from which emissions are reported is the legal territory; this includes a 12-mile zone from the coastline and inland water bodies. It excludes Aruba and the Netherlands Antilles, which are self-governing dependencies of the Royal Kingdom of the Netherlands. Emissions from offshore oil and gas production at the Netherlands' part of the continental shelf are included. Emissions from all electricity generating activities in The Netherlands are accounted for, including the electricity fraction that is exported. Until 1999, The Netherlands imported about 10% of its electricity, but, due to the liberalisation of the European electricity markets, the net import increased by 55%. Emissions from the fishing fleet registered in the Netherlands, but sailing outside Dutch coastal waters for the most part, are included in the national total.
Portugal	CFR 2.5 not estimated CRF 5.C.1 not estimated Tables 5(I), 5(III) not estimated, no data available Table 5(V) B,C not estimated, no data available Notation keys not always used therefore difficult to check completeness CFR 5: CO_2 emissions and removal from soils are not estimated due to insufficient characterisation of the organic carbon stored in soils and its changes. CRF 5: CO_2 emissions from forest and grasland conversion and abandonment of managed land not estimated because of high uncertainty . **Completeness by geographical coverage:** The inventory is almost complete. Covering Portugal Mainland, Azores and Madeira Island. The LULUCF sector covers only emissions and removals from Portugal Mainland.
Spain	CRF 2.A.5,6 not CRF 6.B.1 N_2O emissions not estimated Tables 5.B and 5.C not filled in Tables 5(I), 5(II), 5(III), 5(IV9, 5(V) not filled in
Sweden	CRF 1.B.2.A.3; 1.B.2.C: CO_2 emissions not estimated due to missing data. CRF 1.B.2.A.3; 1.B.2.A.5; 1.B.2.C, 1.A.3.B; Flaring of gas: CH_4 emissions not estimated, no data available. 1.B.2.C.2.2: N_2O emissions not estimated. CRF 2.D.2; Non CO_2 emissions not estimated, no data available.
United Kingdom	CRF CRF 2.B.4 not estimated. CRF 2.A.6;2.D.2: CO_2 emissions not estimated. CRF tables 5(I), 5(II) and 5(III) not estimated CRF 6.B.1: No CH_4 and N_2O emissions from industrial waste water estimated. **Geographical coverage:** This submission is extended and includes emissions from the UK's Crown Dependencies of Guernsey, Jersey and the Isle of Man, and from the UK's Overseas Territories of Bermuda, Cayman Islands, Falkland Islands and Montserrat. Emissions from Gibraltar are not included, but are summarized in Appendix B.

Table 1.19 gives a very broad indication of incomplete source categories. However, a large number of the source categories indicated by Member States can be considered as negligible in quantitative terms in relation to the total emissions of the EC inventory. In order to get more specific information on the relevant omissions, the information on completeness was compiled from UNFCCC inventory review reports of Member States (Table 1.17). However, in a number of cases, those reports only provide a list of incomplete source categories without a clarification if these emissions are considered as relevant in quantitative terms. The last column of Table 1.20 indicates if Member States introduced changes to their NIRs regarding the completeness issues addressed during the review in 2005.

Table 1.20 Completeness of Member States' inventories as indicated in UNFCCC review reports and responses in 2006

Member State, type and year of UNFCCC review	Findings related to completeness from UNFCCC review report	Response in 2006 submission
Austria, centralised review 2005	Austria's 2005 submission is generally complete. A complete time series of all categories and sinks for the territory of Austria is provided. (para 8) **LULUCF:** The CRF for 2003 includes only estimates for CO_2, no other gases are estimated. Also estimates on net removals and emissions from soils are not complete and no changes of carbon stocks in dead organic matter have been reported for category 5.A. Also some cells have not been filled in correctly as they are left blank or are filled with 0. (para 63, 64) FCCC/ARR/2005/AUT	As recommended by the ERT missing source and sink categories such as carbon stock changes in dead organic matter, emission from land use changes and N_2O and CH_4 emissions from biomass burning have been included.
Belgium	Data are provided for all gases, sectors and years. CRF tables 7 (Overview), 8(b) (Recalculation – Explanatory Information) and 9 (Completeness) have not been provided, and table 10 (Trends) is provided only in the CRF tables for 2003. The notation keys are used in some sectoral and background tables in a limited way. Belgium has provided the new LULUCF reporting tables as required by decision 13/CP.9 of the Conference of the Parties for the years 1990–2003, although estimates are only provided for Forest Land Remaining Forest Land. Source category coverage sometimes varies between regions. (para 7) **Waste:** The reporting is complete except for 6.B.1 Industrial Wastewater Handling and CH_4 recovery in the waste-water treatment plants. CRF table 8(b) provides all the recalculated estimates performed in the Waste sector and brief explanations are provided in the NIR but not in the CRF. Belgium is encouraged to fill in the CRF tables by using the appropriate notation keys where emissions estimates are not reported, and providing fuller information on recalculations performed. (para 70) FCCC/ARR/2005/BEL	Table 8(b) is provided, table 10 provided for most recent year. Changes have been made in the LULUCF sector, where estimates were provided for tables 5.B and 5.C
Denmark, centralised review 2005	Inventory data for the years 1990-2003 is provided, including all required tables. The inventory is complete apart from minor omissions noted below under Industrial Processes and Agriculture. Denmark intends to include these in its next inventory. Waste-water handling has been introduced into this submission in response to earlier reviews.(para 7)	Inventory was considered as complete, no recommendations for additions of sources.
Finland, centralised review 2005	Finland has submitted an almost complete inventory, including CRF tables from 1990-2003 and a comprehensive NIR. The geographical coverage is complete and all sectors and relevant categories are covered. Only few gases and emission sources are not reported in the CRF tables. Fugitive emissions of N_2O from the extraction and handling of peat are not estimated. (para 7) **LULUCF:** The submission does not include estimates for Wetlands (in category 5.D), Settlements (in category 5.E) and Other Land (in category 5.F). The ERT notes that not all subcategories under these three categories are mandatory to report. Complete reporting of area of all land-use categories and changes over time would be preferable.(para 54) **Waste:** Finland does not estimate emissions from composting and therefore underestimates current CH_4 and N_2O emissions. The ERT strongly recommends that Finland include these emission sources in the inventory as their relevance may grow in the future. (para 62) FCCC/ARR/2005/FIN	In the LULUCF sector carbon stock changes in forest soils and dead organic matter pool have been included for the first time. Complete areas are reported in LULUCF tables. Emissions from composting have been included in the waste sector in this submission.
France	France has provided inventory data for the years 1990–2003. The ERT noted that in a number of tables France leaves data cells empty. Table 9 – Completeness has not been provided. (para 12-14) **Energy:** For several sources no emissions of CH_4 and N_2O are estimated, although activity data are available. (para 26). **Industrial processes:** Potential emissions of HFCs, PFCs and SF_6 are reported as "NE" for all years. (para 54) **LULUCF:** France has not provided the CRF tables for LULUCF as required by decision 13/CP.9. Thus, background data are reported in the CRF tables for LUCF, which are based on the categories of the Revised 1996 IPCC Guidelines. Consequently, France's inventory in the LUCF sector cannot be considered complete. (para 66) **Waste:** All the sectoral CRF tables have been completed. (para 72) FCCC/ARR/2005/FRA	Issues raised by the review team which could not be addressed in the 2006 submission will be attended to in the 2007 inventory. **Energy:** CH_4 and N_2O estimates for all relevant source categories provided. **LULUCF:** The LULUCF tables are provided as required by decision 13/CP.9.
Germany	Germany has provided inventory data for the years 1990–2003 and included all the required tables. The LULUCF reporting tables are provided as required by decision 13/CP.9 for the years 1990–2003. However, data are not included in the following tables of the LULUCF CRF: Summary 3 (1990–2002), and tables 7, 9 and 10 (1990–2003).(para 7)	According to the recommendations of the review CO_2 emissions from biomass are included in the CRF tables. CO_2 emissions from Calcium Carbide and Methanol and 2.C.2 are

Member State, type and year of UNFCCC review	Findings related to completeness from UNFCCC review report	Response in 2006 submission
	Energy: CO_2 emissions from biomass are generally reported as "0.00". The Party is recommended to include the estimates for CO_2 emissions from biomass in the CRF tables.(para 20) **Waste**: The ERT recommends that Germany provide estimates for N_2O emissions from Waste-water Handling and complete the additional information tables in CRF tables 6.A and 6.B, as required by the revised UNFCCC reporting guidelines. (para 75) FCCC/ARR/2005/DEU	reported in the CRF tables. 2.A.3 and 2.A.4 are included elsewhere. In the waste sector N_2O emissions from domestic and commercial wastewaterhandling are reported. Additional information in table 6.A,C provided.
Greece	Overall, the Greek inventory is complete. The NIR identifies known sources that are missing and provides detailed explanations for this in most cases. Missing sources include Electrical Equipment – SF_6, CO_2 and N_2O emissions from Fugitive Emissions from Fuels, Soda Ash Production, Asphalt Roofing and Road Paving, which are not included either because of inconsistencies in data sources or because of lack of data. A number of other minor sources, such as Foam Blowing – F-gases, Solvents – N_2O, Agricultural Soils – CH_4, Wastewater Handling: Industrial – N_2O and Sludge – CH_4, are also not reported due to lack of activity data (AD) or estimation methodologies. (para 7)	Improvement of the completeness of the inventory will be further investigated. Recommendations not clear in relation to the necessity to include additional sources.
Ireland, centralized review 2005	Ireland's inventory is complete for all years with regard to geographical coverage and is generally complete in terms of coverage of sources and gases. However, in the LULUCF sector a wrong reporting format is used and some important sources are not included in the inventory: Being emissions from the Industrial processes sector and Forest and Grassland Conversion – CO_2; Abandonment of Managed Lands – CO_2; Emissions and Removals from Soil – CO_2 (except for emissions from lime application); Agriculture Soils – CH_4; and Wastewater Handling – N_2O. Ireland believes that many of these categories are minor, with the probable exception of the LULUCF categories. (para 8-10) **LULUCF:** Ireland has not submitted LULUCF reporting tables, but has used the reporting format for Land-use Change and Forestry (LUCF), as contained in decision 18/CP.8. For the LULUCF sector Ireland notes that, due to the high level of uncertainty in annual estimates, until the results of major national research in this area become available, it has not included categories other than Forest Land.(para 61, 63) **Waste:** Emissions from waste water handling are assumed to be negligible and not estimated. Also waste incineration is not estimated due to minor emissions and confidential data. For terms of completeness these emissions should be included in the next submission. (para 71) FCCC/ARR/2005/IRL	Several improvements have been made in response to the review process. F-gases for the years 1990-1994 have been estimated. In the LULUCF sector the reporting format has been changed according to the requirements of decision 13 CP/9 all sources of emissions and removals in the LULUCF sector are covered. Some CH_4 and N_2O emissions from waste water handling are included in this inventory.
Italy, In country review 2005	The 2005 inventory submission is fairly complete. CRF tables including full geographical coverage, all sectors and almost all gases and sources/sinks. Some gaps still exist. In the energy sector some emissions from manufacturing industries and constructions are not estimated. In industrial processes and solvent use sector potential HFC emissions are not reported and N_2O emissions from other use are not calculated. Notation keys are used, but some blank cells still exist. (para 15,16**)** **Energy:** Description of recalculations in CRF table 8(b) is missing. **Agriculture:** Application of sewage sludge to agricultural soils is not included in estimated emissions.(para 85) **LULUCF:** Revised table 7 is not included in the CRFs. Emissions from grassland fires are not reported. Deforestation should be reported, even when assumed to be negligible. (para 114-116) FCCC/ARR/2005/ITA	Updated NIR not yet submitted.
Luxembourg	Was not reviewed due to lack of 2004 NIR	
Netherlands, centralized review 2005	The inventory covers all gases for the whole time series 1990–2003, and is complete in terms of geographical coverage. Some gaps still remain in the inventory. Fugitive emissions from distribution of oil products, CO_2 from lime production, CO_2 from asphalt roofing and paving, CH_4 from poultry, N_2O from industrial waste water and potential emissions from PFCs and SF_6. The party considers some sources to be negligible. The ERT recommends that the Netherlands further explain the rationale for this assessment. (para 9,10) **Energy:** The CRF tables for 2003 are largely complete. Emissions not included are emissions of CO_2 and N_2O from solid and other fuels from Manufacturing Industries and Construction, as well as emissions from the Refining sector. (para 23) **Land use change and forestry:** Not all pools are included for all land categories and it is not always clear whether they are assumed not to change or are not estimated. For the category cropland AD is reported, but emissions are stated as NE. Information on carbon stock changes is not yet available. Emissions from biomass burning are not estimated.	Emissions from Manufacturing Industries have been estimated in this submission. Further improvements have been made in the LULUCF sector with regard to emission estimates from cropland. CH_4 emissions are not relevant for poultry according to IPCC Guidelines.

Member State, type and year of UNFCCC review	Findings related to completeness from UNFCCC review report	Response in 2006 submission
	(para 64-66) FCCC/ARR/2005/NLD	
Portugal, centralized review 2005	Portugal's inventory is generally complete in terms of geographical coverage and coverage of sources and gases. The LULUCF sector does not include emissions and removals from the two autonomous regions of Madeira and the Azores Islands. Some sources are not estimated ("NE") in the inventory, the most important being Solvent and Other Product Use – N_2O; and Potential Emissions of HFCs, PFCs and SF_6. With regard to LULUCF, the NIR and the CRF only provide estimates for Forest Land. Emissions and removals from other LULUCF categories are reported as "NE" or not occurring ("NO"). (para 7,8) **Industrial processes:** CO_2 emissions from asphalt roofing and N_2O emissions from solvent and other product use are reported as not estimated. (para 36) **Land use change and forestry:** Emissions and removals from Forest Land have been estimated only for the living biomass pool. (para 56,57) FCCC/ARR/2005/PRT	Improvements have been made in the LULUCF sector. Net CO_2 emissions and removals have been reported for most categories. Estimates for potential PFCs, HFCs and SF_6 emissions are reported.
Spain	The inventory covers all gases and sectors, although not always completely, particularly in the LUCF sector, for which coverage is restricted to category 5.A Forest and Other Woody Biomass Stocks. Emissions of CO_2 from limestone and dolomite and of CH_4 from ethylene and styrene production have been added to the inventory for the first time in response to the results of previous reviews. (para 9) **Energy:** The inventory covers all significant Energy sector sources for all years and all gases.(SO2).(para 18) **Industrial processes and solvent use:** Potential emissions of HFCs, PFCs and SF_6 are not provided, mainly because of the current lack of information on imports and exports per gas. As observed in the 2004 review, CRF tables 7 and 9 have not been completed. (para 41) **LULUCF:** Categories 5.B Forest and Grassland Conversion, 5.C Abandonment of Managed Lands and 5.D CO_2 Emissions and Removals from Soils are not estimated due to lack of reliable basic data. Emissions from soils and deforestation, and carbon stock changes in the dead organic matter pool, are not reported.(para 68) **Waste:** Emissions have been estimated for most of the source categories except for the incineration of industrial waste.(para 76) FCCC/ARR/2005/ESP	Updated NIR not yet submitted.
Sweden	Overall, the Swedish inventory is complete. Only some minor sources have been identified in the NIR. (para 8) **LULUCF**: In its 2005 submission, Sweden reported the LUCF sector in accordance with the Revised 1996 IPCC Guidelines and relevant CRF tables. The ERT encourages Sweden to report emissions and removals from the LULUCF sector in accordance with decision 13/CP.9, including the LULUCF CRF tables. (para 60,62)	In repsonse to the review, the new IPCC reporting format is used for the LULUCF sector including CRF tables.
United Kingdom	In general, both the NIR and the CRF are largely complete and transparent. **Industrial Processes:** The estimates for the sector are mostly complete except for a small number of minor sources which are noted as "NE" (CH_4 from ammonia, iron and steel, and ferroalloys and aluminium production). The United Kingdom has commented in previous reviews and inventory submissions that these sources have been excluded either because of a lack of methodology or because they are assumed to be negligible.	Inventory was considered as complete, no recommendations for additions of sources.

1.8.2 Data gaps and gap-filling

The EC GHG inventory is compiled by using the inventory submissions of the EC Member States. For data gaps in Member States' inventory submissions, the following procedure is applied by the ETC/ACC in accordance with the implementing provisions under Council Decision No 280/2004/EC for missing emission data:

- If a consistent time series of reported estimates for the relevant source category is available from the Member State for previous years that has not been subject to adjustments under Article 5.2 of the Kyoto Protocol, extrapolation of this time series is used to obtain the emission estimate. As far as CO_2 emissions from the energy sector are concerned, extrapolation of emissions should be based on the percentage change of Eurostat CO_2 emission estimates if appropriate.

- If the estimate for the relevant source category was subject to adjustments under Article 5.2 of the Kyoto Protocol in previous years and the Member State has not submitted a revised estimate, the basic adjustment method used by the expert review team as provided in the 'Technical guidance on methodologies for adjustments under Article 5.2 of the Kyoto Protocol' ([13]) is used without application of the conservativeness factor.

- If a consistent time series of reported estimates for the relevant source category is not available and if the source category has not been subject to adjustments under Article 5.2 of the Kyoto Protocol, the estimation should be based on the methodological guidance provided in the 'Technical guidance on methodologies for adjustments under Article 5.2 of the Kyoto Protocol' without application of the conservativeness factor.

Table 1.21 shows that by 27 May 2006 data gaps exist for eleven Member States.

Table 1.21 Overview of missing data by 27 May 2006

Member State	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6
Cyprus	2004	2004	2004	1990-2004	1990-2004	1990-2004
Estonia				1990-2004	1990-2004	1990-2004
Lithuania	1991; 1999-2000	1991; 1999-2000	1991; 1999-2000	1990-1997; 1999-2000	1990-2004	1990-1997; 1999-2000
Luxembourg	All years: Tables 1B1, 1B2, 1C, 2(I).A-G, 4A, 4B, 4D, 5A, 5B, 5C, 5D, 5E, 5F, 5(I), 5(II), 5(III), 5(IV), 5(V), 6A, 6B, 6C			All years: Tables 2(II), 2(II).C,E, 2(II).F		
Malta	2004	2004	2004	1990-2004	1990-2004	1990-2004
Poland				1990-94	1990-94	1990-94

The following overview shows the general approaches used for obtaining estimates for the missing data; these approaches are based on the principles mentioned above:

Estimates at the beginning or at the end of a time series

Fuel combustion related GHG emissions (CO_2, CH_4, N_2O of sector 1A):

The percentage change from Eurostat CO_2 emission estimates was used for extrapolation, where available

If there were no Eurostat CO_2 emission estimates available linear trend extrapolation was used.

Other sectors:

Linear trend extrapolation was used, where no striking dips or jumps in the time series were identified. In general the trend extrapolation was made on basis of the time series 1994-2003. If only a limited number of years were available or a more consistent time series was available for specific years then these years were used for trend extrapolation.

Previous year values were used where striking dips or jumps in the time series were identified.

Estimates for years within a time series

Linear interpolation between the years available was used

Estimates if no time series is available (only relevant for fluorinated gases):

HFCs:

Emissions were estimated for 2F1 'Refrigeration and air conditioning equipment' on basis of average per capita emissions of either a set of similar countries (if available) or on basis of one single country (if a set of similar countries was not available). Population data was used from Eurostat.

PFCs:

It was checked if aluminum production occurs in the relevant countries, which was not the case. For other PFC emissions no estimates were prepared because of lack of data.

SF6:

Emissions were estimated for 2F7 'Electrical equipment' on basis of average emissions per electricity consumption of either a set of similar countries (if available) or on basis of one single country (if a set of similar countries was not available). Data on electricity consumption was used from Eurostat.

The following country specific approaches were derived from the general approaches:

Cyprus

HFC

Emissions estimated on basis of average per capita emissions of ES, GR, IT; PT for 2F1 'Refrigeration and air conditioning equipment' for 1990-2003 and extrapolated to 2004

SF_6

Emissions estimated on basis of average emissions per electricity consumption of ES, IT; PT for 2F7 'Electrical equipment' for 1990-2003 and extrapolated to 2004

Estonia

HFC

Emissions estimated on basis of per capita emissions of Latvia for 2F1 'Refrigeration and air conditioning equipment' for 1990-2003 and extrapolated to 2004

SF_6

Emissions estimated on basis of average emissions per electricity consumption of LV for 2F7 'Electrical equipment' for 1990-2004

Lithuania

CO_2, CH_4, N_2O

Linear interpolation between 1990 and 1998 for 1991-1997 and linear interpolation between 1998 and 2001 for 1999-2000

HFC

Linear trend extrapolation 2001-2003 for 1990-2000

SF_6

Emissions estimated on basis of emissions per electricity consumption of Latvia for 2F7 'Electrical equipment' for 1990-2003 and extrapolated to 2004

Luxembourg:

Table 1B2:

CH_4 emissions from 1B2b reported in Table 1 were allocated to 1B2biv

Table 1C:

CO_2 emissions from aviation bunkers reported in Table 1 were allocated to 'Jet kerosene'. Activity data was provided by LU for 1990. Activity data for 1991-2004 was extrapolated on basis of constant 1990 IEF.

Table 2(I).A-G:

CO_2 emissions from 2A reported in Table 2(I) were allocated to 2A1. Activity data was provided by LU for 1990. Activity data for 1991-2004 was extrapolated on basis of constant 1990 IEF.

Table 2(II):

HFC emissions from 2F reported in Table 2(I) were allocated to 'Unspecified mix of HFCs listed'.

Table 4D:

N_2O emissions from 4D1 reported in Table 4 were allocated to 4D1.6. 'Other'.

Tables 5, 5A: CO_2

CO_2 net emissions from reported in Table 5 were allocated to 5A1. Stock change in table 5A was calculated on basis of Belgian data because it is assumed that the Belgian circumstances are most similar to LU circumstances than any other MS. Activity data was provided by LU for 1990. Activity data for 1991-2004 was extrapolated on basis of constant 1990 IEF.

Tables 5, 5(III): N_2O

N_2O emissions from reported in Table 5 were allocated to 5B2 because emissions were calcualted on basis of methods used by CITEPA and France allocated the main part of the French emissions to this sub category.

Table 6A:

Activity data for solid waste disposal on land was provided by LU for 1990. Activity data for 1991-2004 was extrapolated on basis of constant 1990 IEF.

Table 6B:

CH_4 emissions from 6B1 reported in Table 6 were allocated to 6B1a because most MS report emissions in this sub-category. CH4 emissions from 6B2 reported in Table 6 were allocated to 6B2a because most MS report emissions in this sub-category.

Malta

CO_2, CH_4, N_2O: fuel combustion related

Extrapolation on basis of percentage change of Eurostat CO2 emissions for 2001-2004

CO_2, CH_4, N_2O: non-fuel combustion related

Linear trend extrapolation 1994-2000 for 2001-2004; in a few cases previous year values were used.

HFC

Emissions estimated on basis of average per capita emissions of ES, GR, IT; PT for 2F1 'Refrigeration and air conditioning equipment' for 1990-2003 and extrapolated to 2004

SF_6

Emissions estimated on basis of average emissions per electricity consumption of ES, IT; PT for 2F7 'Electrical equipment' for 1990-2003 and extrapolated to 2004

Poland:

HFC, PFC, SF_6

HFC for 2F were extrapolated on basis of total HFCs for 1995-1999; then linear trend extrapolation 1995-2002 for 1990-1994.

PFC

PFC from 2C were extrapolated on basis of total PFCs for 1995-1999; then linear trend extrapolation 1995-2001 for 1990-1994.
PFC from 2F were extrapolated on basis of total PFCs for 1995-1999; then linear trend extrapolation 1995-2000 for 1990-1994

SF_6

SF_6 from 2F extrapolated on basis of total SF6 emissions for 1995-1999; then 1995 values for 1990-1994.

Data on CO_2 emissions and electricity consumption were provided by Eurostat in March 2005. Note that all estimates which were derived from the gap filling approaches described above are marked grey in the tables of the next chapter. In addition, they are documented in the relevant annexes: red font refers to gap filling in 2006; blue font refers to gap filling in previous years.

1.8.3 Data basis of the European Community greenhouse gas inventory

The 2006 EC GHG inventory data consist of:

- the GHG submissions of the Member States to the Commission in 2006;
- previous GHG submissions, in cases where Member States did not provide the complete time series for each gas in 2006;
- 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).

Table 1.22 shows the sources of GHG emissions data by Member State and type of submission.

Table 1.22 Sources of GHG emissions data for CRF Table Summary 1.A by Member State and type of submission

Party	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
AT	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06
BE	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06
CY	INV05	INV05	INV05	INV05	INV05	INV05	INV05	INV05	INV05	INV05	INV05	INV05	INV05	INV05	Gap Filling
CZ	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06
DK	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06
EE	TREND INV06	TREND INV06	TREND INV06	TREND INV06	TREND INV06	TREND INV06	TREND INV06	TREND INV06	TREND INV06	TREND INV06	TREND INV06	TREND INV06	TREND INV06	TREND INV06	INV06
FI	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06
FR	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06
DE	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06
GR	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06
HU	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06
IE	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06
IT	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06
LT	TREND INV06	Gap Filling	Gap Filling	Gap Filling	Gap Filling	Gap Filling	Gap Filling	Gap Filling	TREND INV06	Gap Filling	Gap Filling	TREND INV06	TREND INV06	TREND INV06	INV06
LV	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06
LU	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06
MT	INV05	INV05	INV05	INV05	INV05	INV05	INV05	INV05	INV05	INV05	INV05	Gap Filling	Gap Filling	Gap Filling	Gap Filling
NL	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06

Party	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
PL	INV03	INV03	INV03	INV03	INV03	INV03	INV03	INV03	INV03	INV03	TREND INV06	TREND INV06	TREND INV06	TREND INV06	INV06
PT	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06
SK	TREND INV06	TREND INV06	TREND INV06	TREND INV06	TREND INV06	TREND INV06	TREND INV06	TREND INV06	TREND INV06	TREND INV06	TREND INV06	TREND INV06	TREND INV06	TREND INV06	INV06
SI	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06
ES	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06
SE	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06
GB	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06	INV06

Note: This table indicates the source of GHG emission data and whether data were available for specific years. It does not indicate whether the submission for a year covers all gases, categories or CRF tables.

Tables 1.23 to 1.26 show the data basis of the 2006 EC GHG inventory. Values in white cells without a frame are data provided by Member States in 2006 in the CRF Table Summary 1.A. Framed cells indicate that the emission data has been taken from the EC GHG inventory 2005. Shaded values are or will be derived from gap-filling. 'NE' ('not estimated') indicates that data is not available and that no gap-filling has been made.

Table 1.23 Data basis of CO_2 emissions excluding LULUCF (Tg)

EC Member State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Austria	62	65	60	60	61	64	67	67	67	65	66	70	72	78	77
Belgium	119	122	121	119	123	124	128	122	128	123	124	124	123	127	127
Cyprus	5	5	5	6	6	6	6	6	6	6	7	7	7	7	7
Czech Republic	165	155	140	137	131	132	134	138	129	122	129	129	124	128	127
Denmark	53	63	58	60	63	60	74	64	60	58	53	55	54	59	54
Estonia	38	36	26	21	21	19	20	20	18	17	17	17	17	19	19
Finland	57	55	55	56	62	58	64	63	59	59	57	63	65	73	69
France	395	418	411	391	387	393	407	401	421	411	406	409	405	412	417
Germany	1,030	996	948	938	924	920	944	915	907	882	886	899	886	893	886
Greece	84	84	85	85	87	87	90	94	99	98	104	106	106	110	110
Hungary	72	68	62	63	62	61	62	60	60	60	58	59	58	60	59
Ireland	33	33	33	33	34	35	36	39	40	42	44	47	46	45	45
Italy	434	434	434	427	420	445	439	443	454	459	463	469	471	486	490
Latvia	19	16	13	12	10	9	9	9	8	8	7	7	7	7	7
Lithuania	39	36	33	30	27	24	21	19	16	15	14	13	13	12	13
Luxembourg	12	12	12	13	12	9	9	9	8	8	9	9	10	11	12
Malta	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3
Netherlands	159	164	163	167	167	171	178	172	173	168	170	175	175	178	181
Poland	381	367	372	363	372	348	373	362	337	330	314	318	308	319	315
Portugal	43	45	49	48	49	53	50	54	58	65	64	65	69	65	66
Slovakia	61	52	48	45	42	44	44	45	44	43	41	44	42	42	42
Slovenia	15	14	14	14	14	15	16	16	16	15	15	16	16	16	16
Spain	229	235	242	233	245	256	243	263	271	296	308	312	331	334	355
Sweden	57	57	57	56	59	58	62	57	58	55	54	54	55	56	55
United Kingdom	590	597	581	567	559	550	572	549	551	542	548	563	547	559	562
EU25	**4,153**	**4,134**	**4,024**	**3,947**	**3,940**	**3,944**	**4,049**	**3,987**	**3,991**	**3,949**	**3,960**	**4,033**	**4,011**	**4,100**	**4,116**
EU15	**3,357**	**3,382**	**3,308**	**3,255**	**3,252**	**3,283**	**3,362**	**3,311**	**3,354**	**3,331**	**3,355**	**3,420**	**3,416**	**3,485**	**3,506**

Note: Values in white cells without a frame are data provided by Member States in 2006 in the CRF Table Summary 1.A. Framed cells indicate that the emission data has been taken from the EC GHG inventory 2005. Shaded values are or will be derived from gap-filling. 'NE' ('not estimated') indicates that data is not available and that no gap-filling has been made.

Table 1.24 Data basis of CH_4 emissions in CO_2 equivalents (Tg)

EC Member State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Austria	9.2	9.1	8.9	8.8	8.6	8.5	8.3	8.0	7.9	7.8	7.6	7.5	7.3	7.4	7.4
Belgium	10.8	10.7	10.7	10.6	10.6	10.7	10.4	10.3	10.1	9.8	9.5	9.0	8.5	8.1	7.9
Cyprus	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.9	0.9	0.9	1.0	1.0	1.0
Czech Republic	18.6	17.0	15.9	14.8	13.9	13.6	13.5	12.7	12.3	11.6	11.5	11.5	11.4	11.1	10.9
Denmark	5.7	5.8	5.8	5.9	5.9	6.0	6.1	6.0	6.0	5.9	5.9	6.0	6.0	6.0	5.8
Estonia	3.5	3.4	2.8	2.0	2.3	2.2	2.2	2.2	2.0	1.9	2.0	1.8	1.7	1.7	1.7
Finland	6.3	6.3	6.3	6.3	6.3	6.1	6.0	6.0	5.8	5.6	5.4	5.3	5.1	4.9	4.7
France	69.6	70.1	69.7	70.0	69.7	70.3	69.9	66.6	66.6	65.4	65.2	63.8	62.2	60.9	59.5
Germany	99.8	94.3	90.2	89.7	85.3	81.7	78.9	75.2	70.0	68.9	64.9	62.1	59.2	56.2	51.4
Greece	9.2	9.1	9.2	9.2	9.2	9.2	9.4	9.3	9.5	9.1	9.1	8.6	8.6	8.5	8.4
Hungary	11.9	11.4	10.8	10.1	9.9	10.1	10.2	10.1	10.4	10.0	10.1	10.4	9.8	9.5	9.2
Ireland	13.2	13.4	13.5	13.6	13.6	13.7	14.1	14.3	14.3	13.7	13.4	13.2	13.1	13.7	13.3
Italy	41.7	42.9	42.3	42.6	43.2	44.1	44.2	44.7	44.8	44.9	45.1	44.4	42.9	42.6	41.9
Latvia	3.5	3.4	2.9	2.1	2.1	2.0	2.0	2.0	1.9	1.8	1.8	1.9	1.9	1.8	1.8
Lithuania	7.9	7.4	6.9	6.4	5.8	5.3	4.8	4.3	3.7	3.5	3.4	3.2	3.6	3.6	3.3
Luxembourg	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Malta	0.3	0.3	0.3	0.4	0.3	0.4	0.4	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.4
Netherlands	25.4	25.9	25.4	25.1	24.3	23.8	23.0	22.0	21.2	20.1	19.2	18.9	18.0	17.5	17.3
Poland	58.8	54.4	52.0	51.1	51.8	51.6	47.3	47.8	49.0	47.3	45.9	38.8	37.8	37.7	39.0
Portugal	11.4	11.7	11.6	11.6	12.1	12.5	12.5	12.7	13.3	13.5	12.5	12.3	12.7	13.1	12.4
Slovakia	6.4	5.9	5.5	5.1	5.0	5.2	5.2	5.0	4.7	4.6	4.5	4.5	4.6	4.6	4.3
Slovenia	2.3	2.1	2.2	2.1	2.1	2.1	2.0	2.1	2.0	2.1	2.1	2.1	2.2	2.1	2.1
Spain	27.5	27.9	28.7	29.0	29.6	30.1	31.5	32.4	33.5	33.8	34.8	35.5	36.1	36.1	36.6
Sweden	6.7	6.7	6.8	6.8	6.8	6.7	6.7	6.6	6.4	6.3	6.1	6.1	5.9	5.8	5.8
United Kingdom	92.1	91.3	90.1	87.3	80.6	80.0	78.0	74.1	70.1	63.3	60.0	54.4	52.3	47.3	46.0
EU25	**543.0**	**531.8**	**519.5**	**511.8**	**500.4**	**497.3**	**487.9**	**475.9**	**467.2**	**452.6**	**441.7**	**422.8**	**412.3**	**401.9**	**392.4**
EU15	**429.0**	**425.8**	**419.4**	**417.0**	**406.3**	**404.0**	**399.5**	**388.7**	**380.0**	**368.6**	**359.1**	**347.5**	**338.2**	**328.4**	**318.8**

Note: Values in white cells without a frame are data provided by Member States in 2006 in the CRF Table Summary 1.A. Framed cells indicate that the emission data has been taken from the EC GHG inventory 2005. Shaded values are or will be derived from gap-filling. 'NE' ('not estimated') indicates that data is not available and that no gap-filling has been made.

Table 1.25 Data basis of N_2O emissions in CO_2 equivalents (Tg)

EC Member State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Austria	6.3	6.6	6.2	6.0	6.5	6.6	6.3	6.3	6.4	6.3	6.2	6.1	6.1	6.0	5.3
Belgium	12.0	12.0	11.6	12.0	12.5	13.1	13.4	13.0	13.1	13.0	12.6	12.4	11.9	10.8	11.2
Cyprus	0.7	0.7	0.8	0.8	0.8	0.8	0.9	0.9	0.9	0.9	1.0	0.9	1.0	1.0	1.0
Czech Republic	12.6	10.9	9.6	8.6	8.4	8.7	8.3	8.5	8.4	8.1	8.3	8.5	8.2	7.7	8.3
Denmark	10.6	10.4	10.0	9.8	9.6	9.5	9.2	9.1	9.0	8.7	8.5	8.3	7.9	7.9	7.6
Estonia	1.1	1.0	0.9	0.6	0.5	0.4	0.4	0.5	0.5	0.4	0.5	0.4	0.3	0.3	0.4
Finland	8.0	7.3	6.7	6.9	7.0	7.2	7.1	7.1	7.0	6.9	6.9	6.8	6.9	7.0	6.9
France	96.1	94.7	95.7	91.1	92.2	93.9	95.2	96.4	89.3	82.7	82.0	79.6	77.6	75.5	73.2
Germany	84.8	80.5	81.4	77.8	78.1	77.7	78.9	75.7	62.5	59.2	59.6	60.4	59.8	62.4	64.3
Greece	14.1	13.8	13.9	13.1	13.4	13.1	13.6	13.3	13.2	13.2	13.4	13.2	13.2	13.3	13.2
Hungary	18.9	15.2	12.3	12.0	13.2	12.4	13.3	13.2	13.2	13.1	12.6	13.5	12.6	12.4	13.9
Ireland	9.8	9.6	9.7	9.8	10.1	10.3	10.4	10.3	10.9	11.0	10.5	10.1	9.6	9.4	9.2
Italy	41.1	42.1	41.3	41.7	40.5	41.5	41.2	42.4	42.4	43.4	43.7	43.9	43.4	43.2	45.2
Latvia	3.8	3.5	2.8	2.0	1.8	1.4	1.4	1.4	1.4	1.3	1.3	1.4	1.4	1.5	1.4
Lithuania	4.1	3.9	3.7	3.5	3.3	3.0	2.8	2.6	2.4	2.9	3.4	3.8	3.3	1.3	3.7
Luxembourg	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Malta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Netherlands	21.2	21.6	22.4	23.1	22.3	22.4	22.2	21.9	21.7	20.9	19.9	18.9	18.0	17.4	17.7
Poland	19.4	16.1	15.6	15.4	15.6	16.7	16.7	16.7	16.0	23.3	23.9	23.9	22.6	23.9	30.0
Portugal	5.4	5.4	5.4	5.3	5.6	5.8	5.8	6.1	5.9	6.2	6.0	6.3	6.2	6.3	6.2
Slovakia	6.1	5.2	4.4	3.9	4.1	4.2	4.2	4.3	4.0	3.8	3.8	4.1	3.9	4.0	4.1
Slovenia	1.2	1.2	1.3	1.1	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.4	1.3	1.3
Spain	27.8	27.3	26.1	24.2	26.9	26.5	29.9	29.2	30.6	31.8	33.0	31.8	31.1	32.7	31.6
Sweden	8.7	8.6	8.5	8.6	8.7	8.5	8.6	8.6	8.6	8.2	8.0	7.9	7.9	7.8	7.8
United Kingdom	68.4	66.3	59.5	55.7	58.7	57.1	58.9	60.6	57.7	44.5	44.3	42.1	40.5	40.1	40.8
EU25	**482.4**	**464.2**	**449.8**	**433.0**	**440.9**	**442.2**	**450.0**	**449.5**	**426.5**	**411.3**	**410.9**	**405.9**	**394.9**	**393.7**	**404.5**
EU15	**414.4**	**406.4**	**398.6**	**385.1**	**392.1**	**393.2**	**400.7**	**400.2**	**378.5**	**356.2**	**354.9**	**347.9**	**340.2**	**340.1**	**340.4**

Note: Values in white cells without a frame are data provided by Member States in 2006 in the CRF Table Summary 1.A. Framed cells indicate that the emission data has been taken from the EC GHG inventory 2005. Shaded values are or will be derived from gap-filling. 'NE' ('not estimated') indicates that data is not available and that no gap-filling has been made.

Table 1.26 Data basis of actual HFCs, PFCs and SF_6 emissions in CO_2 equivalents (Gg)

Member State		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Austria	HFC	23	45	49	157	207	267	347	427	495	542	596	695	782	865	904
	PFC	1,079	1,087	463	53	59	69	66	97	45	65	72	82	87	103	115
	SF_6	503	653	698	794	986	1,139	1,218	1,120	908	684	633	637	641	594	513
Belgium	HFC	434	434	434	434	434	434	514	622	753	790	897	1,031	1,249	1,406	1,468
	PFC	1,753	1,678	1,830	1,759	2,113	2,335	2,217	1,211	669	348	361	223	82	209	306
	SF_6	1,663	1,576	1,744	1,677	2,035	2,205	2,120	525	270	120	109	105	94	75	66
Cyprus	HFC	0	0	0	0	1	2	4	6	10	14	19	25	31	38	44
	PFC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	SF_6	1	1	1	1	2	2	3	3	3	2	2	2	3	4	4
Czech Republic	HFC	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	1	101	245	317	268	263	393	391	590	600
	PFC	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	0	4	1	1	3	9	12	14	25	17
	SF_6	0	0	0	0	0	75	78	95	64	77	141	168	67	100	50
Denmark	HFC	IA,NE,NO	IA,NE,NO	3	94	135	218	329	324	411	503	605	647	672	695	749
	PFC	IA,NE,NO	IA,NE,NO	IA,NE,NO	NA,NO	0	1	2	4	9	12	18	22	22	19	16
	SF_6	44	64	89	101	122	107	61	73	59	65	59	30	25	31	33
Estonia	HFC	0	0	0	0	0	0	1	1	2	3	4	5	6	7	7
	PFC	0	0	0	0	0	0	0	0	0	0	0	0	0	NE	NE
	SF_6	0	0	0	0	0	0	0	1	1	1	1	2	4	5	5
Finland	HFC	0	0	0	0	7	29	77	168	245	319	502	657	463	652	695
	PFC	0	0	0	0	0	0	0	0	0	28	22	20	13	15	12
	SF_6	94	67	37	34	35	69	72	76	53	52	51	55	51	42	23
France	HFC	3,659	4,230	3,635	2,331	1,712	3,055	4,849	5,245	5,469	6,334	7,317	8,168	9,602	10,802	11,599
	PFC	4,293	3,973	4,048	3,954	3,527	2,562	2,338	2,425	2,846	3,529	2,487	2,191	3,477	3,164	2,266
	SF_6	2,075	2,051	2,084	2,117	2,151	2,184	2,173	2,049	2,147	1,927	1,768	1,449	1,278	1,380	1,377
Germany	HFC	4,369	4,013	4,098	4,226	4,357	6,555	6,044	6,658	7,257	7,401	6,558	7,975	8,647	8,487	8,804
	PFC	2,708	2,333	2,102	1,961	1,650	1,750	1,714	1,369	1,473	1,243	786	723	795	857	831
	SF_6	4,785	5,118	5,634	6,405	6,694	7,224	7,050	6,907	6,704	5,311	5,079	4,899	4,202	4,305	4,480
Greece	HFC	935	1,107	908	1,607	2,144	3,421	4,113	4,538	5,132	6,123	5,282	5,203	5,298	5,559	5,709
	PFC	258	258	252	153	94	83	72	165	204	132	148	91	88	77	72
	SF_6	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4
Hungary	HFC	NA,NO	NA,NO	0	0	1	2	2	45	125	347	206	281	393	479	504
	PFC	271	234	135	146	159	167	159	161	172	189	211	199	203	190	201
	SF_6	40	53	49	52	68	70	69	68	68	127	140	107	120	162	178
Ireland	HFC	1	5	6	9	20	45	76	131	189	195	229	253	289	358	399
	PFC	0	0	0	0	75	75	103	131	62	196	305	296	212	229	196
	SF_6	35	36	37	38	82	83	102	132	94	69	56	69	70	119	70
Italy	HFC	351	355	359	355	482	671	450	755	1,181	1,452	2,005	2,761	3,568	4,590	5,699
	PFC	1,808	1,452	850	707	477	491	243	252	270	258	346	452	414	484	407
	SF_6	333	356	358	370	416	601	683	729	605	405	493	795	738	486	602
Latvia	HFC	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	1	1	2	4	7	9	10	12	13	16
	PFC	IA,NE,NO	IA,NE,NO	IA,NE,NO	IA,NE,NO	IA,NE,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO
	SF_6	0	0	0	0	0	0	0	1	1	1	1	2	3	4	5
Lithuania	HFC	0	0	0	0	0	0	0	4	8	12	16	14	35	22	37
	PFC	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	A,NE,NO
	SF_6	0	0	0	0	0	0	0	1	1	1	2	3	5	6	7
Luxembourg	HFC	14	14	14	14	14	14	14	14	14	14	43	43	43	43	43
	PFC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	SF_6	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4
Malta	HFC	0	0	0	0	1	1	2	4	5	8	11	14	17	21	24
	PFC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	SF_6	0	1	1	1	1	1	2	2	1	1	1	1	2	2	2
Netherlands	HFC	4,432	3,452	4,447	4,998	6,480	6,020	7,678	8,300	9,341	4,859	3,824	1,469	1,541	1,319	1,477
	PFC	2,264	2,245	2,043	2,068	1,990	1,938	2,155	2,344	1,829	1,471	1,581	1,489	2,186	620	285
	SF_6	217	134	143	150	191	301	312	345	329	317	335	356	332	309	328
Poland	HFC	0	0	0	0	0	22	68	192	224	555	890	1,283	1,258	1,655	1,778
	PFC	829	825	821	816	812	820	775	829	810	777	720	881	266	263	267
	SF_6	2	2	2	2	2	2	1	3	6	17	17	18	18	19	41
Portugal	HFC	0	0	0	0	0	6	16	29	49	88	135	169	210	299	355
	PFC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	SF_6	2	2	2	3	3	3	3	3	3	4	5	5	5	5	3
Slovakia	HFC	3	3	3	3	3	22	38	61	41	65	76	82	102	132	153
	PFC	271	267	248	155	132	114	35	35	25	14	12	11	11	21	19
	SF_6	0	0	0	0	9	10	11	11	12	13	13	14	15	15	16
Slovenia	HFC	NA,NO	NA,NO	NA,NO	NA,NO	NA,NO	31	30	38	34	34	45	56	69	83	97
	PFC	257	303	243	251	282	286	240	194	149	106	106	106	116	119	120
	SF_6	10	10	10	11	11	12	12	12	13	16	16	16	17	18	18
Spain	HFC	2,403	2,179	2,763	2,258	3,458	4,645	5,197	6,126	5,809	7,164	8,170	5,284	3,892	4,996	4,612
	PFC	883	827	790	831	819	833	797	820	769	704	412	240	264	267	272
	SF_6	67	73	76	80	89	108	115	130	139	175	205	183	207	208	255
Sweden	HFC	4	8	10	30	73	126	205	313	384	478	550	595	644	686	743
	PFC	440	433	336	351	349	389	344	317	306	330	272	268	296	292	268
	SF_6	107	108	108	97	100	127	108	153	99	102	94	111	104	69	83
United Kingdom	HFC	11,375	11,854	12,324	13,000	14,011	15,492	16,722	19,185	17,272	10,835	9,088	9,682	9,902	10,196	8,867
	PFC	1,401	1,171	573	491	491	471	493	417	421	399	498	425	323	297	352
	SF_6	1,030	1,078	1,124	1,167	1,183	1,239	1,267	1,226	1,262	1,426	1,798	1,425	1,509	1,324	1,127
Total	HFC	28,002	27,699	29,052	29,517	33,540	41,083	46,877	53,433	54,772	48,408	47,337	46,795	49,118	53,992	55,385
	PFC	18,517	17,084	14,733	13,696	13,027	12,383	11,757	10,772	10,061	9,801	8,365	7,732	8,871	7,250	6,022
	SF_6	11,016	11,391	12,205	13,107	14,187	15,571	15,467	13,671	12,850	10,919	11,029	10,461	9,516	9,287	9,295

Note: Values in white cells without a frame are data provided by Member States in 2006 in the CRF Table Summary 1.A. Framed cells indicate that the emission data has been taken from the EC GHG inventory 2005. Shaded values are or will be derived from gap-filling. 'NE' ('not estimated') indicates that data is not available and that no gap-filling has been made.

1.8.4 *Geographical coverage of the European Community inventory*

Table 1.27 shows the geographical coverage of the Member States' national inventories. As the EC inventory is the sum of the Member States' inventories, the EC inventory covers the same geographical area as the inventories of the Member States.

Table 1.27 Geographical coverage of the EC inventory

Member State	Geographical coverage
Austria	Austria
Belgium	Belgium consisting of Flemish Region, Walloon Region and Brussels Region
Cyprus	Cyprus
Czech Republic	Czech Republic
Denmark	Denmark (excluding Greenland and the Faeroe Islands)
Estonia	Estonia
Finland	Finland including Åland Islands
France	France, the overseas departments (Guadeloupe, Martinique, Guyana and Reunion) and the overseas territories (New Caledonia, Wallis and Futuna, French Polynesia, Mayotte, Saint-Pierre and Miquelon)
Germany	Germany
Greece	Greece
Hungary	Hungary
Ireland	Ireland
Italy	Italy
Latvia	Latvia
Lithuania	Lithuania
Luxembourg	Luxembourg
Malta	Malta
Netherlands	The reported emissions have to be allocated to the *legal territory* of The Netherlands. This includes a 12-mile zone from the coastline and also inland water bodies. It excludes Aruba and The Netherlands Antilles, which are self-governing dependencies of the Royal Kingdom of The Netherlands. Emissions from offshore oil and gas production on the Dutch part of the continental shelf are included.
Poland	Poland
Portugal	Mainland Portugal and the two Autonomous regions of Madeira and Azores Islands. Includes also emissions from air traffic and navigation bunkers realized between these areas.
Slovakia	Slovakia
Slovenia	Slovenia
Spain	Spanish part of Iberian mainland, Canary Islands, Balearic Islands, Ceuta and Melilla
Sweden	Sweden
United Kingdom	The geographical coverage of the UK inventory has been extended to include emissions from the UK's Crown Dependencies (CDs) and a number of the UK's Overseas Territories (OTs) who have joined, or are likely to join, the UK's instruments of ratification to the UNFCCC and the Kyoto Protocol. These OTs are the Cayman Islands, Falkland Islands, Bermuda and Montserrat.

1.8.5 *Completeness of the European Community submission*

National inventory report

The EC GHG submission provides GHG emission data for EU-25 and for EU-15. Most chapters and annexes of this report refer to EU-15 only, i.e. Chapters 3-10 and Annexes 1,2,4-11. Chapters 1 and 2 and also Annexes 3, 12 and 13 refer to the EU-25 where relevant. This means that all the detailed information provided in previous reports for the EU-15 is also available in this report. In addition, basic information on institutional arrangements, data availability, QA/QC, uncertainty estimates, completeness, recalculations and emission trends are provided for the EU-25. Table 1.28 shows which information is provided for EU-25 and which chapters refer to EU-15 only.

Table 1.28 Coverage of EC national inventory report (EU-25 or EU-15 only)

Chapter/Annex		EU-25	EU-15 only
Chapter 1	**Introduction**		
1.1	Background information	√	
1.2	Institutional arrangements	√	
1.3	Process of inventory preparation	√	
1.4	General description of methods and data sources	√	

Chapter/Annex		EU-25	EU-15 only
1.5	Key source categories		√
1.6	QA/QC	√	
1.7	Uncertainty evaluation	√	
1.8	Completeness	√ (not Tables 1-13-1.15)	Tables I-13-1.15
Chapter 2	**Emission trends**		
2.1	Aggregated GHG emissions	√	
2.2	Emission trends by gas	√	
2.3	Emission trends by sector	√	
2.4	Emission trends by Member States	√	
2.5	Emission trends for indirect GHG and SO_2		√
Chapter 3	**Energy**		√
Chapter 4	**Industrial processes**		√
Chapter 5	**Solvent use**		√
Chapter 6	**Agriculture**		√
Chapter 7	**LUCF**		√
Chapter 8	**Waste**		√
Chapter 9	**Other**		√
Chapter 10	**Recalculations and improvements**	√	
Annex 1	**Key sources**		√
Annex 2	**EC CRF tables**		√
Annex 3	**Status reports**	√	
Annex 4	**CRF tables summary 1.A**		√
Annex 5	**CRF tables Energy**		√
Annex 6	**CRF tables Industrial processes**		√
Annex 7	**CRF tables Solvent use**		√
Annex 8	**CRF tables Agriculture**		√
Annex 9	**CRF tables LULUCF**		√
Annex 10	**CRF tables Waste**		√
Annex 11	**CRF table 10 for EU-25**	√	
Annex 12	**MS CRF and NIR**	√	

CRF tables in Annex 2

Although the completeness of EU-15 CRF tables in Annex 2 has improved again this year, not all data in the sectoral background tables can be provided by the European Community. The main reasons for not completing all sectoral background data tables are: (1) limited data availability partly due to confidentiality issues; and (2) the use of different type of activity data by Member States. Latter is due to the fact that the Member States are responsible for calculating emissions. If they use country-specific methods they may also use different types of activity data (e.g. cement or clinker production). At EU-15 level these different types of activity data cannot be simply added up. As at EU-15 level no emissions are calculated directly on the basis of activity data, the documentation of very detailed background data seems to be of lower importance. All the details for the calculation of the emissions are documented in the Member States' CRF tables, as part of their national GHG inventories, which also form part of the EC GHG inventory submission (see Annex 12, which is available at the EEA website http://www.eea.eu.int) and in the sector annexes.

Table 1.29 provides an overview of sectoral report and sectoral background tables available in Annex 2, an explanation for each table which is not filled in at EU-15 level and activity data provided for the calculation of implied emission factors. Further information is provided in the relevant sector chapters.

Table 1.29 Inclusion of CRF tables in Annex 2

Table	Included in Annex 2	Comment
Energy		
Table 1	Yes	
Table 1.A (a)	Yes	
Table 1.A (b)	Yes	
Table 1.A (c)	Yes	
Table 1.A (d)	Yes	
Table 1.B.1	Yes	
Table 1.B.2	Partly	Emissions are included, activity data is not because type of activity data used by the MS varies; overview table for 1B2b included in the NIR

Table	Included in Annex 2	Comment
Table 1.C	Yes	
Industrial processes		
Table 2(I)	Yes	
Table 2(II)	Yes	
Table 2(I). A-G	Partly	Emissions are included, activity data is not because type of activity data used by the MS varies; overview tables for large key sources included in the NIR
Table 2(II). C,E	Partly	Emissions are included, activity data is not because type of activity data used by the MS varies; limited data availability; confidentiality issues
Table 2(II). F	No	Limited data availability; confidentiality issues; for 2004 for refrigerationa and air conditioning an overview is provided in the NIR
Solvent use		
Table 3	Yes	
Table 3. A-D	No	Type of activity data used by the MS varies
Agriculture		
Table 4	Yes	
Table 4. A	Yes	
Table 4. B(a)	Yes	
Table 4. B(b)	Yes	
Table 4. C	Yes	
Table 4. D	Yes	
Table 4. E	Yes	
Table 4. F	Yes	
LUCF		
Table 5	Yes	
Table 5. A	Partly	Emissions are included, activity data is not because type of activity data used by the MS varies
Table 5. B	Partly	Emissions are included, activity data is not because type of activity data used by the MS varies
Table 5. C	Partly	Emissions are included, activity data is not because type of activity data used by the MS varies
Table 5. D	Partly	Emissions are included, activity data is not because type of activity data used by the MS varies
Table 5. E	Partly	Emissions are included, activity data is not because type of activity data used by the MS varies
Table 5. F	Partly	Emissions are included, activity data is not because type of activity data used by the MS varies
Table 5 (I)	Yes	
Table 5 (II)	Yes	
Table 5 (III)	Partly	Emissions are included, activity data is not because type of activity data used by the MS varies
Table 5 (IV)	Yes	
Table 5 (V)	Partly	Emissions are included, activity data is not because type of activity data used by the MS varies
Waste		
Table 6	Yes	
Table 6. A, C	Partly	Emissions and some activity data are included
Table 6. B	Partly	Emissions are included, activity data is not because of limited data availability

Table 1.30 provides for specific sectoral background tables an overview of activity data used by Member States in order to explain why this acitivity data cannot be reorted at EU-15 level.

Table 1.30 Activity data reported by Member States in CRF background data tables

Table	Source category		Activity data reported by MS
Table 1B2	1. B. 2. a. Oil (3)		
		I. Exploration	number of wells drilled crude oil number of wells drilled/tested
		ii. Production	Oil throughput PJ of oil produced Crude oil and NGL production Crude oil produced Oil and gas produced

Table	Source category		Activity data reported by MS
		iii. Transport	oil loaded in tankers PJ Loaded Crude oil imports Transport of crude oil Offshore loading of oil only
		iv. Refining / Storage	Oil refined (SNAP 0401) PJ oil refined crude oil & products kt oil refined Refinery input (crude oil and NGL) Refery input: crude oil, NGL crude oil & products Oil refinery throughput
		v. Distribution of Oil Products	Gasoline Consumption (SNAP 0505) kt oil refined Domestic supply of gasoline Oil products
		vi. Other	Transfer loss gas works gas onshore loading of oil only
	1. B. 2. b. Natural Gas		
		i. Exploration	natural gas number of wells drilled/tested
		ii. Production (4) / Processing	Gas throughput PJ gas produced natural gas from crude oil extraction Natural gas production Mm3 gas produced
		iii. Transmission	Pipelines length (km) total amount of gas consumed PJ gas consumed Length of transmission pipeline Mm3 gas transported gas transported PJ gas (NCV) Pressure levelling losses
		iv. Distribution	Distribution network length consumption distribution net PJ gas distributed via local networks PJ gas consumed Length of distribution mains Mm3 gas transported
		v. Other Leakage	PJ gas consumed t of natural gas released from pipelines
	1. B. 2. c. Venting (5)		
		i. Oil	PJ oil produced kt oil refined Crude oil and NGL production
		ii. Gas	PJ gas produced Sour Natural gas production
		iii. Combined	
	Flaring		
		i. Oil	PJ gas consumption kt oil refined Consumed Crude oil and NGL production Mm3 gas consumption oil produced Refinery gas other liquid fuels
		ii. Gas	PJ gas consumption natural gas Natural gas production quantity of gas flared

Table	Source category		Activity data reported by MS
		iii. Combined	
Table 2(I)	2.A Mineral products		
		1. Cement production	Clinker production Cement production
		2. Lime production	Lime produced Lime and dolomite production Production of lime and bricks Limestone consumed
		3. Limestone and dolomite use	Limestone and dolomite used Limestone consumption Clay, shale and limestone use Carbonates input to brick, tiles, ceramic production
		4. Soda ash production	Soda ash production
		4. Soda ash use	Soda ash use Use of soda
		5. Asphalt roofing	Roofing material production Bitumen consumption
		6. Road paving with asphalt	Asphalt production Bitumen consumption Asphalt used in paving Asphalt liquefied
	2.B Chemical industry		
		1. Ammonia production	Ammonia production Natural gas consumption
		2. Nitric acid production	Nitric acid production Nitric acid production: Medium pressure plants
	2.C Metal production		
		1. Iron and steel production	
		Steel	Steel production Crude steel production Production of secondary steel
		Pig iron	Iron production Production of primary iron Pig iron production
		Sinter	Sinter production Sinter consumption
		Coke	Coke production Coke consumption Coke consumed in blast furnace
		2. Ferroalloys production	Ferroalloys production Laterite consumption Use of coal and coke electrodes
		3. Aluminium production	Aluminium production Primary aluminium production
Table 2(II) C	C. PFCs and SF_6 from Metal Production		
		PFCs from aluminium production	Aluminium production Anode effects Primary aluminium production
		SF_6 used in Aluminium and Magnesium Foundries	
		Aluminium foundries	Cast aluminium Consumption of aluminium foundries SF_6 consumption
		Magnesium foundries	Cast magnesium Consumption Mg-Production SF_6 consumption
Table 4.D	1. Direct soil emissions		
		3. N-fixing crops	Nitrogen fixed by N-fixing crops Dry pulses and soybeans produced Area of cultivated soils

Table	Source category		Activity data reported by MS
		4. Crop residues	Nitrogen in crop residues returned to soils Dry production of other crops
Table 5(V)	A. Forest land		Area burned (ha) Biomass burned (kg dm)
	B. Cropland		Area burned (ha) Biomass burned (kg dm)
	C. Grassland		Area burned (ha) Biomass burned (kg dm)
	E. Settlements		Area burned (ha) Biomass burned (kg dm)

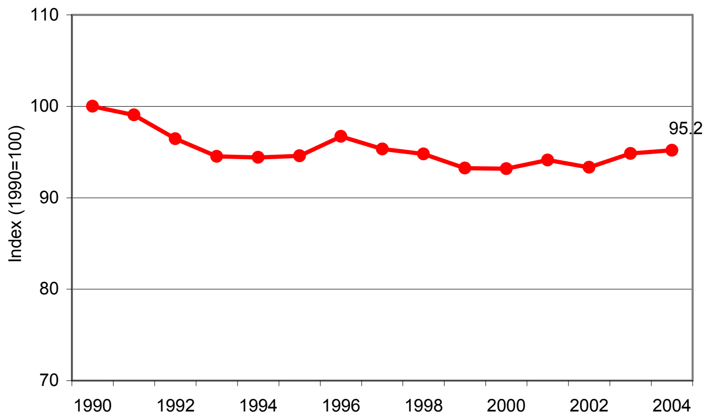
2 European Community greenhouse gas emission trends

This chapter presents the main GHG emission trends in the EC. Firstly, aggregated results are described for EU-25 and EU-15 as regards total GHG emissions and progress towards fulfilling the EC Kyoto target (for EU-15 only). Then, emission trends are briefly analysed mainly at gas level and a short overview of Member States' contributions to EC GHG trends is given. Finally, also the trends of indirect GHGs and SO_2 emissions are also presented for EU-15 only.

2.1 Aggregated greenhouse gas emissions

EU-25: Total GHG emissions without LULUCF in the EU-25 decreased by 4.8 % between 1990 and 2004 (Figure 2.1). Emissions increased by 0.4 % (+18 million tonnes) between 2003 and 2004.

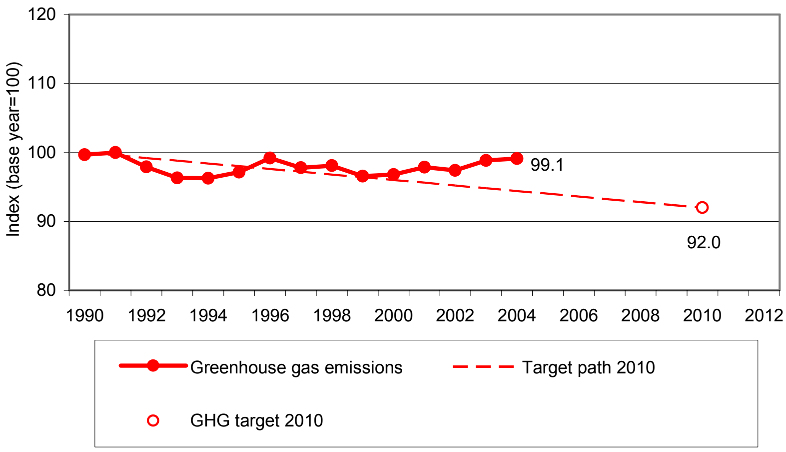
Figure 2.1 EU-25 GHG emissions 1990–2004 (excl. LULUCF)



EU-15: In 2004 total GHG emissions in the EU-15, without LULUCF, were 0.6 % (24 million tonnes CO_2 equivalents) below 1990. Compared to the base year[14], emissions in 2004 were 0.9 % or 39 million tonnes CO_2 equivalents lower. In the Kyoto Protocol, the EC agreed to reduce its GHG emissions by 8 % by 2008–12, from base year levels. Assuming a linear target path from 1990 to 2010, in 2004 total EU-15 GHG emissions were 4.7 index points above this target path (Figure 2.2).

[14] For EU-15 the base year for CO_2, CH_4 and N_2O is 1990; for the fluorinated gases 13 Member States have indicated to select 1995 as the base year, whereas Austria and France have chosen 1990. As the EC inventory is the sum of Member States' inventories, the EC base year estimates for fluorinated gas emissions are the sum of 1995 emissions for 13 Member States and 1990 emissions for Austria and France.

Figure 2.2 **EU-15 GHG emissions 1990–2004 compared with target for 2008–12 (excl. LULUCF)**



Notes: The linear target path is not intended as an approximation of past and future emission trends. It provides a measure of how close the EU-15 emissions in 2004 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 EU-15 with its GHG targets in 2008–12, but aims at evaluating overall EU-15 GHG emissions in 2004. The unit is index points with base year emissions being 100.

GHG emission data for the EU-15 as a whole do not include emissions and removals from LULUCF. In addition, no adjustments for temperature variations or electricity trade are considered.

For the fluorinated gases the EU-15 base year is the sum of Member States base years. Thirteen Member States have indicated to select 1995 as the base year under the Kyoto Protocol, Austria and France have indicated to use 1990. Therefore, the EU-15 base year estimates for fluorinated gas emissions are the sum of 1995 emissions for 13 Member States and 1990 emissions for Austria and France.

The index on the y axis refers to the base year (1995 for fluorinated gases for all Member States except Austria and France, 1990 for fluorinated gases for Austria and France and for all other gases). This means that the value for 1990 needs not to be exactly 100.

Compared to 2003, EU-15 GHG emissions increased by 0.3% or 11.5 million tonnes CO_2 equivalents in 2004.

The increase in GHG emissions 2003-2004 was mainly due to:

- Higher CO_2 emissions from road transport (+11.7 million tonnes or +1,5 %),
- Higher CO_2 emissions from iron and steel production (+8.4 million tonnes or +5.4 % for both energy and process related emissions),
- Higher CO_2 emissions from oil refining (+3.8 million tonnes or +3.3 %) and
- Higher HFCs emissions from refrigeration and air conditioning (+3.7 million tonnes CO_2 equivalents or +12.1 %).

In road transportation the substantial increase of CO_2 from diesel oil consumption (+22.7 million tonnes or +5 %) was only partly offset by the decrease of CO_2 from gasoline consumption (-10.4 million tonnes or -3.2 %).

Substantial decreases in GHG emissions took place in a number of source categories between 2003-2004:

- CO_2 emissions from households and services (-9.2 million tonnes or -1.4 %),

- CH_4 from landfills (-3.8 million tonnes CO_2 equivalents or -4.3 %),
- CH_4 from coal mining and handling (-3.2 million tonnes CO_2 equivalents or -16.5 %) and
- CO_2 from electricity and heat production (-3.2 million tonnes or -0.3 %).

The reduction in CO_2 emissions from electricity and heat production between 2003 and 2004 is a net result of opposing trends: whereas power production increased by 2 % in line with increasing electricity demand within the EU-15, a shift of fuel use in thermal power stations from coal (-1 %) and oil (-14 %) to gas (+9 %) and biomass (+13 %) in combination with increased use of wind power (+24 %), hydro power (+4%) and nuclear power (+1 %) contributed to emission decreases from electricity and heat production.

Table 2.1 shows that between 2003 and 2004, Spain and Italy saw the largest emission increases in absolute terms (+19.7 million tonnes CO_2 equivalents and +5.1 million tonnes CO_2 equivalents respectively). On the positive side, 2004 saw emission reductions from Germany (-9.1 million tonnes CO_2 equivalents), Denmark (-6.0 million tonnes CO_2 equivalents), and Finland (-4.2 million tonnes CO_2 equivalents):

- Spanish emission increases mainly occurred in CO_2 from electricity and heat production (+ 8.9 million tonnes), CO_2 from energy consumption in other manufacturing industry (+3.4 million tonnes), CO_2 from road transport (+3.3 million tonnes) and CO_2 from iron and steel production (+ 2.2 million tonnes, both energy and process related emissions). The strong increase from electricity and heat production reflects a strong increase of thermal electricity production partly due to low hydro power generation.

- In Italy CO_2 emissions increased mostly from oil refining (+2.4 million tonnes) and from road transport (+2.0 million tonnes).

- The German emission reductions occurred primarily in CO_2 from households and services (-9.1 million tonnes) and CO_2 from public electricity and heat production (-3.9 million tonnes), whereas CO_2 emissions from iron and steel production increased by 5.4 million tonnes.

- Danish and Finnish emission reductions are mainly due to CO_2 from electricity and heat production (-6.0 and –3.7 million tonnes respectively) which reflects higher hydro power production in the Nordic electricity market.

In 2004, 12 Member States (including Cyprus and Malta, which do not have a Kyoto target) had GHG emissions above base year levels whereas the remaining 13 Member States had emissions below base year levels.

Table 2.1 Greenhouse gas emissions in CO_2 equivalents (excl. LULUCF) and Kyoto Protocol targets for 2008–12

MEMBER STATE	Base year [1) (million tonnes)	2004 (million tonnes)	Change 2003–2004 (million tonnes)	Change 2003–2004 (%)	Change base year–2004 (%)	Targets 2008–12 under Kyoto Protocol and "EU burden sharing" (%)
Austria	78.9	91.3	-1.2	-1.3%	15.7%	-13.0%
Belgium	146.9	147.9	0.3	0.2%	0.7%	-7.5%
Cyprus [2)	6.0	*8.9*	-0.3	-3.0%	48.2%	-
Czech Republic	196.3	147.1	-0.5	-0.3%	-25.1%	-8.0%
Denmark	69.3	68.1	-6.0	-8.1%	-1.8%	-21.0%
Estonia	42.6	21.3	0.1	0.7%	-50.0%	-8.0%
Finland	71.1	81.4	-4.2	-4.9%	14.5%	0.0%
France	567.1	562.6	1.5	0.3%	-0.8%	0.0%
Germany	1230.0	1015.3	-9.1	-0.9%	-17.5%	-21.0%
Greece	111.1	137.6	0.3	0.3%	23.9%	25.0%
Hungary	122.2	83.1	-0.2	-0.2%	-32.0%	-6.0%
Ireland	55.8	68.5	0.1	0.1%	22.7%	13.0%
Italy	518.9	582.5	5.1	0.9%	12.3%	-6.5%
Latvia	25.9	10.7	0.0	0.4%	-58.5%	-8.0%
Lithuania	50.9	20.3	3.1	17.9%	-60.1%	-8.0%
Luxembourg	12.7	12.7	1.3	11.3%	0.3%	-28.0%
Malta [2)	2.2	*3.2*	0.1	4.2%	45.9%	-
Netherlands	214.3	217.8	2.5	1.1%	1.6%	-6.0%
Poland	565.3	386.4	3.7	1.0%	-31.6%	-6.0%
Portugal	60.0	84.5	0.9	1.0%	41.0%	27.0%
Slovakia	73.2	51.0	-0.1	-0.1%	-30.3%	-8.0%
Slovenia	20.2	20.1	0.4	2.0%	-0.8%	-8.0%
Spain	289.4	427.9	19.7	4.8%	47.9%	15.0%
Sweden	72.5	69.9	-1.1	-1.5%	-3.6%	4.0%
United Kingdom	767.9	659.3	1.3	0.2%	-14.1%	-12.5%
EU-15	**4265.7**	**4227.4**	**11.5**	**0.3%**	**-0.9%**	**-8.0%**

([1]) For EU-15 the base year for CO_2, CH_4 and N_2O is 1990; for the fluorinated gases 13 Member States have indicated to select 1995 as the base year, whereas Austria and France have chosen 1990. As the EU-15 inventory is the sum of Member States' inventories, the EU-15 base year estimates for fluorinated gas emissions are the sum of 1995 emissions for 13 Member States and 1990 emissions for Austria and France.

([2]) Cyprus and Malta did not provide GHG emission estimates for 2004, therefore the data provided in this table is based on gap filling (see Chapter 1.8.2.).

Note: Malta and Cyprus do not have Kyoto targets.

2.2 Emission trends by gas

EU-25: Table 2.2 gives an overview of the main trends in EU-25 GHG emissions and removals for 1990–2004. The most important GHG by far is CO_2, accounting for 83 % of total EU-25 emissions in 2004 excluding LULUCF. In 2004, EU-25 CO_2 emissions without LULUCF were 4 116 Tg, which was 0.9 % below 1990 levels. Compared to 2003, CO_2 emissions increased by 0.4 %.

Table 2.2 Overview of EU-25 GHG emissions and removals from 1990 to 2004 in CO_2 equivalents (Tg)

GREENHOUSE GAS EMISSIONS	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Net CO_2 emissions/removals	3,856	3,779	3,687	3,603	3,590	3,601	3,690	3,644	3,656	3,592	3,611	3,641	3,614	3,740	3,763
CO_2 emissions (without LULUCF)	4,153	4,134	4,024	3,947	3,940	3,944	4,049	3,987	3,991	3,949	3,960	4,033	4,011	4,100	4,116
CH_4	543	532	519	512	500	497	488	476	467	453	442	423	412	402	392
N_2O	482	464	450	433	441	442	450	450	427	411	411	406	395	394	404
HFCs	28	28	29	30	34	41	47	53	55	48	47	47	49	54	55
PFCs	19	17	15	14	13	12	12	11	10	10	8	8	9	7	6
SF_6	11	11	12	13	14	16	15	14	13	11	11	10	10	9	9
Total (with net CO_2 emissions/removals)	**4,939**	**4,832**	**4,712**	**4,604**	**4,592**	**4,609**	**4,702**	**4,647**	**4,627**	**4,525**	**4,530**	**4,534**	**4,489**	**4,606**	**4,630**
Total (without CO2 from LULUCF)	**5,236**	**5,186**	**5,049**	**4,948**	**4,942**	**4,952**	**5,062**	**4,991**	**4,963**	**4,882**	**4,879**	**4,927**	**4,885**	**4,966**	**4,984**
Total (without LULUCF)	**5,231**	**5,181**	**5,045**	**4,944**	**4,938**	**4,948**	**5,058**	**4,986**	**4,958**	**4,878**	**4,874**	**4,923**	**4,882**	**4,961**	**4,980**

EU-15: Table 2.3 gives an overview of the main trends in EU-15 GHG emissions and removals for 1990–2004. Also in the EU-15 the most important GHG is CO_2, also accounting for 83 % of total EU-

15 emissions in 2004. In 2004, EU-15 CO_2 emissions without LULUCF were 3 506 Tg, which was 4.4% above 1990 levels (Figure 2.3). Compared to 2003, CO_2 emissions increased by 0.6 %. The largest four key sources account for 80 % of total CO_2 emissions in 2004. Figure 2.4 shows that the main reason for increases between 1990 and 2004 was growing road transport demand. The large increase in road transport-related CO_2 emissions was only partly offset by reductions in energy-related emissions from manufacturing industries and from ‘Other’. The largest reductions of ‘Other’ as shown in Figure 2.4 occurred in 1.A.1.c ‘Manufacture of solid fuels and other energy industries’ and in 1.A.5 ‘Other’.

Table 2.3 Overview of EU-15 GHG emissions and removals from 1990 to 2004 in CO_2 equivalents (Tg)

GREENHOUSE GAS EMISSIONS	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Net CO_2 emissions/removals	3,147	3,147	3,125	3,069	3,008	2,997	3,039	3,104	3,057	3,096	3,062	3,098	3,135	3,120	3,202	3,215
CO_2 emissions (without LULUCF)	3,357	3,357	3,382	3,308	3,255	3,252	3,283	3,362	3,311	3,354	3,331	3,355	3,420	3,416	3,485	3,506
CH_4	429	429	426	419	417	406	404	400	389	380	369	359	348	338	328	319
N_2O	414	414	406	399	385	392	393	401	400	378	356	355	348	340	340	340
HFCs	41	28	28	29	30	34	41	47	53	54	47	46	45	47	51	52
PFCs	14	17	15	13	12	12	11	11	10	9	9	7	7	8	7	5
SF_6	15	11	11	12	13	14	15	15	13	13	11	11	10	9	9	9
Total (with net CO_2 emissions/removals)	**4,060**	**4,047**	**4,011**	**3,941**	**3,865**	**3,855**	**3,904**	**3,977**	**3,921**	**3,930**	**3,853**	**3,875**	**3,892**	**3,863**	**3,937**	**3,941**
Total (without CO2 from LULUCF)	**4,270**	**4,257**	**4,269**	**4,181**	**4,112**	**4,110**	**4,148**	**4,235**	**4,175**	**4,188**	**4,122**	**4,133**	**4,177**	**4,158**	**4,220**	**4,232**
Total (without LULUCF)	**4,266**	**4,252**	**4,264**	**4,176**	**4,107**	**4,106**	**4,144**	**4,231**	**4,171**	**4,184**	**4,119**	**4,129**	**4,173**	**4,155**	**4,216**	**4,227**

Figure 2.3 CO_2 emissions without LULUCF 1990 to 2004 in CO_2 equivalents (Tg) and share of largest key source categories in 2004 for EU-15

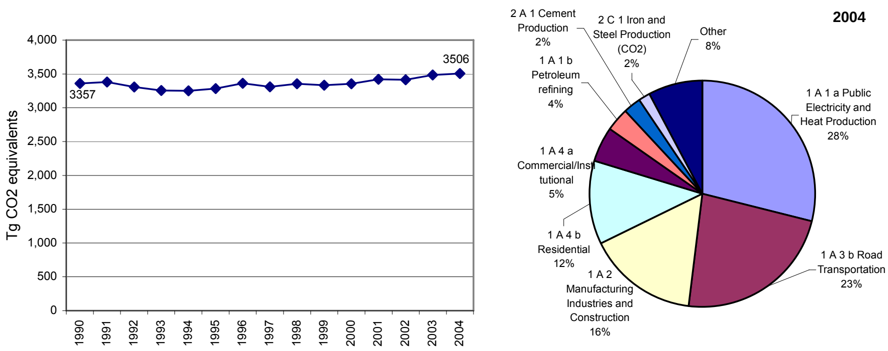
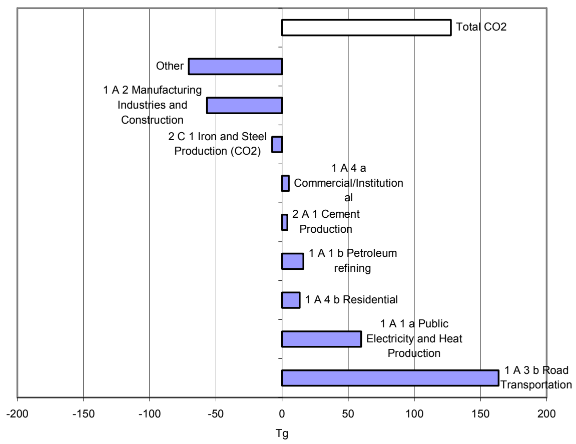


Figure 2.4 Absolute change of CO_2 emissions by large key source categories 1990 to 2004 in CO_2 equivalents (Tg) for EU-15



CH_4 emissions account for 7.5 % of total EU-15 GHG emissions and decreased by 26 % since 1990 to 319Tg CO_2 equivalents in 2004 (Figure 2.5). The two largest key sources account for 53 % of CH_4

emissions in 2004. Figure 2.6 shows that the main reasons for declining CH_4 emissions were reductions in solid waste disposal on land and falling sheep and cattle population.

Figure 2.5 CH_4 emissions 1990 to 2004 in CO_2 equivalents (Tg) and share of largest source categories in 2004 for EU-15

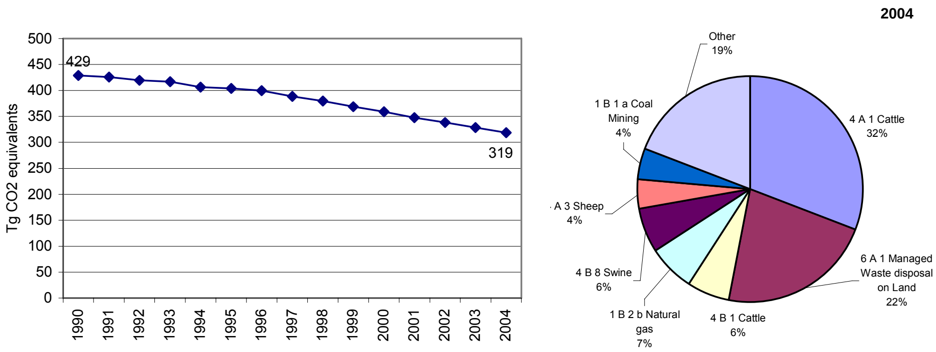
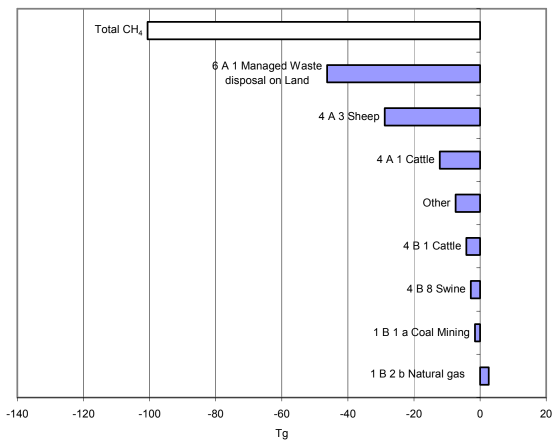


Figure 2.6 Absolute change of CH_4 emissions by large key source categories 1990 to 2004 in CO_2 equivalents (Tg) for EU-15



N_2O emissions are responsible for 8 % of total EU-15 GHG emissions and decreased by 18 % to 340 Tg CO_2 equivalents in 2004 (Figure 2.7). The two largest key sources account for about 51 % of N_2O emissions in 2004. Figure 2.8 shows that the main reason for large N_2O emission cuts were reduction measures in the adipic acid production.

Figure 2.7 N_2O emissions 1990 to 2004 in CO_2 equivalents (Tg) and share of largest source categories in 2004 for EU-15

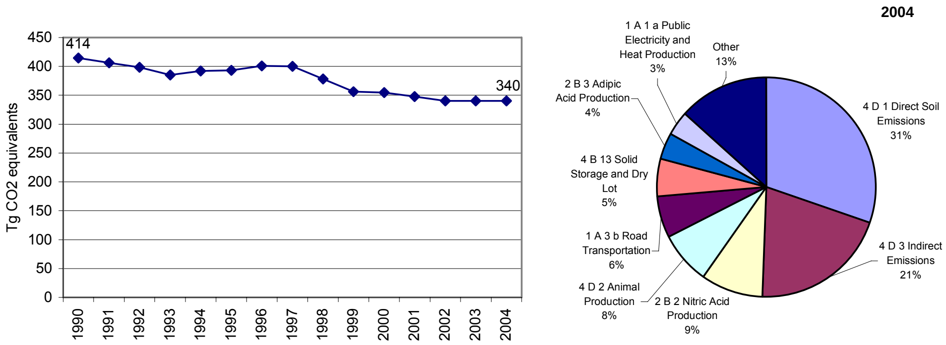
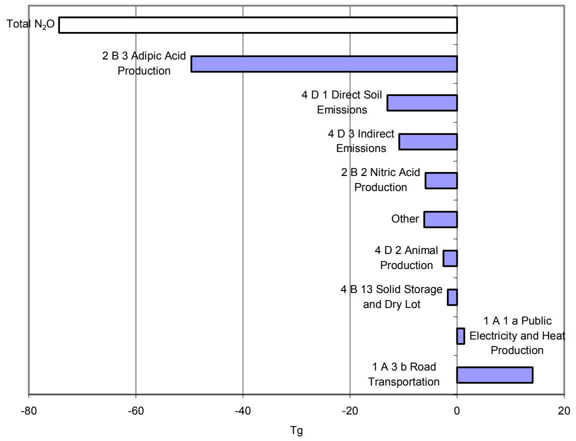


Figure 2.8 Absolute change of N_2O emissions by large key source categories 1990 to 2004 in CO_2 equivalents (Tg) for EU-15



Fluorinated gas emissions account for 1.6 % of total EU-15 GHG emissions. In 2004, emissions were 66 Tg CO_2 equivalents, which was 19 % above 1990 levels (Figure 2.9). The two largest key sources account for 78 % of fluorinated gas emissions in 2004. Figure 2.10 shows that HFCs from consumption of halocarbons showed large increases between 1990 and 2004. The main reason for this is the phase-out of ozone-depleting substances such as chlorofluorocarbons under the Montreal Protocol and the replacement of these substances with HFCs (mainly in refrigeration, air conditioning, foam production and as aerosol propellants). On the other hand, HFC emissions from production of halocarbons decreased substantially. The decrease started in 1998 and was strongest in 1999.

Figure 2.9 **Fluorinated gas emissions 1990 to 2004 in CO_2 equivalents (Tg) and share of largest source categories in 2004 for EU-15**

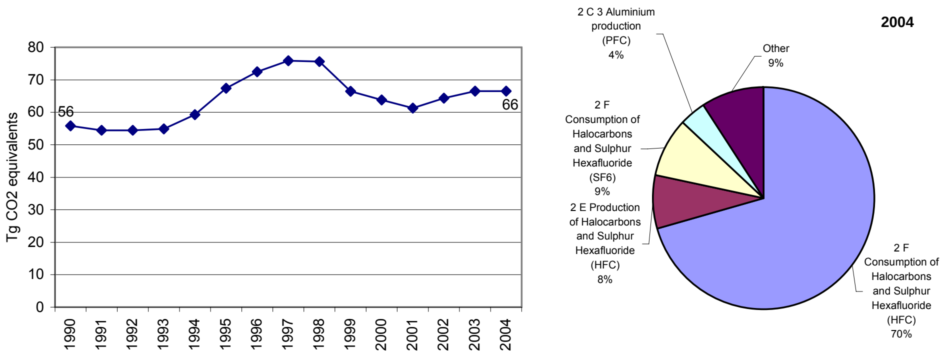
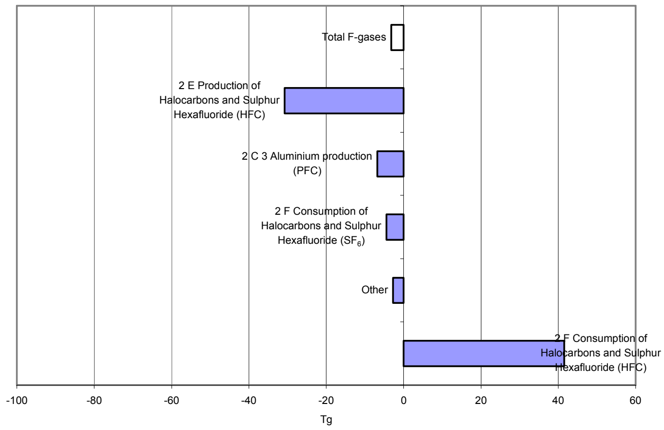


Figure 2.10 **Absolute change of fluorinated gas emissions by large key source categories 1990 to 2004 in CO_2 equivalents (Tg) for EU-15**



2.3 Emission trends by source

EU-25: Table 2.4 gives an overview of EU-25 GHG emissions in the main source categories for 1990–2004. The most important sector by far is 'Energy' accounting for 80 % of total EU-25 emissions in 2004. The second largest sector is 'Agriculture' (9 %), followed by Industrial processes' (8 %).

Table 2.4 **Overview of EU-25 GHG emissions in the main source and sink categories 1990 to 2004 in CO_2 equivalents (Tg)**

GHG SOURCE AND SINK	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1. Energy	4,062	4,058	3,947	3,883	3,853	3,853	3,969	3,893	3,892	3,852	3,850	3,931	3,907	3,990	3,995
2. Industrial Processes	431	406	395	379	404	418	416	429	404	367	375	366	360	370	379
3. Solvent and Other Product Use	11	11	11	10	10	10	10	10	10	10	10	10	9	10	10
4. Agriculture	524	503	488	473	472	472	474	474	473	476	471	463	457	451	458
5. Land-Use, Land-Use Change and Forest	-291	-350	-332	-340	-346	-339	-356	-339	-331	-352	-344	-389	-393	-355	-349
6. Waste	199	199	200	195	194	191	184	177	176	168	164	149	144	138	134
7. Other	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Total (with net CO_2 emissions/removals)	**4,939**	**4,832**	**4,712**	**4,604**	**4,592**	**4,609**	**4,702**	**4,647**	**4,627**	**4,525**	**4,530**	**4,534**	**4,489**	**4,606**	**4,630**
Total (without LULUCF)	**5,231**	**5,181**	**5,045**	**4,944**	**4,938**	**4,948**	**5,058**	**4,986**	**4,958**	**4,878**	**4,874**	**4,923**	**4,882**	**4,961**	**4,980**

EU-15: Table 2.5 gives an overview of EU-15 GHG emissions in the main source categories for 1990–2004. More detailed trend descriptions are included in Chapters 3 to 9.

Table 2.5 Overview of EU-15 GHG emissions in the main source and sink categories 1990 to 2004 in CO_2 equivalents (Tg)

GHG SOURCE AND SINK	Base year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1. Energy	3,261	3,261	3,297	3,228	3,180	3,157	3,183	3,270	3,208	3,249	3,229	3,242	3,312	3,306	3,371	3,383
2. Industrial Processes	392	378	364	352	340	363	375	374	384	360	325	329	321	319	325	331
3. Solvent and Other Product Use	10	10	10	10	9	9	9	9	9	9	9	9	9	9	8	8
4. Agriculture	435	435	425	419	411	412	414	418	418	418	417	413	405	399	395	393
5. Land-Use, Land-Use Change and Forest	-205	-205	-253	-235	-242	-251	-240	-254	-250	-254	-266	-253	-282	-292	-279	-286
6. Waste	163	163	165	164	163	161	158	155	148	143	135	131	123	118	113	109
7. Other	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Total (with net CO_2 emissions/removals)	**4,060**	**4,047**	**4,011**	**3,941**	**3,865**	**3,855**	**3,904**	**3,977**	**3,921**	**3,930**	**3,853**	**3,875**	**3,892**	**3,863**	**3,937**	**3,941**
Total (without LULUCF)	**4,266**	**4,252**	**4,264**	**4,176**	**4,107**	**4,106**	**4,144**	**4,231**	**4,171**	**4,184**	**4,119**	**4,129**	**4,173**	**4,155**	**4,216**	**4,227**

2.4 Emission trends by Member State

Table 2.6 gives an overview of Member States' contributions to the EC GHG emissions for 1990–2004. Member States show large variations in GHG emission trends.

Table 2.6 Overview of Member States' contributions to EC GHG emissions excluding LULUCF from 1990 to 2004 in CO_2 equivalents (Tg)

Member State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Austria	79	83	76	76	77	80	84	83	83	81	81	85	87	93	91
Belgium	146	149	147	146	151	152	156	148	153	147	147	147	145	148	148
Cyprus	6	6	7	7	7	7	8	8	8	8	9	8	9	9	9
Czech Republic	196	183	166	160	154	154	156	160	150	142	149	149	144	148	147
Denmark	69	80	73	76	79	76	90	80	76	73	68	70	69	74	68
Estonia	43	40	30	23	24	22	23	23	21	19	19	19	19	21	21
Finland	71	69	68	69	75	71	77	76	72	72	70	75	78	86	81
France	567	589	582	557	553	562	578	570	585	568	561	562	556	561	563
Germany	1,226	1,182	1,131	1,118	1,100	1,095	1,116	1,080	1,054	1,023	1,023	1,035	1,019	1,024	1,015
Greece	109	108	109	109	112	113	117	122	127	127	132	133	133	137	138
Hungary	103	95	85	85	85	84	86	84	84	84	81	84	81	83	83
Ireland	56	56	56	56	58	59	61	64	66	67	69	71	69	68	68
Italy	520	521	519	513	505	533	526	532	543	549	555	561	562	577	583
Latvia	26	23	19	16	14	12	12	12	11	11	10	11	11	11	11
Lithuania	51	47	44	40	36	33	29	25	22	21	21	20	20	17	20
Luxembourg	13	13	13	13	13	10	10	9	8	9	10	10	11	11	13
Malta	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3
Netherlands	213	218	217	222	222	225	233	227	227	215	215	216	215	215	218
Poland	460	438	440	430	440	417	437	427	404	402	386	383	370	383	386
Portugal	60	62	66	65	67	71	69	72	77	85	82	84	88	84	85
Slovakia	73	63	59	55	52	53	54	54	52	51	49	52	51	51	51
Slovenia	18	17	17	18	18	19	19	20	19	19	19	20	20	20	20
Spain	287	293	301	290	306	318	311	331	342	370	384	385	402	408	428
Sweden	72	73	73	72	75	74	78	73	73	70	68	69	70	71	70
United Kingdom	764	769	744	725	714	704	727	704	698	663	664	671	652	658	659
EU25	**5,231**	**5,181**	**5,045**	**4,944**	**4,938**	**4,948**	**5,058**	**4,986**	**4,958**	**4,878**	**4,874**	**4,923**	**4,882**	**4,961**	**4,980**
EU15	**4,252**	**4,264**	**4,176**	**4,107**	**4,106**	**4,144**	**4,231**	**4,171**	**4,184**	**4,119**	**4,129**	**4,173**	**4,155**	**4,216**	**4,227**

Note: For some countries the data provided in this table is based on gap filling (see Chapter 1.8.2 for details.).

The overall EC GHG emission trend is dominated by the two largest emitters Germany and the United Kingdom, accounting for about one third of total EU-25 GHG emissions. These two Member States have achieved total GHG emission reductions of 316 million tonnes CO_2 euqivalents compared to 1990 ([15]).

The main reasons for the favourable trend in Germany are increasing efficiency in power and heating plants and the economic restructuring of the five new *Länder* after the German reunification. The reduction of GHG emissions in the United Kingdom was primarily the result of liberalising energy markets and the subsequent fuel switches from oil and coal to gas in electricity production and N_2O emission reduction measures in the adipic acid production.

Italy and France are the third and fourth largest emitters with a shares of 12 % and 11 % respectively. Italy's GHG emissions were about 12% above 1990 levels in 2004. Italian GHG emissions increased since 1990 primarily from road transport, electricity and heat production and petrol-refining. France's emissions were 1 % below 1990 levels in 2004. In France, large reductions were achieved in N_2O emissions from the adipic acid production, but CO_2 emissions from road transport increased considerably between 1990 and 2004.

([15]) The EU-15 as a whole needs emission reductions of total GHG of 8 %, i.e. 341 million tonnes on the basis of the 2006 inventory in order to meet the Kyoto target.

Spain and Poland are the fifth and sixth largest emitters in the EU-25 each accounting for about 9 % and 8 % of total EU-25 GHG emissions respectively. Spain increased emissions by 48 % between 1990 and 2004. This was largely due to emission increases from road transport, electricity and heat production, and manufacturing industries. Poland decreased GHG emissions by 16 % between 1990 and 2004 (-32 % since the base year, which is 1988 in the case of Poland). Main factors for decreasing emissions in Poland — as for other new Member States — was the decline of energy inefficient heavy industry and the overall restructuring of the economy in the late 1980s and early 1990s. The notable exception was transport (especially road transport) where emissions increased.

2.5 Emission trends for indirect greenhouse gases and sulphur dioxide (EU-15)

Emissions of CO, NO_x, NMVOC and SO_2 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 2.7 shows the total indirect GHG and SO_2 emissions in the EU-15 between 1990–2004. All emissions were reduced significantly from 1990 levels: the largest reduction was achieved in SO_2 (– 70 %) followed by CO (– 50 %) NMVOC (– 42 %) and NO_x (– 31 %).

Table 2.7 Overview of EU-15 indirect GHG and SO_2 emissions for 1990–2004 (Gg)

GREENHOUSE GAS EMISSIONS	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
	(Gg)														
NOx	13,386	13,096	12,866	12,292	11,943	11,692	11,414	10,966	10,730	10,420	10,093	9,865	9,561	9,436	9,188
CO	51,339	49,067	46,863	44,570	41,990	40,156	38,840	37,077	35,579	33,522	30,999	29,744	27,761	26,843	25,466
NMVOC	15,348	14,719	14,352	13,663	13,191	12,733	12,166	12,000	11,509	11,075	10,330	9,979	9,504	9,169	8,955
SO2	16,535	14,906	13,728	12,473	11,289	9,986	8,932	8,200	7,645	6,795	6,075	5,873	5,662	5,217	5,022

Table 2.8 shows the NO_x emissions of the EU-15 Member States between 1990–2004. The largest emitters, the United Kingdom, Spain, and Germany made up 51 % of total NO_x emissions in 2004. The United Kingdom and Germany reduced their emissions from 1990 levels. This was counterbalanced by increases from Spain, Greece, Portugal and Austria. All other Member States reduced emissions.

Table 2.8 Overview of EU-15 Member States' contributions to EU-15 NO_x emissions for 1990–2004 (Gg)

Member State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Austria	212	223	210	203	195	193	212	200	212	199	204	213	220	230	227
Belgium	360	364	360	351	356	349	333	326	325	298	306	295	284	281	273
Denmark	273	323	280	279	277	262	300	254	232	215	198	194	190	198	181
Finland	298	273	266	267	267	245	250	243	228	222	209	211	210	218	205
France	1,833	1,904	1,867	1,762	1,718	1,666	1,637	1,571	1,552	1,483	1,411	1,364	1,312	1,280	1,252
Germany	2,884	2,651	2,495	2,385	2,236	2,140	2,057	1,985	1,948	1,925	1,865	1,774	1,685	1,617	1,567
Greece	280	290	295	295	301	298	302	309	324	314	305	317	320	320	317
Ireland	116	71	129	117	114	114	118	116	120	117	123	132	121	117	116
Italy	1,943	2,001	2,020	1,921	1,841	1,808	1,732	1,654	1,554	1,453	1,373	1,352	1,258	1,245	1,173
Luxembourg	23	23	24	24	23	20	21	20	19	16	18	17	17	17	15
Netherlands	559	461	447	429	412	470	457	417	406	411	396	385	378	376	355
Portugal	166	175	185	177	178	188	180	176	179	187	177	178	188	174	171
Spain	1,202	1,240	1,276	1,255	1,286	1,312	1,278	1,324	1,338	1,414	1,435	1,423	1,480	1,476	1,518
Sweden	306	295	293	281	283	271	261	250	242	230	217	211	206	203	197
United Kingdom	2,932	2,803	2,719	2,545	2,455	2,355	2,277	2,121	2,052	1,936	1,856	1,799	1,693	1,685	1,621
EU15	**13,386**	**13,096**	**12,866**	**12,292**	**11,943**	**11,692**	**11,414**	**10,966**	**10,730**	**10,420**	**10,093**	**9,865**	**9,561**	**9,436**	**9,188**

Table 2.9 shows the CO emissions of the EU-15 Member States between 1990–2004. The largest emitters, France, Italy and Germany that made up 57 % of the total CO emissions in 2004, reduced their emissions from 1990 levels substantially. Also all other Member States reduced emissions.

Table 2.9 Overview of EU-15 Member States' contributions to EU-15 CO emissions for 1990–2004 (Gg)

Member State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Austria	1,222	1,242	1,198	1,155	1,102	1,010	1,021	954	915	863	798	782	738	762	742
Belgium	1,339	1,316	1,297	1,196	1,109	1,080	1,050	978	944	936	1,017	956	937	904	789
Denmark	765	797	789	784	736	728	723	665	630	593	587	604	588	604	588
Finland	710	677	668	653	641	637	627	630	623	617	597	591	581	572	543
France	11,506	11,347	10,870	10,326	9,625	9,513	8,944	8,494	8,341	7,848	7,304	6,952	6,670	6,475	6,566
Germany	12,095	9,891	8,562	7,768	6,844	6,409	6,086	6,038	5,646	5,290	4,994	4,699	4,437	4,314	3,668
Greece	1,295	1,307	1,338	1,338	1,334	1,328	1,354	1,355	1,384	1,310	1,356	1,266	1,230	1,193	1,155
Ireland	397	387	391	347	326	301	303	308	313	281	275	270	251	235	238
Italy	7,183	7,477	7,677	7,623	7,402	7,166	6,867	6,607	6,197	5,897	5,164	5,086	4,468	4,381	4,207
Luxembourg	177	185	186	198	169	121	113	86	58	49	56	53	48	48	41
Netherlands	1,137	1,026	982	925	896	862	851	772	759	739	716	680	648	627	617
Portugal	442	466	396	381	374	435	391	379	422	400	431	404	413	596	422
Spain	3,659	3,712	3,753	3,561	3,538	3,219	3,352	3,185	3,181	2,903	2,692	2,601	2,478	2,406	2,384
Sweden	1,133	1,110	1,090	1,053	1,036	1,010	967	903	836	787	730	691	659	627	588
United Kingdom	8,280	8,128	7,668	7,261	6,856	6,338	6,189	5,723	5,328	5,010	4,283	4,108	3,614	3,099	2,919
EU15	**51,339**	**49,067**	**46,863**	**44,570**	**41,990**	**40,156**	**38,840**	**37,077**	**35,579**	**33,522**	**30,999**	**29,744**	**27,761**	**26,843**	**25,466**

Table 2.10 shows the NMVOC emissions of the EU-15 Member States between 1990–2004. The largest emitters France, Germany and Italy that made up 57 % of the total NMVOC emissions in 2004, reduced their emissions from 1990 levels. All Member States except for Greece and Portugal reduced emissions.

Table 2.10 Overview of EU-15 Member States' contributions to EU-15 NMVOC emissions for 1990–2004 (Gg)

Member State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Austria	284	272	243	238	221	221	216	203	190	179	179	182	176	175	172
Belgium	321	312	309	297	286	273	257	248	241	232	217	212	199	194	160
Denmark	166	167	165	161	156	152	152	145	135	130	127	122	118	116	116
Finland	222	212	205	195	191	185	178	174	169	164	158	155	150	146	141
France	3,689	3,672	3,609	3,476	3,441	3,387	3,150	3,237	3,063	3,093	2,933	2,914	2,782	2,715	2,649
Germany	3,585	3,043	2,776	2,520	2,247	2,100	1,974	1,913	1,842	1,714	1,513	1,421	1,320	1,212	1,234
Greece	308	318	327	333	341	343	348	348	357	353	354	350	347	339	332
Ireland	103	103	107	98	99	97	103	106	108	87	76	74	67	63	60
Italy	1,986	2,048	2,129	2,097	2,033	2,004	1,952	1,884	1,779	1,688	1,506	1,432	1,335	1,299	1,263
Luxembourg	18	18	19	19	18	17	16	15	14	12	12	11	11	11	10
Netherlands	466	412	389	361	340	333	293	264	263	249	235	213	202	187	180
Portugal	194	198	200	196	207	215	219	226	231	226	226	233	237	253	243
Spain	1,170	1,204	1,211	1,139	1,161	1,107	1,127	1,143	1,199	1,193	1,165	1,139	1,122	1,124	1,119
Sweden	443	428	417	395	373	362	349	330	303	293	282	270	264	265	255
United Kingdom	2,394	2,313	2,248	2,138	2,076	1,937	1,830	1,764	1,615	1,461	1,346	1,250	1,173	1,072	1,022
EU15	**15,348**	**14,719**	**14,352**	**13,663**	**13,191**	**12,733**	**12,166**	**12,000**	**11,509**	**11,075**	**10,330**	**9,979**	**9,504**	**9,169**	**8,955**

Table 2.11 shows the SO_2 emissions of the EU-15 Member States between 1990–2004. The largest emitters, Spain and the United Kingdom, that made up 44 % of the total SO_2 emissions in 2004, reduced their emissions from 1990 levels. All other Member States except for Greece reduced emissions.

Table 2.11 Overview of EU-15 Member States' contributions to EU-15 SO_2 emissions for 1990–2004 (Gg)

Member State	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Austria	74	71	55	53	48	47	45	40	36	34	32	33	33	33	29
Belgium	357	361	353	327	284	256	242	221	208	169	165	164	152	148	151
Denmark	178	237	182	148	146	136	171	99	76	55	28	26	25	32	24
Finland	273	200	152	133	121	101	105	102	94	88	80	91	88	101	84
France	1,376	1,485	1,306	1,153	1,094	1,028	1,003	857	876	763	672	608	570	572	550
Germany	5,322	3,921	3,223	2,860	2,400	1,713	1,430	1,202	960	779	633	631	591	599	562
Greece	472	513	529	525	516	539	529	522	530	548	499	504	516	554	548
Ireland	183	180	170	161	175	161	147	166	176	157	131	126	96	76	70
Italy	1,795	1,677	1,578	1,478	1,388	1,320	1,210	1,134	997	900	755	705	625	528	496
Luxembourg	15	15	14	15	13	8	8	6	4	4	3	3	2	2	3
Netherlands	190	141	133	126	119	128	121	102	94	88	72	73	67	63	64
Portugal	305	295	356	302	281	320	265	287	335	336	303	290	290	197	200
Spain	2,180	2,173	2,136	2,013	1,964	1,809	1,579	1,756	1,603	1,619	1,479	1,457	1,562	1,287	1,360
Sweden	117	114	109	96	93	79	77	70	67	54	52	51	51	52	47
United Kingdom	3,699	3,522	3,430	3,085	2,649	2,343	1,999	1,635	1,591	1,202	1,173	1,111	994	973	833
EU15	**16,535**	**14,906**	**13,728**	**12,473**	**11,289**	**9,986**	**8,932**	**8,200**	**7,645**	**6,795**	**6,075**	**5,873**	**5,662**	**5,217**	**5,022**

3 Energy (CRF Sector 1)

This chapter starts with an overview on emission trends in CRF Sector 1: 'Energy'. For each EU-15 key source overview tables are presented including the Member States' contributions to the key source in terms of level and trend, information on methodologies and emission factors. The chapter includes also sections on uncertainty estimates, sector-specific QA/QC, recalculations, the reference approach, and international bunkers. The main improvement compared to the inventory report 2005 are more detailed information on activity data and emission factors for all EC key sources and the description of sub-sectors of source category 1A2 Manufacturing industries.

3.1 Overview of sector

CRF Sector 1: 'Energy' contributes 77 % to total GHG emissions and is the largest emitting sector in the EU-15. Total GHG emissions from this sector increased by 3.6 % from 3 127 Tg in 1990 to 3 278 Tg in 2004 (Figure 3.1). In 2004, emissions increased by 0.5 % compared to 2003.

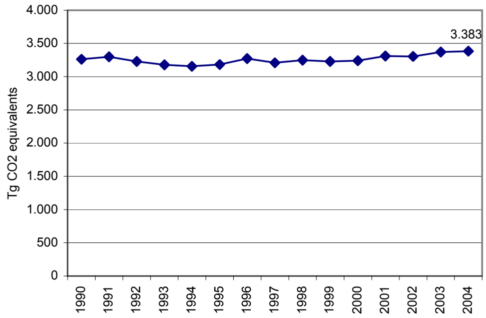
The most important energy-related gas is CO_2 that makes up 78 % of the total EU-15 GHG emissions. CH_4 and N_2O are each responsible for 1 % of the total GHG emissions. The key sources in this sector are as follows.

1 A 1 a Public Electricity and Heat Production: Gaseous Fuels (CO_2)
1 A 1 a Public Electricity and Heat Production: Liquid Fuels (CO_2)
1 A 1 a Public Electricity and Heat Production: Other Fuels (CO_2)
1 A 1 a Public Electricity and Heat Production: Solid Fuels (CO_2)
1 A 1 a Public Electricity and Heat Production: Solid Fuels (N_2O)
1 A 1 b Petroleum refining: Gaseous Fuels (CO_2)
1 A 1 b Petroleum refining: Liquid Fuels (CO_2)
1 A 1 b Petroleum refining: Solid Fuels (CO_2)
1 A 1 c Manufacture of Solid fuels and Other Energy Industries: Gaseous Fuels (CO_2)
1 A 1 c Manufacture of Solid fuels and Other Energy Industries: Solid Fuels (CO_2)
1 A 2 a Iron and Steel: Gaseous Fuels (CO_2)
1 A 2 a Iron and Steel: Liquid Fuels (CO_2)
1 A 2 a Iron and Steel: Solid Fuels (CO_2)
1 A 2 b Non-Ferrous Metals: Gaseous Fuels (CO_2)
1 A 2 b Non-Ferrous Metals: Solid Fuels (CO_2)
1 A 2 c Chemicals: Gaseous Fuels (CO_2)
1 A 2 c Chemicals: Liquid Fuels (CO_2)
1 A 2 c Chemicals: Other Fuels (CO_2)
1 A 2 c Chemicals: Solid Fuels (CO_2)
1 A 2 d Pulp, Paper and Print: Gaseous Fuels (CO_2)
1 A 2 d Pulp, Paper and Print: Liquid Fuels (CO_2)
1 A 2 d Pulp, Paper and Print: Solid Fuels (CO_2)
1 A 2 e Food Processing, Beverages and Tobacco: Gaseous Fuels (CO_2)
1 A 2 e Food Processing, Beverages and Tobacco: Liquid Fuels (CO_2)
1 A 2 e Food Processing, Beverages and Tobacco: Solid Fuels (CO_2)
1 A 2 f Other: Gaseous Fuels (CO_2)
1 A 2 f Other: Liquid Fuels (CO_2)
1 A 2 f Other: Solid Fuels (CO_2)
1 A 3 a Civil Aviation: Jet Kerosene (CO_2)
1 A 3 b Road Transportation: Diesel oil (CO_2)
1 A 3 b Road Transportation: Diesel oil (N_2O)
1 A 3 b Road Transportation: Gasoline (CO_2)
1 A 3 b Road Transportation: Gasoline (N_2O)
1 A 3 b Road Transportation: LPG (CO_2)
1 A 3 c Railways: Liquid Fuels (CO_2)
1 A 3 d Navigation: Gas/Diesel Oil (CO_2)
1 A 3 d Navigation: Residual Oil (CO_2)
1 A 4 a Commercial/Institutional: Gaseous Fuels (CO_2)
1 A 4 a Commercial/Institutional: Liquid Fuels (CO_2)
1 A 4 a Commercial/Institutional: Solid Fuels (CO_2)
1 A 4 b Residential: Biomass (CH_4)
1 A 4 b Residential: Gaseous Fuels (CO_2)
1 A 4 b Residential: Liquid Fuels (CO_2)
1 A 4 b Residential: Solid Fuels (CO_2)
1 A 4 c Agriculture/Forestry/Fisheries: Gaseous Fuels (CO_2)
1 A 4 c Agriculture/Forestry/Fisheries: Liquid Fuels (CO_2)
1 A 4 c Agriculture/Forestry/Fisheries: Solid Fuels (CO_2)

1 A 5 a Stationary: Solid Fuels (CO_2)
1 A 5 b Mobile: Liquid Fuels (CO_2)
1 B 1 a Coal Mining: (CH_4)
1 B 2 a Oil: (CO_2)
1 B 2 b Natural gas: (CH_4)
1 B 2 c Venting and flaring: (CO_2)

Figure 3.1 shows that the six largest key sources account for about 90 % of emissions in Sector 1.

Figure 3.1 EU-15 GHG emissions for 1990–2004 from CRF Sector 1: 'Energy' in CO_2 equivalents (Tg) and share of largest key source categories in 2004



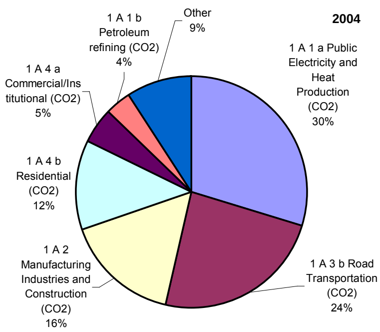
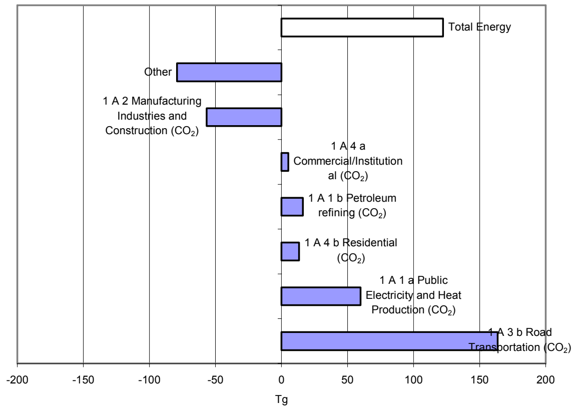


Figure 3.2 shows that CO_2 emissions from road transport had the highest increase in absolute terms of all energy-related emissions, while CO_2 emissions from manufacturing industries decreased substantially between 1990 and 2004. The increases in road transport occurred in almost all Member States, whereas the emission reductions from manufacturing industries mainly occurred in Germany after the reunification. The decline of coal-mining (CH_4) and decreasing CO_2 emissions from 1.A.1.c: 'Manufacture of solid fuels and other energy industries' and from 1.A.5: 'Other' are the main reasons for the large absolute emission reductions from 'Other' in Figure 3.2.

Figure 3.2 Absolute change of GHG emissions by large key source categories 1990–2004 in CO_2 equivalents (Tg) in CRF Sector 1: 'Energy'



3.2 Source categories

3.2.1 Energy industries (CRF Source Category 1.A.1)

Figure 3.3 shows the emission trend within the category 1.A.1, which is mainly dominated by CO_2 emissions from public electricity and heat production. Total GHG emissions increased by 4 %, mainly due to increases in CO_2 emissions from public electiricy and heat production (+6 %).

Figure 3.3: Total GHG, CO_2 and N_2O emission trends for Category 1.A.1

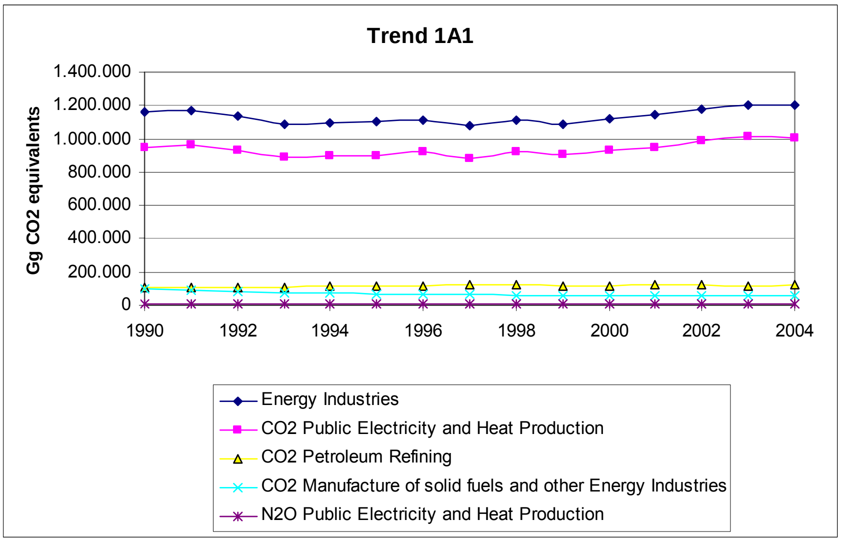


Table 3.1 summarises information by Member State on methodologies and emission factors for CO_2 from 1.A.1: 'Energy industries'. CO_2 emissions from energy industries increased by 3.5 % between 1990 and 2004. Eight Member States had increases in this source during this time, but the United Kingdom (-12 %) and Germany (-12 %) had major decreases, emissions of other countries decreased within a range of 1.7 % - 4.6 %, with the exception of Luxembourg (-69.8 %). The highest relative increase ocurred in Finland (70.5 %), Spain (48.9 %) and Italy (37.1 %).

This source category includes three key sources: CO_2 from 1.A.1.a: 'Electricity and heat production' and CO_2 from 1.A.1.b: 'Petroleum-refining', and CO_2 from 1.A.1.c: 'Manufacture of solid fuels and other energy industries'.

Table 3.1 Member States' contributions to CO_2 emissions from 1.A.1: 'Energy industries' and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1]	EF [1]
Austria	13.663	15.535	T2	CS
Belgium	29.863	29.358	CS	CS
Denmark	26.173	25.388	CR	CS
Finland	19.248	32.820	T3	CS,D,PS
France	66.343	63.305	C	CS
Germany	413.994	363.824	CS	CS
Greece	43.199	57.458	CR,NA	CS,D,NA
Ireland	11.099	15.219	T1,T3	CS,PS
Italy	134.092	160.903	T3	CS
Luxembourg	1.268	383	C/D	C/D
Netherlands	52.384	70.273	T2	CS
Portugal	15.944	21.256	T2	D+C
Spain	77.357	115.155	NA,T2	CS, PS,CR,NA
Sweden	10.050	12.291	T2, T3,T1	CS
United Kingdom	235.812	207.101	T2	CS
EU15	1.150.489	1.190.270	C,CS,D,T1,T2,T3, CR, NA	C, CS, D, PS, CR, NA

([1]) Information source: CRF Summary Table 3 for 2004.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 3.2 provides information on the contribution of Member States to EU-15 recalculations in CO_2 from 1.A.1 'Energy industries' for 1990 and 2003 and main explanations for the largest recalculations in absolute terms.

Table 3.2 Contribution of MS to EU-15 recalculations in CO_2 from 1.A.1 'Energy industries' for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

	1990		2003		Main explanations
	Gg	Percent	Gg	Percent	
Austria	40	0,3	135	0,8	
Belgium	-44	-0,1	23	0,1	
Denmark	0	0,0	0	0,0	
Finland	731	3,9	418	1,2	
France	-1.673	-2,5	-149	-0,2	Updated EF from coke oven furnaces Replacement of emissions from 3 plants from 1A2 to 1A1a
Germany	49	0,0	4.541	1,3	Inclusion of SO_2-scrubbing by use of limestone in 1A1a
Greece	5	0,0	4	0,0	
Ireland	42	0,4	119	0,8	
Italy	-860	-0,6	-2.291	-1,4	Revised method for emissions from iron and steel
Luxembourg	-10	-0,7	0	0,0	
Netherlands	758	1,5	768	1,1	Reallocation of emissions from gas compressors from 1B2 to 1A1c
Portugal	0	0,0	321	1,6	
Spain	-136	-0,2	422	0,4	
Sweden	-137	-1,3	263	2,1	
UK	25	0,0	-5.208	-2,4	Energy statistics revisions and emission factor changes
EU15	**-1.208**	**-0,1**	**-634**	**-0,1**	

Table 3.3 summarises information by Member State on methodologies and emission factors for the N_2O emissions from 1.A.1: 'Energy industries'. N_2O emissions from this source increased by 8 % between 1990 and 2004. Most Member States had increases in this source during this time. Germany and the United Kingdom had the only emission decreases which were counterbalanced by increases in other Member States (in particular Greece, Spain, Italy, France).

This source category includes one key source: N_2O from 1.A.1.a: 'Electricity and heat production'.

Table 3.3 Member States' contributions to N_2O emissions from 1.A.1: 'Energy industries' and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1)]	EF [1)]
Austria	46	74	T2	CS
Belgium	209	343	C	D
Denmark	119	154	CR	CR
Finland	205	299	T3	CS
France	734	1.087	C	CS
Germany	4.530	3.898	T2	CS
Greece	1.779	2.284	CR,NA	CR,NA
Ireland	416	533	T1,T3	CR,D
Italy	1.684	2.131	T3	D
Luxembourg	0	3	C/D	C/D
Netherlands	128	161	T1,T2	CS,D
Portugal	61	107	T2	D+C
Spain	283	689	NA,T2	CR, OTH,D,NA
Sweden	342	425	T2, T3,T1	CS
United Kingdom	1.881	1.273	T2	CS,D
EU15	12.416	13.461	C,D,T1,T2,T3, CR, NA	C,CS,D,CR,NA

([1]) Information source: CRF Summary Table 3 for 2004.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 3.4 provides information on the contribution of Member States to EU-15 recalculations in N_2O from 1.A.1 'Energy industries' for 1990 and 2003 and main explanations for the largest recalculations in absolute terms.

Table 3.4. Contribution of MS to EU-15 recalculations in N_2O from 1.A.1 'Energy industries' for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

	1990		2003		Main explanations
	Gg	Percent	Gg	Percent	
Austria	0	-1,1	4	5,6	
Belgium	-75	-26,5	-144	-40,1	
Denmark	-157	-56,9	-157	-47,9	
Finland	-74	-26,6	-221	-40,3	
France	-2	-0,3	9	0,8	
Germany	36	0,8	112	3,0	
Greece	-3	-0,2	-3	-0,1	
Ireland	-15	-3,4	2	0,5	
Italy	1	0,1	-20	-1,0	
Luxembourg	0	-	0	-	
Netherlands	-31	-19,5	-51	-23,3	
Portugal	0	0,0	2	1,6	
Spain	-1	-0,4	13	2,0	
Sweden	4	1,0	7	1,7	
UK	-452	-19,4	-1.497	-53,4	New emission factor for coal and natural gas combustion
EU15	**-770**	**-5,8**	**-1.943**	**-12,8**	

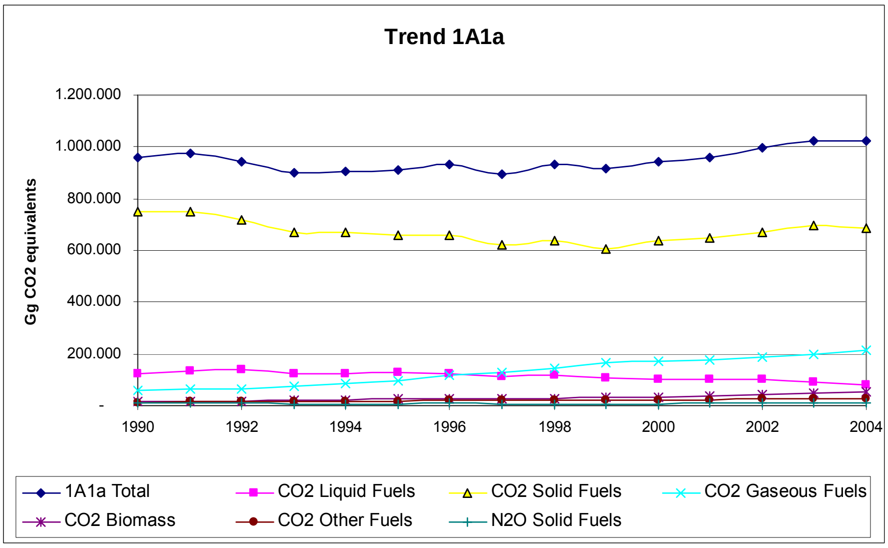
3.2.1.1. Public Electricity and Heat Production (1A1a)

In this chapter information about emission trends, Member States contribution, activity data and emission factors is provided for category 1A1a on a fuel base.

CO_2 emissions from 1.A.1.a: 'Electricity and heat production' are the largest key source in the EU-15 accounting for 24 % of total GHG emissions in 2004. Between 1990 and 2004, CO_2 emissions from electricity and heat production increased by 6 % in the EU-15 (Table 3.3). The emissions from this key source are due to fossil fuel consumption in public electricity and heat plants, which increased by 17 % between 1990 and 2004. Emissions did not increase in line with fuel consumption mainly because of the shift from coal to gas: coal consumption in heat and power plants decreased by 8 % between 1990 and 2004, whereas gas consumption more than tripled.

Figure 3.4 shows the emission trend within the category 1.A.1.a, which is mainly dominated by CO_2 emissions from solid fuels. Total emissions increased by 6 %, mainly due to increases in emissions from gaseous fuels (+257 %). Decreasing emissions were reported for liquid (-38 %) and solid (-8 %) fuels.

Figure 3.4: Total, CO_2 and N_2O emission trends for Category 1A1a



Between 1990 and 2004, large CO_2 emission decreases in absolute terms had been achieved by the United Kingdom and Germany, whereas emissions increased considerably in Spain (Table 3.5). The most important reason for German CO_2 reductions from electricity and heat production were efficiency improvements in coal-fired power plants. In the United Kingdom, the most important factor for emission reductions was the fuel switch from coal to gas in power production. The fossil fuel consumption in electricity and heat production in Spain increased by 72 % between 1990 and 2004, leading to a 55 % increase in emissions from this source.

Table 3.5: Member States' contributions to CO_2 emissions from 1.A.1.a: 'Electricity and heat production'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	10,888	13,422	12,799	1.3%	-623	-5%	1,911	18%
Belgium	23,420	23,590	23,822	2.4%	232	1%	403	2%
Denmark	24,736	28,869	22,832	2.3%	-6,037	-21%	-1,904	-8%
Finland	16,646	33,271	29,609	2.9%	-3,661	-11%	12,964	78%
France	48,131	46,145	45,224	4.5%	-921	-2%	-2,906	-6%
Germany	334,810	328,709	324,809	32.2%	-3,900	-1%	-10,000	-3%
Greece	40,632	52,709	53,897	5.3%	1,188	2%	13,265	33%
Ireland	10,876	15,109	14,737	1.5%	-372	-2%	3,860	35%
Italy	107,135	124,833	124,901	12.4%	69	0%	17,766	17%
Luxembourg	1,268	266	383	0.0%	117	44%	-885	-70%
Netherlands	39,923	54,995	56,472	5.6%	1,477	3%	16,549	41%
Portugal	13,960	17,680	18,770	1.9%	1,090	6%	4,810	34%
Spain	64,341	91,082	100,004	9.9%	8,922	10%	35,663	55%
Sweden	7,691	10,216	9,363	0.9%	-853	-8%	1,671	22%
United Kingdom	203,991	170,578	170,607	16.9%	29	0%	-33,384	-16%
EU15	948,449	1,011,473	1,008,230	100.0%	-3,242	0%	59,782	6%

Abbreviations explained in the Chapter 'Units and abbreviations'.

N_2O emissions increased by 13 % between 1990 and 2004 (Table 3.6). Spain and Finland reported a major increase (>100 %), only the United Kingdom, Germany and Belgium showed a decrease in emission. The Member States emitting most in 2004 are Germany, Greece, Italy and the United Kingdom, together 73 %.

Table 3.6: Member States' contributions to N_2O emissions from 1.A.1.a: 'Electricity and heat production'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	43	68	71	0.6%	2	3%	28	64%
Belgium	79	46	45	0.4%	0	0%	-34	-43%
Denmark	103	142	125	1.1%	-17	-12%	22	21%
Finland	107	305	276	2.3%	-29	-9%	170	159%
France	592	934	953	8.0%	19	2%	361	61%
Germany	3,659	3,575	3,560	30.0%	-15	0%	-99	-3%
Greece	1,688	2,119	2,157	18.1%	38	2%	468	28%
Ireland	412	541	524	4.4%	-17	-3%	112	27%
Italy	1,530	1,839	1,948	16.4%	109	6%	418	27%
Luxembourg	0	0	3	0.0%	3	-	3	-
Netherlands	119	154	149	1.3%	-5	-3%	29	25%
Portugal	52	86	97	0.8%	11	13%	46	89%
Spain	197	563	574	4.8%	11	2%	376	191%
Sweden	305	408	381	3.2%	-27	-7%	76	25%
United Kingdom	1,662	1,054	1,022	8.6%	-33	-3%	-640	-39%
EU15	10,548	11,833	11,884	100.0%	51	0%	1,336	13%

1A1a Electricity And Heat Production - Liquid Fuels (CO_2)

CO_2 emissions resulting from liquid fuels within the category 1A1a were in 2004 responsible for 8 % of the total GHG emissions in 1A1a. Within the EU-15 the emissions decreased between 1990 and 2004 by 38 % (Table 3.7). The largest relative increase ocurred in the Netherlands, whereas the largest absolute decrease reported Italy between 1990 and 2004.

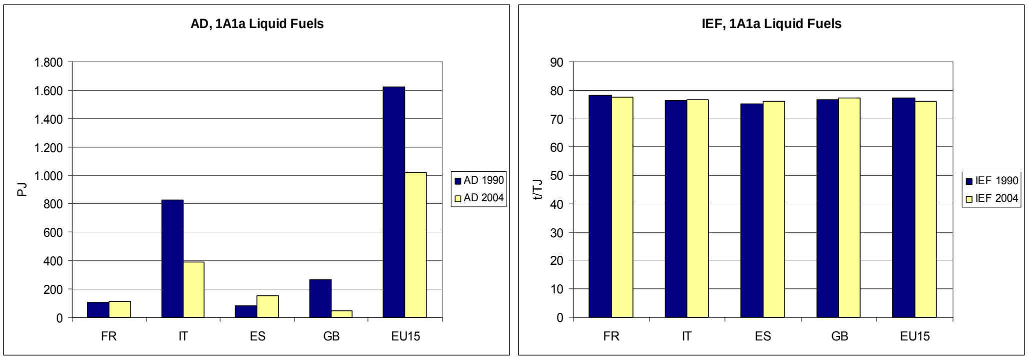
Table 3.7: Member States' contributions to CO_2 emissions from 1.A.1.a Electricity and heat production: liquid fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	1.229	1.117	1.061	1,4%	-56	-5%	-168	-14%	T2	NS, PS	CS
Belgium	659	628	1.045	1,3%	417	66%	386	59%	CS	PS,RS	CS,PS
Denmark	947	1.715	1.204	1,5%	-511	-30%	257	27%	C	NS/PS	CS/C
Finland	1.248	1.285	983	1,3%	-302	-23%	-265	-21%	T3	PS	CS
France	8.100	8.504	8.537	11,0%	33	0%	438	5%	C	PS	CS
Germany	8.507	4.697	4.567	5,9%	-130	-3%	-3.940	-46%	CS	NS/AS	CS
Greece	5.375	6.378	5.705	7,3%	-673	-11%	330	6%	C	NS	D
Ireland	1.087	1.993	2.540	3,3%	547	27%	1.453	134%	T3	NS, PS	PS
Italy	63.047	43.090	29.949	38,5%	-13.141	-30%	-33.098	-52%	T3	NS, PS	CS
Luxembourg	9	8	12	0,0%	4	44%	3	37%	C/D		C/D
Netherlands	206	2.158	2.230	2,9%	73	3%	2.024	981%	T2	NS/Q	CS
Portugal	6.301	3.358	3.033	3,9%	-325	-10%	-3.268	-52%	D	PS+NS	D
Spain	6.007	10.995	11.877	15,3%	882	8%	5.871	98%	T2	PS	PS, C
Sweden	1.278	2.530	1.574	2,0%	-956	-38%	296	23%	T1,T2,T3	PS	CS
United Kingdom	20.691	2.542	3.427	4,4%	885	35%	-17.265	-83%	T2	NS/AS	CS
EU15	124.690	90.999	77.745	100,0%	-13.253	-15%	-46.945	-38%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.5 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – France, Italy, Spain and the United Kingdom; together they cause 78 % (1990) resp. 69 % (2004) of the CO_2 emissions from liquid fuels in 1A1a. Fuel combustion is highest in Italy; implied emission factors of the EU-15 Member States range from 59.9 to 79.8 t/TJ in 2004.

Figure 3.5: Activity Data and Implied Emission Factors for CO_2 from Liquid Fuels in 1A1a



1A1a Electricity And Heat Production - Solid Fuels (CO_2, N_2O)

CO_2 emissions resulting from solid fuels within the category 1.A.1.a were in 2004 responsible for 67 % of the total GHG emissions in 1.A.1.a. Within the EU-15 the emissions decreased between 1990 and 2004 by 8 % (Table 3.8) . The largest absolute decrease reported the United Kingdom; significant relative changes ocurred in Finland (+60 %), Portugal (+56 %), and Italy (+60 %) between 1990 and 2004.

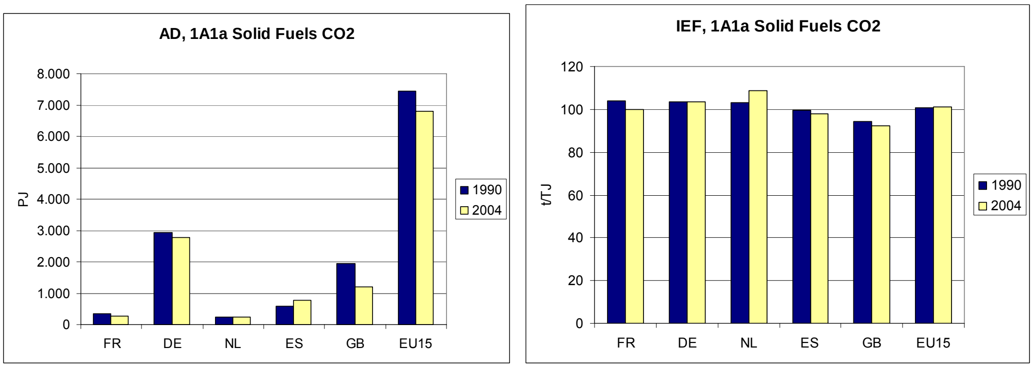
Table 3.8: Member States' contributions to CO_2 emissions from 1.A.1.a Electricity and heat production: solid fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	6.247	6.915	6.676	1,0%	-239	-3%	429	7%	T2	NS, PS	CS
Belgium	19.345	12.433	12.527	1,8%	94	1%	-6.818	-35%	CS	PS,RS	CS,PS
Denmark	22.462	21.851	16.384	2,4%	-5.467	-25%	-6.077	-27%	C	NS/PS	CS/C
Finland	9.426	17.397	15.061	2,2%	-2.335	-13%	5.636	60%	T3	PS	CS/D
France	36.565	29.672	26.689	3,9%	-2.982	-10%	-9.876	-27%	C	PS	CS
Germany	303.719	290.806	286.675	41,7%	-4.131	-1%	-17.045	-6%	CS	NS/AS	CS
Greece	35.257	42.914	44.486	6,5%	1.572	4%	9.229	26%	C	NS	D/CS[1]
Ireland	7.909	7.732	7.078	1,0%	-653	-8%	-831	-11%	T3	NS, PS	PS
Italy	28.148	34.707	41.348	6,0%	6.640	19%	13.200	47%	T3	NS, PS	CS
Luxembourg	1.234	0	0	0,0%	0	-	-1.234	-100%	C/D		C/D
Netherlands	25.776	27.586	27.004	3,9%	-582	-2%	1.228	5%	T2	NS/Q	CS
Portugal	7.659	11.648	11.961	1,7%	313	3%	4.302	56%	D	PS	D
Spain	57.787	71.666	75.245	10,9%	3.579	5%	17.457	30%	T2	PS	PS
Sweden	5.376	6.092	6.173	0,9%	81	1%	797	15%	T1,T2,T3	PS	CS
United Kingdom	183.150	114.290	110.022	16,0%	-4.268	-4%	-73.128	-40%	T2	NS/AS	CS
EU15	750.061	695.707	687.329	100,0%	-8.378	-1%	-62.732	-8%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.6 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – France, Germany, the Netherlands, Spain and the United Kingdom; together they cause 81 % (1990) resp. 76 % (2004) of the CO_2 emissions from solid fuels in 1A1a. Fuel combustion is highest in Germany; implied emission factors of the EU-15 Member States vary from 90.2 to 142.6 t/TJ in 2004.

Figure 3.6: Activity Data and Implied Emission Factors for CO_2 from Solid Fuels in 1A1a



N_2O emissions resulting from solid fuels within the category 1A1a were in 2004 responsible for 1 % of the total GHG emissions in 1A1a. Within the EU-15 the emissions increased between 1990 and 2004 by 1 % (Table 3.9) . Between 1990 and 2004, the largest relative increase reported Spain (152 %), in absolute terms Greece and Italy are leading. The largest relative reductions ocurred in the United Kingdom.

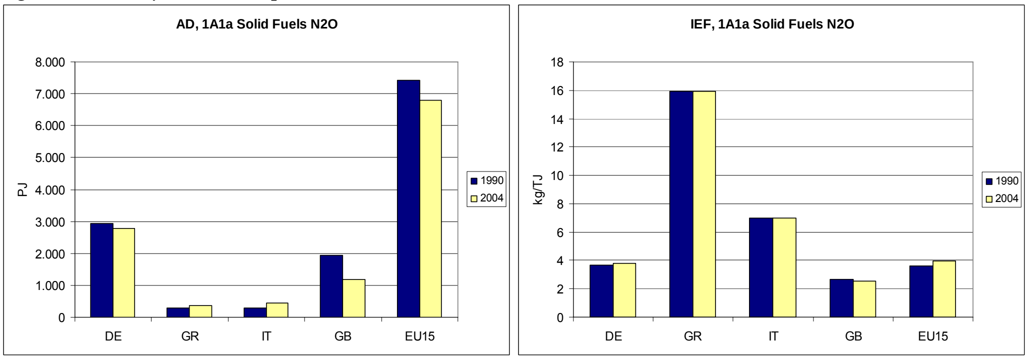
Table 3.9: Member States' contributions to N_2O emissions from 1.A.1.a Electricity and heat production: solid fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	23	27	28	0,3%	0	2%	5	21%	T2	NS, PS	CS
Belgium	66	28	26	0,3%	-2	-8%	-40	-61%	CS	PS,RS	CS
Denmark	63	57	43	0,5%	-14	-25%	-20	-32%	C	NS/PS	CS/C
Finland	44	80	71	0,8%	-8	-10%	27	62%	T3	PS	CS
France	321	371	355	4,2%	-16	-4%	34	10%	C	PS	CS
Germany	3.335	3.311	3.259	38,7%	-53	-2%	-76	-2%	T2	NS/AS	CS
Greece	1.426	1.750	1.801	21,4%	51	3%	375	26%	C	NS	C
Ireland	318	342	296	3,5%	-45	-13%	-21	-7%	T3	NS, PS	C
Italy	645	806	961	11,4%	155	19%	316	49%	T3	NS, PS	D
Luxembourg	0	0	0	0,0%	0	-	0	-	C/D		C/D
Netherlands	101	101	97	1,2%	-4	-4%	-3	-3%	T1	Q	D
Portugal	36	55	57	0,7%	1	3%	21	57%	T2	PS	D
Spain	146	383	366	4,4%	-17	-4%	221	152%	T2	PS	D, C, OTH
Sweden	233	145	129	1,5%	-15	-11%	-103	-44%	T1,T2,T3	PS	CS
United Kingdom	1.604	966	930	11,0%	-36	-4%	-675	-42%	T2	NS/AS	CS,D,C
EU15	8.359	8.420	8.418	100,0%	-2	0%	59	1%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.7 shows activity data and implied emission factors for N_2O for EU-15 and the Member States with the largest emissions – Germany, Greece, Italy and the United Kingdom; together they cause 84 % (1990) resp. 83 % (2004) of the N_2O emissions from solid fuels in 1A1a. Fuel combustion is highest in Germany; implied emission factors of EU-15 Member States vary from 0.8 to 16.0 kg/TJ in 2004.

Figure 3.7: Activity Data and Implied Emission Factors for N_2O from Solid Fuels in 1A1a



1A1a Electricity And Heat Production - Gaseous Fuels (CO_2)

CO_2 emissions resulting from gaseous fuels within the category 1A1a were in 2004 responsible for 21 % of the total GHG emissions in 1A1a. Within the EU-15 the emissions increased between 1990 and 2004 by 257 % (Table 3.10), all Member States show an overall increase in this period. The largest absolute increases between 1990 and 2004 reported the United Kingdom, Italy, the Netherlands and Spain; the same is true for changes between 2003 and 2004.

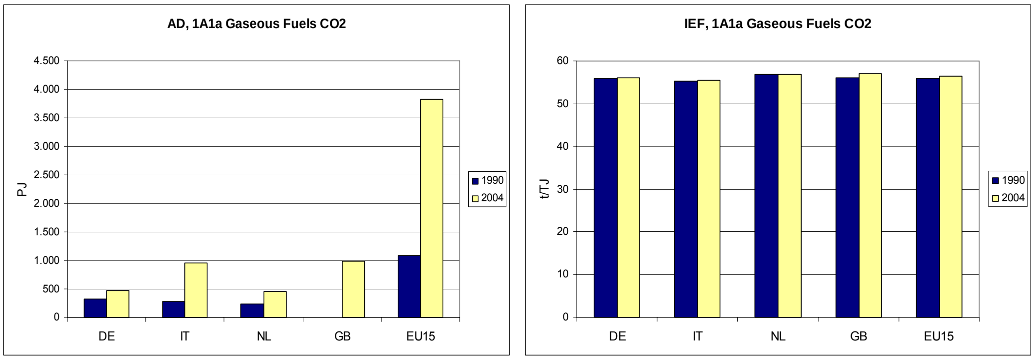
Table 3.10: Member States' contributions to CO_2 emissions from 1.A.1.a Electricity and heat production: gaseous fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	3.294	4.900	4.524	2,1%	-376	-8%	1.230	37%	T2	NS, PS	CS
Belgium	2.751	9.540	9.335	4,3%	-205	-2%	6.584	239%	CS	PS,RS	CS,PS
Denmark	1.000	4.709	4.645	2,2%	-64	-1%	3.645	365%	C	NS/PS	CS/C
Finland	2.021	5.637	5.278	2,4%	-359	-6%	3.257	161%	T3	PS	CS
France	984	3.091	4.785	2,2%	1.693	55%	3.801	386%	C	PS	CS
Germany	18.462	26.118	26.118	12,1%	0	0%	7.656	41%	CS	NS/AS	CS
Greece	NO	3.417	3.707	1,7%	290	8%	3707	-	C	NS	D
Ireland	1.881	5.384	5.119	2,4%	-266	-5%	3.238	172%	T3	NS, PS	PS
Italy	15.787	46.867	53.443	24,8%	6.576	14%	37.656	239%	T3	NS, PS	CS
Luxembourg	25	258	371	0,2%	113	44%	346	1406%	C/D		C/D
Netherlands	13.348	23.502	25.488	11,8%	1.986	8%	12.140	91%	T2	NS/Q	CS
Portugal	0	2.674	3.776	1,7%	1.102	41%	3.776	-	D	PS	D
Spain	427	7.860	12.239	5,7%	4.379	56%	11.812	2765%	T2	PS	PS, CS
Sweden	485	779	651	0,3%	-128	-16%	166	34%	T1,T2,T3	PS	CS
United Kingdom	16	52.821	56.318	26,1%	3.497	7%	56.302	353142%	T2	NS	CS
EU15	60.480	197.560	215.797	100,0%	18.238	9%	155.318	257%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.8 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – Germany, Italy, the Netherlands and the United Kingdom; together they cause 79 % (1990) resp. 75 % (2004) of the CO_2 emissions from gaseous fuels in 1A1a. Fuel combustion in 1990 is in general much lower than in 2004. The implied emission factors of EU-15 Member States vary from 54.8 to 58.2 t/TJ in 2004.

Figure 3.8: Activity Data and Implied Emission Factors for CO_2 from Gaseous Fuels in 1A1a



1A1a Electricity And Heat Production - Other Fuels (CO_2)

CO_2 emissions resulting from other fuels within the category 1A1a were in 2004 responsible for 3 % of the total emissions in 1A1a. Within the EU-15 the emissions increased between 1990 and 2004 by 107 % (Table 3.11); all Member States show an overall increase in this period. Finland, France and Germany are the largest emitters in 1990 as well as in 2004. The United Kingdom, Austria, Spain and the Netherlands had the highest relative increase between 1990 and 2004.

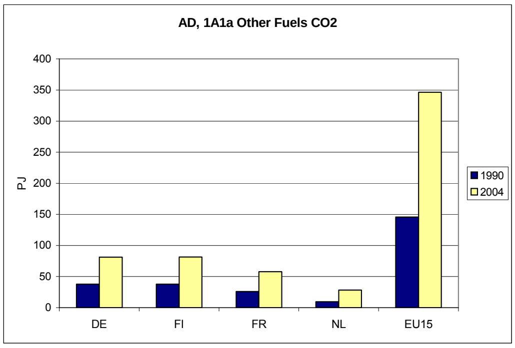
Table 3.11: Member States' contributions to CO_2 emissions from 1.A.1.a Electricity and heat production: other fuels

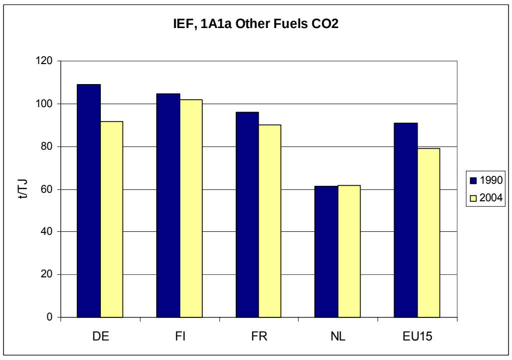
Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	118	489	537	2,0%	48	10%	419	355%	T2	NS, PS	CS,D
Belgium	665	989	915	3,3%	-74	-8%	250	38%	CS	PS,RS	CS,PS
Denmark	328	593	598	2,2%	5	1%	270	83%	C	NS/PS	CS/C
Finland	3.952	8.952	8.287	30,3%	-665	-7%	4.336	110%	T3	PS	CS
France	2.483	4.878	5.214	19,1%	335	7%	2.731	110%	C	PS	CS
Germany	4.121	7.087	7.449	27,2%	362	5%	3.328	81%	CS	NS/AS	CS
Greece	NO	NO	NO	-	-	-	-	-	NO[2]	NO	NO
Ireland	NO	NO	NO	-	-	-	-	-	NO	NO	NO
Italy	153	169	162	0,6%	-7	-4%	8	5%	T3	NS, PS	CS
Luxembourg	0	0	0	0,0%	0	-	0	-	C/D		C/D
Netherlands	592	1.750	1.750	6,4%	0	0%	1.157	195%	T2	NS/Q	CS
Portugal	0	0	0	0,0%	0	-	0	-	D	PS	D
Spain	120	561	643	2,4%	82	15%	523	435%	T2	PS	PS, CS, C
Sweden	553	815	965	3,5%	150	18%	412	75%	T1,T2,T3	PS	CS
United Kingdom	134	924	840	3,1%	-84	-9%	706	526%	T2	NS	CS
EU15	13.218	27.207	27.359	100,0%	152	1%	14.141	107%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.9 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – Germany, Finland, France and the Netherlands; together they cause 84 % (1990) resp. 83 % (2004) of the CO_2 emissions from other fuels in 1A1a. In 1990 fuel combustion of EU-15 is significantly lower than in 2004. Emission factors of EU-15 Member States range between 30.5 and 108.8 t/TJ in 2004.

Figure 3.9: Activity Data and Implied Emission Factors for CO_2 from Other Fuels in 1A1a





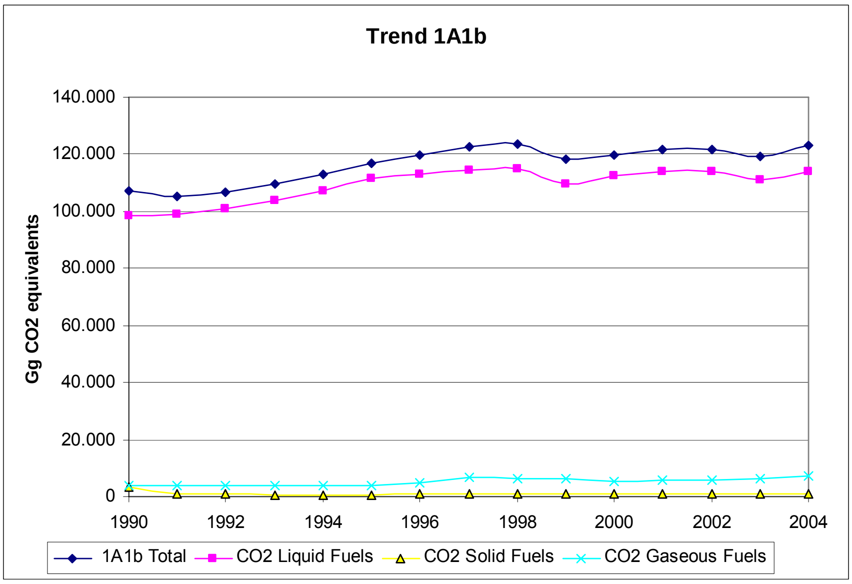
3.2.1.2. Petroleum Refining (1A1b)

In this chapter information about emission trends, Member States contribution, activity data and emission factors is provided for category 1.A.1.b on a fuel base.

CO_2 emissions from 1.A.1.b: 'Petroleum-refining' is the sixth largest key source in the EU-15 accounting for 2.9 % of total GHG emissions in 2004. Between 1990 and 2004, CO_2 emissions from this source increased by 15 % in the EU-15 (Table 3.12).

Figure 3.10 shows the emission trend within the category 1.A.1.b, which is mainly dominated by CO_2 emissions from liquid fuels (93 % in 2004). Total emissions increased by 15 %, mainly due to increases in emissions from liquid fuels (+16 %). Decreasing emissions were reported from solid fuels (-75 %).

Figure 3.10: Total and CO_2 emission trends for Category 1A1b



Between 1990 and 2004, all Member States show an increase except the United Kingdom and Germany with a small relative decrease (Table 3.12). Italy (20.9 %), Germany (16 %), France

(11.5 %) and Spain (11.0 %) are the largest emitters in this category. Italy had the largest increases in absolute terms, followed by Spain.

Table 3.12 Member States' contributions to CO_2 emissions from 1.A.1.b: 'Petroleum-refining'

Member State	Greenhouse gas emissions (Gg CO_2			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	2.467	2.530	2.572	2,1%	42	2%	105	4%
Belgium	4.299	5.156	5.111	4,2%	-45	-1%	812	19%
Denmark	897	1.013	988	0,8%	-24	-2%	91	10%
Finland	2.255	2.803	2.793	2,3%	-10	0%	537	24%
France	13.239	13.559	14.086	11,5%	528	4%	847	6%
Germany	19.774	19.373	19.491	16,0%	117	1%	-283	-1%
Greece	2.465	3.305	3.452	2,8%	147	4%	987	40%
Ireland	181	372	367	0,3%	-5	-1%	185	102%
Italy	16.337	23.124	25.499	20,9%	2.375	10%	9.162	56%
Luxembourg	0	0	0	0,0%	0	-	0	-
Netherlands	11.041	11.213	11.823	9,7%	610	5%	782	7%
Portugal	1.910	2.650	2.486	2,0%	-164	-6%	577	30%
Spain	10.906	12.709	13.398	11,0%	689	5%	2.492	23%
Sweden	1.997	2.481	2.567	2,1%	87	3%	570	29%
United Kingdom	18.275	18.033	17.560	14,4%	-473	-3%	-715	-4%
EU15	106.043	118.321	122.193	100,0%	3.872	3%	16.150	15%

Abbreviations explained in the Chapter 'Units and abbreviations'.

1A1b Petroleum Refining - Liquid Fuels (CO_2)

CO_2 emissions resulting from liquid fuels within the category 1A1b were in 2004 responsible for 93 % of the total GHG emissions in 1A1b . Within the EU-15 the emissions increased between 1990 and 2004 by 16 % (Table 3.13). The largest relative increase ocurred in Ireland, whereas in absolute terms Italy, Germany and Spain show a relevant increase between 1990 and 2004. Only the Nehterlands and the United Kingdom report a decrease.

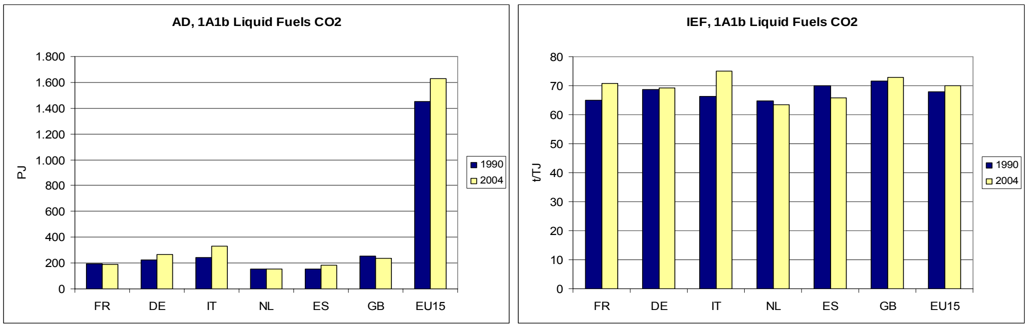
Table 3.13: Member States' contributions to CO_2 emissions from 1.A.1.b Petroleum Refining: liquid fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	1.960	2.051	2.165	1,9%	114	6%	204	10%	T2	NS	CS
Belgium	4.285	4.964	4.943	4,3%	-21	0%	658	15%	CS	RS	CS
Denmark	897	1.013	988	0,9%	-24	-2%	91	10%	C	NS/PS	CS/C
Finland	1.599	1.929	1.847	1,6%	-82	-4%	248	16%	T3	PS	CS
France	12.732	13.008	13.330	11,7%	323	2%	598	5%	C	PS	CS
Germany	15.315	18.160	18.344	16,1%	184	1%	3.030	20%	CS	NS/AS	CS
Greece	2.465	3.305	3.452	3,0%	147	4%	987	40%	C	NS	D
Ireland	181	372	367	0,3%	-5	-1%	185	102%	T3	NS, PS	PS
Italy	16.178	22.921	24.949	21,9%	2.029	9%	8.772	54%	T3	NS, PS	CS
Luxembourg	0	0	0	0,0%	0	-	0	-	C/D		C/D
Netherlands	9.999	9.070	9.556	8,4%	486	5%	-443	-4%	T2	NS/Q	CS
Portugal	1.910	2.650	2.475	2,2%	-175	-7%	566	30%	D	PS	D+CS
Spain	10.861	11.655	12.057	10,6%	401	3%	1.196	11%	T2	PS	PS, C
Sweden	1.997	2.431	2.486	2,2%	54	2%	489	24%	T1,T2,T3	PS	CS
United Kingdom	18.226	17.520	17.125	15,0%	-395	-2%	-1.101	-6%	T2	NS	CS
EU15	98.604	111.049	114.085	100,0%	3.036	3%	15.481	16%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.11 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – France, Germany, Italy, the Netherlands, Spain and the United Kingdom; together they cause 84 % (1990) resp. 84 % (2004) of the CO_2 emissions from liquid fuels in 1.A.1.b. In 2004 fuel combustion in the EU-15 is higher than 1990, which is also the case for the EU-15 implied emission factor. Emission factors of EU-15 Member States range between 58.7 and 73.5 t/TJ in 2004.

Figure 3.11: Activity Data and Implied Emission Factors for CO_2 from Liquid Fuels in 1A1b



1A1b Petroleum Refining - Solid Fuels (CO_2)

CO_2 emissions resulting from solid fuels within the category 1A1b were in 2004 responsible for 1 % of the total GHG emissions in 1A1b. Within the EU-15 the emissions decreased between 1990 and 2004 by 75 % (Table 3.14). Emissions are only reported by Finland, France and Germany. Germany had 1990 the highest emissions and reports a decrease of 87 %.

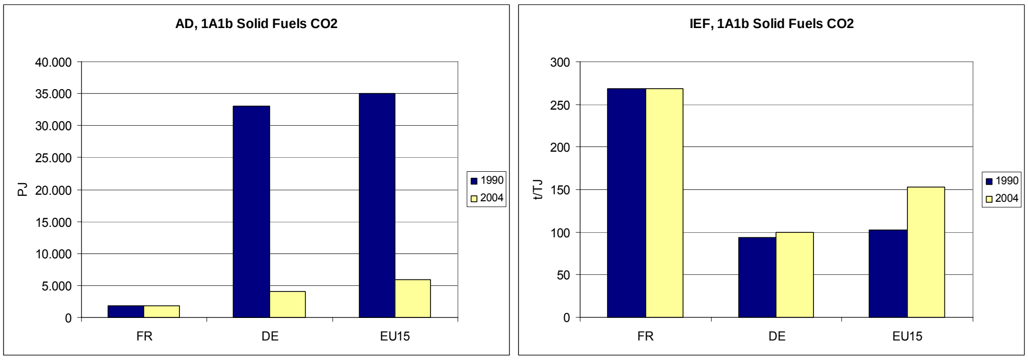
Table 3.14: Member States' contributions to CO_2 emissions from 1.A.1.b Petroleum Refining: solid fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	NO	NO	NO	-	-	-	-	-	T2	NS, PS	PS
Belgium	NO	NO	NO	-	-	-	-	-		PS	CS
Denmark	NO	NO	NO	-	-	-	-	-	C	NS, PS	CS, C
Finland	12	1	1	0,1%	0	-7%	-11	-90%	T3	PS	D, CS, PS
France	492	443	499	55,4%	56	13%	7	1%	C	PS	CS
Germany	3.082	488	400	44,4%	-88	-18%	-2.681	-87%	CS	NS	CS
Greece	NO	NO	NO	-	-	-	-	-	C	NS	C
Ireland	NO	NO	NO	-	-	-	-	-	T3	NS, PS	PS
Italy	NO	NO	NO	-	-	-	-	-	T3	NS, PS	CS
Luxembourg	0	0	0	0,0%	0	-	0	-	C/D		
Netherlands	NO	NO	NO	-	-	-	-	-	T2	NS, Q	PS, CS
Portugal	0	0	0	0,0%	0	-	0	-	D	PS	D, CS
Spain	NA	NA	NA	-	-	-	-	-	T2	Q	D, C, PS
Sweden	NA	NA	NA	-	-	-	-	-	T1,T2,T3	PS	CS, D
United Kingdom	NO	NO	NO	-	-	-	-	-	T2	NS	CS
EU15	3.586	932	900	100,0%	-32	-3%	-2.686	-75%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.12 shows activity data and implied emission factors for CO_2 comparing the EU-15 average and the Member States with the largest emissions – France and Germany; together they cause almost 100 % (1990 and 2004) of the CO_2 emissions from solid fuels in 1A1b. Fuel combustion in the EU-15 was in 1990 much higher than in 2004. Emission factors of EU-15 Member States range between 93.3 and 268 t/TJ in 2004.

Figure 3.12: Activity Data and Implied Emission Factors for CO_2 from Solid Fuels in 1A1b



1A1b Petroleum Refining - Gaseous Fuels (CO_2)

CO_2 emissions resulting from gaseous fuels within the category 1A1b were in 2004 responsible for 6 % of the total GHG emissions in 1A1b . Within the EU-15 the emissions increased between 1990 and 2004 by 96 % (Table 3.15). The Netherlands, Spain and Ireland reported the highest emissions, relative increases of more than 100 % between 1990 and 2004 ocurred in Spain, France and Belgium.

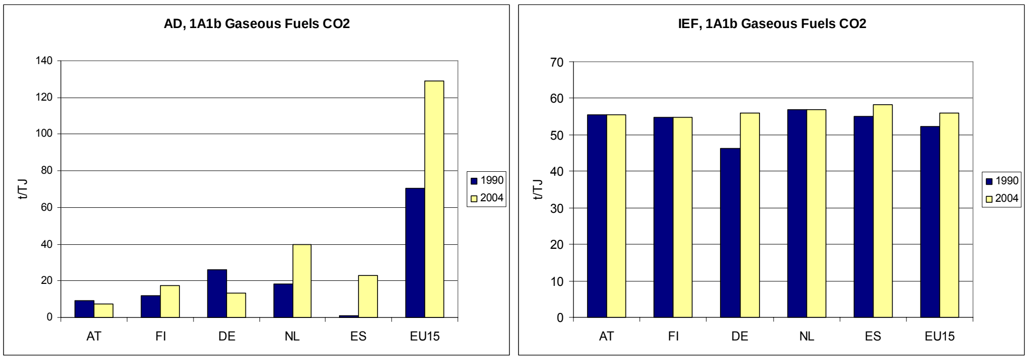
Table 3.15: Member States' contributions to CO_2 emissions from 1.A.1.b Petroleum Refining: gaseous fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	506	479	407	5,6%	-72	-15%	-99	-20%	C	NS, PS	PS
Belgium	14	192	168	2,3%	-24	-12%	154	1114%	CS	PS	CS
Denmark	NO	NO	NO	-	-	-	-	-	C	NS, PS	CS, C
Finland	644	873	944	13,1%	72	8%	300	47%	T2(CS)	PS	D, CS, PS
France	14	108	257	3,6%	149	137%	243	1709%	C	PS	CS
Germany	1.203	725	746	10,4%	21	3%	-457	-38%	CS	NS	CS
Greece	NO	NO	NO	-	-	-	-	-	C	NS	C
Ireland	NO	NO	NO	-	-	-	-	-	T3	NS, PS	PS
Italy	159	204	550	7,6%	346	170%	391	245%	T3	NS, PS	CS
Luxembourg	0	0	0	0,0%	0	-	0	-			
Netherlands	1.042	2.144	2.267	31,5%	123	6%	1.225	118%	CS	NS, Q	PS, CS
Portugal	0	0	11	0,2%	11	-	11	-	D	PS	D, CS
Spain	45	1.053	1.341	18,6%	288	27%	1.296	2875%	D, C, CS	Q	D, C, PS
Sweden	NA	49	81	1,1%	32	65%	81	-	T2, T3	PS	CS, D
United Kingdom	49	514	435	6,0%	-79	-15%	386	780%	T2	NS	CS
EU15	3.678	6.340	7.208	100,0%	868	14%	3.529	96%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.13 shows activity data and implied emission factors for CO_2 comparing the EU-15 average and the Member States with the largest emissions – Austria, Finland, Germany, the Netherlands and Spain; together they cause almost 94 % (1990) resp. 79 % (2004) of the CO_2 emissions from gaseous fuels in 1A1b. Fuel combustion in the EU-15 doubled between 1990 and 2004. Emission factors of EU-15 Member States range between 46.3 and 58.2 t/TJ in 2004.

Figure 3.13: Activity Data and Implied Emission Factors for CO_2 from Gaseous Fuels in 1A1b



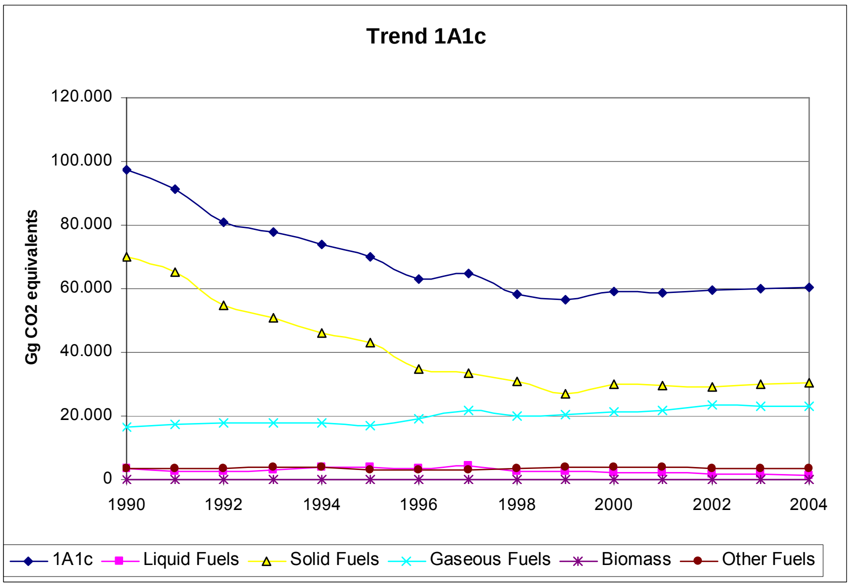
3.2.1.3. Manufacture of Solid Fuels and Other Energy Industries (1A1c)

In this chapter information about emission trends, Member States contribution, activity data and emission factors is provided for category 1A1c on a fuel base.

CO_2 emissions from 1.A.1.c: 'Manufacture of solid fuels and other energy industries' account for 1.4 % of total EU-15 GHG emissions in 2004. Between 1990 and 2004, CO_2 emissions from this source decreased by 38 % in the EU-15 (Table 3.15).

Figure 3.14 shows the emission trend within the category 1.A.1.c, which is from 1990 to 1998 mainly dominated by CO_2 emissions from solid fuels. After 1998 solid fuel emissions are stable whereas gaseous fuel emissions are rising. The declining emissions trend is mainly due to decreased emissions from solid fuels (-57 %), but partly counterbalanced by an increase in emissions from gaseous fuels (+41 %).

Figure 3.14: Total and CO_2 emission trends for Category 1A1c



Between 1990 and 2004, Germany had large emission decreases in absolute and relative terms, whereas absolute emissions increased considerably in the United Kingdom (Table 3.16). Denmark and Ireland reported a rise in emissions of more than 100 %. Although emissions from this source decreased between 1990 and 2004, only four Member States reported a decrease in emissions from 2003 to 2004.

Table 3.16: Member States' contributions to CO_2 emissions from 1.A.1.c: 'Manufacture of solid fuels and other energy industries'

Member State	Greenhouse gas emissions (Gg CO_2			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	308	214	164	0,3%	-49	-23%	-144	-47%
Belgium	2.144	418	425	0,7%	7	2%	-1.719	-80%
Denmark	540	1.520	1.567	2,6%	47	3%	1.028	190%
Finland	347	391	418	0,7%	26	7%	71	20%
France	4.973	3.950	3.995	6,7%	45	1%	-978	-20%
Germany	59.411	19.041	19.524	32,6%	483	3%	-39.886	-67%
Greece	102	90	109	0,2%	19	21%	7	7%
Ireland	41	119	116	0,2%	-3	-3%	74	179%
Italy	10.620	10.635	10.502	17,5%	-133	-1%	-118	-1%
Luxembourg	0	0	0	0,0%	0	-	0	-
Netherlands	1.420	1.907	1.978	3,3%	71	4%	558	39%
Portugal	75	0	0	0,0%	0	-	-75	-100%
Spain	2.110	1.963	1.753	2,9%	-210	-11%	-356	-17%
Sweden	361	335	361	0,6%	26	8%	-1	0%
United Kingdom	13.545	18.910	18.934	31,6%	24	0%	5.389	40%
EU15	95.997	59.493	59.846	100,0%	354	1%	-36.151	-38%

1A1c Manufacture of Solid Fuels and Other Energy Industries – Gaseous Fuels (CO_2)

In 2004 CO_2 from gaseous fuels had a share of 38 % within source category 1A1c (compared to 17 % in 1990). Belgium, Finland, France, Ireland, Luxembourg, Portugal and Sweden report emissions in 2004 as 'Not occuring', Not applicable' or '0'. (Table 3.17). Emission trends are dominated by the United Kingdom.

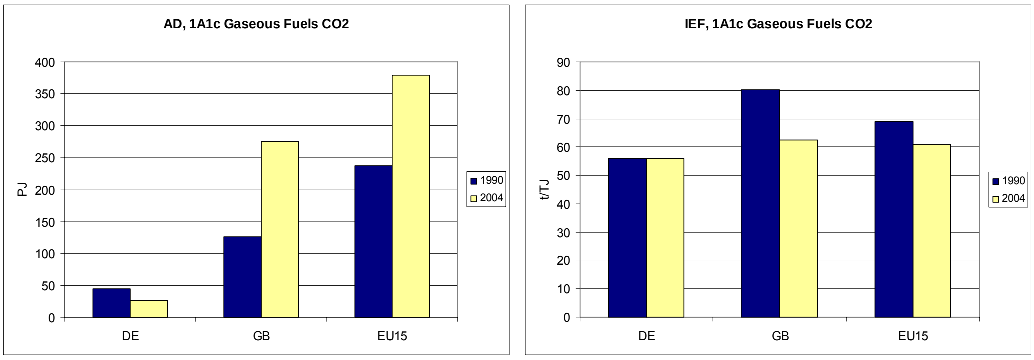
Table 3.17 Member States' contributions to CO_2 emissions from 1.A.1.c Manufacture of solid fuels and other energy industries : gaseous fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	304	207	164	0,7%	-43	-21%	-140	-46%	T2	NS	CS
Belgium	3	0	0	0,0%	0	-100%	-3	-100%	CS	PS,RS	CS
Denmark	540	1.520	1.567	6,8%	47	3%	1.028	190%	C	NS	CS/C
Finland	NO	NO	NO	-	-	-	-	-	T3	PS	CS
France	586	NO	NO	-	-	-	-586	-	C	AS/PS	CS
Germany	2.501	1.487	1.487	6,4%	0	0%	-1.014	-41%	CS	NS/AS	CS
Greece	102	90	109	0,5%	19	21%	7	7%	C	NS	CS[3]
Ireland	NO	NO	NO	-	-	-	-	-	NO	NO	NO
Italy	615	465	369	1,6%	-96	-21%	-247	-40%	T2	NS	CS
Luxembourg	0	0	0	0,0%	0	-	0	-	C/D		C/D
Netherlands	1.418	1.906	1.978	8,6%	71	4%	559	39%	T2	NS/Q	CS
Portugal	0	0	0	0,0%	0	-	0	-	D	NS	CS
Spain	205	213	196	0,8%	-17	-8%	-9	-5%	T2	PS, NS	CS
Sweden	NA	NA	NA	-	-	-	-	-	NA	NA	NA
United Kingdom	10.124	17.078	17.231	74,6%	153	1%	7.107	70%	T2	NS	CS
EU15	16.398	22.966	23.101	100,0%	135	1%	6.703	41%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.15 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – Germany and the United Kingdom; together they cause almost 77 % (1990) resp. 81 % (2004) of the CO_2 emissions from gaseous fuels in 1A1c. Fuel combustion in the EU-15 increased by 60 % between 1990 and 2004. Emission factors of EU-15 Member States range between 55.4 and 62.5 t/TJ in 2004.

Figure 3.15: Activity Data and Implied Emission Factors for CO_2 from Gaseous Fuels in 1A1c



1A1c Manufacture of Solid Fuels and Other Energy Industries – Solid Fuels (CO_2)

In 2004 CO_2 from solid fuels had a share of 72 % within source category 1A1c (compared to 50 % in 1990). Austria, Denmark, Greece, Luxembourg and the Netherlands and Portugal report emissions as 'Not occuring' or '0' (Table 3.18). Emission trends are dominated by Germany and Italy; between 1990 and 2004 Germany's emission were decreasing by 68 %; Italy had an 11 % increase.

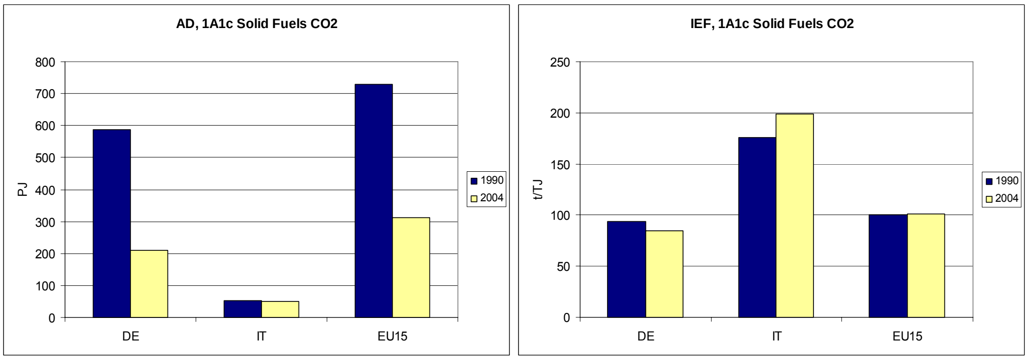
Table 3.18 Member States' contributions to CO_2 emissions from 1.A.1.c Manufacture of solid fuels and other energy industries: solid fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	NO	NO	NO	-	-	-	-	-	-	-	-
Belgium	2.137	418	425	1,3%	7	2%	-1.713	-80%	CS	PS,RS	CS
Denmark	NO	NO	NO	-	-	-	-	-	-	NO	-
Finland	347	391	418	1,3%	26	7%	71	20%	T3	PS	CS
France	1.315	315	315	1,0%	0	0%	-1.000	-76%	C	AS/PS	CS
Germany	55.344	17.338	17.825	56,5%	487	3%	-37.519	-68%	CS	NS/AS	CS
Greece	NO	NO	NO	-	-	-	-	-	C	NO	NO
Ireland	41	119	116	0,4%	-3	-3%	74	179%	T1	NS, PS	C
Italy	9.062	10.075	10.053	31,9%	-22	0%	991	11%	T2	NS	CS
Luxembourg	0	0	0	0,0%	0	-	0	-	C/D		C/D
Netherlands	IE	NO	NO	-	-	-	-	-	NA	NS/Q	NA
Portugal	25	0	0	0,0%	0	-	-25	-100%	D	PS	D
Spain	1.847	1.079	1.105	3,5%	26	2%	-742	-40%	T2	PS, NS, AS, Q	PS, CS
Sweden	360	334	360	1,1%	26	8%	-1	0%	T1,T2,T3,NA	PS/NA	CS, NA
United Kingdom	2.326	1.068	939	3,0%	-129	-12%	-1.387	-60%	T2	NS	CS
EU15	72.805	31.136	31.554	100,0%	417	1%	-41.251	-57%			

Emissions of the Netherlands are included in 1.A.2.A
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.16 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – Germany and Italy; together they cause almost 88 % (1990) resp. 88 % (2004) of the CO_2 emissions from solid fuels in 1A1c. Four Member States reported no activity. EU-15 fuel combustion decreased between 1990 and 2004 by more than 50 %. Emission factors of EU-15 Member States range between 40.8 and 199 t/TJ in 2004.

Figure 3.16 Activity Data and Implied Emission Factors for CO_2 from Solid Fuels in 1A1c



3.2.2. Manufacturing industries and construction (CRF Source Category 1.A.2)

Figure 3.17 shows the emission trends within source category 1.A.2, which is mainly dominated by CO_2 from 1A2f (Other) and 1A2a (Iron and steel). CO_2 emissions from 1A2f (Other) are in 2004 responsible for 55 % of total GHG emissions in source category 1A2. Several Member States still have difficulties to allocate emissions to all sub-categories under 1A2, which is a main reason for 1A2f being the largest sub-category in this source category.

Figure 3.17: Total and CO_2 emission trends for Category 1A2

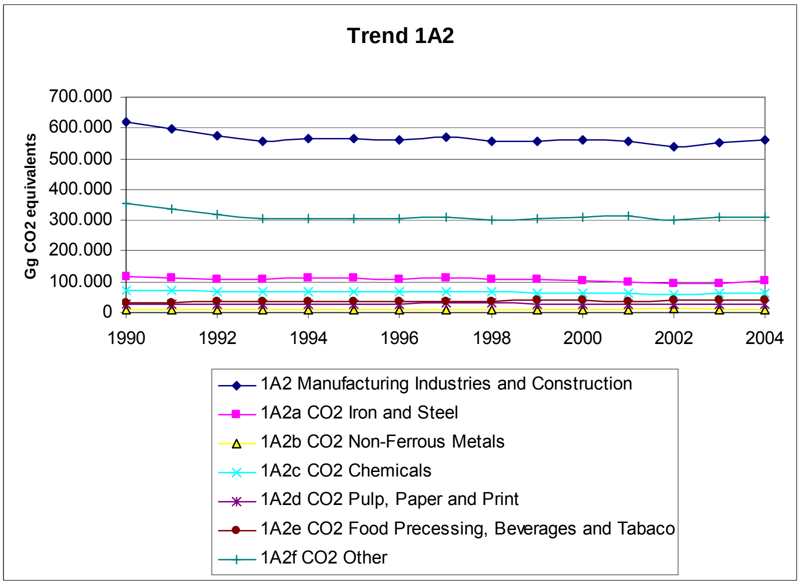


Table 3.19 summarises information by Member State on emission trends, methodologies and emission factors for the CO_2 from 1.A.2: 'Manufacturing industries and construction'.

Table 3.19 Member States' contributions to CO_2 emissions from 1.A.2: 'Manufacturing industries and construction' and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1]	EF [1]
Austria	13.453	15.328	T2	CS
Belgium	32.852	29.354	C	C, CS
Denmark	5.423	5.841	CR	CS
Finland	13.037	11.191	M,T3	CS,PS
France	83.482	79.033	C	CS
Germany	153.104	99.480	D,CS	D,CS
Greece	10.457	9.406	CR,NA	D,NA
Ireland	4.112	4.710	T1	CR
Italy	88.937	85.351	T2	CS
Luxembourg	5.149	2.505	C/D	C/D
Netherlands	33.002	27.288	T2	CS
Portugal	9.158	10.668	T2	D+C
Spain	46.266	72.498	T3,NA,T2	CS,PS,CR,CS,NA
Sweden	11.045	11.400	T2, T3,NA,T1	CS,NA
United Kingdom	99.023	87.857	T2	CS
EU15	608.501	551.910	C,CS,D,T1,T2,T3, M,CR,NA	C,CS,D,PS,NA,CR

([1]) Information source: CRF Summary Table 3 for 2004.
Abbreviations explained in the Chapter 'Units and abbreviations'.

CO_2 emissions from 1.A.2: 'Manufacturing industries and construction' is the third largest key source in the EU-15 accounting for 13.1 % of total GHG emissions in 2004. Between 1990 and 2004, CO_2 emissions from manufacturing industries declined by 9 % in the EU-15. The emissions from this key source are due to fossil fuel consumption in manufacturing industries and construction, which decreased by 2 % between 1990 and 2004. Also in industry a shift from solid fuels to gas took place.

Between 1990 and 2004, Germany shows by far the largest emission reductions in absolute terms. Also United Kingdom, the Netherlands, France, Belgium, and Luxembourg show emission reductions of more than two million tonnes, whereas large emission increases occurred mainly in Spain. The main reason for the large decline in Germany was the restructuring of the industry and efficiency improvements after German reunification.

Table 3.20 provides information on the contribution of Member States to EU-15 recalculations in CO_2 from 1.A.2 'Manufacturing industries' for 1990 and 2003 and main explanations for the largest recalculations in absolute terms.

Table 3.20 Contribution of MS to EU-15 recalculations in CO_2 from 1.A.2 'Manufacturing industries' for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

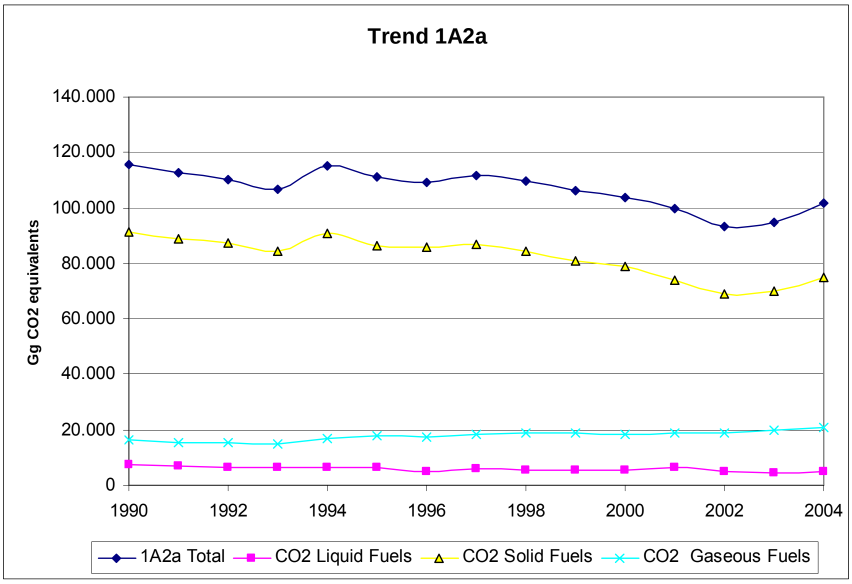
	1990		2003		Main explanations
	Gg	Percent	Gg	Percent	
Austria	482	3.7	395	2.8	
Belgium	-30	-0.1	-86	-0.3	
Denmark	47	0.9	294	5.4	
Finland	-1,888	-12.6	-2,169	-15.7	Revised and harmonised fuel classification Reallocation of process-related CO2-emissions 2C1 to 1A2a Updated emission factors Addition of previously missing fuels
France	226	0.3	423	0.5	
Germany	-43,211	-22.0	-32,940	-25.5	Reallocation of process related CO2 emissions to 2.C.1 (a) New calculation of fuel consumptions of the Neue Bundesländer (b,e,f) Disaggregation (a-f) Reassignment of some fuels (a)
Greece	-34	-0.3	103	1.0	
Ireland	279	7.3	0	0.0	
Italy	3,968	4.7	971	1.1	Revised method for emissions from iron and steel
Luxembourg	-109	-2.1	0	0.0	
Netherlands	234	0.7	158	0.6	
Portugal	55	0.6	14	0.1	
Spain	504	1.1	-75	-0.1	
Sweden	321	3.0	246	2.2	
UK	1,731	1.8	-1,569	-1.8	Reallocation of gas oil consumption from stationary industrial plants to off-road vehicles and mobile machinery Replacement of fuel usage estimates from cement kilns based on DUKES with actual fuel usage data supplied by kiln operators Activity data revisions (1A2a)
EU15	**-37,423**	**-5.8**	**-34,235**	**-5.9**	

3.2.2.1. Iron and Steel (1A2a)

In this chapter information about emission trends, Member States contribution, activity data and emission factors is provided for category 1.A.2.a on a fuel base. CO_2 emissions from 1.A.2.a: 'Iron and Steel' account for 2.4 % of total GHG emissions in 2004.

Figure 3.18 shows the emission trend within the category 1.A.2.a, which is mainly dominated by CO_2 emissions from solid fuels. Total emissions decreased by 12 %, mainly due to decreases in emissions from solid fuels -18 %). Increasing emissions were reported for gaseous fuels (+27 %).

Figure 3.18: Total, CO_2 and N_2O emission trends for Category 1A2a



Between 1990 and 2004, CO_2 emissions from 'Iron and Steel' decreased by 12 % in the EU-15 (Table 3.21), mainly due to decreases in the United Kingdom, Italy, Belgium and Luxembourg. Between 2003 and 2004 emissions increased by 7 % mainly caused by Germany and Spain.

Table 3.21 Member States' contributions to CO_2 emissions from 1.A.2.a: 'Iron and Steel'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	4,938	5,512	5,858	5.8%	346	6%	920	19%
Belgium	14,213	11,841	10,838	10.7%	-1,002	-8%	-3,375	-24%
Denmark	326	408	401	0.4%	-6	-1%	76	23%
Finland	2,537	3,554	3,524	3.5%	-31	-1%	986	39%
France	16,959	17,115	17,876	17.7%	760	4%	917	5%
Germany	12,590	6,910	11,209	11.1%	4,299	62%	-1,381	-11%
Greece	475	305	231	0.2%	-74	-24%	-244	-51%
Ireland	175	13	2	0.0%	-11	-82%	-173	-99%
Italy	20,729	17,076	16,856	16.7%	-220	-1%	-3,873	-19%
Luxembourg	3,235	254	252	0.2%	-2	-1%	-2,983	-92%
Netherlands	4,011	4,432	4,787	4.7%	355	8%	777	19%
Portugal	623	168	162	0.2%	-6	-3%	-461	-74%
Spain	8,726	6,697	8,682	8.6%	1,985	30%	-45	-1%
Sweden	1,176	1,270	1,277	1.3%	7	1%	101	9%
United Kingdom	24,101	18,489	19,027	18.8%	538	3%	-5,074	-21%
EU15	114,815	94,044	100,983	100.0%	6,939	7%	-13,832	-12%

1A2a Iron and Steel - Liquid Fuels (CO_2)

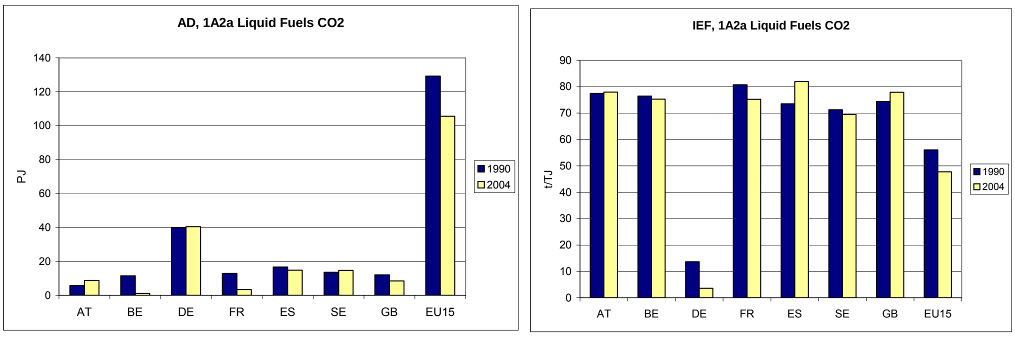
In 2004 CO_2 from liquid fuels had a share of 5 % within this category and 6 % in 1990. Between 1990 and 2004 emissions decreased by 30 % (Table 3.22). Significant absolute decreases could be achieved in Belgium, France, Germany, Greece and the United Kingdom. Italy and Austria reported increases in this period.

Table 3.22: Member States' contributions to CO_2 emissions from 1.A.2.a 'Iron and Steel': Liquid Fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	444	556	688	13,6%	131	24%	244	55%
Belgium	879	84	89	1,8%	5	6%	-790	-90%
Denmark	125	46	47	0,9%	1	2%	-78	-63%
Finland	309	334	363	7,2%	28	8%	54	17%
France	1.038	332	253	5,0%	-79	-24%	-784	-76%
Germany	545	101	146	2,9%	45	45%	-399	-73%
Greece	475	167	77	1,5%	-90	-54%	-398	-84%
Ireland	16	13	NO	-	-	-	-	-
Italy	153	332	378	7,5%	46	14%	224	146%
Luxembourg	0	0	0	0,0%	0	-	0	-
Netherlands	21	11	12	0,2%	1	9%	-9	-44%
Portugal	154	93	94	1,9%	1	1%	-60	-39%
Spain	1.231	601	1.211	24,0%	610	102%	-20	-2%
Sweden	969	1.048	1.024	20,3%	-24	-2%	55	6%
United Kingdom	894	580	667	13,2%	87	15%	-228	-25%
EU15	7.253	4.297	5.047	100,0%	750	17%	-2.206	-30%

Figure 3.19 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – Austria, Belgium, France, Germany, Spain Sweden and the United Kingdom; together they cause 83 % (1990) resp. 93 % (2004) of the CO_2 emissions from liquid fuels in 1A2a. Fuel combustion in the EU-15 decreased by 18 % between 1990 and 2004. Implied emission factors of EU-15 Member States range between 3.6 and 80.8 t/TJ in 2004.

Figure 3.19 Activity Data and Implied Emission Factors for CO_2 from Liquid Fuels in 1A2a



1A2a Iron and Steel - Solid Fuels (CO_2)

In 2004 CO_2 from solid fuels had a share of 74 % within this category and 79 % in 1990. Between 1990 and 2004 the emissions decreased by 18 % (Table 3.23). Between 1990 and 2004 major decreases show the United Kingdom, Spain, Luxembourg, Denmark and Italy. Between 2003 and 2004, Germany reported a substantial increase of 124 %.

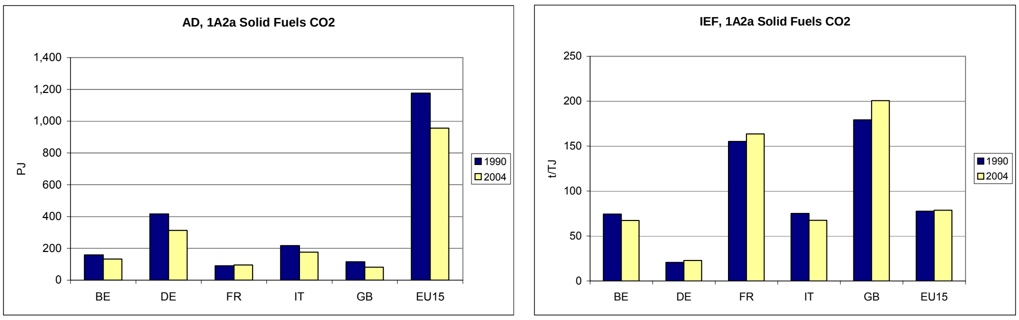
Table 3.23 Member States' contributions to CO_2 emissions from 1.A.2.a 'Iron and Steel': Solid Fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	3.844	3.938	4.058	5,4%	120	3%	213	6%
Belgium	11.849	9.970	8.947	11,9%	-1.023	-10%	-2.902	-24%
Denmark	17	3	3	0,0%	0	16%	-14	-83%
Finland	2.136	3.083	3.021	4,0%	-62	-2%	885	41%
France	14.004	14.567	15.697	20,9%	1.130	8%	1.693	12%
Germany	8.545	3.173	7.124	9,5%	3.951	124%	-1.420	-17%
Greece	NO	NO	NO	-	-	-	-	-
Ireland	115	NO	NO	-	-	-	-	-
Italy	16.300	12.212	11.918	15,9%	-294	-2%	-4.382	-27%
Luxembourg	2.957	2	2	0,0%	0	0%	-2.955	-100%
Netherlands	3.323	3.671	4.097	5,5%	426	12%	774	23%
Portugal	466	0	0	0,0%	0	-	-466	-100%
Spain	6.771	3.401	3.716	4,9%	315	9%	-3.055	-45%
Sweden	182	161	185	0,2%	24	15%	3	2%
United Kingdom	20.744	15.872	16.360	21,8%	488	3%	-4.384	-21%
EU15	91.253	70.052	75.127	100,0%	5.075	7%	-16.126	-18%

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.20 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – Belgium, France, Germany, Italy and the United Kingdom; together they cause 78 % (1990) resp. 80 % (2004) of the CO_2 emissions from solid fuels in 1A2a. Fuel combustion in the EU-15 decreased by 19 % between 1990 and 2004. Implied emission factors of EU-15 Member States range between 4.6 and 200.6 t/TJ in 2004.

Figure 3.20 Activity Data and Implied Emission Factors for CO_2 from Solid Fuels in 1A2a



1A2a Iron and Steel - Gaseous Fuels (CO_2)

In 2004 CO_2 from gaseous fuels had a share of 20 % within source category 1A2a (compared to 14 % in 1990). Between 1990 and 2004 the emissions increased by 27 % (Table 3.24). Between 1990 and 2004 all Member States except Ireland, Luxembourg and the United Kingdom reported increases. The highest increase occurred in Spain (+419 %).

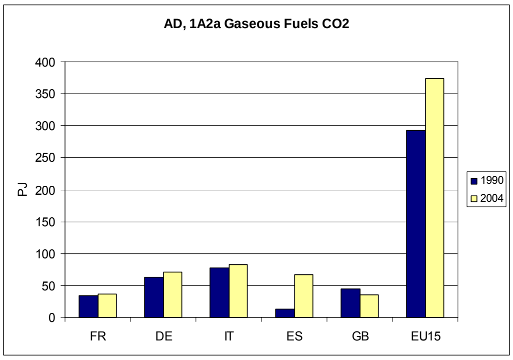
Table 3.24 Member States' contributions to CO_2 emissions from 1.A.2.a 'Iron and Steel': Gaseous Fuels

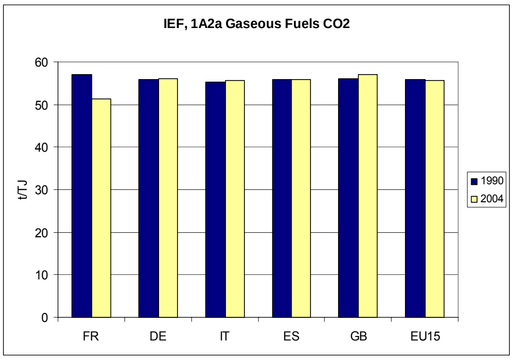
Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	650	1,018	1,113	5.4%	95	9%	463	71%
Belgium	1,485	1,787	1,803	8.7%	16	1%	317	21%
Denmark	184	359	352	1.7%	-7	-2%	168	92%
Finland	92	137	140	0.7%	3	2%	48	52%
France	1,917	2,160	1,857	9.0%	-303	-14%	-60	-3%
Germany	3,500	3,636	3,939	19.0%	303	8%	439	13%
Greece	NO	138	154	0.7%	15	11%	154	-
Ireland	44	NO	2	0.0%	2	-	-41	-95%
Italy	4,276	4,532	4,560	22.0%	28	1%	285	7%
Luxembourg	279	252	250	1.2%	-2	-1%	-28	-10%
Netherlands	667	750	679	3.3%	-71	-9%	12	2%
Portugal	0	75	68	0.3%	-7	-9%	68	-
Spain	724	2,695	3,754	18.1%	1,060	39%	3,030	419%
Sweden	25	61	68	0.3%	7	12%	43	170%
United Kingdom	2,463	2,037	2,000	9.6%	-37	-2%	-463	-19%
EU15	16,305	19,637	20,740	100.0%	1,102	6%	4,434	27%

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.21 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – France, Germany, Italy, Spain and the United Kingdom; together they cause 79 % (1990) resp. 78 % (2004) of the CO_2 emissions from solid fuels in 1A2a. Fuel combustion in the EU-15 rose by 28 % between 1990 and 2004. Implied emission factors of EU-15 Member States range between 54.9 and 61.6 t/TJ in 2004.

Figure 3.21 Activity Data and Implied Emission Factors for CO_2 from Gaseous Fuels in 1A2a



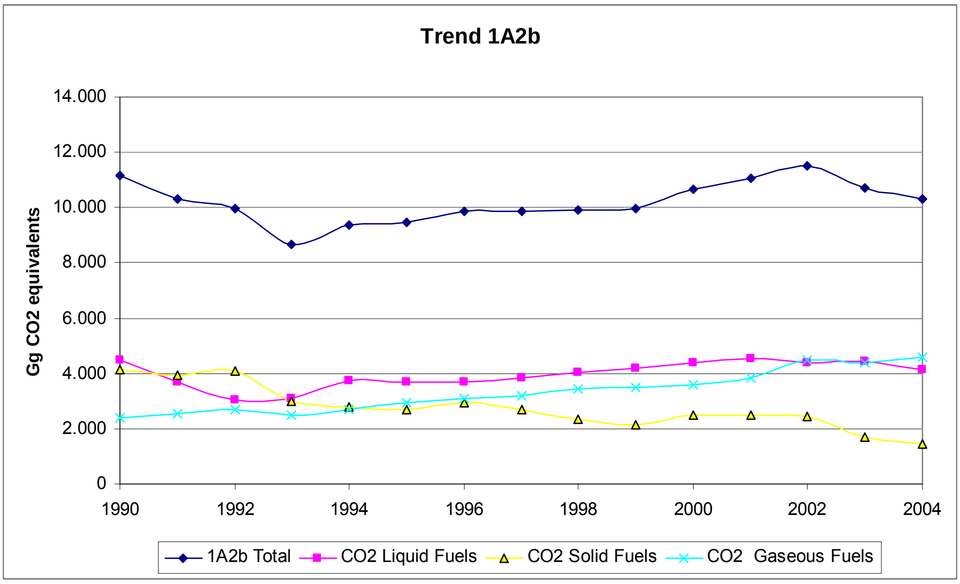


3.2.2.2. Non Ferrous Metals (1A2b)

In this chapter information about emission trends, Member States contribution, activity data and emission factors is provided for category 1A2b by fuels. CO_2 emissions from 1.A.2.b: 'Non-Ferrous Metals' account for 0.2 % of total GHG emissions in 2004.

Figure 3.22 shows the emission trend within the category 1.A.2.b, which is mainly dominated by CO_2 emissions from liquid, solid and gaseous fuels. Total GHG emissions decreased by 8 %, mainly due to decreases in emissions from solid fuels (-65 %). Increasing emissions were reported for gaseous fuels (+91 %).

Figure 3.22: Total and CO_2 emission trends for Category 1A2b



Between 1990 and 2004, CO_2 emissions from 'Non-Ferrous Metals' decreased by 8 % in the EU-15 (Table 3.25), mainly due to decreases in France; Spain reported a substantial increase in this period of 119 %.

Table 3.25: Member States' contributions to CO_2 emissions from 1.A.2.b: 'Non-Ferrous Metals'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	131	220	239	2.4%	19	9%	108	82%
Belgium	624	523	547	5.4%	24	5%	-77	-12%
Denmark	12	14	14	0.1%	0	-1%	2	19%
Finland	336	121	112	1.1%	-9	-7%	-224	-67%
France	4,010	2,147	1,956	19.3%	-191	-9%	-2,054	-51%
Germany	1,600	979	936	9.2%	-43	-4%	-664	-42%
Greece	1,261	1,770	1,668	16.4%	-102	-6%	407	32%
Ireland	809	1,050	721	7.1%	-329	-31%	-87	-11%
Italy	738	1,211	1,187	11.7%	-24	-2%	449	61%
Luxembourg	38	52	41	0.4%	-11	-22%	3	8%
Netherlands	216	199	234	2.3%	35	18%	18	8%
Portugal	0	0	0	0.0%	0	-	0	-
Spain	1,095	2,150	2,398	23.6%	248	12%	1,302	119%
Sweden	142	91	92	0.9%	0	0%	-51	-36%
United Kingdom	IE	IE	IE	-	-	-	-	-
EU15	11,011	10,527	10,145	100.0%	-382	-4%	-867	-8%

UK includes emissions under 1A2f.
Abbreviations explained in the Chapter 'Units and abbreviations'.

1A2b Non-Ferrous Metals - Solid Fuels (CO_2)

In 2004 CO_2 from solid fuels had a share of 14 % within source category 1A2b category (compared to 37 % in 1990). Between 1990 and 2004 the emissions decreased by 65 % (Table 3.26). Portugal and the United Kingdom report emissions as 'Included elsewhere', the Netherlands, Luxembourg and Denmark report emissions as 'Not occuring' or '0'. Substantial decreases between 1990 and 2004 were reported by France and Germany. The only Member State showing a slight increase in this period is Greece (+7 %).

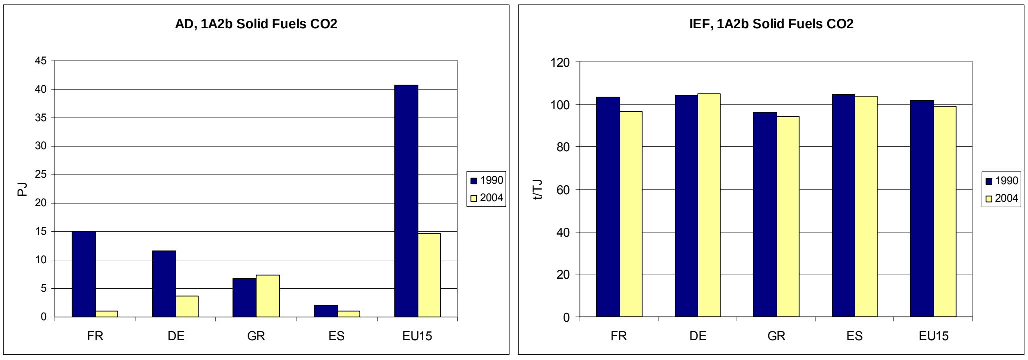
Table 3.26 Member States' contributions to CO_2 emissions from 1.A.2.b 'Non-Ferrous Metals': Solid Fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	22	16	21	1,4%	5	28%	-1	-5%
Belgium	146	80	80	5,5%	0	0%	-66	-45%
Denmark	NO	NO	NO	-	-	-	-	-
Finland	155	24	24	1,6%	0	1%	-131	-85%
France	1.548	186	95	6,5%	-91	-49%	-1.454	-94%
Germany	1.206	418	390	26,7%	-28	-7%	-816	-68%
Greece	653	766	698	47,9%	-68	-9%	45	7%
Ireland	4	NO	NO	-	-	-	-	-
Italy	163	31	28	1,9%	-3	-11%	-135	-83%
Luxembourg	0	0	0	0,0%	0	-	0	-
Netherlands	0	NO	NO	-	-	-	-	-
Portugal	IE	IE	IE	-	-	-	-	-
Spain	221	163	106	7,2%	-57	-35%	-115	-52%
Sweden	22	17	17	1,2%	0	1%	-5	-22%
United Kingdom	IE	IE	IE	-	-	-	-	-
EU15	4.141	1.700	1.458	100,0%	-242	-14%	-2.683	-65%

UK includes emissions under 1A2f.
Portugal includes emiassions under 1A2f because the separation of AD between ferrous and non-ferrous industry not available
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.21 shows activity data and implied emission factors for CO_2 comparing the EU-15 average and the Member States with the largest emissions – France, Germany, Greece and Spain; together they cause 88 % (both in 1990 and 2004) of the CO_2 emissions from solid fuels in 1A2b. Fuel combustion in the EU-15 decreased by 64 % between 1990 and 2004. Emission factors of EU-15 Member States range between 84.3 and 106.0 t/TJ in 2004.

Figure 3.23 Activity Data and Implied Emission Factors for CO_2 from Solid Fuels in 1A2b



1A2b Non-Ferrous Metals - Gaseous Fuels (CO_2)

In 2004 CO_2 from gaseous fuels had a share of 44 % within source category 1A2b (compared to 21 % in 1990). Between 1990 and 2004 the emissions increased by +91 % (Table 3.27). Between 1990 and 2004 all Member States except Ireland reported increases. The highest increase ocurred in Spain (+1428 %). Also between 2003 and 2004 emissions increased all Member States except Denmark, France and Germany.

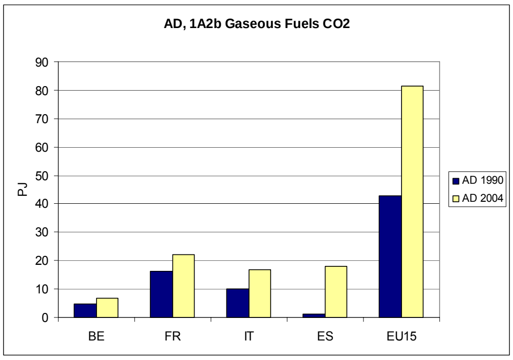
Table 3.27 Member States' contributions to CO_2 emissions from 1.A.2.b 'Non-Ferrous Metals': Gaseous Fuels

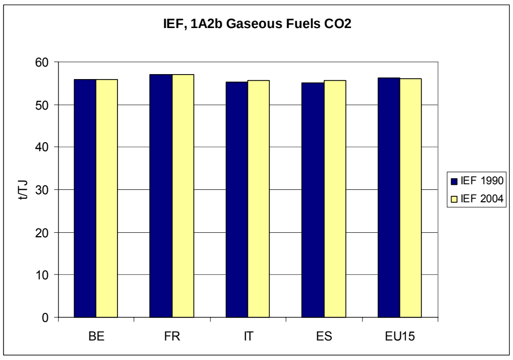
Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	75	162	184	4,0%	22	13%	109	145%
Belgium	260	343	375	8,2%	32	9%	116	45%
Denmark	7	11	11	0,2%	0	-2%	4	53%
Finland	NO	NO	NO	-	-	-	-	-
France	919	1.370	1.262	27,6%	-108	-8%	343	37%
Germany	253	426	411	9,0%	-16	-4%	157	62%
Greece	NO	127	129	2,8%	2	2%	-	-
Ireland	39	NO	11	0,3%	-	-	-28	-71%
Italy	558	922	932	20,4%	10	1%	374	67%
Luxembourg	0	0	0	0,0%	0	-	0	-
Netherlands	213	199	234	5,1%	35	18%	21	10%
Portugal	IE	IE	IE	-	-	-	-	-
Spain	66	805	1.004	22,0%	199	25%	938	1428%
Sweden	10	17	21	0,5%	4	26%	10	100%
United Kingdom	IE	IE	IE	-	-	-	-	-
EU15	2.400	4.381	4.573	100,0%	192	4%	2.173	91%

UK includes emissions under 1A2f.
Portugal includes emiassions under 1A2f because the separation of AD between ferrous and non-ferrous industry not available
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.24 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – Belgium, France, Italy and Spain; together they cause 75 % (1990) resp. 78 % (2004) of the CO_2 emissions from gaseous fuels in 1A2b. Fuel combustion in the EU-15 rose by 91 % between 1990 and 2004. Implied emission factors of EU-15 Member states range between 54.9 and 61.7 t/TJ in 2004.

Figure 3.24 Activity Data and Implied Emission Factors for CO_2 from Gaseous Fuels in 1A2b



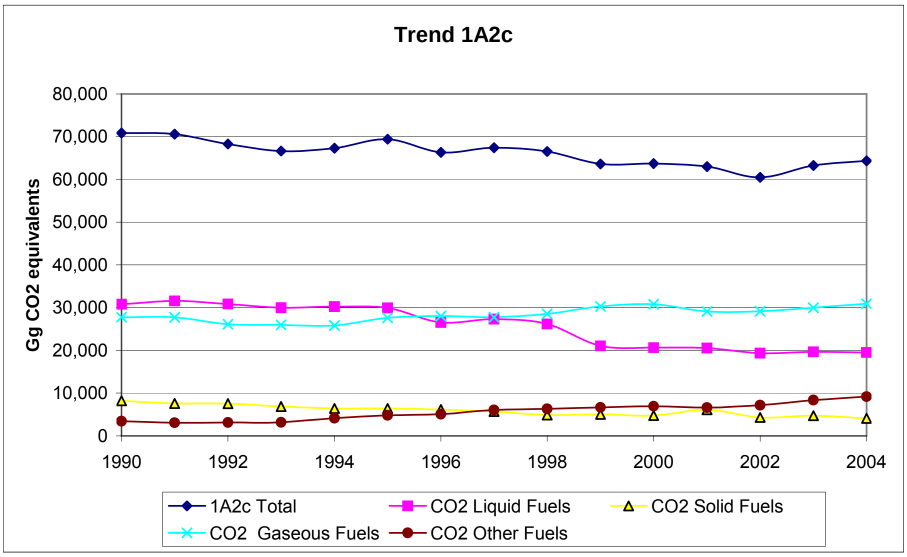


3.2.2.3. Chemicals (1A2c)

In this chapter information about emission trends, Member States contribution, activity data and emission factors is provided for category 1A2c on a fuel base. CO_2 emissions from 1.A.2.c: 'Chemicals' account for 1.5 % of total GHG emissions in 52004.

Figure 3.25 shows the emission trend within the category 1.A.2.c, which is mainly dominated by CO_2 emissions from liquid and gaseous fuels. Total emissions decreased by 9 %, mainly due to decreases in emissions from solid (-50 %) and liquid (-37 %) fuels. Increasing emissions were reported for gaseous fuels and other fuels.

Figure 3.25: Total and CO_2 emission trends for Category 1A2c



Between 1990 and 2004, CO_2 emissions from 'Chemicals' decreased by 9 % in the EU-15 (Table 3.28), mainly due to decreases in Italy and the Netherlands; Spain reported a substantial increase of 80 % in this period. Between 2003 and 2004 emissions in all Member States increased except France, Ireland and the Netherlands.

Table 3.28: Member States' contributions to CO_2 emissions from 1.A.2.c: 'Chemicals'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	955	1.409	1.595	2,5%	187	13%	640	67%
Belgium	6.311	7.715	7.847	12,3%	132	2%	1.536	24%
Denmark	379	458	461	0,7%	3	1%	82	22%
Finland	1.311	1.333	1.332	2,1%	-1	0%	22	2%
France	14.177	13.422	13.270	20,8%	-152	-1%	-907	-6%
Germany	IE	IE	IE	-	-	-	-	-
Greece	1.391	970	1.083	1,7%	112	12%	-308	-22%
Ireland	407	719	455	0,7%	-264	-37%	48	12%
Italy	20.052	12.481	12.475	19,6%	-5	0%	-7.576	-38%
Luxembourg	0	0	0	0,0%	0	-	0	-
Netherlands	17.133	11.993	11.734	18,4%	-259	-2%	-5.399	-32%
Portugal	1.479	1.715	1.931	3,0%	216	13%	452	31%
Spain	5.458	8.904	9.838	15,4%	933	10%	4.380	80%
Sweden	1.183	1.596	1.727	2,7%	131	8%	544	46%
United Kingdom	IE	IE	IE	-	-	-	-	-
EU15	70.234	62.714	63.748	100,0%	1.034	2%	-6.487	-9%

Emissions of Germany and the UK are inlcuded in 1.A.2.f.
Abbreviations explained in the Chapter 'Units and abbreviations'.

1A2c Chemicals - Liquid (CO_2)

In 2004 CO_2 from liquid fuels had a share of 30 % within source category 1A2c (compared to 43 % in 1990). Between 1990 and 2004 the emissions decreased by 37 % (Table 3.29). Seven of the EU-15 Member States reported decreasing CO_2 emissions from this source category; Italy shows the highest reduction. The Netherlands contributing most to EU-15 emissions in 2004 reports a small decrease between 1990 and 2004.

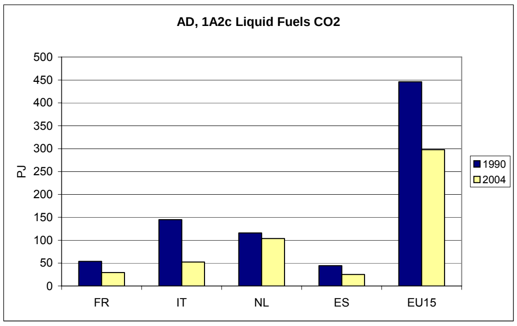
Table 3.29 Member States' contributions to CO_2 emissions from 1.A.2.c 'Chemicals': Liquid Fuels

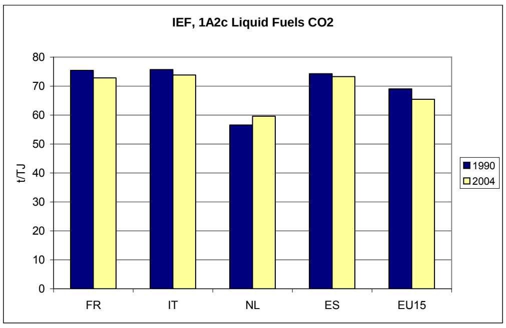
Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	77	71	39	0,2%	-32	-45%	-38	-49%
Belgium	1.835	830	835	4,3%	5	1%	-1.000	-54%
Denmark	237	98	100	0,5%	2	2%	-137	-58%
Finland	797	833	885	4,5%	52	6%	88	11%
France	4.063	2.849	2.164	11,1%	-686	-24%	-1.899	-47%
Germany	NO	NO	NO	-	-	-	-	-
Greece	584	727	810	4,2%	84	12%	227	39%
Ireland	133	407	204	1,0%	-203	-50%	71	54%
Italy	10.956	3.621	3.880	19,9%	259	7%	-7.076	-65%
Luxembourg	0	0	0	0,0%	0	-	0	-
Netherlands	6.570	6.246	6.172	31,7%	-74	-1%	-398	-6%
Portugal	1.372	1.245	1.393	7,1%	148	12%	22	2%
Spain	3.295	1.587	1.858	9,5%	271	17%	-1.437	-44%
Sweden	885	1.138	1.148	5,9%	10	1%	263	30%
United Kingdom	IE	IE	IE	-	-	-	-	-
EU15	30.803	19.653	19.491	100,0%	-162	-1%	-11.312	-37%

Emissions of the UK are included in 1A2f
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.26 shows activity data and implied emission factors for CO_2 comparing the EU-15 average and the Member States with the largest emissions – France, Italy, the Netherlands and Spain; together they cause 81 % (1990) resp. 72 % (2004) of the CO_2 emissions from liquid fuels in 1A2c. Fuel combustion in the EU-15 decreased by 33 % between 1990 and 2004. Implied emission factors of EU-15 Member States range between 52.1 and 78.0 t/TJ in 2004.

Figure 3.26: Activity Data and Implied Emission Factors for CO_2 from Liquid Fuels in 1A2c





1A2c Chemicals - Solid Fuels (CO_2)

In 2004 solid fuels had a share of 6 % within source category 1A2c (compared to 12 % in 1990). Between 1990 and 2004 the emissions decreased by -50 % (Table 3.30). Between 1990 and 2004 France and the Netherlands reported significant increases. Germany and the UK include emissions from this source category in source category 1A2f. Absolute changes in emissions between 2003 and 2004 were relatively small in all Member States except in France and Spain.

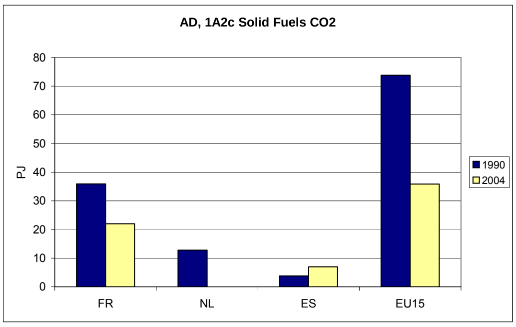
Table 3.30: Member States' contributions to CO_2 emissions from 1.A.2.c 'Chemicals': Solid Fuels

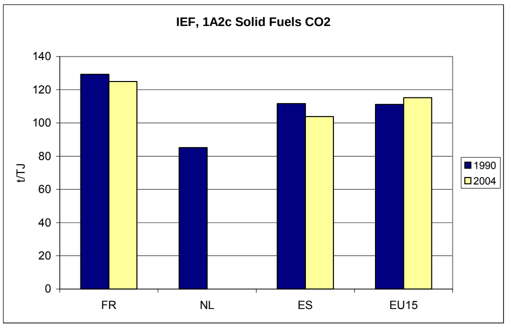
Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	111	251	263	6,4%	12	5%	151	136%
Belgium	397	3	9	0,2%	5	175%	-388	-98%
Denmark	7	45	52	1,3%	7	16%	45	608%
Finland	213	210	213	5,2%	3	1%	0	0%
France	4.643	2.965	2.750	66,6%	-215	-7%	-1.893	-41%
Germany	IE	IE	IE	-	-	-	-	-
Greece	648	NO	NO	-	-	-	-	-
Ireland	71	NO	NO	-	-	-		-
Italy	478	28	21	0,5%	-7	-23%	-456	-96%
Luxembourg	0	0	0	0,0%	0	-	0	-
Netherlands	1.087	NO	NO	-	-	-	-1.807	-
Portugal	44	58	63	1,5%	5	9%	18	42%
Spain	424	1.149	727	17,6%	-422	-37%	304	72%
Sweden	79	31	30	0,7%	0	0%	-49	-62%
United Kingdom	IE	IE	IE	-	-	-	-	-
EU15	8.204	4.740	4.129	100,0%	-611	-13%	-4.075	-50%

Emissions of Germany and the UK are inlcuded in 1.A.2.f.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.27 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – France, the Netherlands and Spain; together they cause 75 % (1990) resp. 84 % (2004) of the CO_2 emissions from solid fuels in 1A2c. Fuel combustion in the EU-15 decreased by 51 % between 1990 and 2004. Implied emission factors of EU-15 Member States range between 85.0 and 129.3 t/TJ in 2004.

Figure 3.27: Activity Data and Implied Emission Factors for CO_2 from Solid Fuels in 1A2c





1A2c Chemicals – Gaseous Fuels (CO_2)

In 2004 CO_2 from gaseous fuels had a share of 48 % within source category 1A2c (compared to 39 % in 1990). Between 1990 and 2004 the emissions increased by 11 % (Table 3.31). Between 1990 and 2004 all Member States except the Netherlands, Italy and Finland reported increases. The highest absolute increase ocurred in Spain. The United Kingdom include emissions from this source category in source category 1A2f.

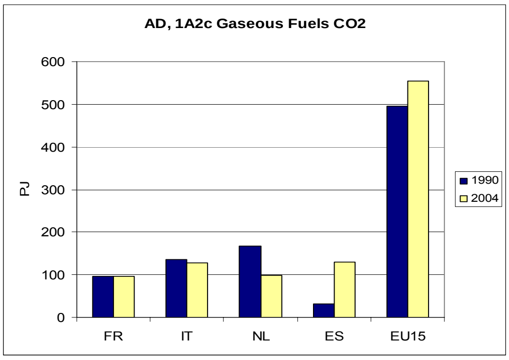
Table 3.31: Member States' contributions to CO_2 emissions from 1.A.2.c 'Chemicals': Gaseous Fuels

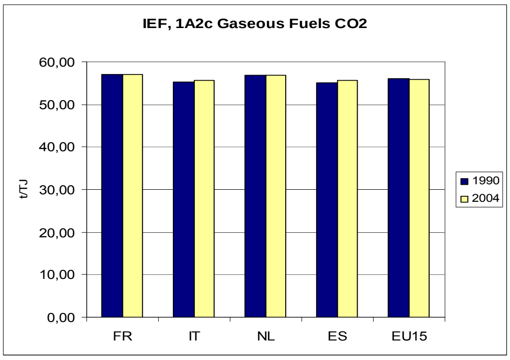
Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	530	821	941	3,0%	120	15%	411	78%
Belgium	2.246	3.000	3.019	9,8%	19	1%	773	34%
Denmark	134	314	308	1,0%	-6	-2%	173	129%
Finland	98	33	36	0,1%	3	8%	-62	-64%
France	5.471	5.461	5.531	17,9%	70	1%	60	1%
Germany	NO	NO	NO	-	-	-	-	-
Greece	159	244	272	0,9%	29	12%	113	71%
Ireland	202	311	250	0,8%	-61	-20%	48	24%
Italy	7.561	7.328	7.077	22,9%	-252	-3%	-485	-6%
Luxembourg	0	0	0	0,0%	0	-	0	-
Netherlands	9.476	5.747	5.562	18,0%	-185	-3%	-3.914	-41%
Portugal	0	354	388	1,3%	34	10%	388	-
Spain	1.739	6.168	7.252	23,4%	1.084	18%	5.514	317%
Sweden	154	190	298	1,0%	108	57%	144	93%
United Kingdom	IE	IE	IE	-	-	-	-	-
EU15	27.771	29.973	30.935	100,0%	962	3%	3.164	11%

Emissions of the UK are inlcuded in 1.A.2.f.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.28 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions –France, Italy, the Netherlands and Spain; together they cause 87 % (1990) resp. 82 % (2004) of the CO_2 emissions from gaseous fuels in 1A2c. Fuel combustion in the EU-15 rose by 12 % between 1990 and 2004. Implied emission factors of EU-15 Member States range between 39.4 and 57.0 t/TJ in 2004.

Figure 3.28: Activity Data and Implied Emission Factors for CO_2 from Gaseous Fuels in 1A2c





1A2c Chemicals - Other Fuels (CO_2)

In 2004 CO_2 from other fuels had a share of 14 % within source category 1A2c (compared to 5 % in 1990). Between 1990 and 2004 the emissions increased by 166 % (Table 3.32). Germany, Greece, Ireland, Denmark, Luxembourg, the Netherlands and Spain report emissions as 'Not occuring', 'Not applicable' or '0', the UK includes emissions in 1A2f. Major increases were reported by Belgium and France between 1990 and 2004.

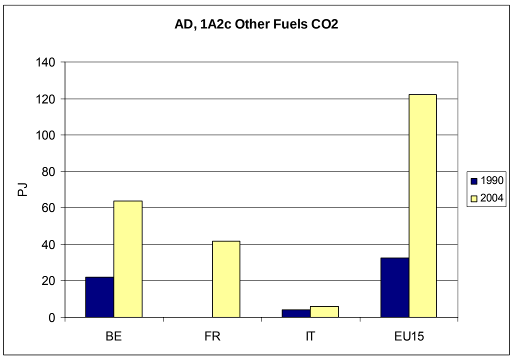
Table 3.32: Member States' contributions to CO_2 emissions from 1.A.2.c 'Chemicals': Other Fuels

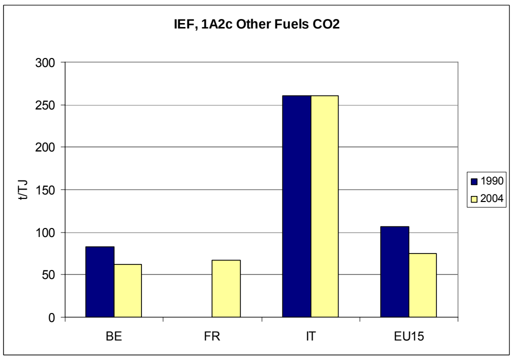
Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	236	265	352	3,8%	87	33%	116	49%
Belgium	1.834	3.882	3.985	43,3%	102	3%	2.151	117%
Denmark	NO	NO	NO	-	-	-	-	-
Finland	202	256	198	2,2%	-58	-23%	-4	-2%
France	NO	2.146	2.824	30,7%	679	32%	2.824	-
Germany	NO	NO	NO	-	-	-	-	-
Greece	NO	NO	NO	-	-	-	-	-
Ireland	NO	NO	NO	-	-	-	-	-
Italy	1.057	1.503	1.497	16,3%	-6	0%	440	42%
Luxembourg	0	0	0	0,0%	0	-	0	-
Netherlands	NO	NO	NO	-	-	-	-	-
Portugal	63	57	87	0,9%	29	51%	24	38%
Spain	NA	NA	NA	-	-	-	-	-
Sweden	64	237	250	2,7%	13	5%	186	289%
United Kingdom	IE	IE	IE	-	-	-	-	-
EU15	3.456	8.348	9.193	100,0%	845	10%	5.737	166%

Emissions of the UK are inlcuded in 1.A.2.f.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.29 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – Belgium, France and Italy; together they cause 84 % (1990) resp. 90 % (2004) of the CO_2 emissions from other fuels in 1A2c. Fuel combustion in the EU-15 rose by 275 % between 1990 and 2004. Implied emission factors of EU-15 Member states range between 60.0 and 260.4 t/TJ in 2004.

Figure 3.29: Activity Data and Implied Emission Factors for CO_2 from Other Fuels in 1A2c



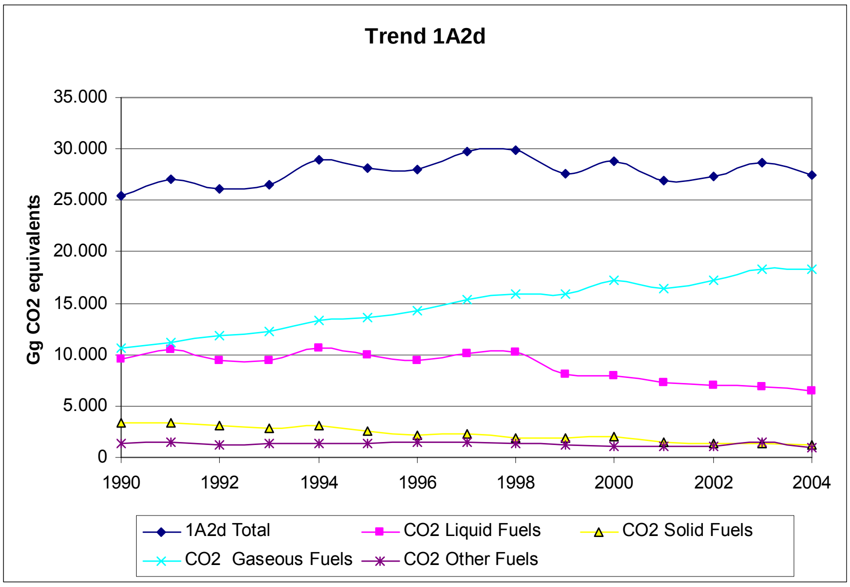


3.2.2.4. Pulp, Paper and Print (1A2d)

In this chapter information about emission trends, Member States contribution, activity data and emission factors is provided for category 1A2d by fuels. CO_2 emissions from 1.A.2.d: 'Pulp, Paper and Print' account for 0.6 % of total GHG emissions in 2004.

Figure 3.30 shows the emission trend within the category 1.A.2.d, which is mainly dominated by CO_2 emissions from gaseous and liquid fuels. Total GHG emissions increased by 8 %, mainly due to increases in emissions from gaseous fuels (+73 %), emissions by all other fuel types decreased.

Figure 3.30: Total and CO_2 emission trends for Category 1A2d



Between 1990 and 2004, CO_2 emissions from 'Pulp, Paper and Print' increased by 8 % in the EU-15 (Table 3.33), mainly due to increases in Italy and Spain; Finland reported a relevant decrease in this period. Between 2003 and 2004 emissions decreased by 4 %.

Table 3.33: Member States' contributions to CO_2 emissions from 1.A.2.d: 'Pulp, Paper and Print'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	2.237	1.800	1.844	6,9%	44	2%	-393	-18%
Belgium	637	660	624	2,3%	-37	-6%	-14	-2%
Denmark	366	224	220	0,8%	-4	-2%	-146	-40%
Finland	5.146	3.971	3.538	13,2%	-433	-11%	-1.609	-31%
France	5.206	5.389	5.217	19,4%	-171	-3%	11	0%
Germany	4	16	16	0,1%	0	0%	13	351%
Greece	301	365	253	0,9%	-112	-31%	-48	-16%
Ireland	28	29	95	0,4%	66	231%	67	236%
Italy	3.076	4.464	4.586	17,1%	122	3%	1.510	49%
Luxembourg	0	0	0	0,0%	0	-	0	-
Netherlands	1.743	1.461	1.463	5,4%	2	0%	-281	-16%
Portugal	743	966	910	3,4%	-56	-6%	166	22%
Spain	3.212	6.222	5.694	21,2%	-527	-8%	2.482	77%
Sweden	2.186	2.510	2.398	8,9%	-112	-4%	212	10%
United Kingdom	IE	IE	IE	-	-	-	-	-
EU15	24.888	28.076	26.859	100,0%	-1.217	-4%	1.971	8%

Emissions of the UK are inlcuded in 1.A.2.f.
Abbreviations explained in the Chapter 'Units and abbreviations'.

1A2d Pulp, Paper and Print - Liquid (CO_2)

In 2004 CO_2 from liquid fuels had a share of 23 % within source category 1A2d (compared to 38 % in 1990). Between 1990 and 2004 the emissions decreased by 33 % (Table 3.34). Between 1990 and 2004 all Member States except Sweden reported decreasing CO_2 emissions from this source category.

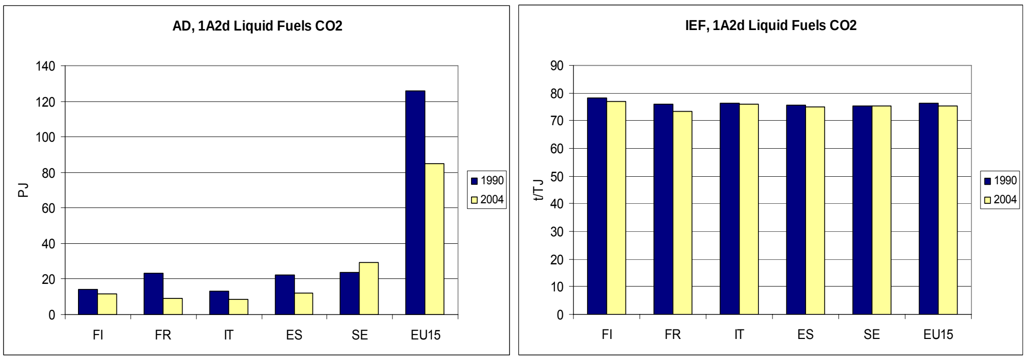
Table 3.34 Member States' contributions to CO_2 emissions from 1.A.2.d 'Pulp, Paper and Print': Liquid Fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	822	173	140	2,2%	-33	-19%	-681	-83%
Belgium	232	208	174	2,7%	-34	-16%	-58	-25%
Denmark	90	17	17	0,3%	0	2%	-73	-81%
Finland	1.111	856	889	13,8%	33	4%	-222	-20%
France	1.755	796	685	10,7%	-111	-14%	-1.070	-61%
Germany	NO	NO	NO	-	-	-	-	-
Greece	297	301	181	2,8%	-120	-40%	-116	-39%
Ireland	28	29	26	0,4%	-3	-9%	-2	-8%
Italy	1.015	561	639	10,0%	78	14%	-376	-37%
Luxembourg	0	0	0	0,0%	0	-	0	-
Netherlands	20	4	2	0,0%	-2	-45%	-18	-88%
Portugal	743	632	576	9,0%	-56	-9%	-167	-22%
Spain	1.693	982	898	14,0%	-83	-8%	-795	-47%
Sweden	1.786	2.312	2.189	34,1%	-123	-5%	402	23%
United Kingdom	IE	IE	IE	-	-	-	-	-
EU15	9.593	6.870	6.416	100,0%	-454	-7%	-3.176	-33%

Emissions of the UK are inlcuded in 1.A.2.f.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.31 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – Finland, France, Italy, Spain and Sweden; together they cause 77 % (1990) resp. 83 % (2004) of the CO_2 emissions from liquid fuels in 1A2d. Fuel combustion in the EU-15 decreased by 32 % between 1990 and 2004. Implied emission factors of EU-15 Member States range between 72.6 and 81.5 t/TJ in 2004.

Figure 3.31: Activity Data and Implied Emission Factors for CO_2 from Liquid Fuels in 1A2d



1A2d Pulp, Paper and Print - Solid (CO_2)

In 2004 CO_2 from solid fuels had a share of 4 % within source category 1A2d (compared to 13 % in 1990). Between 1990 and 2004 the emissions decreased by 64 % (Table 3.35). Only six of the EU-15 Member States reported CO_2 emissions from this source category. All reporting Member States show decreases.

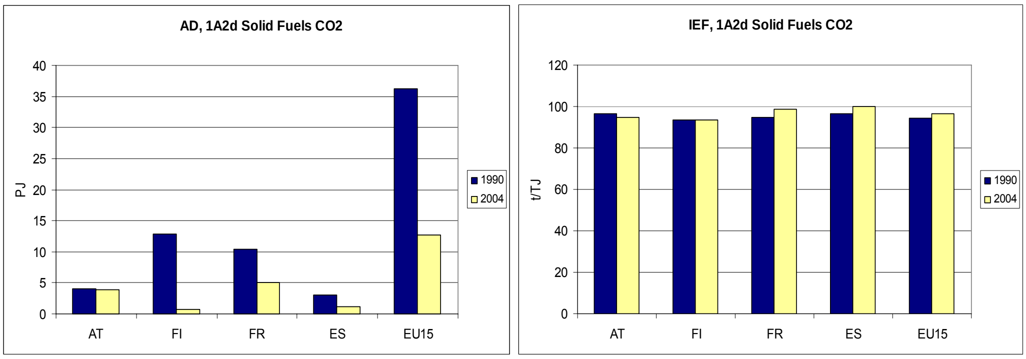
Table 3.35 Member States' contributions to CO_2 emissions from 1.A.2.d 'Pulp, Paper and Print': Solid Fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	393	367	367	29,8%	0	0%	-26	-7%
Belgium	125	129	121	9,8%	-8	-6%	-4	-3%
Denmark	143	NO	NO	-	-	-	-143	-
Finland	1.209	57	62	5,1%	5	9%	-1.147	-95%
France	990	590	499	40,5%	-91	-15%	-492	-50%
Germany	NO	NO	NO	-	-	-	-	-
Greece	NO	NO	NO	-	-	-	-	-
Ireland	NO	NO	NO	-	-	-	-	-
Italy	6	0	0	0,0%	0	-	-6	-100%
Luxembourg	0	0	0	0,0%	0	-	0	-
Netherlands	8	NO	NO	-	-	-	-8	-
Portugal	0	0	0	0,0%	0	-	0	-
Spain	286	155	115	9,3%	-40	-26%	-172	-60%
Sweden	263	58	67	5,4%	8	15%	-196	-75%
United Kingdom	IE	IE	IE	-	-	-	-	-
EU15	3.423	1.356	1.230	100,0%	-125	-9%	-2.193	-64%

Emissions of the UK are inlcuded in 1.A.2.f.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.32 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – Austria, Finland, France and Spain; together they cause 84 % (1990) resp. 85 % (2004) of the CO_2 emissions from solid fuels in 1A2d. Fuel combustion in the EU-15 decreased by 65 % between 1990 and 2004. Implied emission factors of EU-15 Member States range between 91.2 and 105.9 t/TJ in 2004.

Figure 3.32: Activity Data and Implied Emission Factors for CO_2 from Solid Fuels in 1A2d



1A2d Pulp, Paper and Print - Gaseous (CO_2)

In 2004 CO_2 from gaseous fuels had a share of 67 % within source category 1A2d (compared to 42 % in 1990). Between 1990 and 2004 the emissions increased by 73 % (Table 3.36). In all EU-15 Member States emissions increased between 1990 and 2004 except in the Netherlands. Germany reports emissions as 'Not occuring', the United Kingdom includes emissions in 1A2f.

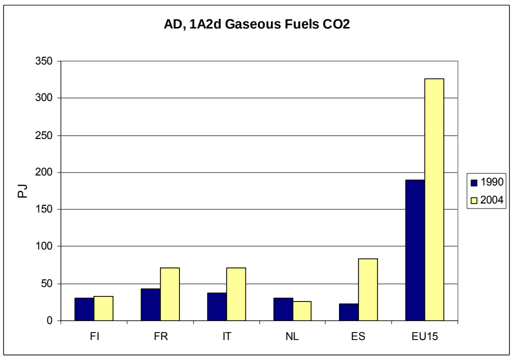
Table 3.36 Member States' contributions to CO_2 emissions from 1.A.2.d 'Pulp, Paper and Print': Gaseous Fuels

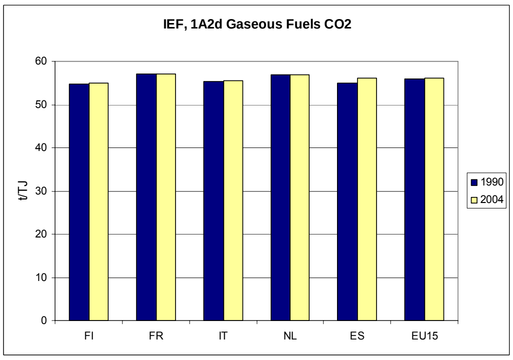
Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	954	1.244	1.312	7,2%	68	6%	359	38%
Belgium	280	324	329	1,8%	5	2%	48	17%
Denmark	133	207	203	1,1%	-4	-2%	70	53%
Finland	1.672	1.722	1.789	9,8%	67	4%	117	7%
France	2.461	3.870	4.032	22,0%	161	4%	1.571	64%
Germany	NO	NO	NO	-	-	-	-	-
Greece	5	65	73	0,4%	8	12%	68	1421%
Ireland	NO	NO	69	0,4%	-	-	69	-
Italy	2.055	3.903	3.947	21,5%	44	1%	1.892	92%
Luxembourg	0	0	0	0,0%	0	-	0	-
Netherlands	1.715	1.456	1.460	8,0%	4	0%	-255	-15%
Portugal	0	334	334	1,8%	0	0%	334	-
Spain	1.233	5.085	4.681	25,6%	-404	-8%	3.449	280%
Sweden	66	104	89	0,5%	-15	-14%	24	36%
United Kingdom	IE	IE	IE	-	-	-	-	-
EU15	10.574	18.314	18.317	100,0%	3	0%	7.744	73%

Emissions of the UK are inlcuded in 1.A.2.f.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.33 shows activity data and implied emission factors for CO_2 comparing the EU-15 average and the Member States with the largest emissions – Finland, France, Italy, the Netherlands and Spain; together they cause 86 % (1990) resp. 87 % (2004) of the CO_2 emissions from gaseous fuels in 1A2d. Fuel combustion in the EU-15 rose by 72 % between 1990 and 2004. Implied emission factors of EU-15 Member States range between 54.8 and 61.7 t/TJ in 2004.

Figure 3.33: Activity Data and Implied Emission Factors for CO_2 from Gaseous Fuels in 1A2d



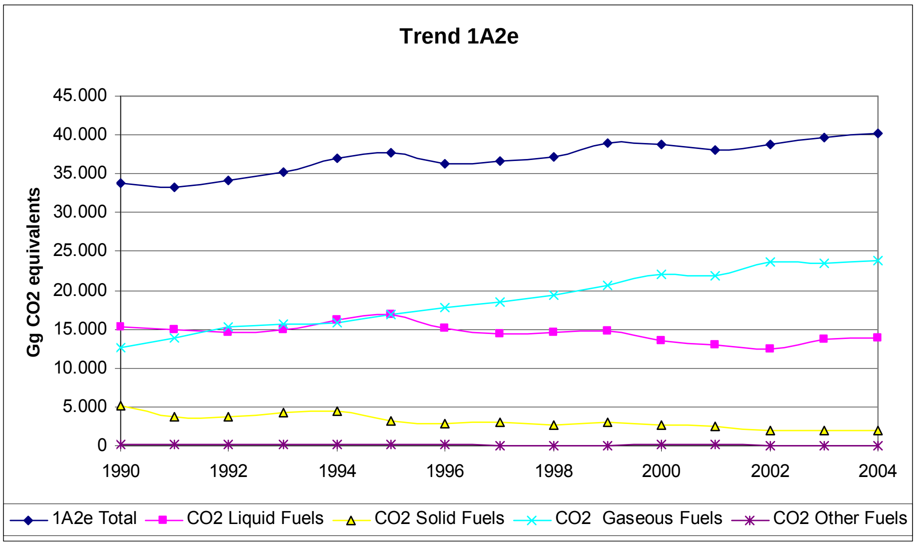


3.2.2.5. Food Processing, Beverages and Tobacco (1A2e)

In this chapter information about emission trends, Member States contribution, activity data and emission factors is provided for category 1A2e by fuels. CO_2 emissions from 1.A.2.e: 'Food Processing, Beverages and Tobacco' account for 0.9 % of total GHG emissions in 2004.

Figure 3.34 shows the emission trend within the category 1.A.2.e, which is mainly dominated by CO_2 emissions from gaseous and liquid fuels. Total GHG emissions increased by 19 %, mainly due to increases in emissions from gaseous fuels (+88 %), emissions from all other fuel types decreased.

Figure 3.34: Total and CO_2 emission trends for Category 1A2e



Between 1990 and 2004, CO_2 emissions from 'Food Processing, Beverages and Tobacco' increased by 19 % in the EU-15 (Table 3.37), mainly due to increases in Italy and Spain. Between 2003 and 2004 emissions rose by 1 % only.

Table 3.37: Member States' contributions to CO_2 emissions from 1.A.2.e: 'Food Processing, Beverages and Tobacco'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	851	1.109	1.179	3,0%	70	6%	328	39%
Belgium	2.998	2.300	2.431	6,1%	131	6%	-567	-19%
Denmark	1.679	1.575	1.606	4,1%	31	2%	-73	-4%
Finland	745	304	282	0,7%	-22	-7%	-463	-62%
France	10.156	11.911	11.863	29,9%	-48	0%	1.707	17%
Germany	1.990	1.275	1.032	2,6%	-242	-19%	-957	-48%
Greece	902	1.093	878	2,2%	-215	-20%	-25	-3%
Ireland	965	605	1.399	3,5%	794	131%	435	45%
Italy	3.853	6.798	6.858	17,3%	60	1%	3.005	78%
Luxembourg	0	0	0	0,0%	0	-	0	-
Netherlands	4.079	4.086	4.020	10,1%	-65	-2%	-59	-1%
Portugal	822	1.151	943	2,4%	-207	-18%	122	15%
Spain	3.376	6.138	6.385	16,1%	247	4%	3.009	89%
Sweden	949	844	771	1,9%	-73	-9%	-178	-19%
United Kingdom	IE	IE	IE	-	-	-	-	-
EU15	33.364	39.187	39.648	100,0%	461	1%	6.284	19%

Emissions of the UK are inlcuded in 1.A.2.f.
Abbreviations explained in the Chapter 'Units and abbreviations'.

1A2e Food Processing, Beverages and Tobacco - Liquid (CO_2)

In 2004 CO_2 from liquid fuels had a share of 34 % within source category 1A2e (compared to 45 % in 1990). Between 1990 and 2004 the emissions decreased by 10 % (Table 3.38). Between 1990 and 2004 Belgium and France show substantial emission reductions. Ireland and Italy are the only two Member States reporting emission increases.

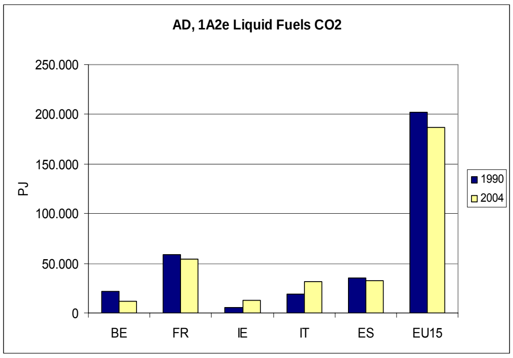
Table 3.38: Member States' contributions to CO_2 emissions from 1.A.2.e 'Food Processing, Beverages and Tobacco': Liquid Fuels

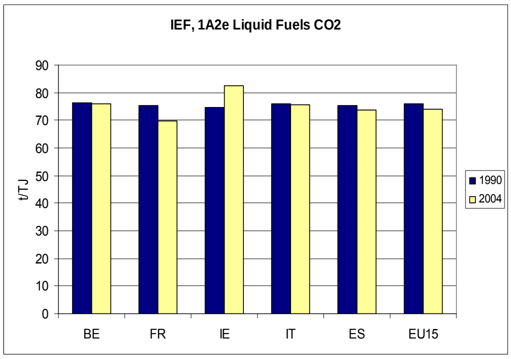
Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	326	186	128	0,9%	-58	-31%	-198	-61%
Belgium	1.671	855	874	6,3%	19	2%	-797	-48%
Denmark	739	489	499	3,6%	10	2%	-241	-33%
Finland	316	181	159	1,1%	-22	-12%	-156	-50%
France	4.428	3.751	3.790	27,3%	39	1%	-638	-14%
Germany	889	862	666	4,8%	-197	-23%	-223	-25%
Greece	847	906	670	4,8%	-236	-26%	-177	-21%
Ireland	434	294	1.037	7,5%	743	253%	602	139%
Italy	1.421	2.443	2.378	17,2%	-65	-3%	957	67%
Luxembourg	0	0	0	0,0%	0	-	0	-
Netherlands	235	31	26	0,2%	-5	-16%	-209	-89%
Portugal	820	893	695	5,0%	-198	-22%	-125	-15%
Spain	2.636	2.199	2.417	17,4%	219	10%	-219	-8%
Sweden	597	581	526	3,8%	-54	-9%	-71	-12%
United Kingdom	IE	IE	IE	-	-	-	-	-
EU15	15.359	13.671	13.866	100,0%	195	1%	-1.494	-10%

Emissions of the UK are inlcuded in 1.A.2.f.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.35 shows activity data and implied emission factors for CO_2 comparing the EU-15 average and the Member States with the largest emissions – Belgium, France, Ireland, Italy and Spain; together they cause 69 % (1990) resp. 76 % (2004) of the CO_2 emissions from liquid fuels in 1A2e. Fuel combustion in the EU-15 decreased by 7 % between 1990 and 2004. Implied emission factors of EU-15 Member States range between 73.0 and 82.6 t/TJ in 2004.

Figure 3.35: Activity Data and Implied Emission Factors for CO_2 from Liquid Fuels in 1A2e





1A2e Food Processing Beverages and Tobacco - Solid (CO_2)

In 2004 solid fuels had a share of 5 % within source category 1A2e (compared to 15 % in 1990). Between 1990 and 2004 the emissions decreased by 63 % (Table 3.39). Between 1990 and 2004 all Member States except Austria reported decreasing CO_2 emissions from this source category. Between 2003 and 2004 only four Member States (France, Germany the Netherlands and Sweden) show emission reductions.

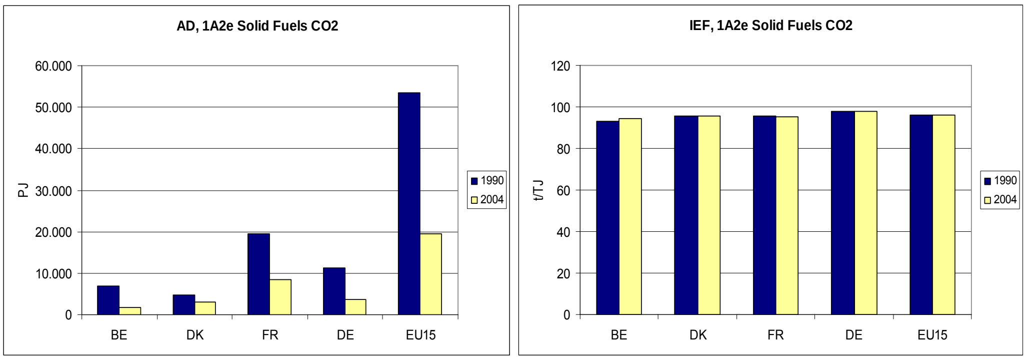
Table 3.39: Member States' contributions to CO_2 emissions from 1.A.2.e 'Food Processing, Beverages and Tobacco': Solid Fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	18	32	41	2,2%	9	28%	23	129%
Belgium	638	156	156	8,3%	0	0%	-482	-76%
Denmark	454	243	281	14,9%	38	16%	-174	-38%
Finland	221	39	42	2,2%	3	6%	-179	-81%
France	1.868	874	808	43,0%	-66	-7%	-1.059	-57%
Germany	1.101	412	367	19,5%	-46	-11%	-734	-67%
Greece	47	NO	NO	-	-	-	-47	-
Ireland	277	NO	21	1,1%	21	-	-256	-92%
Italy	86	0	0	0,0%	0	-	-86	-100%
Luxembourg	0	0	0	0,0%	0	-	0	-
Netherlands	227	77	49	2,6%	-27	-35%	-178	-78%
Portugal	1	0	0	0,0%	0	-	-1	-100%
Spain	109	67	105	5,6%	38	56%	-4	-4%
Sweden	90	12	11	0,6%	-1	-8%	-79	-87%
United Kingdom	IE	IE	IE	-	-	-	-	-
EU15	5.136	1.912	1.882	100,0%	-30	-2%	-3.254	-63%

Emissions of the UK are inlcuded in 1.A.2.f.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.36 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – Belgium, Denmark, France and Germany; together they cause 79 % (1990) resp. 86 % (2004) of the CO_2 emissions from solid fuels in 1A2e. Fuel combustion in the EU-15 decreased by 63 % between 1990 and 2004. Implied emission factors of EU-15 Member States range between 93.1 and 106.0 t/TJ in 2004.

Figure 3.36: Activity Data and Implied Emission Factors for CO_2 from Solid Fuels in 1A2e



1A2e Food Processing Beverages and Tobacco - Gaseous (CO_2)

In 2004 CO_2 from gaseous fuels had a share of 59 % within source category 1A2e (compared to 38 % in 1990). Between 1990 and 2004 the emissions decreased by 88 % (Table 3.40). Between 1990 and 2004 all Member States except Finland and Sweden reported increasing CO_2 emissions from this source category. Major increases ocurred in Spain, Italy and France.

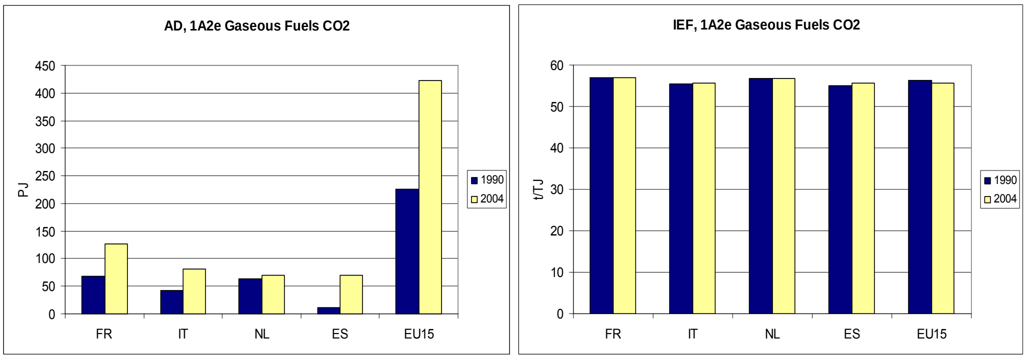
Table 3.40: Member States' contributions to CO_2 emissions from 1.A.2.e 'Food Processing, Beverages and Tobacco': Gaseous Fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	507	891	1.010	4,2%	119	13%	503	99%
Belgium	681	1.289	1.401	5,9%	112	9%	720	106%
Denmark	485	843	826	3,5%	-17	-2%	341	70%
Finland	63	25	29	0,1%	4	14%	-34	-54%
France	3.861	7.280	7.265	30,5%	-15	0%	3.404	88%
Germany	0	NE	NE	-	-	-	-	-
Greece	9	187	208	0,9%	21	11%	199	2216%
Ireland	253	311	341	1,4%	30	10%	88	35%
Italy	2.346	4.355	4.480	18,8%	125	3%	2.134	91%
Luxembourg	0	0	0	0,0%	0	-	0	-
Netherlands	3.617	3.978	3.945	16,5%	-33	-1%	328	9%
Portugal	0	257	248	1,0%	-9	-4%	248	-
Spain	631	3.873	3.863	16,2%	-9	0%	3.232	512%
Sweden	253	245	226	0,9%	-19	-8%	-28	-11%
United Kingdom	IE	IE	IE	-	-	-	-	-
EU15	12.707	23.534	23.841	100,0%	307	1%	11.134	88%

Emissions of the UK are inlcuded in 1.A.2.f.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.37 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – France, Italy, the Netherlands and Spain; together they cause 82 % (both in 1990 and 2004) of the CO_2 emissions from gaseous fuels in 1A2e. Fuel combustion in the EU-15 rose by 87 % between 1990 and 2004. Implied emission factors of EU-15 Member States range between 54.9 and 61.7 t/TJ in 2004.

Figure 3.37: Activity Data and Implied Emission Factors for CO_2 from Gaseous Fuels in 1A2e

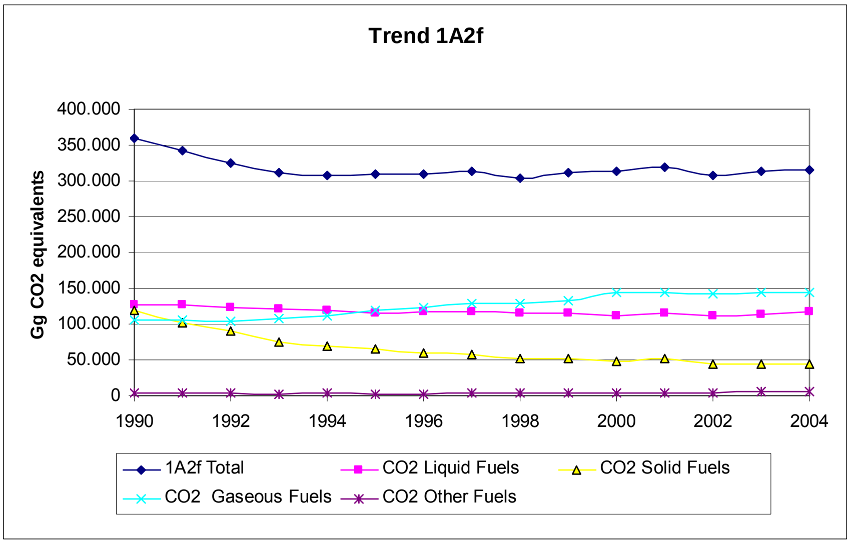


3.2.2.6. Other (1A2f)

In this chapter information about emission trends, Member States contribution, activity data and emission factors is provided for category 1A2f by fuels. CO_2 emissions from 1.A.2.f: 'Other' account for 7.4 % of total GHG emissions in 2004.

Figure 3.38 shows the emission trend within the category 1.A.2.f, which is mainly dominated by CO_2 emissions from gaseous and liquid fuels; the decrease in the early 1990s was mainly due to a decline of solid fuel combustion. Total GHG emissions decreased by 12 %, mainly due to decreases in emissions from solid (-63 %) and liquid (-7 %) fuels, emissions from all other fuel types increased.

Figure 3.38: Total and CO_2 emission trends for Category 1A2f



Between 1990 and 2004, CO_2 emissions from 'Other' decreased by 12 % in the EU-15 (Table 3.41), mainly due to decreases in Germany (-37 %). Spanish emissions increased by 62 % in the same period.

Table 3.41: Member States' contributions to CO_2 emissions from 1.A.2.f: 'Other'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	4.341	4.510	4.613	1,5%	103	2%	272	6%
Belgium	8.069	7.237	7.068	2,3%	-169	-2%	-1.001	-12%
Denmark	2.662	3.019	3.139	1,0%	120	4%	477	18%
Finland	2.962	2.373	2.403	0,8%	30	1%	-559	-19%
France	32.974	28.074	28.852	9,3%	777	3%	-4.122	-13%
Germany	136.921	86.936	86.285	27,8%	-650	-1%	-50.635	-37%
Greece	6.126	5.599	5.293	1,7%	-306	-5%	-833	-14%
Ireland	1.729	2.369	2.037	0,7%	-332	-14%	308	18%
Italy	40.489	43.976	43.388	14,0%	-587	-1%	2.900	7%
Luxembourg	1.876	1.995	2.212	0,7%	217	11%	336	18%
Netherlands	5.820	5.044	5.049	1,6%	6	0%	-770	-13%
Portugal	5.491	6.736	6.721	2,2%	-15	0%	1.230	22%
Spain	24.399	37.049	39.502	12,7%	2.453	7%	15.103	62%
Sweden	5.409	5.064	5.135	1,7%	71	1%	-274	-5%
United Kingdom	74.921	67.662	68.830	22,2%	1.169	2%	-6.091	-8%
EU15	354.189	307.643	310.528	100,0%	2.886	1%	-43.661	-12%

Abbreviations explained in the Chapter 'Units and abbreviations'.

1A2f Other - Liquid (CO_2)

In 2004 liquid fuels had a share of 37 % within source category 1A2f (compared to 35 % in 1990). Between 1990 and 2004 the emissions decreased by 7 % (Table 3.42). Between 1990 and 2004 the highest absolute decrease achieved Germany, the United Kingdom and France. The highest increase is reported by Spain (+51 %). Between 2003 and 2004 the United Kingdom and Spain show the highest absolute increase, as well as Luxembourg in relative terms (+106 %).

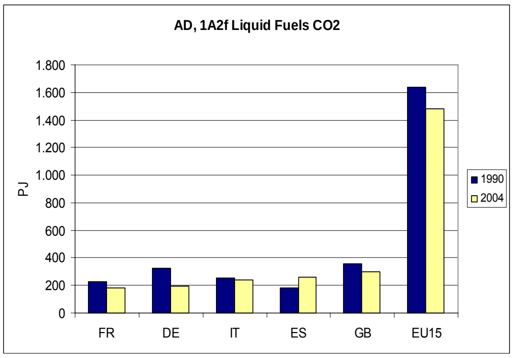
Table 3.42: Member States' contributions to CO_2 emissions from 1.A.2.f 'Other': Liquid Fuels

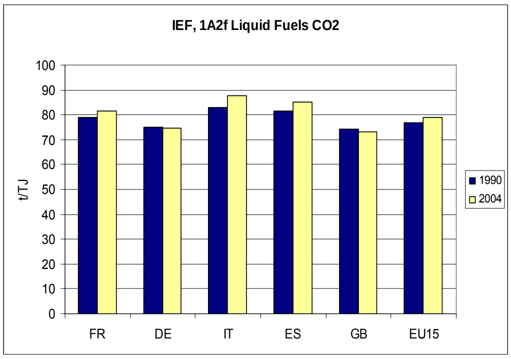
Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	2.073	1.954	1.963	1,7%	9	0%	-110	-5%
Belgium	2.698	2.771	2.597	2,2%	-174	-6%	-101	-4%
Denmark	1.488	1.845	1.881	1,6%	36	2%	393	26%
Finland	1.861	1.560	1.608	1,4%	48	3%	-253	-14%
France	17.756	14.240	14.773	12,6%	533	4%	-2.983	-17%
Germany	24.307	14.526	14.689	12,5%	164	1%	-9.618	-40%
Greece	2.828	3.763	3.443	2,9%	-320	-8%	615	22%
Ireland	854	1.344	1.279	1,1%	-65	-5%	425	50%
Italy	20.965	21.848	21.283	18,1%	-565	-3%	317	2%
Luxembourg	423	160	329	0,3%	169	106%	-94	-22%
Netherlands	1.940	1.283	1.289	1,1%	6	0%	-650	-34%
Portugal	3.368	3.991	4.118	3,5%	127	3%	750	22%
Spain	14.856	20.965	22.392	19,1%	1.427	7%	7.536	51%
Sweden	4.002	3.767	3.760	3,2%	-8	0%	-242	-6%
United Kingdom	26.774	18.841	22.006	18,7%	3.165	17%	-4.769	-18%
EU15	126.193	112.855	117.409	100,0%	4.554	4%	-8.784	-7%

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.39 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – France, Germany, Italy, Spain and the United Kingdom; together they cause 83 % (1990) resp. 81 % (2004) of the CO_2 emissions from liquid fuels in 1A2f. Fuel combustion in the EU-15 decreased by 9 % between 1990 and 2004. Implied emission factors of EU-15 Member States range between 62.0 and 87.6 t/TJ in 2004.

Figure 3.39: Activity Data and Implied Emission Factors for CO_2 from Liquid Fuels in 1A2f





1A2f Other - Solid (CO_2)

In 2004 CO_2 from solid fuels had a share of 14 % within source category 1A2f (compared to 33 % in 1990). Between 1990 and 2004 the emissions decreased by 63 % (Table 3.43). Between 1990 and 2004, Germany (-52 %), the United Kingdom (-48 %), Spain (-88 %) and France (-67 %) report the highest decrease, but all other Member States had a decrease in their emissions as well. Between 2003 and 2004 six Member States reported decreases; EU-15 emissions declined by 1 % within this period.

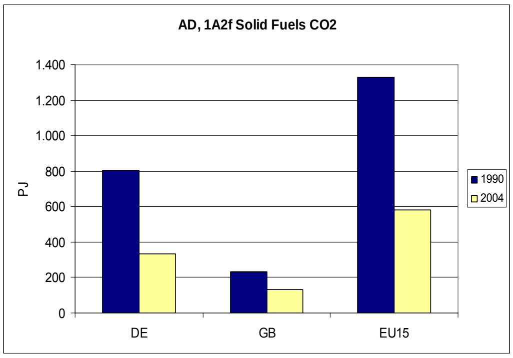
Table 3.43: Member States' contributions to CO_2 emissions from 1.A.2.f 'Other': Solid Fuels

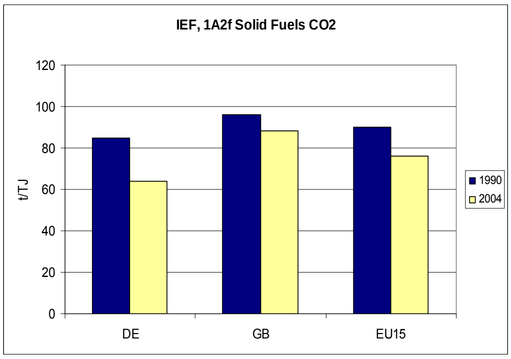
Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	625	365	242	0,5%	-122	-34%	-383	-61%
Belgium	2.600	1.050	1.051	2,4%	1	0%	-1.549	-60%
Denmark	823	552	638	1,4%	87	16%	-184	-22%
Finland	825	471	493	1,1%	22	5%	-332	-40%
France	5.903	2.030	1.920	4,3%	-111	-5%	-3.984	-67%
Germany	67.931	22.026	21.411	48,4%	-615	-3%	-46.520	-68%
Greece	3.295	1.601	1.589	3,6%	-12	-1%	-1.705	-52%
Ireland	532	529	177	0,4%	-352	-67%	-355	-67%
Italy	4.233	2.043	2.323	5,3%	281	14%	-1.910	-45%
Luxembourg	1.127	302	334	0,8%	31	10%	-793	-70%
Netherlands	549	230	238	0,5%	8	4%	-311	-57%
Portugal	2.103	539	539	1,2%	0	0%	-1.565	-74%
Spain	5.497	894	642	1,5%	-252	-28%	-4.854	-88%
Sweden	1.229	1.048	1.151	2,6%	104	10%	-78	-6%
United Kingdom	22.312	10.864	11.496	26,0%	633	6%	-10.816	-48%
EU15	119.585	44.542	44.245	100,0%	-297	-1%	-75.339	-63%

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.40 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – Germany and the United Kingdom; together they cause 75 % (1990) resp. 74 % (2004) of the CO_2 emissions from solid fuels in 1A2f. Fuel combustion in the EU-15 decreased by 56 % between 1990 and 2004. Implied emission factors of EU-15 Member States range between 62.0 and 147.3 t/TJ in 2004.

Figure 3.40: Activity Data and Implied Emission Factors for CO_2 from Solid Fuels in 1A2f





1A2f Other - Gaseous (CO_2)

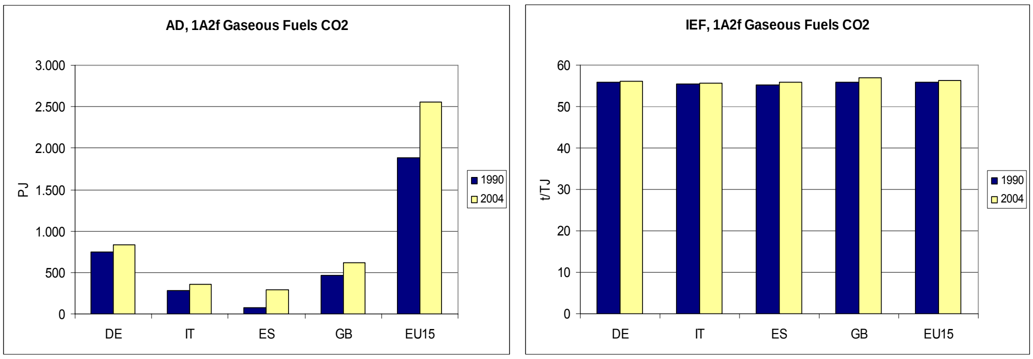
In 2004 CO_2 from gaseous fuels had a share of 45 % within source category 1A2f (compared to 29 % in 1990). Between 1990 and 2004 the emissions increased by 37 % (Table 3.44). Between 1990 and 2004, all Member States show increasing emissions; the United Kingdom, Spain, Italy and Germany show the highest absolute increases. Between 2003 and 2004 six Member States reported declining emissions, leading to a 1 % decline of EU-15 emissions.

Table 3.44: Member States' contributions to CO_2 emissions from 1.A.2.f 'Other': Gaseous Fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	1.573	1.791	2.023	1,4%	232	13%	450	29%
Belgium	2.559	2.860	2.865	2,0%	5	0%	306	12%
Denmark	351	579	567	0,4%	-12	-2%	216	62%
Finland	172	187	187	0,1%	0	0%	15	9%
France	9.312	11.803	12.158	8,5%	355	3%	2.845	31%
Germany	41.787	46.966	46.552	32,4%	-414	-1%	4.765	11%
Greece	4	235	261	0,2%	26	11%	257	6565%
Ireland	343	497	582	0,4%	85	17%	239	70%
Italy	15.290	20.085	19.782	13,8%	-303	-2%	4.492	29%
Luxembourg	326	1.534	1.550	1,1%	16	1%	1.224	375%
Netherlands	3.331	3.531	3.522	2,5%	-9	0%	191	6%
Portugal	0	2.177	2.035	1,4%	-142	-7%	2.035	-
Spain	4.046	14.928	16.192	11,3%	1.263	8%	12.145	300%
Sweden	178	237	211	0,1%	-26	-11%	33	19%
United Kingdom	25.833	37.755	35.127	24,5%	-2.628	-7%	9.294	36%
EU15	105.104	145.165	143.613	100,0%	-1.552	-1%	38.509	37%

Figure 3.41 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – Germany, Italy, Spain and the United Kingdom; together they cause 83 % (1990) resp. 82 % (2004) of the CO_2 emissions from gaseous fuels in 1A2f. Fuel combustion in the EU-15 rose by 36 % between 1990 and 2004. Implied emission factors of EU-15 Member States range between 53.0 and 57.7 t/TJ in 2004.

Figure 3.41: Activity Data and Implied Emission Factors for CO_2 from Gaseous Fuels in 1A2f



3.2.3. Transport (CRF Source Category 1.A.3)

Greenhouse gas emissions from 1.A.3 "Transport" is shown in Figure 3.42. CO_2 emissions from this source category account for 20.3 %, CH_4 for 0.06 %, N_2O for 0.5 % of total GHG emissions. Between 1990 and 2004, greenhouse gas emissions form Transport increased by 26 % in the EU-15.

Figure 3.42 Greenhouse gas emissions from 1.A.3. "Transport"

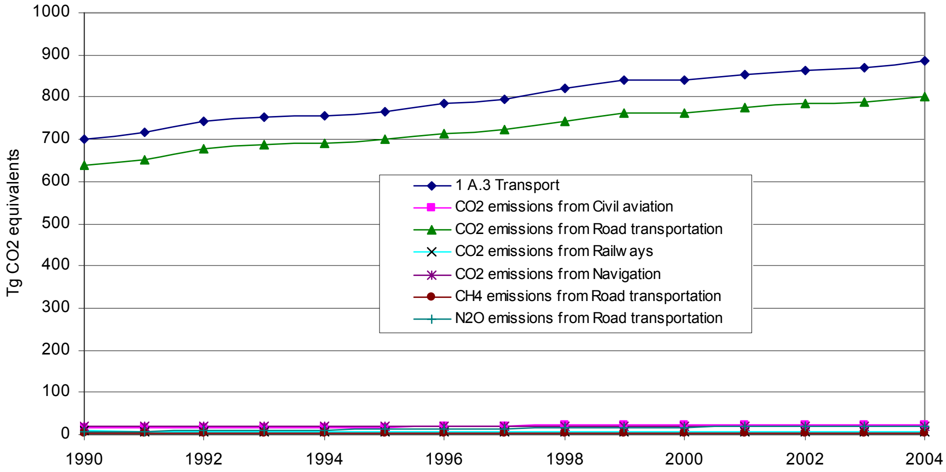


Table 3.45 summarises information by Member State on methodologies and emission factors for CO_2 emissions from 1.A.3: 'Transport'. This source category includes four key sources: CO_2 from 1.A.3.a: 'Civil Aviation', 1.A.3.b: 'Road transportation', 1.A.3.c: 'Railways', and 1.A.3.d: 'Navigation'.

Table 3.45 Member States' contributions to CO_2 emissions from 1.A.3: 'Transport' and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1)]	EF [1)]
Austria	12.400	23.455	CS,M	CS
Belgium	19.947	26.452	C,M	C,M
Denmark	10.336	12.859	OTH	CS
Finland	12.541	13.456	CS,M,T1,T3	CS
France	119.100	141.900	C /CS /M	C /M /CS
Germany	162.486	171.186	T1,T3,CS	CS
Greece	15.355	21.646	CR,M,NA,T1,T2	D,M,NA
Ireland	5.036	12.093	T1,T2	CS
Italy	101.461	128.008	D, T1, T2a, C	CS
Luxembourg	2.724	6.987	C/D	C/D
Netherlands	26.009	34.824	CS,T2	CS
Portugal	9.828	19.407	M	D+C
Spain	56.512	99.223	CR,NA,T2	CR,D,NA
Sweden	18.209	19.886	CS,NA,T1	CS,NA
United Kingdom	117.227	128.487	CS,T2,T3	CS
EU15	689.172	859.866	C,CS,D,M,T1, T2, T2a, T3,NA,CR	C,CS,D,M,NA

([1]) Information source: CRF Summary Table 3 for 2004.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 3.46 provides information on the contribution of Member States to EU-15 recalculations in CO_2 from 1.A.3 'Transport' for 1990 and 2003 and main explanations for the largest recalculations in absolute terms.

Table 3.46: Contribution of MS to EU-15 recalculations in CO_2 from 1.A.3 'Transport' for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

	1990		2003		Main explanations
	Gg	Percent	Gg	Percent	
Austria	-5	0,0	157	0,7	
Belgium	196	1,0	-35	-0,1	
Denmark	-105	-1,0	-181	-1,4	
Finland	225	1,8	36	0,3	
France	0	0,0	109	0,1	
Germany	127	0,1	129	0,1	
Greece	0	0,0	4	0,0	
Ireland	16	0,3	0	0,0	
Italy	-398	-0,4	20	0,0	No information provided.
Luxembourg	0	0,0	0	0,0	
Netherlands	1	0,0	103	0,3	
Portugal	-309	-3,1	-110	-0,6	Revision of parameters in the road traffic model First time estimate of emissions of road traffic due to the consumption of natural gas in vehicles Improvements in the methodologies and activity data used to make estimates of emissions from air traffic and maritime movements
Spain	-1	0,0	-97	-0,1	
Sweden	-142	-0,8	-386	-1,9	
UK	18	0,0	1.047	0,8	Review of lubricant use (change of activity data and allocation to industrial sectors) New estimates of gas oil usage by off-road vehicles and machinery Inclusion of emissions from UK Overseas Territories
EU15	**-378**	**-0,1**	**795**	**0,1**	

Table 3.47 summarises information by Member State on methodologies and emission factors for CH_4 emissions from 1.A.3: 'Transport'. This source category includes one key source: CH_4 from 1.A.3.b: 'Road transportation'.

Table 3.47: Member States' contributions to CH_4 emissions from 1.A.3: 'Transport' and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1)]	EF [1)]
Austria	61	21	CS,M	CS
Belgium	102	68	C,M	C,M
Denmark	53	54	OTH	OTH
Finland	100	54	CS,M,T1,T3	CS,D,OTH
France	770	502	C /CS	C /M /CS
Germany	1.285	211	T1,CS	M,CS
Greece	114	161	CR,M,NA,T1,T2	CR,D,M,NA
Ireland	37	47	T1,T3	CR,M
Italy	775	657	D, T1, T2a, C	C, CS
Luxembourg	7	8	C/D	C/D
Netherlands	158	68	CS,T2,T3	CS,D
Portugal	72	62	M	D+C+CS
Spain	241	193	CR,NA,T2	OTH,CR,CS,NA
Sweden	97	42	CS,NA,T1,T2	CS, M,CR,CS,D,NA
United Kingdom	625	197	T2,T3	CR,CS,D
EU15	4.497	2.344	C,CS,D,M,T1, T2, T2a, T3	C,CS,D,M, T2a,OTH,CR,NA

([1]) Information source: CRF Summary Table 3 for 2004.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 3.48 provides information on the contribution of Member States to EU-15 recalculations in CH_4 from 1.A.3 'Transport' for 1990 and 2003.

Table 3.48 Contribution of MS to EU-15 recalculations in CH_4 from 1.A.3 'Transport' for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

	1990		2003	
	Gg	Percent	Gg	Percent
Austria	0	0,1	0	1,0
Belgium	29	40,0	33	82,8
Denmark	-4	-6,8	-5	-7,1
Finland	-3	-3,0	0	0,1
France	0	0,0	-1	-0,2
Germany	-49	-3,6	-8	-3,5
Greece	0	0,0	0	0,0
Ireland	0	0,0	0	0,0
Italy	0	0,0	5	0,8
Luxembourg	0	-3,1	0	0,0
Netherlands	0	0,0	0	0,2
Portugal	15	25,5	11	21,6
Spain	4	1,5	10	5,0
Sweden	-172	-64,0	-94	-67,9
UK	0	0,0	4	1,8
EU15	**-181**	**-3,9**	**-45**	**-1,8**

Table 3.49 summarises information by Member State on methodologies and emission factors for N_2O emissions from 1.A.3: 'Transport'. This source category includes one key source: N_2O from 1.A.3.b: 'Road transportation'.

Table 3.49: Member States' contributions to N_2O emissions from 1.A.3: 'Transport' and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied 1)	EF 1)
Austria	264	290	CS,M	CS
Belgium	352	829	C,M	C,M
Denmark	141	434	OTH	OTH
Finland	174	573	CS,M,T1,T3	CS,D
France	1.666	4.438	C /CS	C /M /CS
Germany	672	1.359	T1,T2,T3,CS	M,CS
Greece	175	496	CR,M,NA,T1,T2	CR,D,M,NA
Ireland	87	439	T1,T3	CR,M
Italy	1.717	3.967	D, T1, T2a, C	C, CS
Luxembourg	16	59	C/D	C/D
Netherlands	272	487	CS,T2	CS,D
Portugal	152	574	M	D+C+CS
Spain	783	2.595	CR,NA,T1,T2	CR,D,NA
Sweden	163	211	CS,NA,T1,T2	CR,CS,D,NA
United Kingdom	1.375	5.471	T2,T3	CS,D
EU15	8.008	22.222	C,CS,D,M,T1,T2, T2a,T3,CR,OTH, NA	C, CS, D, M

(1) Information source: CRF Summary Table 3 for 2004.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 3.50 provides information on the contribution of Member States to EU-15 recalculations in N_2O from 1.A.3 'Transport' for 1990 and 2003.

Table 3.50: Contribution of MS to EU-15 recalculations in N_2O from 1.A.3 'Transport' for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

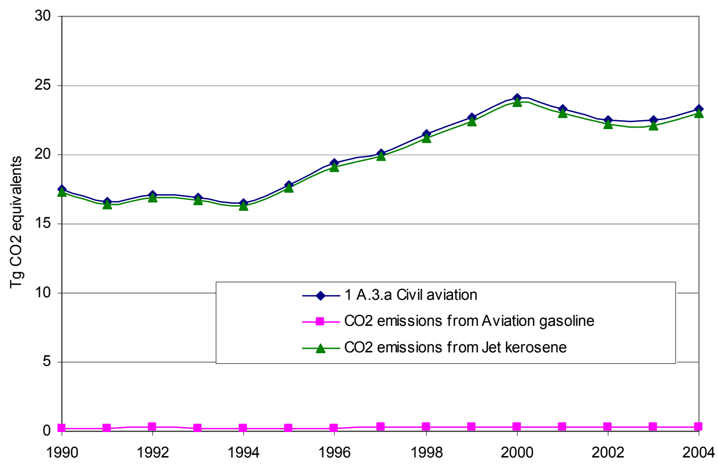
	1990		2003		Main explanations
	Gg	Percent	Gg	Percent	
Austria	93	54,4	25	8,9	
Belgium	-4	-1,0	3	0,4	
Denmark	-6	-4,4	-13	-3,0	
Finland	1	0,5	0	0,0	
France	0	0,0	9	0,2	
Germany	-2.407	-78,2	-2.846	-67,2	New fuel consumption data
Greece	0	0,0	0	0,0	
Ireland	0	0,0	0	0,0	
Italy	-7	-0,4	4	0,1	
Luxembourg	3	25,0	0	0,0	
Netherlands	0	0,0	0	0,1	
Portugal	8	5,2	42	7,9	
Spain	1	0,2	29	1,2	
Sweden	-161	-49,8	-501	-70,0	
UK	38	2,9	220	4,4	
EU15	**-2.441**	**-23,4**	**-3.028**	**-12,4**	

3.2.3.1. Civil Aviation (1A3a)

CO_2 emissions from 1.A.3.a 'Civil aviation' account for 0.6 % of total GHG emissions in 2004. Between 1990 and 2004, CO_2 emissions from civil aviation increased by 33 % in the EU-15 (Table 3.46).

CO_2 emissions from Jet Kerosine account for 98 % of total GHG emissions from 1.A.3.a "Civil Aviation". Between 2003 and 2004, CO_2 emissions from civil aviation increased by 4 % in the EU-15 (Figure 3.43).

Figure 3.43 CO_2 Emissions from 1.A.3.a "Civil Aviation"



The Member States France, Spain and Germany contributed the most to the emissions from this source (65 %). Most Member States increased emissions from civil aviation between 1990 and 2004. The Member States with the highest increases in absolute terms were Germany, Italy and Spain. The countries with most reductions were Greece and Denmark (Table 3.51).

Table 3.51: Member States' contributions to CO_2 emissions from 1.A.3.a: 'Civil aviation'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	32	162	192	0.8%	30	18%	160	501%
Belgium	12	14	11	0.0%	-2	-17%	-1	-6%
Denmark	243	137	128	0.5%	-9	-6%	-115	-47%
Finland	385	327	332	1.4%	5	2%	-53	-14%
France	4,541	5,032	4,968	21.3%	-64	-1%	428	9%
Germany	2,897	4,288	4,408	18.9%	120	3%	1,511	52%
Greece	1,455	1,164	1,227	5.3%	63	5%	-228	-16%
Ireland	59	103	105	0.5%	3	2%	46	78%
Italy	1,597	2,772	2,668	11.4%	-104	-4%	1,071	67%
Luxembourg	0	0	0	0.0%	0	-	0	-
Netherlands	41	41	41	0.2%	0	0%	0	0%
Portugal	165	387	401	1.7%	14	4%	236	143%
Spain	4,135	5,340	5,890	25.2%	549	10%	1,754	42%
Sweden	673	582	667	2.9%	85	15%	-6	-1%
United Kingdom	1,282	2,114	2,303	9.9%	189	9%	1,021	80%
EU15	17,517	22,462	23,342	100.0%	880	4%	5,825	33%

Abbreviations explained in the Chapter 'Units and abbreviations'.

1A3a Civil Aviation – Jet Kerosine (CO_2)

CO_2 emissions resulting from jet kerosene within the category 1.A.3.a were in 2004 responsible for 99 % of CO_2 emissions in 1.A.3.a. Within the EU-15 the emissions increased between 1990 and 2004 by 33 % (Table 3.52). The largest absolute increase occurred in Spain, Italy and Germany. Between 2003 and 2004, the emissions increased by 4 %.

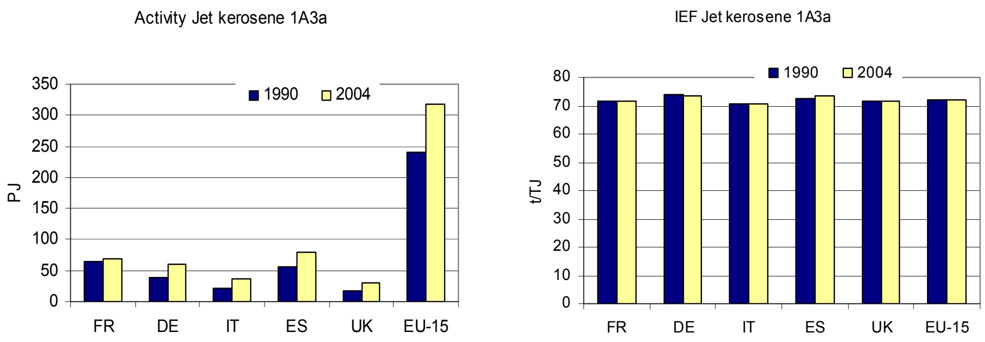
Table 3.52 Member States' contributions to CO_2 emissions from 1.A.3.a: 'Civil Aviation': jet kerosine

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	24	154	185	0,8%	31	20%	160	664%	CS	NS	CS
Belgium	5	0	0	0,0%	0	-	-5	-100%	C,M	PS	C
Denmark	234	130	121	0,5%	-9	-7%	-113	-48%	C	NS	C
Finland	377	323	329	1,4%	6	2%	-49	-13%	T2/B	NS	CS
France	4.541	5.032	4.968	21,6%	-64	-1%	428	9%	M	NS	M
Germany	2.897	4.288	4.408	19,1%	120	3%	1.511	52%	T1	NS/AS	CS
Greece	1.430	1.103	1.166	5,1%	63	6%	-265	-19%	T2a	NS/AS[4]	T2a
Ireland	59	103	105	0,5%	3	2%	46	78%	T2a	NS	CS
Italy	1.563	2.725	2.625	11,4%	-101	-4%	1.062	68%	T1, T2a	NS	CS
Luxembourg	0	0	0	0,0%	0	-	0	-	C/D		C/D
Netherlands	16	16	16	0,1%	0	0%	0	0%	T2	NS	CS
Portugal	164	384	398	1,7%	14	4%	234	143%	T2b	NS+AS	D
Spain	4.135	5.340	5.890	25,6%	549	10%	1.754	42%	T2	NS	D
Sweden	668	579	664	2,9%	85	15%	-4	-1%	T1	NS	CS
United Kingdom	1.200	1.971	2.148	9,3%	177	9%	947	79%	T3	NS/AS	CS
EU15	17.315	22.148	23.022	100,0%	874	4%	5.708	33%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

France, Germany, Italy, Spain and the UK account for 87 % of activity data and 87 % of CO_2 emissions from Jet kerosene in 2004 (Figure 3.44). The IEF for the EU-15 is 72.3 t/TJ Jet kerosene in 2004.

Figure 3.44 Activity data and implied emission factors for CO_2 from Jet Kerosine 1.A.3.a



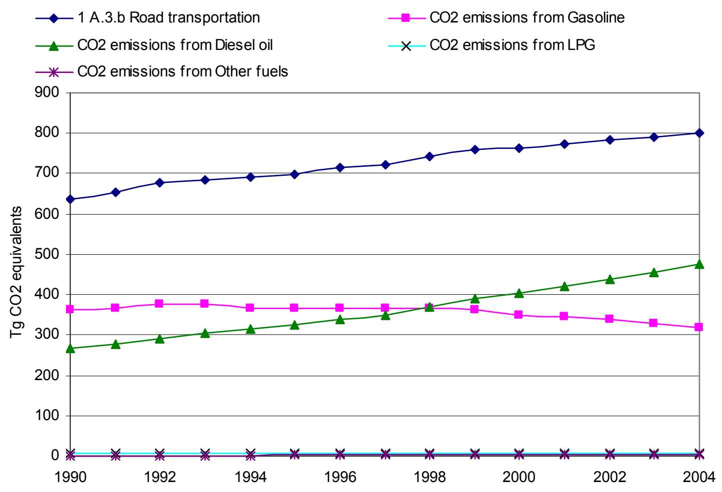
3.2.3.2. Road Transportation (1A3b)

CO_2 emissions from 1A3b Road Transportation

CO_2 emissions from 1.A.3.b: 'Road transportation' is the second largest key source of all categories in the EU-15 accounting for 19.0 % of total GHG emissions in 2004. Between 1990 and 2004, CO_2 emissions from road transportation increased by 26 % in the EU-15 (Table 3.48). The emissions from this key source are due to fossil fuel consumption in road transport, which increased by 26 % between 1990 and 2004.

Figure 3.45 gives an overview of the CO_2 trend caused by different fuels. The trend is mainly dominated by emissions resulting from gasoline and diesel oil. The decline of gasoline and the strong increase of diesel shows the switch from gasoline passenger cars to diesel in several EU-15 Member States.

Figure 3.45 CO_2 Emission Trend from 1.A.3.b "Road Transport"



The Member States Germany, France and the United Kingdom contributed most to the CO_2 emissions from this source (52 %). All Member States increased emissions from road transportation between 1990 and 2004. The Member States with the highest increases in absolute terms were Spain, France and Italy. The countries with the lowest increase were Finland, Germany and United Kingdom (Table 3.53).

Table 3.53 Member States' contributions to CO_2 emissions from 1.A.3.b: 'Road transportation'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	11.924	21.884	22.393	2,8%	508	2%	10.468	88%
Belgium	19.270	24.813	25.799	3,2%	986	4%	6.529	34%
Denmark	9.241	11.722	12.024	1,5%	302	3%	2.783	30%
Finland	10.872	11.447	11.811	1,5%	364	3%	939	9%
France	111.403	132.501	132.684	16,6%	183	0%	21.281	19%
Germany	150.358	159.827	160.409	20,0%	581	0%	10.051	7%
Greece	11.873	18.015	18.135	2,3%	120	1%	6.262	53%
Ireland	4.696	10.993	11.675	1,5%	681	6%	6.979	149%
Italy	93.616	116.351	118.387	14,8%	2.035	2%	24.771	26%
Luxembourg	2.693	5.993	6.960	0,9%	968	16%	4.267	158%
Netherlands	25.472	33.433	33.841	4,2%	408	1%	8.369	33%
Portugal	9.249	18.784	18.708	2,3%	-76	0%	9.459	102%
Spain	50.442	87.095	90.369	11,3%	3.273	4%	39.926	79%
Sweden	16.667	18.118	18.319	2,3%	201	1%	1.651	10%
United Kingdom	109.622	118.386	119.591	14,9%	1.204	1%	9.968	9%
EU15	637.400	789.363	801.103	100,0%	11.740	1,5%	163.703	26%

1A3b Road Transportation – Diesel Oil (CO_2)

CO_2 emissions from Diesel oil account for 59 % of CO_2 emissions from 1.A.3.b "Road transport" in 2004 (Figure 3.54). All Member States increased emissions from Diesel oil between 1990 and 2004. Member States with the highest increase in percent were Luxembourg, Austria and Ireland. The countries with the lowest increase were Finland and Italy.

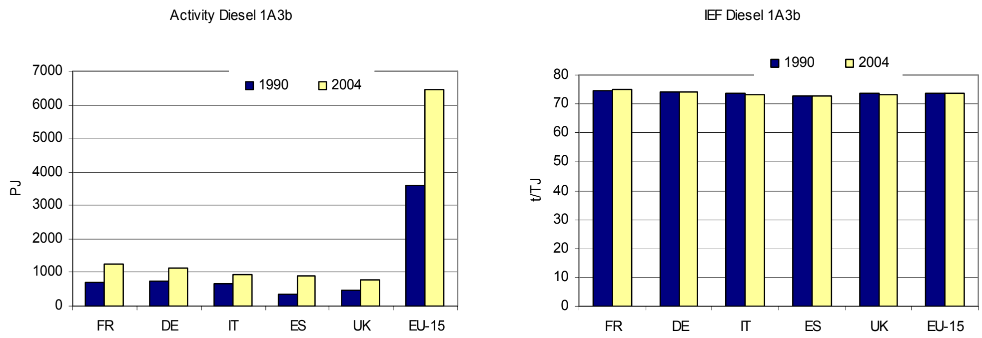
Table 3.54 Member States' contributions to CO_2 emissions from 1.A.3.b: 'Road transportation': Diesel Oil

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	4.013	15.112	15.806	3,3%	694	5%	11.793	294%	CS	NS	CS
Belgium	10.892	18.156	19.741	4,1%	1.585	9%	8.849	81%	C,M,CS	NS	C,CS
Denmark	4.436	5.829	6.231	1,3%	403	7%	1.795	40%	COPERT III	NS	C
Finland	4.956	6.021	6.278	1,3%	257	4%	1.322	27%	T3	NS	CS
France	52.404	92.174	94.284	19,8%	2.110	2%	41.881	80%	M	NS	M
Germany	54.458	79.800	82.890	17,4%	3.090	4%	28.432	52%	T3	NS/AS	CS
Greece	4.326	6.670	6.537	1,4%	-133	-2%	2.211	51%	COPERT III	NS	D
Ireland	1.915	6.074	6.593	1,4%	520	9%	4.678	244%	T1	NS	CS
Italy	48.020	64.608	69.718	14,6%	5.110	8%	21.699	45%	COPPERT3	NS/AS	CS
Luxembourg	1.378	4.204	5.183	1,1%	979	23%	3.804	276%	C/D		C/D
Netherlands	11.832	18.884	19.542	4,1%	657	3%	7.709	65%	T2	NS	CS
Portugal	4.947	12.539	12.714	2,7%	175	1%	7.768	157%	D	NS	D
Spain	24.436	61.287	65.598	13,8%	4.311	7%	41.162	168%	C	NS, Q	C
Sweden	4.243	6.208	6.623	1,4%	415	7%	2.381	56%	T1	NS	C2
United Kingdom	33.717	56.016	58.554	12,3%	2.538	5%	24.837	74%	T3	NS/AS	CS
EU15	265.972	453.582	476.294	100,0%	22.712	5,0%	210.321	79%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

France, Germany, Italy, Spain and the UK account for 78 % of activity data and CO_2 emissions from Diesel oil in 2004 (Figure 3.46). The IEF for the EU-15 is 73.6 t/TJ Diesel in 2004.

Figure 3.46 Activity Data and Implied Emission Factor for CO_2 emission from Diesel Oil in 1.A.3.b



1A3b Road Transportation – Gasoline (CO_2)

Between 1990 and 2004, CO_2 emissions from gasoline decreased by 13 % in the EU-15. The countries with the highest decrease were Belgium and France (Table 3.55). Countries with the highest increase were Greece, Ireland and Portugal.

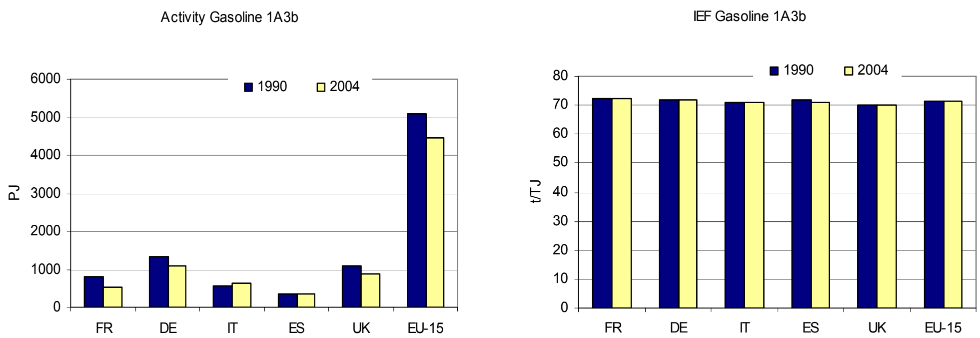
Table 3.55 Member States' contributions to CO_2 emissions from 1.A.3.b: 'Road transportation': Gasoline

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	7.911	6.772	6.587	2,1%	-185	-3%	-1.324	-17%	CS	NS	CS
Belgium	8.223	6.347	5.827	1,8%	-520	-8%	-2.396	-29%	C,M,CS	NS	C,CS
Denmark	4.805	5.894	5.793	1,8%	-101	-2%	988	21%	COPERT III	NS	C
Finland	5.916	5.419	5.526	1,7%	108	2%	-390	-7%	T3	NS	CS
France	58.816	39.720	37.846	11,9%	-1.874	-5%	-20.970	-36%	M	NS	M
Germany	95.794	79.848	77.337	24,4%	-2.511	-3%	-18.458	-19%	T3	NS/AS	CS
Greece	7.294	11.218	11.464	3,6%	246	2%	4.171	57%	COPERT III	NS	D
Ireland	2.762	4.907	5.069	1,6%	163	3%	2.307	84%	T1	NS	CS
Italy	41.084	47.255	44.479	14,0%	-2.777	-6%	3.394	8%	COPPERT3	NS/AS	CS
Luxembourg	1.303	1.781	1.772	0,6%	-10	-1%	468	36%	C/D		C/D
Netherlands	10.902	13.254	13.168	4,1%	-86	-1%	2.266	21%	T2	NS	CS
Portugal	4.303	6.151	5.908	1,9%	-243	-4%	1.605	37%	D	NS	D
Spain	25.928	25.594	24.556	7,7%	-1.038	-4%	-1.372	-5%	C	NS, Q	C
Sweden	12.422	11.878	11.651	3,7%	-227	-2%	-771	-6%	T1	NS	C2
United Kingdom	75.643	61.848	60.488	19,1%	-1.361	-2%	-15.155	-20%	T3	NS/AS	CS
EU15	363.108	327.887	317.471	100,0%	-10.416	-3,2%	-45.637	-13%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

France, Germany, Italy, Spain and the United Kingdom account for 77 % of activity data (Figure 3.47). The IEF for the EU-15 is 71.3 t/TJ Gasoline in 2004.

Figure 3.47 Activity data and implied emission factors for CO_2 from Gasoline 1.A.3.b



1A3b Road Transportation –LPG (CO_2)

Between 1990 and 2004, CO_2 emissions from LPG decreased by 26 % in the EU-15. Six Member States report emissions as 'Not occuring' or '0'. Of the remaining nine Member States, Belgium and Spain show increases, the other decreases. Between 2003 and 2004 emissions changed by -9 % (Table 3.56).

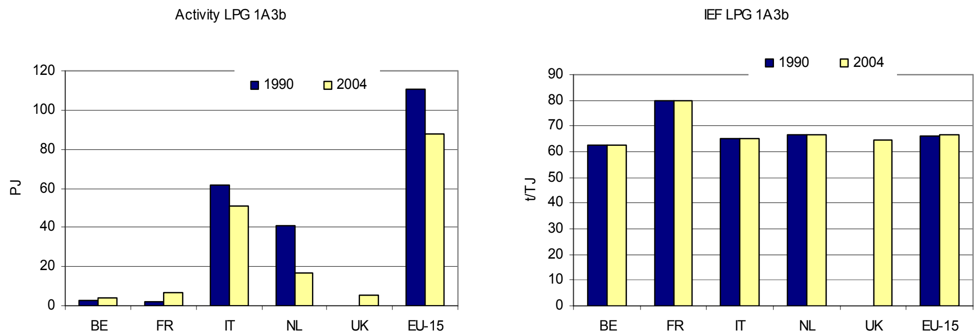
Table 3.56 Member States' contributions to CO_2 emissions from 1.A.3.b: 'Road transportation': LPG

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	NO	NO	NO	-	-	-	-	-	M	NS	CS
Belgium	154	310	231	4.0%	-79	-26%	76	49%	C, M, CS	NS	C, CS
Denmark	1	0	0	0.0%	0	-1%	-1	-96%	COPERT3	NS	C
Finland	NO	NO	NO	-	-	-	-	-	T2 (M)	NS	CS
France	183	607	554	9.5%	-54	-	370	-	M	NS	M
Germany	9	7	7	0.1%	0	0%	-2	-28%	T3	NS	CS
Greece	110	44	40	0.7%	-4	-8%	-70	-63%	COPERT3	NS	C
Ireland	19	13	12	0.2%	-1	-7%	-7	-36%	T1	NS	CS
Italy	4,020	3,620	3,312	56.8%	-308	-9%	-709	-18%	COPERT3	NS, AS	CS
Luxembourg	0	0	0	0.0%	0	-	0	-			
Netherlands	2,738	1,294	1,131	19.4%	-163	-13%	-1,606	-59%	T1	NS	CS
Portugal	0	0	0	0.0%	0	-	0	-	D	NS	D
Spain	79	215	215	3.7%	0	0%	136	173%	COPERT3	NS, IS	CS
Sweden	NO	NO	NO	-	-	-	-	-	T1	NS	CS
United Kingdom	NO	307	330	5.7%	24	8%	330	-	T3	NS	CS
EU15	7,313	6,416	5,831	100.0%	-585	-9%	-1,481	-20%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Belgium, France, Italy, the Netherlands and the United Kingdom account for 96 % of emission and for 95 % of activity data (Figure 3.48). The IEF for the EU-15 is 66.5 t/TJ LPG in 2004.

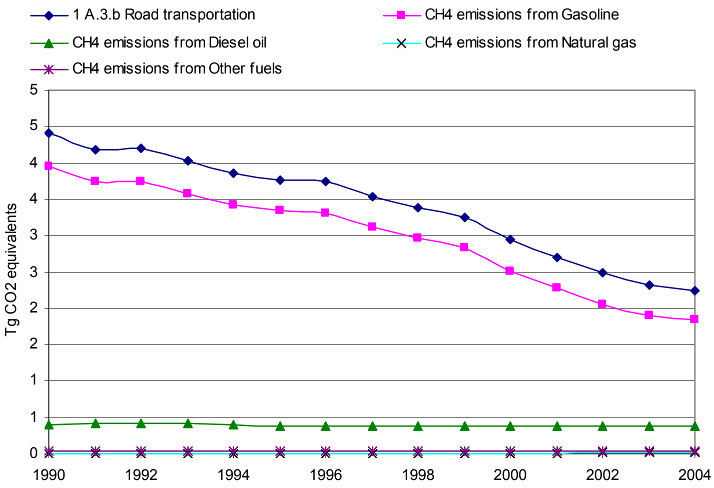
Figure 3.48 **Activity data and implied emission factors for CO_2 from LPG in 1.A.3.b**



CH_4 emissions from 1A3b Road Transportation

CH_4 emissions from 1.A.3.b: 'Road transportation' account for 0.1 % of total EU-15 GHG emissions in 2004. Figure 3.49 gives an overview of the CH_4 trend caused by different fuels. The trend is mainly dominated by emissions resulting from gasoline.

Figure 3.49 CH_4 Emissions from 1.A.3.b "Road Transportation"



CH_4 emissions decreased between 1990 and 2004 by 49 %. Denmark, Greece, Ireland and Luxembourg reported increases for this period. Between 2003 and 2004 all Member States except Italy show a decrease in CH_4 emissions (Table 3.57).

Table 3.57 Member States' contributions to CH_4 emissions from 1.A.3.b: 'Road transportation'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	61	22	20	0.9%	-2	-8%	-41	-67%
Belgium	102	73	67	3.0%	-6	-8%	-35	-34%
Denmark	52	59	53	2.4%	-6	-11%	1	3%
Finland	90	47	43	1.9%	-4	-9%	-46	-52%
France	763	510	495	22.0%	-15	-3%	-268	-35%
Germany	1,271	221	200	8.9%	-21	-10%	-1,071	-84%
Greece	108	158	155	6.9%	-4	-2%	46	43%
Ireland	37	49	47	2.1%	-2	-4%	10	28%
Italy	743	584	622	27.6%	38	7%	-121	-16%
Luxembourg	6	9	7	0.3%	-1	-17%	1	17%
Netherlands	157	72	67	3.0%	-6	-8%	-90	-57%
Portugal	72	64	61	2.7%	-3	-4%	-11	-15%
Spain	238	199	189	8.4%	-10	-5%	-49	-21%
Sweden	93	41	39	1.7%	-2	-6%	-54	-58%
United Kingdom	613	209	185	8.2%	-24	-12%	-428	-70%
EU15	4,405	2,318	2,250	100.0%	-69	-3%	-2,156	-49%

1A3b Road Transportation – Gasoline (CH_4)

Between 1990 and 2004, CH_4 emissions from gasoline decreased by 54 % in the EU-15, all Member States reported decreasing emissions except Denmark (+4 %), Greece (+45 %), Ireland (+22) and Luxembourg (+11 %). The highest reduction shows Germany (-86 %). Between 2003 and 2004, the EU-15 total sank by 3 % (Table 3.58).

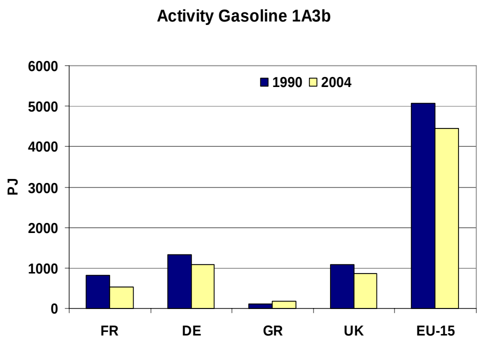
Table 3.58 Member States' contributions to CH_4 emissions from 1.A.3.b: 'Road transportation': Gasoline

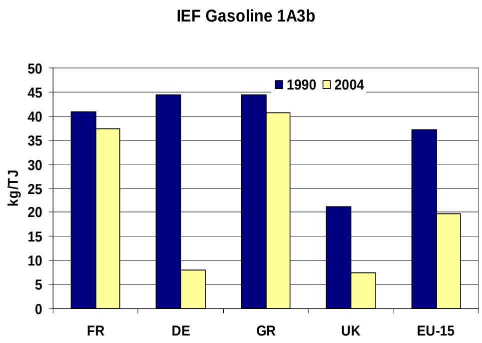
Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	58	19	17	0,9%	-2	-10%	-41	-71%	M	NS, Q	CS
Belgium	87	54	48	2,6%	-6	-11%	-39	-45%	C, M	RS	C
Denmark	44	52	46	2,5%	-6	-12%	2	4%	COPERT3	NS	C
Finland	78	40	36	2,0%	-4	-10%	-42	-54%	T3 (M)	NS	CS
France	697	426	411	22,4%	-15	-4%	-286	-41%	M	NS	M
Germany	1.242	200	179	9,8%	-21	-10%	-1.063	-86%	T3	NS	CS, M
Greece	99	147	143	7,8%	-4	-2%	44	45%	COPERT3	NS	C
Ireland	35	44	42	2,3%	-2	-5%	8	22%	T3	NS	COPERT3
Italy	643	477	519	28,3%	42	9%	-124	-19%	COPERT3	NS, AS	CS
Luxembourg	6	8	7	0,4%	-1	-18%	1	11%			
Netherlands	130	63	58	3,2%	-5	-8%	-72	-55%	T3	NS, Q	CS
Portugal	66	49	47	2,5%	-3	-5%	-20	-30%	M	NS, AS	C
Spain	205	126	112	6,1%	-14	-11%	-93	-45%	COPERT3	NS, IS	CS
Sweden	91	40	37	2,0%	-2	-6%	-54	-59%	T2	NS	CS
United Kingdom	479	156	134	7,3%	-22	-14%	-345	-72%	T3	NS	CS
EU15	3.960	1.901	1.835	100,0%	-66	-3%	-2.125	-54%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

France, Germany, Greece and the United Kingdom account for 47.3 % of emission and for 59 % of activity data (Figure 3.50). The IEF for the EU-15 is 19.6 kg/TJ Gasoline in 2004.

Figure 3.50 Activity data and implied emission factors for CH_4 from Gasoline 1.A.3.b

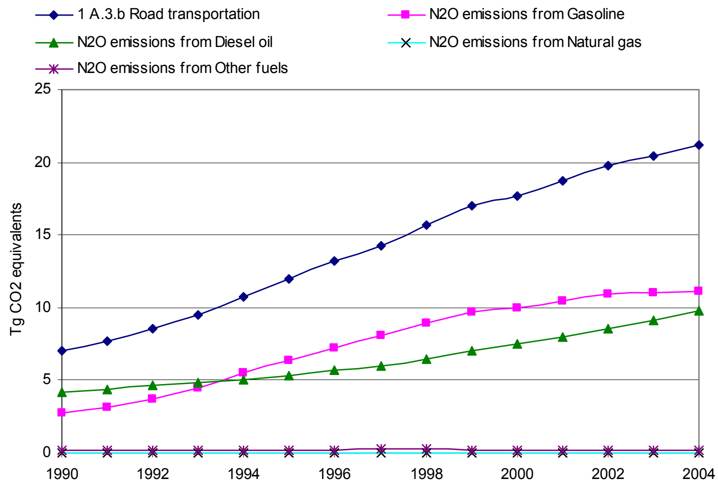




N_2O emissions from 1A3b Road Transportation

N_2O emissions from 1.A.3.b: 'Road transportation' account for 0.5 % of total EU-15 GHG emissions in 2004. Figure 3.51 gives an overview of the N_2O trend caused by different fuels. The trend is mainly dominated by emissions resulting from gasoline and diesel oil.

Figure 3.51 N_2O Emissions from 1.A.3.b "Road Transportation"



N_2O emissions increased between 1990 and 2004 by 200 % (Table 3.59). The emissions have been increasing through the 1990s as the number of cars equipped with a catalytic converter (with higher emission factors than cars without a catalytic converter) has increased. All Member States except Austria, the Netherlands and Sweden had an increase higher than 100 %. Between 2003 and 2004 two Member States (Germany and Sweden) reported a slight decrease in N_2O emissions.

Table 3.59 Member States' contributions to N_2O emissions from 1.A.3.b: 'Road transportation'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	253	292	276	1,3%	-16	-5%	23	9%
Belgium	300	760	778	3,7%	18	2%	478	159%
Denmark	125	402	421	2,0%	18	5%	296	237%
Finland	160	516	559	2,6%	44	8%	400	251%
France	1.592	4.268	4.349	20,6%	81	2%	2.758	173%
Germany	609	1.296	1.262	6,0%	-35	-3%	652	107%
Greece	123	421	452	2,1%	30	7%	329	268%
Ireland	56	383	413	2,0%	30	8%	357	636%
Italy	1.605	3.674	3.877	18,3%	203	6%	2.271	141%
Luxembourg	12	53	56	0,3%	3	6%	43	350%
Netherlands	271	470	485	2,3%	15	3%	214	79%
Portugal	137	561	563	2,7%	2	0%	426	310%
Spain	679	2.328	2.478	11,7%	150	6%	1.799	265%
Sweden	102	158	153	0,7%	-4	-3%	52	51%
United Kingdom	1.024	4.845	5.033	23,8%	188	4%	4.010	392%
EU15	7.047	20.427	21.155	100,0%	728	4%	14.107	200%

1A3b Road Transportation – Diesel Oil (N_2O)

N_2O emissions from Diesel oil account for 46 % of N_2O emissions from 1.A.3.b "Road Transportation" in 2004. N_2O emissions from Diesel oil increased in all Member States between 1990 and 2004; within the EU-15 the emission increased by 136 %. The smallest increase in absolute terms is reported by Sweden, Finland and Luxembourg. Between 2003 and 2004, EU-15 emissions rose by 7 %, the only Member State reporting a slight decrease is Greece (Table 3.60).

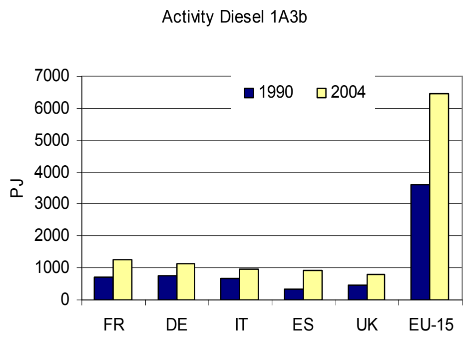
Table 3.60 Member States' contributions to N_2O emissions from 1.A.3.b: 'Road transportation': Diesel Oil

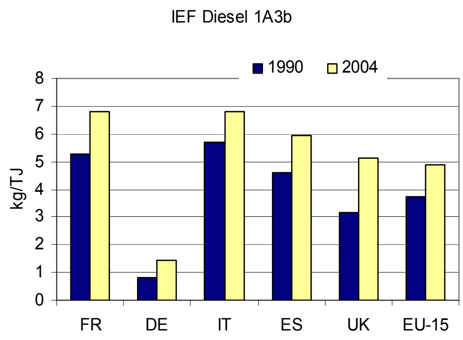
Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	33	104	108	1,1%	4	4%	75	226%	CS	NS	NS
Belgium	237	511	540	5,5%	28	6%	302	127%	C,M,CS	NS	C, CS
Denmark	85	128	142	1,5%	15	12%	58	68%	COPERT III	NS	C
Finland	68	84	86	0,9%	2	3%	18	26%	T3	NS	CS
France	1.142	2.574	2.645	27,0%	71	3%	1.502	132%	M	NS	M
Germany	189	458	495	5,1%	37	8%	306	162%	T3	NS/AS	CS
Greece	72	115	111	1,1%	-4	-4%	39	54%	COPERT III	NS	C
Ireland	33	145	160	1,6%	15	10%	127	391%	T3	NS	COPPERT3
Italy	1.155	1.777	2.004	20,5%	227	13%	849	74%	COPPERT3	NS/AS	CS
Luxembourg	6	25	31	0,3%	6	25%	25	400%	C/D		C/D
Netherlands	72	176	182	1,9%	6	4%	110	154%	T2	NS/Q	CS
Portugal	105	314	324	3,3%	9	3%	218	208%	T3	NS+AS	C
Spain	481	1.519	1.661	17,0%	142	9%	1.181	246%	C	NS, Q	C
Sweden	19	31	32	0,3%	0	1%	12	64%	T2	NS	CS
United Kingdom	450	1.182	1.276	13,0%	94	8%	826	183%	T3	NS/AS	COPERT3
EU15	4.147	9.143	9.796	100,0%	653	7%	5.649	136%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

France, Germany, Italy, Spain and the United Kingdom account for 83 % of the emissions and 78 % of activity data (Figure 3.52). The IEF for the EU-15 is 4.9 kg/TJ Diesel in 2004.

Figure 3.52 Activity Data and Implied Emission Factor for N_2O emission from Diesel Oil in 1.A.3.b





1A3b Road Transportation – Gasoline (N_2O)

N_2O emissions from Gasoline account for 53 % of N_2O emissions from 1.A.3.b "Road Transportation" in 2004. Between 1990 and 2004, N_2O emissions from gasoline increased by 309 % in the EU-15, all Member States reported increased emissions. The United Kingdom, Italy and France had the highest absolute increase. Between 2003 and 2004, seven Member States show decreasing emission, the EU-15 total rose by 1 % (Table 3.61).

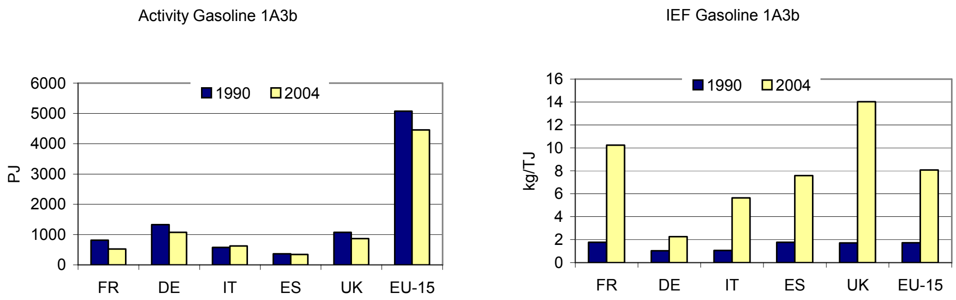
Table 3.61 Member States' contributions to N_2O emissions from 1.A.3.b: 'Road transportation': Gasoline

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	219	188	167	1,5%	-20	-11%	-52	-24%	CS	NS	NS
Belgium	60	242	233	2,1%	-9	-4%	173	286%	C,M,CS	NS	C,CS
Denmark	40	275	278	2,5%	4	1%	238	596%	COPERT III	NS	C
Finland	91	432	474	4,3%	41	10%	382	418%	T3	NS	CS
France	445	1.648	1.659	14,9%	11	1%	1.213	272%	M	NS	M
Germany	421	828	752	6,8%	-75	-9%	332	79%	T3	NS/AS	CS
Greece	48	305	340	3,1%	35	11%	292	603%	COPERT III	NS	C
Ireland	24	238	253	2,3%	16	7%	230	975%	T3	NS	COPPERT3
Italy	327	1.769	1.753	15,7%	-17	-1%	1.425	436%	COPPERT3	NS/AS	CS
Luxembourg	6	28	25	0,2%	-3	-11%	19	300%	C/D		C/D
Netherlands	156	261	272	2,4%	12	4%	116	74%	T2	NS/Q	CS
Portugal	32	246	239	2,1%	-7	-3%	206	639%	T3	NS+AS	C
Spain	197	803	812	7,3%	9	1%	615	312%	C	NS, Q	C
Sweden	82	127	122	1,1%	-5	-4%	39	48%	T2	NS	CS
United Kingdom	573	3.663	3.757	33,7%	94	3%	3.184	555%	T3	NS/AS	COPERT3
EU15	2.724	11.052	11.135	100,0%	84	1%	8.411	309%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

France, Germany, Italy, Spain and the United Kingdom account for 79 % of emission and for 77 % of activity data (Figure 3.53). The IEF for the EU-15 is 8.1 kg/TJ Gasoline in 2004.

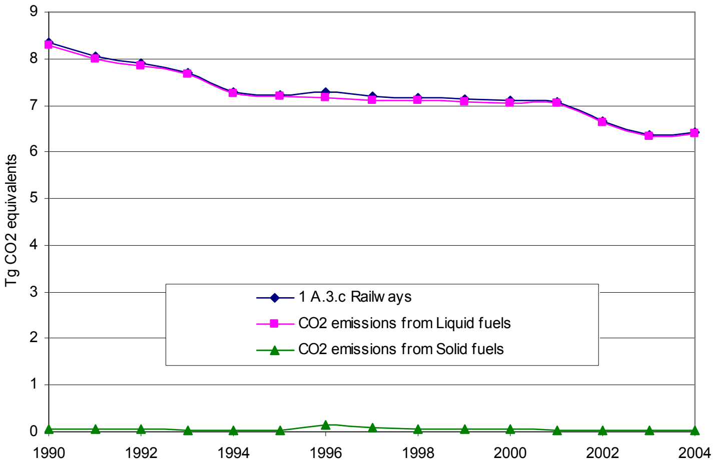
Figure 3.53 **Activity data and implied emission factors for N_2O from Gasoline 1.A.3.b**



3.2.3.3. Railways (1A3c)

CO_2 emissions from 1.A.3.c: 'Railways' account for 0.15 % of total EU-15 GHG emissions in 2004. Between 1990 and 2004, CO_2 emissions from rail transportation decreased by 23 % in the EU-15. The total trend is dominated by CO_2 emissions from liquid fuels (Figure 3.54). The emissions from this key source are due to fossil fuel consumption in rail transport, which decreased by 22 % between 1990 and 2004.

Figure 3.54 CO_2 Emission Trend from 1.A.3.c 'Railways"



The Member States France, Germany and the United Kingdom contributed most to the emissions from this source (75 %). Nearly all Member States decreased emissions from rail transportation between 1990 and 2004, only Austria, United Kingdom and the Netherlands increased their emissions. The Member States with the highest decreases in absolute terms were Germany, France and Italy (Table 3.62).

Table 3.62 Member States' contributions to CO_2 emissions from 1.A.3.c: 'Railways'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	168	178	170	2,7%	-8	-5%	2	1%
Belgium	202	63	122	1,9%	58	92%	-81	-40%
Denmark	297	218	216	3,4%	-2	-1%	-81	-27%
Finland	191	136	140	2,2%	3	2%	-51	-27%
France	1.070	711	700	10,9%	-11	-1%	-370	-35%
Germany	2.879	1.621	1.611	25,1%	-10	-1%	-1.268	-44%
Greece	203	129	129	2,0%	0	0%	-74	-37%
Ireland	147	125	121	1,9%	-4	-3%	-27	-18%
Italy	441	207	114	1,8%	-93	-45%	-326	-74%
Luxembourg	26	21	21	0,3%	0	0%	-5	-21%
Netherlands	91	103	109	1,7%	6	6%	18	20%
Portugal	173	95	86	1,3%	-9	-9%	-87	-50%
Spain	414	307	303	4,7%	-4	-1%	-111	-27%
Sweden	103	68	68	1,1%	0	0%	-35	-34%
United Kingdom	1.933	2.380	2.500	39,0%	120	5%	567	29%
EU15	8.338	6.363	6.410	100,0%	47	1%	-1.928	-23%

1A3c Railways –Liquid Fuels (CO_2)

Between 1990 and 2004, CO_2 emissions from liquid fuels decreased by 23 % in the EU-15. In the United Kingdom, the Nehterlands and Austria emissions increased. A substantial decrease occurred in Germany (-44 %) and in Italy (-74 %). Between 2003 and 2004, total EU-15 emissions changed marginally (+1 %) (Table 3.63).

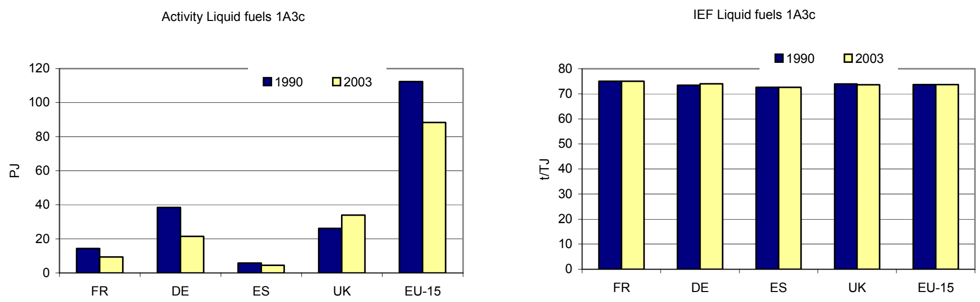
Table 3.63 Member States' contributions to CO_2 emissions from 1.A.3.c: 'Railways': Liquid Fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	161	176	168	2,6%	-8	-5%	7	4%	CS	NS	CS
Belgium	202	63	122	1,9%	58	92%	-81	-40%	C,M	RS	C
Denmark	297	218	216	3,4%	-2	-1%	-81	-27%	C	NS	C
Finland	191	136	140	2,2%	3	2%	-51	-27%	T2	NS	CS
France	1.070	711	700	11,0%	-11	-1%	-370	-35%	C	NS	CS
Germany	2.826	1.599	1.590	24,9%	-10	-1%	-1.236	-44%	T1	NS/AS	CS
Greece	200	129	129	2,0%	0	0%	-72	-36%	C	NS	D
Ireland	147	125	121	1,9%	-4	-3%	-27	-18%	T1	NS	CS
Italy	441	207	114	1,8%	-93	-45%	-326	-74%	D	NS	CS
Luxembourg	26	21	21	0,3%	0	0%	-5	-21%	C/D		C/D
Netherlands	91	103	109	1,7%	6	6%	18	20%	CS	AS	CS
Portugal	173	95	86	1,4%	-9	-9%	-87	-50%	D	NS	D
Spain	414	307	303	4,7%	-4	-1%	-111	-27%	T2	Q	C
Sweden	103	68	68	1,1%	0	0%	-35	-34%	CS	NS	CS
United Kingdom	1.933	2.380	2.500	39,2%	120	5%	567	29%	T2	NS/AS	CS
EU15	8.275	6.339	6.386	100,0%	47	1%	-1.889	-23%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

France, Germany, Spain and the United Kingdom account for 82 % of emissions and for 80 % of activity data (Figure 3.55). The IEF for the EU-15 is 73.7 t/TJ Liquid fuels in 2004.

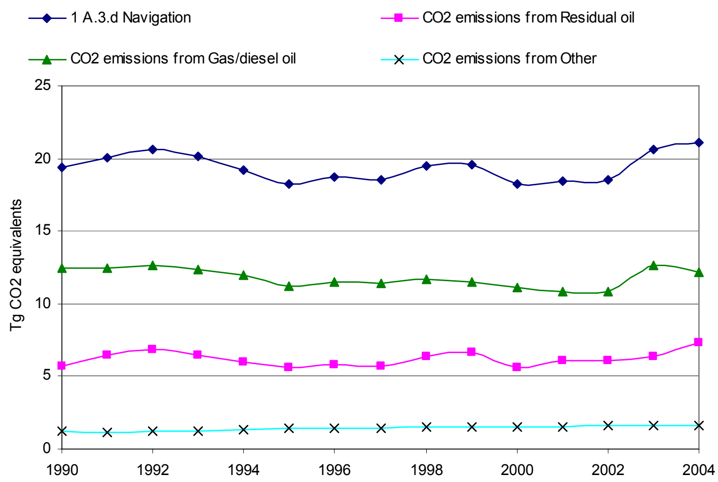
Figure 3.55 Activity data and implied emission factors for CO_2 from Liquid fuels 1.A.3.c



3.2.3.4. Navigation (1A3d)

CO_2 emissions from 1.A.3.d: 'Navigation' account for 0.5 % of total EU-15 GHG emissions in 2004. Between 1990 and 2004, CO_2 emissions from navigation increased by 9 % in the EU-15 (Table 3.57). The emissions from this key source are due to fossil fuel consumption in navigation, which increased by 9 % between 1990 and 2004. The total CO_2 emission trend is dominated by emissions from gas/diesel oil and residual oil (Figure 3.56).

Figure 3.56 CO_2 Emission Trend from 1.A.3.d 'Navigation'



Four Member States (Italy, France, Spain and the United Kingdom) contributed most to the emissions from this source (71 %). Nearly all Member States increased emissions from navigation between 1990 and 2004, only Germany, Ireland, Denmark, Portugal and the United Kingdom decreased their emissions. The Member States with the highest decreases in absolute terms were Germany and the United Kingdom (Table 3.64).

Table 3.64 Member States' contributions to CO_2 emissions from 1.A.3.d: 'Navigation'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	52	84	87	0,4%	2	3%	34	66%
Belgium	267	353	366	1,7%	13	4%	99	37%
Denmark	555	527	490	2,3%	-37	-7%	-65	-12%
Finland	441	535	523	2,5%	-12	-2%	82	19%
France	1.873	2.579	2.703	12,8%	124	5%	829	44%
Germany	2.050	769	868	4,1%	99	13%	-1.182	-58%
Greece	1.825	1.923	2.153	10,2%	230	12%	329	18%
Ireland	85	61	56	0,3%	-4	-7%	-29	-34%
Italy	5.401	6.162	6.132	29,1%	-30	0%	731	14%
Luxembourg	6	6	6	0,0%	0	0%	0	0%
Netherlands	405	682	832	3,9%	150	22%	428	106%
Portugal	240	207	211	1,0%	5	2%	-29	-12%
Spain	1.500	2.374	2.419	11,5%	45	2%	919	61%
Sweden	537	645	567	2,7%	-79	-12%	30	5%
United Kingdom	4.122	3.744	3.674	17,4%	-70	-2%	-448	-11%
EU15	19.359	20.651	21.087	100,0%	436	2%	1.728	9%

1A3d Navigation – Residual Oil (CO_2)

CO_2 emissions from Residual oil account for 35 % of CO_2 emissions from 1.A.3.d "Navigation" in 2004. Between 1990 and 2004, CO_2 emissions from Residual oil increased by 28 % in the EU-15. The countries with the highest increase were Greece, Spain and the United Kingdom. The Member State with the highest decrease is Denmark. Austria, Belgium, Germany, Luxembourg and the Netherlands report emissions as 'Not occuring' or '0' (Table 3.65).

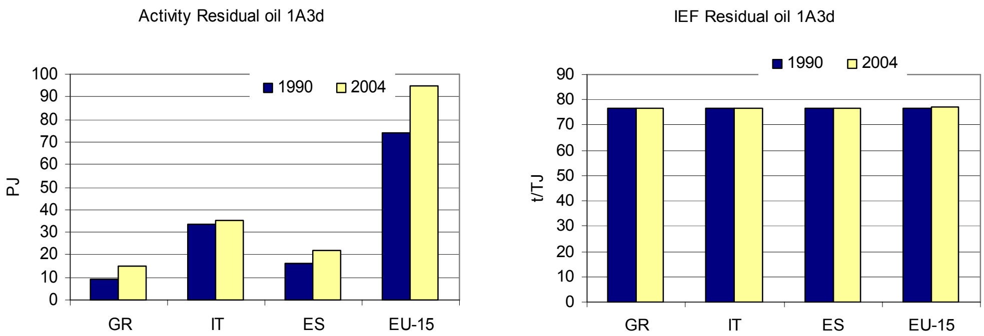
Table 3.65 Member States' contributions to CO_2 emissions from 1.A.3.d: 'Navigation': Residual Oil

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	NO	NO	NO	-	-	-	-	-	M	NS	CS
Belgium	0	0	0	0,0%	0	-	0	-	C, M	RS	C
Denmark	278	142	130	1,8%	-12	-8%	-147	-53%	C	NS	C
Finland	123	180	158	2,2%	-22	-12%	35	28%	T2 (M)	NS	CS
France	105	157	127	1,7%	-30	-19%	22	21%	C	NS	CS
Germany	NO	NO	NO	-	-	-	-	-	T1	NS	CS
Greece	730	942	1.154	15,9%	212	23%	425	58%	C	NS	C
Ireland	64	57	53	0,7%	-4	-6%	-10	-16%	T1	NS	CS
Italy	2.553	2.722	2.720	37,4%	-3	0%	166	7%	T1, T2	NS	CS
Luxembourg	0	0	0	0,0%	0	-	0	-			
Netherlands	NO	NO	NO	-	-	-	-	-	CS	NS, Q	CS
Portugal	173	149	152	2,1%	3	2%	-21	-12%	D	NS	D
Spain	1.234	1.661	1.693	23,3%	31	2%	459	37%	C	AS, IS	C
Sweden	194	227	231	3,2%	4	2%	37	19%	T1	NS	CS
United Kingdom	251	163	858	11,8%	696	428%	607	242%	T1	NS	CS
EU15	5.704	6.400	7.277	100,0%	877	14%	1.572	28%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

France, Germany, Spain and the United Kingdom account for 77 % of emissions and for 77 % of activity data (Figure 3.57). The IEF for the EU-15 is 77.0 t/TJ Liquid fuels in 2004.

Figure 3.57 Activity data and implied emission factors for CO_2 from Residual fuel oil 1.A.3.d



1A3d Navigation – Gas/Diesel Oil (CO_2)

CO_2 emissions from Gas/Diesel oil account for 58 % of CO_2 emissions from 1.A.3.d "Navigation" in 2004 (Table 3.66). The CO_2 emissions from Gas/Diesel oil decreased slightly between 1990 and 2004 (-1.6 %). Member States with the highest increase in percent were Spain, Austria and the Netherlands. The countries with the highest decrease were Germany and Ireland.

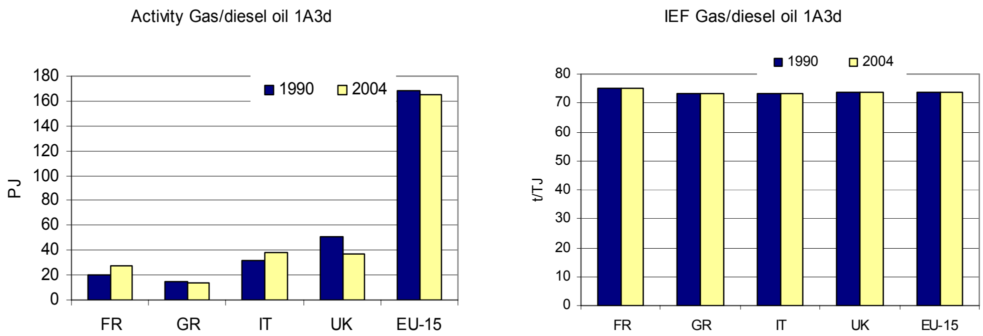
Table 3.66 Member States' contributions to CO_2 emissions from 1.A.3.d: 'Navigation': Gas/Diesel Oil

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	43	75	78	0,6%	2	3%	35	81%	CS	NS	CS
Belgium	267	353	366	3,0%	13	4%	99	37%	C,M	RS	C
Denmark	246	355	331	2,7%	-25	-7%	85	34%	C	NS	C
Finland	186	198	207	1,7%	9	4%	20	11%	T2	NS	CS
France	1.471	1.899	2.036	16,7%	137	7%	565	38%	C	NS	CS
Germany	2.050	769	868	7,1%	99	13%	-1.182	-58%	T1	NS/AS	CS
Greece	1.068	956	979	8,0%	22	2%	-89	-8%	C	NS	D
Ireland	21	4	3	0,0%	-1	-19%	-18	-85%	T1	NS	CS
Italy	2.299	2.755	2.759	22,6%	4	0%	460	20%	T1, T2	NS	CS
Luxembourg	6	6	6	0,0%	0	0%	0	0%	C/D		C/D
Netherlands	405	682	832	6,8%	150	22%	428	106%	T2	NS/Q	CS
Portugal	67	58	59	0,5%	1	2%	-8	-12%	T1	NS+AS	D
Spain	266	712	726	5,9%	13	2%	460	173%	T2	NS, AS	C
Sweden	269	344	261	2,1%	-83	-24%	-8	-3%	T1	NS	CS
United Kingdom	3.763	3.462	2.691	22,1%	-770	-22%	-1.072	-28%	T2	NS/AS	CS
EU15	12.426	12.629	12.201	100,0%	-428	-3%	-225	-2%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

France, Greece, Italy and the United Kingdom account for 71 % of activity data and for 69 % of the CO_2 emissions (Figure 3.58). The IEF for the EU-15 is 73.8 t/TJ residual oil in 2004.

Figure 3.58 Activity data and implied emission factors for CO_2 from Gas/Diesel oil 1.A.3.d



3.2.3.5. Other (1A3e)

CO_2 emissions from 1.A.3.e: 'Other' account for 0.2 % of total EU-15 GHG emissions in 2004. This source includes mainly pipeline transport and ground activities in airports and harbours. Between 1990 and 2004, CO_2 emissions from 'Other' sources increased by 21 % in the EU-15 (Table 3.66). The emissions from this key source are due to fossil fuel consumption in other transportation, which increased by 26 % between 1990 and 2004. A fuel shift occurred from oil to gas.

Two Member States (Germany and France) contributed most to the emissions from this source (60 %). Between 1990 and 2004 all Member States except Germany (-10 %) reported increasing emissions. Denmark, Luxembourg, the Netherlands and Portugal report emissions as 'Not occuring' or '0' (Table 3.67).

Table 3.67 Member States' contributions to CO_2 emissions from 1.A.3.e: 'Other'

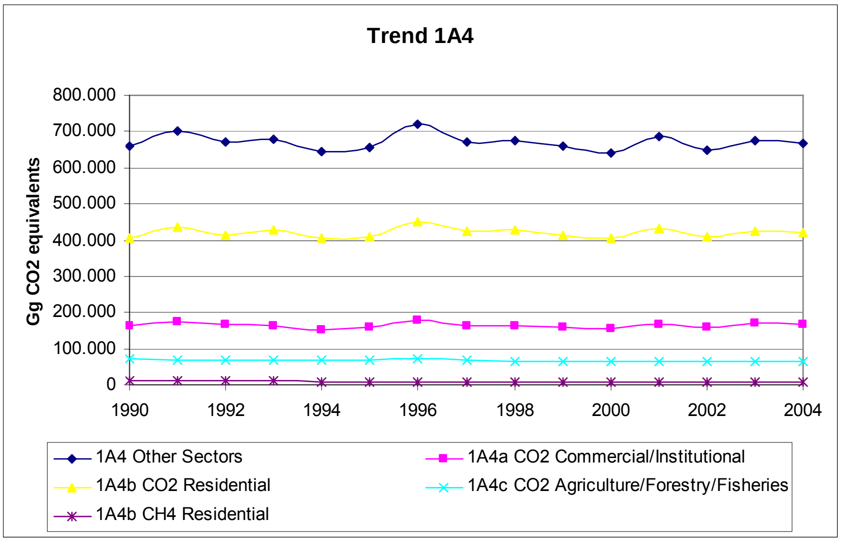
Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	224	541	613	7.7%	73	13%	389	173%
Belgium	196	19	154	1.9%	135	-	-42	-
Denmark	NO	NO	NO	-	-	-	-	-
Finland	651	659	651	8.2%	-8	-1%	-1	0%
France	213	671	845	10.7%	174	26%	632	296%
Germany	4,302	3,833	3,890	49.1%	57	1%	-412	-10%
Greece	NO	4	2	0.0%	-1	-39%	2	-
Ireland	48	112	136	1.7%	24	22%	88	181%
Italy	406	543	707	8.9%	164	30%	301	74%
Luxembourg	0	0	0	0.0%	0	-	0	-
Netherlands	NO	NO	NO	-	-	-	-	-
Portugal	0	0	0	0.0%	0	-	0	-
Spain	20	285	243	3.1%	-42	-15%	222	1098%
Sweden	228	256	265	3.3%	9	3%	36	16%
United Kingdom	268	396	419	5.3%	23	6%	151	56%
EU15	6,558	7,318	7,924	100.0%	607	8%	1,366	21%

Abbreviations explained in the Chapter 'Units and abbreviations'.

3.2.4. Other sectors (CRF Source Category 1.A.4)

Figure 3.59 shows the trend of total GHG emissions within source category 1.A.4 and the dominating sources: CO_2 emissions from 'Residential" and from 'Commercial/Residential'. The emission of the key sources only changed slightly, CO_2 emissions from 1.A.4.c and CH_4 emissions from 1.A.4.b decreased.

Figure 3.59: Total, CO_2 and CH_4 emission trends for category 1.A.4



CO_2 emissions from source category 1.A.4 account for 15 %, CH_4 for 0.2 %, N_2O for 0.2 % of total GHG emissions. This source category includes three key sources: CO_2 from 1.A.4.a: 'Commercial/Institutional', CO_2 from 1.A.4.b: 'Residential' and CO_2 from 1.A.4.c: 'Agriculture/forestry/fisheries'.

Table 3.68 summarises information by Member State on methodologies and emission factors for CO_2 from 1.A.4: 'Other sectors'. CO_2 emissions from 'Other sectors' increased by 1.7 % between 1990 and 2004. Most Member States had increases in this source during this time. The relative growth was highest in Portugal (70 %).

Table 3.68 Member States' contributions to CO_2 emissions from 1.A.4: 'Other sectors' and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1]	EF [1]
Austria	14.391	14.181	T2	CS
Belgium	27.215	31.243	C	C
Denmark	9.159	7.159	CR	CS
Finland	7.066	5.931	M,T1,T3	CS,D
France	93.838	106.240	C	CS
Germany	204.313	169.009	CS	CS
Greece	8.126	13.490	CR,NA	D,NA
Ireland	9.998	10.595	T1	CS
Italy	76.548	84.109	T2	CS
Luxembourg	1.278	1.355	C/D	C/D
Netherlands	37.867	40.125	T2	CS,D
Portugal	4.025	6.832	T2	D+C
Spain	25.280	38.358	T3,NA,T2	CR,CS,NA
Sweden	10.703	5.765	T2, T3,NA,T1	CS,NA
United Kingdom	109.076	115.457	T2	CS
EU15	638.883	649.850	C,CS,D,T1,T2,T3, CR,NA,M	C,CS,D,CR,NA

([1]) Information source: CRF Summary Table 3 for 2002.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 3.69 provides information on the contribution of Member States to EU-15 recalculations in CO_2 from 1.A.4 'Other sectors' for 1990 and 2003 and main explanations for the largest recalculaltions in absolute terms.

Table 3.69 Contribution of MS to EU-15 recalculations in CO_2 from 1.A.4 'Other sectors' for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

	1990		2003		Main explanations
	Gg	Percent	Gg	Percent	
Austria	-1	0.0	557	3.8	
Belgium	-16	-0.1	524	1.7	
Denmark	30	0.3	24	0.3	
Finland	97	1.4	-42	-0.7	
France	-578	-0.6	3,020	3.0	Updated energy consumption (2003)
Germany	-101	0.0	299	0.2	
Greece	100	1.2	-8	-0.1	
Ireland	272	2.8	0	0.0	
Italy	286	0.4	856	1.0	
Luxembourg	0	0.0	0	0.0	
Netherlands	436	1.2	468	1.2	
Portugal	0	0.0	-25	-0.4	
Spain	-493	-1.9	1,271	3.6	No explanation provided
Sweden	197	1.9	336	5.4	
UK	-1,099	-1.0	4,303	3.9	Reallocation of gas oil use to agricultural vehicles and mobile machinery
EU15	**-870**	**-0.1**	**11,582**	**1.8**	

Table 3.70 summarises information by Member State on methodologies and emission factors for CH_4 from 1.A.4: 'Other sectors'. CH_4 emissions from 'Other sectors' decreased by 32 % between 1990 and 2004. Most Member States had decreases in this source during this time, except Italy, Finland and Denmark. This source category includes one key source: CH_4 from 1.A.4.b: 'Residential'.

Table 3.70 Member States' contributions to CH_4 emissions from 1.A.4: 'Other sectors' and information on methods applied and emissions factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1]	EF [1]
Austria	388	260	T2	CS
Belgium	129	92	C	D
Denmark	91	176	CR	CS
Finland	200	210	M,T1,T3	CS,D
France	3.997	3.297	C	CS
Germany	2.593	640	T2	CS
Greece	213	213	CR,NA	CR,NA
Ireland	94	48	T1	CR,D
Italy	309	559	T2	C
Luxembourg	11	7	C/D	C/D
Netherlands	393	386	T1,T2	CS,D
Portugal	348	317	T2	D+C
Spain	819	656	T3,NA,T2	CR,NA
Sweden	248	227	T2, T3,NA,T1	CS,NA
United Kingdom	1.538	666	T2	CR,CS,D
EU15	11.374	7.754	C,D,T1,T2,T3,CR,M,NA	C,CS,D,PS,CR,NA

([1]) Information source: CRF Summary Table 3 for 2004.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 3.71 provides information on the contribution of Member States to EU-15 recalculations in CH_4 from 1.A.4 'Other sectors' for 1990 and 2003.

Table 3.71 Contribution of MS to EU-15 recalculations in CH_4 from 1.A.4 'Other sectors' for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

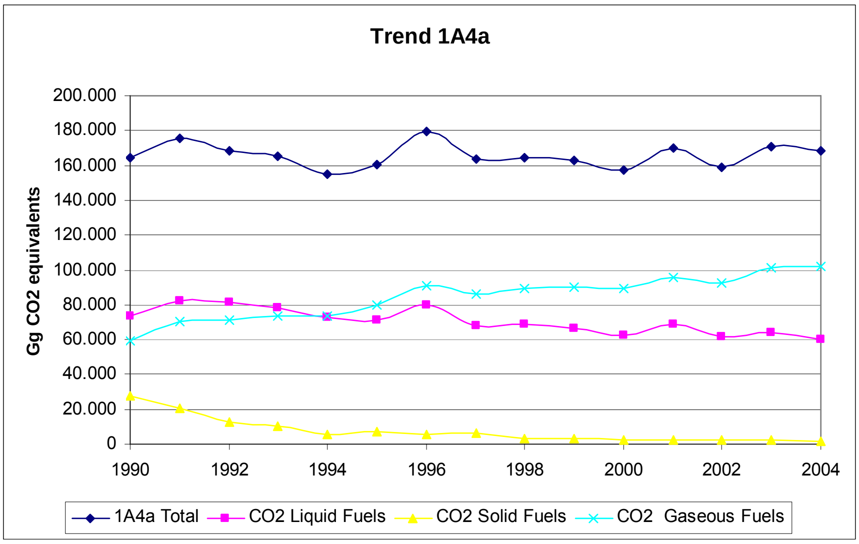
	1990		2003	
	Gg	Percent	Gg	Percent
Austria	-8	-2,1	-34	-11,5
Belgium	0	0,0	-1	-1,4
Denmark	1	1,3	11	6,9
Finland	-104	-34,2	-113	-34,8
France	13	0,3	11	0,3
Germany	35	1,4	1	0,2
Greece	-1	-0,4	1	0,6
Ireland	6	6,4	0	0,0
Italy	0	-0,1	0	0,0
Luxembourg	-1	-5,3	0	0,0
Netherlands	0	0,1	0	0,0
Portugal	0	0,0	0	0,0
Spain	-1	-0,1	2	0,3
Sweden	23	10,2	-11	-4,4
UK	70	4,8	139	29,2
EU15	**32**	**0,3**	**7**	**0,1**

3.2.4.1. Commercial/Institutional (1A4a)

In this chapter information about emission trends, member states' contribution, activity data, and emission factors is provided for categroy 1.A.4.a by fuels. CO_2 emissions from 1.A.4.a: 'Commercial/institutional' are the fifth largest key source of GHG emissions in the EU-15 and account for 4 % of total GHG emissions in 2004.

Figure 3.60 shows the emission trend within the category 1.A.4.a, which is mainly dominated by CO_2 emissions from liquid and gaseous fuels. Total emissions increased by 3 %, mainly due to increases in emissions from gaseous fuels (+72 %). Decreasing emissions are reported for solid (-93 %) and liquid (-18 %) fuels.

Figure 3.60: Total and CO_2 emission trends for category 1.A.4.a



Between 1990 and 2004, CO_2 emissions from services increased by 3 % in the EU-15 (Table 3.72). Main factors influencing CO_2 emissions from this source category are (1) outdoor temperature, (2) number and size of offices, (3) building codes, (4) age distribution of the existing building stock, and (5) fuel split for heating and warm water. Fossil fuel consumption in services increased by 11 % between 1990 and 2004, with a fuel shift from coal and oil to gas.

The United Kingdom, Germany and France contributed the most to the emissions from this source (61 %). The Member States with the highest increases in absolute terms were Spain, Italy, France and the Netherlands. The Member State with the highest reduction was Germany. Between 2003 and 2004 changes in the Member States were small (from-4 % to +8 %), except Austria (-19 %) and Sweden (-31 %).

Table 3.72 Member States' contributions to CO_2 emissions from 1.A.4.a: 'Commercial/institutional'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	2,442	3,264	2,660	1.6%	-604	-19%	218	9%
Belgium	4,272	6,294	6,124	3.7%	-170	-3%	1,852	43%
Denmark	1,403	969	956	0.6%	-14	-1%	-447	-32%
Finland	1,964	1,309	1,295	0.8%	-15	-1%	-670	-34%
France	27,949	31,350	32,196	19.3%	845	3%	4,247	15%
Germany	63,950	48,806	46,706	28.0%	-2,100	-4%	-17,244	-27%
Greece	527	1,131	1,221	0.7%	91	8%	694	132%
Ireland	2,267	3,044	2,942	1.8%	-101	-3%	675	30%
Italy	16,211	24,238	24,499	14.7%	261	1%	8,288	51%
Luxembourg	599	646	639	0.4%	-7	-1%	40	7%
Netherlands	7,523	11,548	11,341	6.8%	-206	-2%	3,818	51%
Portugal	744	3,221	3,494	2.1%	273	8%	2,750	370%
Spain	3,745	8,709	9,028	5.4%	319	4%	5,283	141%
Sweden	2,541	1,152	792	0.5%	-360	-31%	-1,749	-69%
United Kingdom	25,468	23,145	22,940	13.8%	-205	-1%	-2,527	-10%
EU15	161,603	168,825	166,833	100.0%	-1,993	-1%	5,229	3%

1A4 a Commercial/Institutional – Liquid Fuels (CO_2)

In 2004 CO_2 from liquid fuels had a share of 36 % within source category 1A4a (compared to 45 % in 1990). Between 1990 and 2004 the emissions decreased by 18 % (Table 3.73). Five Member States had increases in this time, with the highest in Portugal (+325 %). The highest absolute reduction was achieved in Germany. Between 2003 and 2004 EU-15 total emission decreased by 5 %.

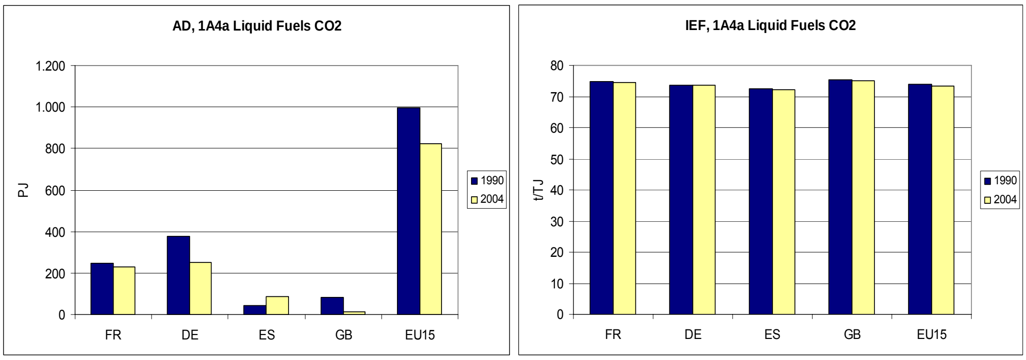
Table 3.73 Member States' contributions to CO_2 emissions from 1.A.4.a 'Commercial/institutional': Liquid Fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	1.372	2.090	1.323	2,2%	-766	-37%	-49	-4%	T2	NS	CS
Belgium	2.312	2.776	2.723	4,5%	-52	-2%	412	18%	C	RS	C
Denmark	1.008	350	356	0,6%	5	2%	-653	-65%	C	NS	CS/C
Finland	1.890	1.141	1.140	1,9%	-1	0%	-750	-40%	T1	NS	CS
France	18.338	17.190	17.267	28,6%	77	0%	-1.071	-6%	C	NS	CS
Germany	27.633	20.263	18.460	30,6%	-1.803	-9%	-9.173	-33%	T2	NS/AS	CS
Greece	505	1.066	1.120	1,9%	54	5%	614	122%	C	NS	D
Ireland	1.977	2.235	2.126	3,5%	-109	-5%	149	8%	T1	NS	CS
Italy	5.142	4.696	4.309	7,1%	-387	-8%	-833	-16%	T2	NS	CS
Luxembourg	331	331	342	0,6%	12	4%	11	3%	C/D		C/D
Netherlands	742	241	169	0,3%	-71	-30%	-572	-77%	T2	NS	CS
Portugal	744	2.890	3.162	5,2%	272	9%	2.418	325%	D	NS	D
Spain	3.196	6.086	6.163	10,2%	78	1%	2.968	93%	T2	NS	C
Sweden	2.455	971	726	1,2%	-246	-25%	-1.730	-70%	T1,T2,T3	NS	CS
United Kingdom	6.236	1.424	987	1,6%	-437	-31%	-5.249	-84%	T2	NS/AS	CS
EU15	73.881	63.749	60.374	100,0%	-3.375	-5%	-13.507	-18%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.61 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – France, Germany, Spain and the United Kingdom; together they cause 75 % (1990) resp. 71 % (2004) of the CO_2 emissions from liquid fuels in 1A4a. Fuel combustion in the EU-15 decreased by 18 % between 1990 and 2004. Implied emission factors of EU-15 Member States range between 67.5 and 76.0 t/TJ in 2004.

Figure 3.61 Activity Data and Implied Emission Factors for CO_2 from Liquid Fuels in 1A4a



1A4a Commercial/Institutional – Solid Fuels (CO_2)

In 2004 CO_2 from solid fuels had a share of 1 % within source category 1A4a (compared to 17 % in 1990). Between 1990 and 2004 the emissions decreased by 93 % (Table 3.74). Denmark, Sweden, Greece, France, Finland and Portugal report emissions as 'Not occuring' or '0'. All other Member States decreased emissions, except Ireland (+39 %). Between 2003 and 2004 Luxembourg, the Netherlands and Spain reported increases, all other Member States show decreases; EU-15 emissions declined by 12 %.

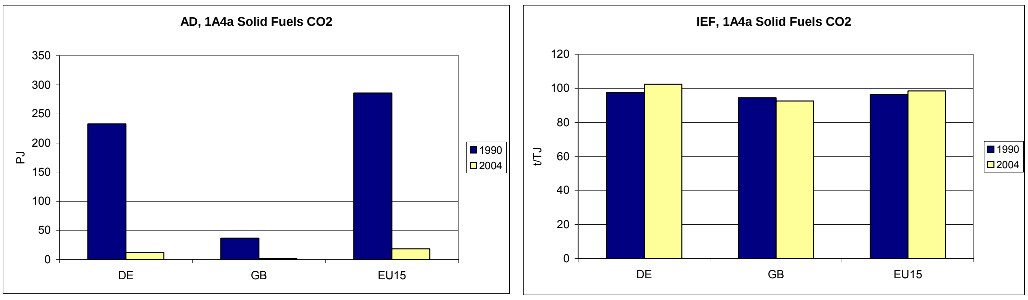
Table 3.74 Member States' contributions to CO_2 emissions from 1.A.4.a 'Commercial/institutional': Solid Fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	90	115	61	3,4%	-54	-47%	-29	-32%	T2	NS	CS
Belgium	9	3	2	0,1%	-1	-29%	-7	-78%	C	RS	C
Denmark	8	NO	0	0,0%	-	-	-8	-99%	C	NS	CS/C
Finland	NO	NO	NO	-	-	-	-	-	T1	NS	CS
France	698	NO	NO	-	-	-	-698	-	C	NS	CS
Germany	22.712	1.197	1.202	66,9%	5	0%	-21.510	-95%	T2	NS/AS	CS
Greece	10	NO	NO	-	-	-	-10	-	C	NS	D
Ireland	74	111	103	5,7%	-8	-7%	29	39%	T1	NS	CS
Italy	218	5	2	0,1%	-2	-52%	-216	-99%	T2	NS	CS
Luxembourg	48	4	4	0,2%	0	2%	-44	-92%	C/D		C/D
Netherlands	128	102	114	6,4%	12	12%	-13	-11%	T2	NS	CS
Portugal	0	0	0	0,0%	0	-	0	-	D	NS	D
Spain	154	120	123	6,9%	3	3%	-31	-20%	T2	NS	C
Sweden	NO	NO	NO	-	-	-	-	-	NA	NA	NA
United Kingdom	3.454	377	186	10,4%	-191	-51%	-3.268	-95%	T2	NS/AS	CS
EU15	27.603	2.033	1.797	100,0%	-236	-12%	-25.806	-93%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.62 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – Germany and the Unitded Kingdom; together they cause 95 % (1990) resp. 77 % (2004) of the CO_2 emissions from solid fuels in 1A4a. Fuel combustion in the EU-15 decreased by 94 % between 1990 and 2004. Implied emission factors of EU-15 Member states range between 72.6 and 103.5 t/TJ in 2004.

Figure 3.62 Activity Data and Implied Emission Factors for CO_2 from Solid Fuels in 1A4a



1A4a Commercial/Institutional – Gaseous Fuels (CO_2)

In 2004 CO_2 from gaseous fuels had a share of 60 % within source category 1A4a (compared to 36 % in 1990). Between 1990 and 2004 the emissions increased by 72 % (Table 3.75). All Member States reported increasing emissions except Sweden (-23 %). The highest absolute increase occurred in Germany, Italy and France. Spain shows a relative increase of +594 %. Between 2003 and 2004 EU-15 emissions changed marginally (+1 %), seven Member States reported a decrease.

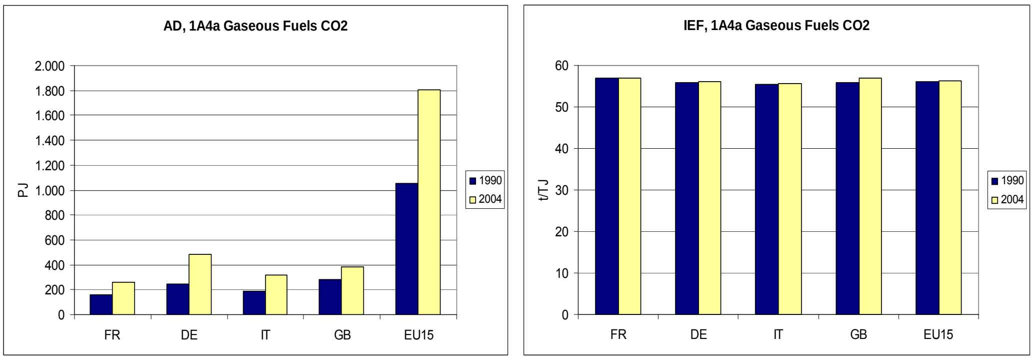
Table 3.75 Member States' contributions to CO_2 emissions from 1.A.4.a 'Commercial/institutional': Gaseous Fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	740	992	1.127	1,1%	135	14%	387	52%	T2	NS	CS
Belgium	1.921	3.462	3.323	3,3%	-139	-4%	1.402	73%	C	RS	C
Denmark	365	587	574	0,6%	-13	-2%	209	57%	C	NS	CS/C
Finland	47	136	126	0,1%	-11	-8%	79	168%	T1	NS	CS
France	8.910	14.161	14.928	14,7%	768	5%	6.018	68%	C	NS	CS
Germany	13.605	27.346	27.044	26,6%	-302	-1%	13.439	99%	T2	NS/AS	CS
Greece	12	65	102	0,1%	37	57%	90	743%	C	NS	D
Ireland	216	698	714	0,7%	16	2%	497	230%	T1	NS	CS
Italy	10.243	17.615	17.707	17,4%	92	1%	7.464	73%	T2	NS	CS
Luxembourg	220	311	293	0,3%	-18	-6%	73	33%	C/D		C/D
Netherlands	6.653	11.205	11.057	10,9%	-147	-1%	4.404	66%	T2	NS	CS
Portugal	0	331	332	0,3%	1	0%	332	-	D	NS	D
Spain	395	2.503	2.741	2,7%	238	10%	2.346	594%	T2	NS	CS
Sweden	86	180	66	0,1%	-114	-63%	-20	-23%	T1,T2,T3	NS	CS
United Kingdom	15.717	21.303	21.727	21,3%	424	2%	6.009	38%	T2	NS	CS
EU15	59.130	100.895	101.861	100,0%	966	1%	42.731	72%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.63 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – France, Germany, Italy and the United Kingdom; together they cause 82 % (1990) resp. 80 % (2004) of the CO_2 emissions from gaseous fuels in 1A4a. Fuel combustion in the EU-15 rose by 71 % between 1990 and 2004. Implied emission factors of EU-15 Member States range between 54.8 and 57.0 t/TJ in 2004.

Figure 3.63 Activity Data and Implied Emission Factors for CO_2 from Gaseous Fuels in 1A4a

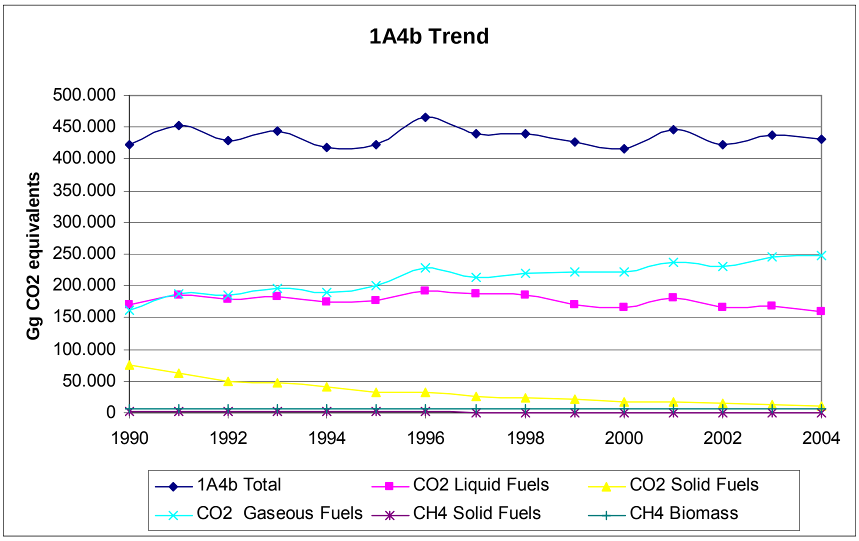


3.2.4.2. Residential (1A4b)

In this chapter information about emission trends, Member States' contribution, activity data, and emission factors is provided for category 1.A.4.b by fuels. CO_2 emissions from 1.A.4.b: 'Residential' are the fourth largest key source of GHG emissions in the EU-15 and account for 10 % of total GHG emissions in 2004.

Figure 3.64 shows the emission trend within the category 1.A.4.b, which is mainly dominated by CO_2 emissions from liquid and gaseous fuels. Total emissions increased by 2 %, mainly due to increases in emissions from gaseous fuels (+53 %). Decreasing emissions are reported from all other fuels.

Figure 3.64: Total, CO_2 and CH_4 emission trends for category 1.A.4.b



CO_2 emissions from 1A4b Residential

Between 1990 and 2004, CO_2 emissions from households increased by 3 % in the EU-15 (Table 3.76). Main factors influencing CO_2 emissions from this source category are (1) outdoor temperature, (2) number and size of dwellings, (3) building codes, (4) age distribution of the existing building stock, and (5) fuel split for heating and warm water. Fossil fuel consumption in households increased by 13 % between 1990 and 2004, with a fuel shift from coal and oil to gas.

Between 1990 and 2004, the largest reduction in absolute terms was reported by Germany reducing emissions by 14 million tonnes. Denmark shows emission reductions of more than 1 million tonnes and Sweden more than 3 million tonnes. The United Kingdom and France had the largest emission increases in absolute terms. One reason for the performance of the Nordic countries is increased use of district heating. As district heating replaces heating boilers in households, an increase in the share of district heating reduces CO_2 emissions from households (but increases emissions from energy industries if fossil fuels are used). In Germany, efficiency improvements and the fuel switch in eastern German households are two reasons for the emission reductions.

Table 3.76 Member States' contributions to CO_2 emissions from 1.A.4.b: 'Residential'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	9.906	10.289	9.784	2,3%	-505	-5%	-122	-1%
Belgium	20.213	23.146	22.802	5,4%	-345	-1%	2.588	13%
Denmark	5.084	4.176	4.065	1,0%	-111	-3%	-1.018	-20%
Finland	3.072	2.597	2.566	0,6%	-31	-1%	-506	-16%
France	55.218	62.647	64.565	15,4%	1.919	3%	9.347	17%
Germany	129.446	122.441	115.623	27,6%	-6.818	-6%	-13.823	-11%
Greece	4.671	10.036	9.602	2,3%	-434	-4%	4.931	106%
Ireland	7.071	6.382	6.849	1,6%	467	7%	-222	-3%
Italy	51.990	52.408	51.313	12,2%	-1.095	-2%	-677	-1%
Luxembourg	601	648	641	0,2%	-7	-1%	40	7%
Netherlands	19.495	19.360	19.087	4,5%	-273	-1%	-408	-2%
Portugal	1.621	2.273	2.276	0,5%	3	0%	655	40%
Spain	12.979	18.675	19.439	4,6%	764	4%	6.460	50%
Sweden	6.419	3.439	3.031	0,7%	-408	-12%	-3.388	-53%
United Kingdom	78.465	87.449	87.896	21,0%	447	1%	9.431	12%
EU15	406.251	425.967	419.540	100,0%	-6.427	-2%	13.289	3%

Abbreviations explained in the Chapter 'Units and abbreviations'.

1A4b Residential – Liquid Fuels (CO_2)

In 2004 CO_2 from liquid fuels had a share of 37 % within source category 1A4b (compared to 40 % in 1990). Between 1990 and 2004 the emissions decreased by 6 % (Table 3.77). The highest increases show Greece, Ireland and Spain. The highest absolute decrease was achieved by Italy. Between 2003 and 2004 EU-15 emissions decreased by 5 %.

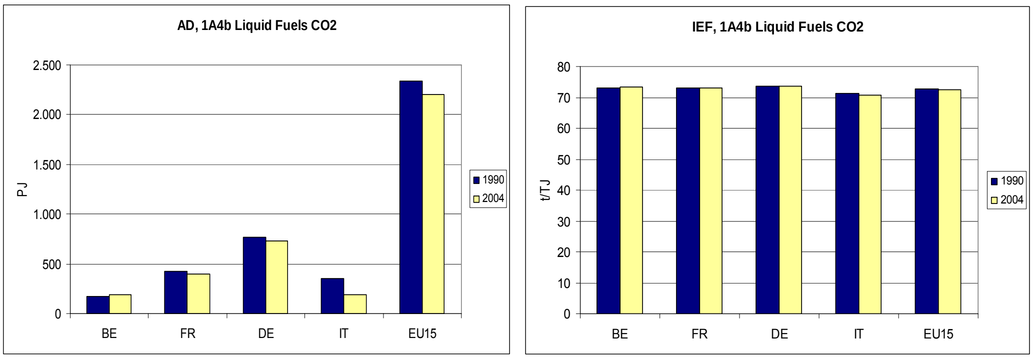
Table 3.77 Member States' contributions to CO_2 emissions from 1.A.4.b 'Residential': Liquid Fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	5.603	6.021	5.734	3,6%	-287	-5%	131	2%	T2	NS	CS
Belgium	12.609	13.905	13.656	8,5%	-249	-2%	1.047	8%	C	RS	C
Denmark	4.023	2.370	2.269	1,4%	-101	-4%	-1.754	-44%	C	NS	CS/C/D
Finland	2.951	2.482	2.450	1,5%	-32	-1%	-501	-17%	T1	NS	CS
France	31.037	29.040	29.133	18,2%	93	0%	-1.904	-6%	C	NS	CS
Germany	56.344	58.965	53.556	33,5%	-5.409	-9%	-2.789	-5%	T2	NS/AS	CS
Greece	4.585	9.978	9.498	5,9%	-480	-5%	4.913	107%	C	NS	D
Ireland	1.194	3.382	3.371	2,1%	-10	0%	2.178	182%	T1	NS	CS
Italy	25.165	14.638	13.731	8,6%	-906	-6%	-11.433	-45%	T2	NS	CS
Luxembourg	334	333	345	0,2%	12	4%	11	3%	C/D		C/D
Netherlands	737	285	281	0,2%	-4	-1%	-456	-62%	T2	NS	CS
Portugal	1.621	1.903	1.892	1,2%	-10	-1%	271	17%	D	NS	D
Spain	9.971	11.740	11.943	7,5%	202	2%	1.972	20%	T2	NS	C
Sweden	6.333	3.342	2.982	1,9%	-360	-11%	-3.351	-53%	T1,T2,T3	NS	CS
United Kingdom	7.171	10.279	8.966	5,6%	-1.313	-13%	1.794	25%	T2	NS/AS	CS
EU15	169.679	168.662	159.807	100,0%	-8.856	-5%	-9.872	-6%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.65 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – Belgium, France, Germany and Italy; together they cause 74 % (1990) resp. 69 % (2004) of the CO_2 emissions from liquid fuels in 1A4b. Fuel combustion in the EU-15 decreased by 6 % between 1990 and 2004. Implied emission factors of EU-15 Member steas range between 62.9 and 75.3 t/TJ in 2004.

Figure 3.65 Activity Data and Implied Emission Factors for CO_2 from Liquid Fuels in 1A4b



1A4b Residential –Solid Fuels (CO_2)

In 2004 CO_2 from solid fuels had a share of 3 % within source category 1A4b (compared to 18 % in 1990). Between 1990 and 2004 the emissions decreased by 85 % (Table 3.78). All Member States reported decreasing emissions with the highest reductions in relative terms in Germany, Denmark and Luxembourg.Between 2003 and 2004 EU-15 emissions changed by -4 %, although five Member States reported rising emissions. France, Sweden and Portugal report emissions for 2004 as 'Not occuring' or '0'.

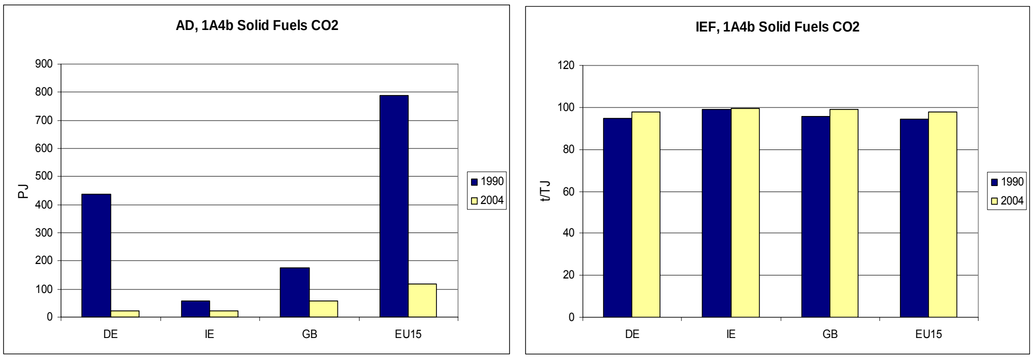
Table 3.78 Member States' contributions to CO_2 emissions from 1.A.4.b 'Residential': Solid Fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	2.512	665	547	4,7%	-118	-18%	-1.966	-78%	T2	NS	CS
Belgium	1.759	525	500	4,3%	-25	-5%	-1.259	-72%	C	RS	C
Denmark	72	3	3	0,0%	0	-6%	-69	-96%	C	NS	CS/C/D
Finland	33	9	9	0,1%	0	0%	-24	-73%	T1	NS	CS
France	3.350	NO	NO	-	-	-	-3.350	-	C	NS	CS
Germany	41.387	2.940	2.147	18,6%	-792	-27%	-39.240	-95%	T2	NS/AS	CS
Greece	82	14	23	0,2%	9	66%	-58	-71%	C	NS	D
Ireland	5.608	1.761	2.068	18,0%	307	17%	-3.539	-63%	T1	NS	CS
Italy	702	68	33	0,3%	-36	-52%	-670	-95%	T2	NS	CS
Luxembourg	48	4	4	0,0%	0	2%	-44	-92%	C/D		C/D
Netherlands	61	20	20	0,2%	0	-1%	-41	-68%	NA	NS	NA
Portugal	0	0	0	0,0%	0	-	0	-	D	NS	D
Spain	2.091	416	421	3,7%	5	1%	-1.669	-80%	T2	NS	C
Sweden	NO	NO	NO	-	-	-	-	-	NA	NS	NA
United Kingdom	16.821	5.583	5.745	49,9%	162	3%	-11.076	-66%	T2	NS/AS	CS
EU15	74.526	12.008	11.520	100,0%	-488	-4%	-63.006	-85%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.66 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – Germany, Ireland and the United Kingdom; together they cause 86 % (1990) resp. 86 % (2004) of the CO_2 emissions from gaseous fuels in 1A4b. Fuel combustion in the EU-15 decreased by 85 % between 1990 and 2004. Implied emission factors of EU-15 Member States range between 72.2 and 107.9 t/TJ in 2004.

Figure 3.66 Activity Data and Implied Emission Factors for CO_2 from Solid Fuels in 1A4b



1A4b Residential – Gaseous Fuels (CO_2)

In 2004 CO_2 from gaseous fuels had a share of 57 % within source category 1A4b (compared to 38 % in 1990). Between 1990 and 2004 the emissions increased by +53 % (Table 3.79). All Member States reported increasing emissions except Sweden (-43 %). The highest absolute increase occurred in Germany, Italy, France and the United Kingdom. Between 2003 and 2004 EU-15 emissions changed marginally (+1 %), seven Member States reported a decrease.

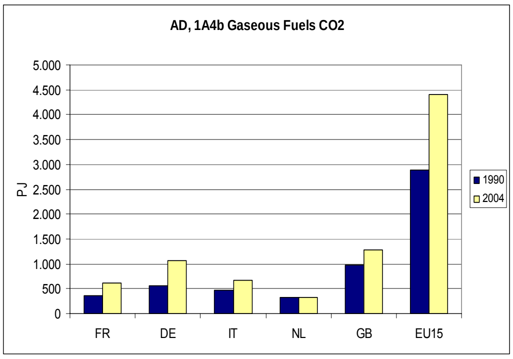
Table 3.79 Member States' contributions to CO_2 emissions from 1.A.4.b 'Residential': Gaseous Fuels

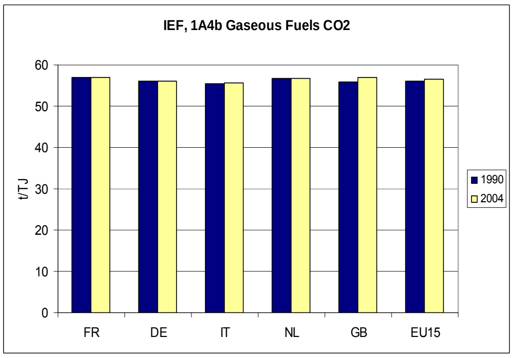
Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	1.791	3.602	3.503	1,4%	-99	-3%	1.712	96%	T2	NS	CS
Belgium	5.824	8.697	8.620	3,5%	-77	-1%	2.796	48%	C	RS	C
Denmark	988	1.804	1.793	0,7%	-10	-1%	806	82%	C	NS	CS/C/D
Finland	22	58	59	0,0%	2	3%	37	163%	T1	NS	CS
France	20.764	33.532	35.350	14,3%	1.818	5%	14.586	70%	C	NS	CS
Germany	31.714	60.536	59.920	24,2%	-616	-1%	28.206	89%	T2	NS/AS	CS
Greece	5	44	81	0,0%	37	85%	76	1545%	C	NS	D
Ireland	269	1.240	1.409	0,6%	170	14%	1.140	424%	T1	NS	CS
Italy	26.123	37.702	37.549	15,1%	-153	0%	11.426	44%	T2	NS	CS
Luxembourg	220	311	293	0,1%	-18	-6%	73	33%	C/D		C/D
Netherlands	18.696	19.056	18.786	7,6%	-270	-1%	90	0%	T2	NS	CS
Portugal	0	371	384	0,2%	13	4%	384	-	D	NS	D
Spain	918	6.519	7.075	2,9%	556	9%	6.157	671%	T2	NS	CS
Sweden	86	97	49	0,0%	-48	-50%	-37	-43%	T1,T2,T3	NA	CS
United Kingdom	54.473	71.587	73.186	29,5%	1.599	2%	18.713	34%	T2	NS	CS
EU15	161.893	245.154	248.057	100,0%	2.903	1%	86.164	53%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.67 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – France, Germany, Italy, the Netherlands and the United Kingdom; together they cause 94 % (1990) resp. 91 % (2004) of the CO_2 emissions from gaseous fuels in 1A4b. Fuel combustion in the EU-15 rose 52 % between 1990 and 2004. Implied emission factors of EU-15 Member States range between 54.8 and 57.0 t/TJ in 2004.

Figure 3.67 Activity Data and Implied Emission Factors for CO_2 from Gaseous Fuels in 1A4b





CH_4 emissions from 1A4b Residential

CH_4 emissions from 1.A.4.b: 'Residential' account for 0.2 % of total GHG emissions in 2004. Between 1990 and 2004, CH_4 emissions from households decreased by 26 % in the EU-15 (Table 3.80). France is reponsible for 45 % of total CH_4 emissions and achieved between 1990 and 2004 a reduction of 18 %. All Member States except Denmark, Finland and Italy reported a decrease in emissions. Between 2003 and 2004 EU-15 emissions hardly changed.

Table 3.80 Member States' contributions to CH_4 emissions from 1.A.4.b: 'Residential'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	377	229	225	3,2%	-4	-2%	-152	-40%
Belgium	121	84	83	1,2%	-1	-2%	-39	-32%
Denmark	68	112	112	1,6%	0	0%	45	66%
Finland	164	182	181	2,5%	-1	-1%	17	10%
France	3.905	3.306	3.217	45,2%	-90	-3%	-689	-18%
Germany	1.200	578	548	7,7%	-30	-5%	-652	-54%
Greece	205	204	205	2,9%	1	0%	0	0%
Ireland	90	36	41	0,6%	5	13%	-49	-55%
Italy	260	366	431	6,1%	65	18%	171	66%
Luxembourg	5	3	3	0,0%	0	0%	-2	-42%
Netherlands	355	346	342	4,8%	-4	-1%	-13	-4%
Portugal	344	308	311	4,4%	2	1%	-34	-10%
Spain	775	613	614	8,6%	1	0%	-161	-21%
Sweden	239	223	213	3,0%	-11	-5%	-27	-11%
United Kingdom	1.449	534	585	8,2%	50	9%	-864	-60%
EU15	9.558	7.127	7.110	100,0%	-17	0%	-2.448	-26%

Abbreviations explained in the Chapter 'Units and abbreviations'.

1A4b Residential –Solid Fuels (CH_4)

In 2004 CH_4 from solid fuels had a share of 0.1 % within source category 1A4b (compared to 0.6 % in 1990). Between 1990 and 2004 the emissions decreased by 81 % (Table 3.81). All Member States reported decreasing emissions. France reduced its emissions to zero, Denmark by 96 % and Germany by 94 %. Between 2003 and 2004 EU-15 emissions changed by +7 %, mainly due to increases in the United Kingdom (+17 %).

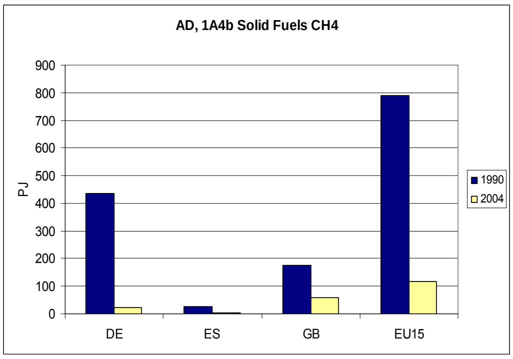
Table 3.81 Member States' contributions to CH_4 emissions from 1.A.4.b 'Residential': Solid Fuels

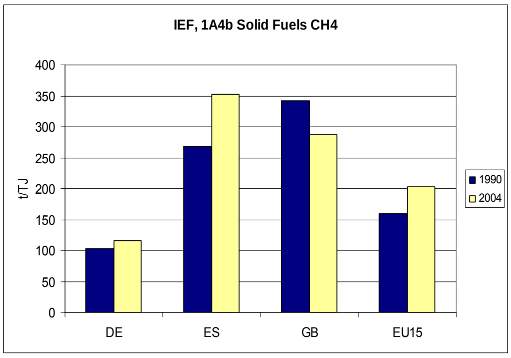
Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	59	14	12	2,4%	-3	-18%	-47	-80%
Belgium	65	17	16	3,1%	-1	-5%	-50	-76%
Denmark	0	0	0	0,0%	0	-7%	0	-96%
Finland	2	1	1	0,1%	0	0%	-2	-73%
France	63	0	0	0,0%	0	-	-63	-100%
Germany	949	77	54	10,8%	-23	-30%	-895	-94%
Greece	4	1	2	0,3%	1	138%	-3	-61%
Ireland	86	25	31	6,3%	6	24%	-55	-64%
Italy	7	0	1	0,3%	1	372%	-6	-80%
Luxembourg	2	0	0	0,0%	0	0%	-2	-89%
Netherlands	0	0	0	0,0%	0	-1%	0	-68%
Portugal	0	0	0	0,0%	0	-	0	-
Spain	145	35	35	6,9%	0	0%	-111	-76%
Sweden	0	0	0	0,0%	0	-	0	-
United Kingdom	1.263	298	349	69,8%	51	17%	-914	-72%
EU15	2.647	468	500	100,0%	33	7%	-2.146	-81%

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.68 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – Germany, Spain and the United Kingdom; together they cause 89 % (1990) resp. 87 % (2004) of the CO_2 emissions from gaseous fuels in 1A4b. Fuel combustion in the EU-15 decreased by 85 between 1990 and 2004. Implied emission factors of EU-15 Member States range between 0.4 and 351.9 kg/TJ in 2004.

Figure 3.68 Activity Data and Implied Emission Factors for CH_4 from Solid Fuels in 1A4b





1A4b Residential – Biomass (CH_4)

In 2004 CH_4 from biomass had a share of 1.4 % within source category 1A4b (compared to 1.5 % in 1990). Between 1990 and 2004 the emissions decreased by 6 % (Table 3.82). France reported the highest absolute decrease, while Germany's (+98 %) and Italy's (+104 %) CH_4 emissions increased significantly. Between 2003 and 2004 EU-15 emissions changed marginally (-1 %); Italy reported an increase of 21 %.

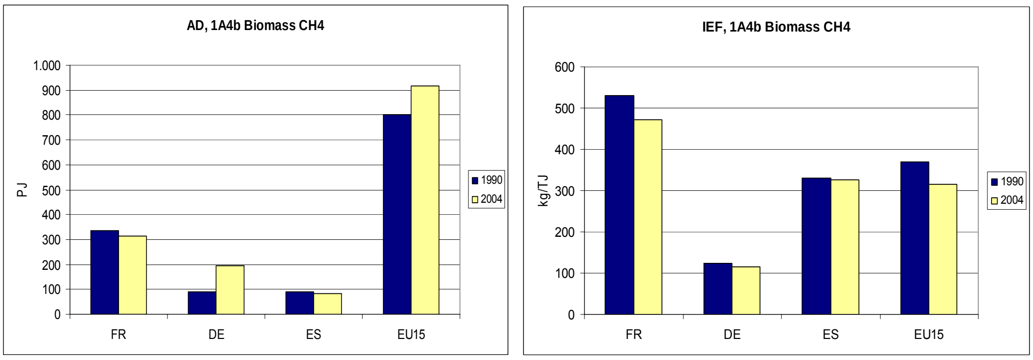
Table 3.82 Member States' contributions to CH_4 emissions from 1.A.4.b 'Residential': Biomass

Member State	Greenhouse gas emissions (Gg CO_2			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	312	212	211	3,6%	-2	-1%	-101	-33%
Belgium	30	37	37	0,6%	0	0%	7	22%
Denmark	59	86	85	1,5%	0	-1%	26	45%
Finland	152	173	173	3,0%	-1	0%	20	13%
France	3.752	3.196	3.103	53,2%	-93	-3%	-649	-17%
Germany	235	473	466	8,0%	-6	-1%	231	98%
Greece	198	198	198	3,4%	0	0%	0	0%
Ireland	1	1	1	0,0%	0	-1%	0	-4%
Italy	183	307	374	6,4%	66	21%	190	104%
Luxembourg	2	1	1	0,0%	0	0%	-1	-40%
Netherlands	73	59	59	1,0%	0	0%	-14	-19%
Portugal	343	307	309	5,3%	2	1%	-34	-10%
Spain	621	562	562	9,6%	0	0%	-59	-9%
Sweden	229	213	202	3,5%	-10	-5%	-27	-12%
United Kingdom	46	54	54	0,9%	0	0%	8	17%
EU15	6.237	5.879	5.835	100,0%	-45	-1%	-402	-6%

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.69 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – France, Germany and Spain; together they cause 74 % (1990) resp. 71 % (2004) of the CO_2 emissions from gaseous fuels in 1A4b. Fuel combustion in the EU-15 rose by 14 % between 1990 and 2004. Implied emission factors of EU-15 Member States range between 30.0 and 530.0 kg/TJ in 2004.

Figure 3.69 Activity Data and Implied Emission Factors for CH_4 from Biomass in 1A4b

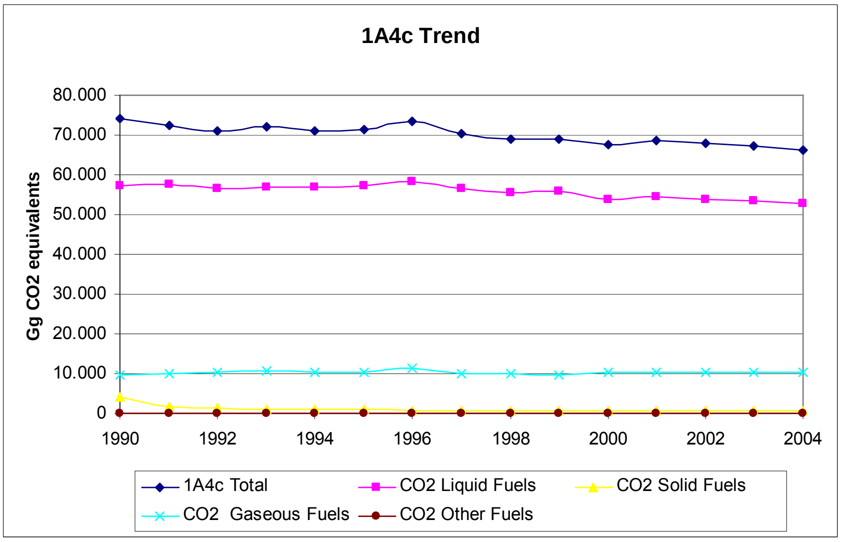


3.2.4.3. Agriculture/Forestry/Fisheries (1A4c)

In this chapter information about emission trends, Member States' contribution, activity data, and emission factors is provided for category 1.A.4.c by fuels. CO_2 emissions from 1.A.4.c: 'Agriculture/forestry/fisheries' account for 1.5 % of total EU-15 GHG emissions in 2004. Between 1990 and 2004, CO_2 emissions from 'Agriculture/forestry/fisheries' decreased by 9 % in the EU-15 (Table 3.83).

Figure 3.70 shows the emission trend within source category 1.A.4.c, which is mainly dominated by CO_2 emissions from liquid fuels. Total GHG emissions decreased by 11 %, mainly due to decreases in CO_2 emissions from liquid fuels (-8 %).

Figure 3.70: Total and CO_2 emission trends for category 1.A.4.c



Three Member States (Spain, France and the Netherlands) contributed the most to the emissions from this source (46 %). The Member State with the highest increase in absolute terms was Spain, the highest decreases were in Germany, France, the United Kingdom and the Netherlands. In the Netherlands, this decrease was due to significant energy conservation measures in the greenhouse horticulture which account for approximately 85 % of the primary energy use of the Dutch agricultural sector.

Table 3.83 Member States' contributions to CO_2 emissions from 1.A.4.c: 'Agriculture/forestry/fisheries'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	2.043	1.706	1.737	2,7%	32	2%	-306	-15%
Belgium	2.730	2.322	2.318	3,7%	-5	0%	-412	-15%
Denmark	2.673	2.281	2.138	3,4%	-142	-6%	-535	-20%
Finland	2.029	2.083	2.071	3,3%	-12	-1%	42	2%
France	10.671	9.477	9.479	14,9%	2	0%	-1.192	-11%
Germany	10.917	6.844	6.680	10,5%	-164	-2%	-4.237	-39%
Greece	2.927	3.119	2.666	4,2%	-453	-15%	-261	-9%
Ireland	660	837	803	1,3%	-33	-4%	143	22%
Italy	8.347	8.372	8.297	13,1%	-75	-1%	-50	-1%
Luxembourg	78	75	75	0,1%	0	0%	-3	-4%
Netherlands	10.850	9.711	9.697	15,3%	-14	0%	-1.153	-11%
Portugal	1.660	1.076	1.061	1,7%	-14	-1%	-599	-36%
Spain	8.556	9.701	9.892	15,6%	191	2%	1.336	16%
Sweden	1.743	1.911	1.943	3,1%	31	2%	200	11%
United Kingdom	5.144	4.728	4.621	7,3%	-108	-2%	-523	-10%
EU15	71.028	64.242	63.477	100,0%	-765	-1%	-7.551	-11%

Abbreviations explained in the Chapter 'Units and abbreviations'.

1A4c Agriculture/Forestry/Fisheries –Liquid Fuels (CO_2)

In 2004 CO_2 from liquid fuels had a share of 79 % within source category 1A4c (compared to 77 % in 1990). Between 1990 and 2004 the emissions decreased by 8 % (Table 3.84). Five Member States (Finland, Ireland, the Netherlands, Spain and the United Kingdom) reported increasing emissions with the highest increases in absolute terms in Spain. Between 2003 and 2004 EU-15 emissions changed by -1 %, the highest change reported Greece (-15 %).

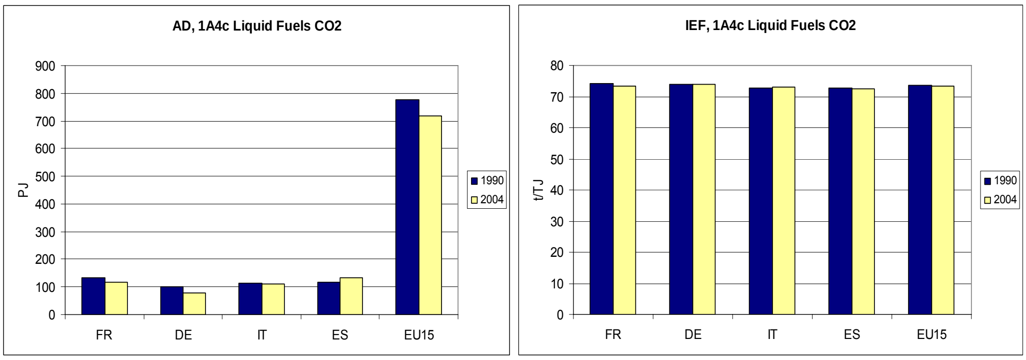
Table 3.84 Member States' contributions to CO_2 emissions from 1.A.4.c 'Agriculture/Forestry/Fisheries': Liquid Fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	1.972	1.651	1.687	3,2%	36	2%	-285	-14%	T2	NS	CS
Belgium	2.455	1.958	1.953	3,7%	-5	0%	-502	-20%	C	RS	C
Denmark	2.301	1.865	1.744	3,3%	-122	-7%	-557	-24%	C	NS	CS/C
Finland	1.944	1.985	1.968	3,7%	-18	-1%	24	1%	T1/T2	NS	CS
France	9.935	8.472	8.474	16,1%	2	0%	-1.461	-15%	C	NS	CS
Germany	7.484	5.917	5.762	11,0%	-154	-3%	-1.722	-23%	T2	NS/AS	CS
Greece	2.917	3.119	2.666	5,1%	-453	-15%	-250	-9%	C	NS	D
Ireland	660	837	803	1,5%	-33	-4%	143	22%	T1	NS	CS
Italy	8.295	8.063	7.971	15,2%	-92	-1%	-325	-4%	T2	NS	CS
Luxembourg	75	75	75	0,1%	0	0%	0	0%	C/D		C/D
Netherlands	2.522	2.669	2.656	5,0%	-13	0%	134	5%	T2	NS/Q	CS/D
Portugal	1.660	1.068	1.054	2,0%	-14	-1%	-606	-36%	D	NS	D
Spain	8.513	9.569	9.742	18,5%	173	2%	1.229	14%	T2, T3	NS, Q	C
Sweden	1.553	1.855	1.887	3,6%	32	2%	334	21%	T1,T2,T3	NS	CS
United Kingdom	4.914	4.279	4.165	7,9%	-114	-3%	-749	-15%	T2	NS/AS	CS
EU15	57.198	53.381	52.606	100,0%	-775	-1%	-4.592	-8%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.71 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – France, Germany, Italy and Spain; together they cause 60 % (1990) resp. 61 % (2004) of the CO_2 emissions from liquid fuels in 1A4c. Fuel combustion in the EU-15 decreased by 7 % between 1990 and 2004. Implied emission factors of EU-15 Member States range between 72.6 and 75.2 t/TJ in 2004.

Figure 3.71 Activity Data and Implied Emission Factors for CO_2 from Liquid Fuels in 1A4c



1A4c Agriculture/Forestry/Fisheries – Solid Fuels (CO_2)

In 2004 CO_2 from solid fuels had a share of 1 % within source category 1A4c (compared to 5 % in 1990). Between 1990 and 2004 the emissions decreased by 86 % (Table 3.85). All Member States reported decreasing emissions except Finland. In Greece, Ireland, Italy, the Netherlands and Sweden CO_2 emissions from this key source are not ocurring; Luxemburg and Portugal report '0'. Between 2003 and 2004 EU-15 emissions changed by -3 %.

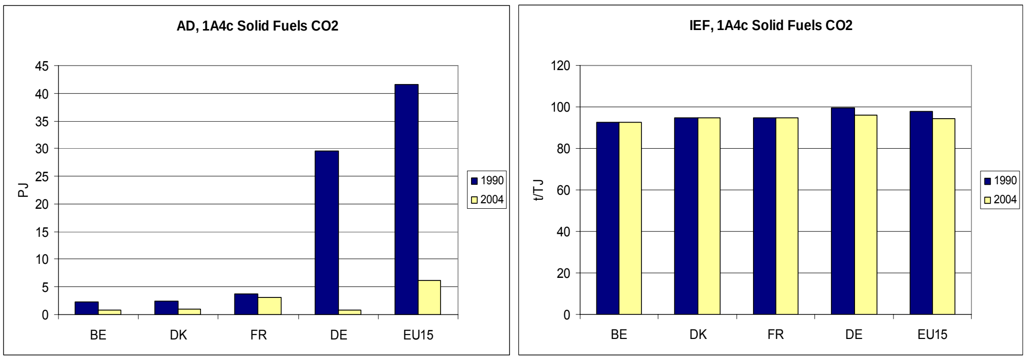
Table 3.85 Member States' contributions to CO_2 emissions from 1.A.4.c 'Agriculture/Forestry/Fisheries': Solid Fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	51	13	11	1,8%	-3	-19%	-41	-79%	T2	NS	CS
Belgium	208	76	76	12,9%	0	0%	-132	-64%	C	RS	C
Denmark	239	114	99	16,9%	-16	-14%	-140	-59%	C	NS	CS/C
Finland	13	16	16	2,8%	0	0%	3	24%	T1	NS	CS
France	353	287	287	49,1%	0	0%	-66	-19%	C	NS	CS
Germany	2.948	76	75	12,8%	-1	-1%	-2.873	-97%	T2	NS/AS	CS
Greece	11	NO	NO	-	-	-	-11	-	C	NS	D
Ireland	NO	NO	NO	-	-	-	-	-	T1	NS	CS
Italy	NO	NO	NO	-	-	-	-	-	T2	NS	CS
Luxembourg	0	0	0	0,0%	0	-	0	-	C/D		C/D
Netherlands	NO	NO	NO	-	-	-	-	-	NA	NS/Q	NA
Portugal	0	0	0	0,0%	0	-	0	-	D	NS	D
Spain	37	NA	NA	-	-	-	-37	-	T2	NS	C
Sweden	157	NO	NO	-	-	-	-157	-	NA	NA	NA
United Kingdom	48	19	21	3,6%	2	12%	-27	-56%	T2	NS/AS	CS
EU15	4.066	602	585	100,0%	-17	-3%	-3.481	-86%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.72 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – Belgium, Denmark, France and Germany; together they cause 92 % (both in 1990 and 2004) of the CO_2 emissions from gaseous fuels in 1A4b. Fuel combustion in the EU-15 decreased by85 % between 1990 and 2004. Implied emission factors of EU-15 Member States range between 72.2 and 107.9 t/TJ in 2004.

Figure 3.72 Activity Data and Implied Emission Factors for CO_2 from Solid Fuels in 1A4c



1A4c Agriculture/Forestry/Fisheries –Gaseous Fuels (CO_2)

In 2004 CO_2 from gaseous fuels had a share of 15 % within source category 1A4c (compared to 13 % in 1990). Between 1990 and 2004 the emissions increased by 5 % (Table 3.86). All Member States reported increasing emissions except Finland and Luxembourg.The highest relative increase ocurred in Spain (+2332 %). Between 2003 and 2004 EU-15 emissions hardly changed.

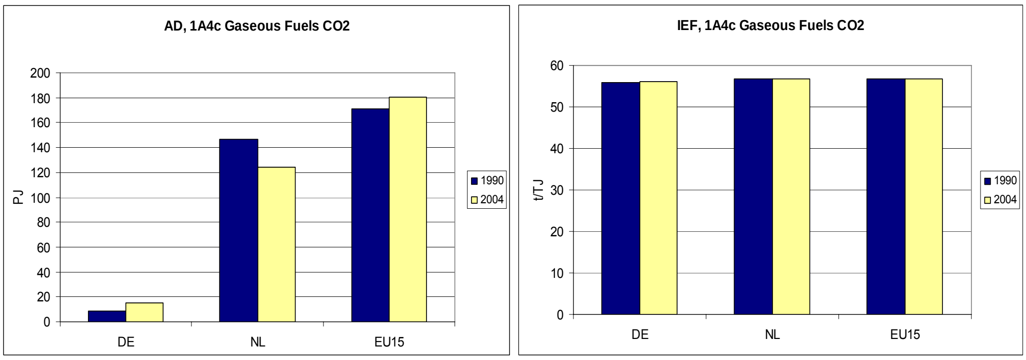
Table 3.86 Member States' contributions to CO_2 emissions from 1.A.4.c 'Agriculture/Forestry/Fisheries': Gaseous Fuels

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	20	41	40	0,4%	-1	-3%	19	96%	T2	NS	CS
Belgium	67	289	289	2,8%	0	0%	222	331%	C	RS	C
Denmark	132	301	296	2,9%	-5	-2%	163	123%	C	NS	CS/C
Finland	32	30	28	0,3%	-2	-7%	-4	-13%	T1	NS	CS
France	383	718	718	7,0%	0	0%	335	88%	C	NS	CS
Germany	485	852	842	8,2%	-9	-1%	357	74%	T2	NS/AS	CS
Greece	NO	NO	NO	-	-	-	-	-	C	NS	D
Ireland	NO	NO	NO	-	-	-	-	-	T1	NS	CS
Italy	52	309	326	3,2%	17	5%	275	532%	T2	NS	CS
Luxembourg	3	0	0	0,0%	0	-	-3	-100%	C/D		C/D
Netherlands	8.328	7.042	7.041	68,8%	-1	0%	-1.287	-15%	T2	NS/Q	CS
Portugal	0	8	7	0,1%	-1	-7%	7	-	D	NS	D
Spain	6	132	150	1,5%	18	14%	144	2332%	T2	NS	CS
Sweden	33	56	56	0,5%	0	0%	23	70%	T1,T2,T3	NS	CS
United Kingdom	182	430	435	4,3%	4	1%	253	139%	T2	NS	CS
EU15	9.723	10.208	10.227	100,0%	20	0%	504	5%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.73 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – Germany and the Netherlands; together they cause 91 % (1990) resp. 77 % (2004) of the CO_2 emissions from gaseous fuels in 1A4c. Fuel combustion in the EU-15 decreased by 5 % between 1990 and 2004. Implied emission factors of EU-15 Member States range between 55.0 and 57.0 t/TJ in 2004.

Figure 3.73 Activity Data and Implied Emission Factors for CO_2 from Gaseous Fuels in 1A4c



3.2.5. Other (CRF Source Category 1.A.5)

Table 3.87 provides an overview of Member States' source allocation to Source Category 1.A.5: 'Other'.

Table 3.87 Member States' allocation of sources to 1.A.5: 'Other'

Member State	Source allocation to 1.A.5: 'Other'	Source
Austria	Mobile: Military use	CRF Table 1.s.2
Belgium	Mobile: Military aviation	NIR 2006
Denmark	Mobile: Military use	CRF Table 1.s.2
Finland	Stationary: Other non-specified & Non-energy use of fuel Mobile: other non-specified	CRF Table 1.s.2
France	Emissions are '0'	CRF Table 1.s.2
Germany	Military: stationary and mobile	CRF Table 1.s.2
Greece	Emissions are 'Not occuring'	CRF Table 1.s.2
Ireland	Emissions are 'Not occuring'	CRF Table 1.s.2
Italy	Mobile	CRF Table 1.s.2
Luxembourg	Emissions are '0'	CRF Table 1.s.2
Netherlands	Mobile: military use	CRF Table 1.s.2
Portugal	No split available for 1990-1993 (allocated to stationary because solid fuels are used); for 1994-2004 Portugal reports emissions to be '0'	CRF Table 1.s.2
Spain	No 'Other ' emissions	CRF Table 1.s.2
Sweden	Mobile: Military use	CRF Table 1.s.2
United Kingdom	Mobile: military use	CRF Table 1.s.2

Figure 3.74 shows the total trend within source category 1.A.5 and the dominating emission sources: CO_2 emissions from 'Mobile' and from 'Stationary'. Total GHG emissions of source category 1.A.5 decreased by 86 % between 1990 and 2003.

Figure 3.74: Total and CO_2 emission trends for category 1.A.5

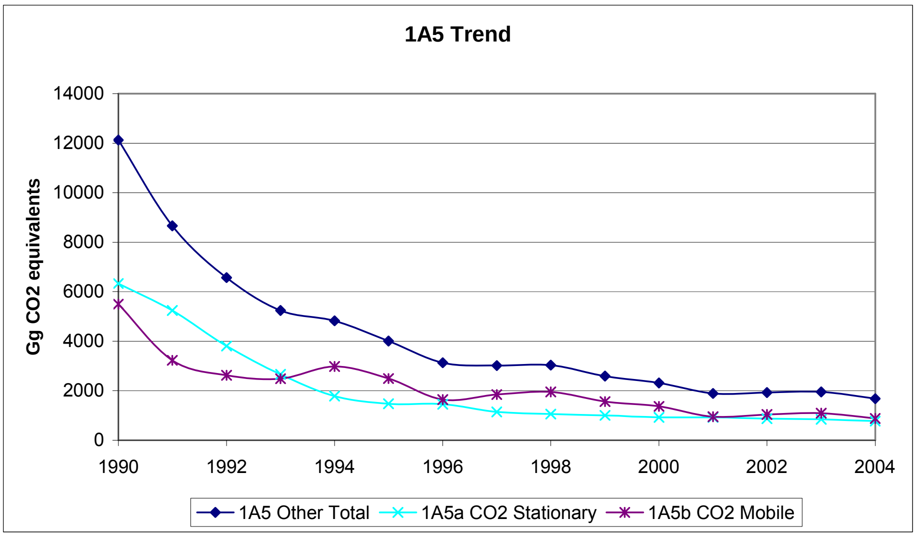


Table 3.88 summarises information by Member State on emission trends, methodologies and emission factors for the key source CO_2 from 1.A.5: 'Other'. CO_2 emissions from 1.A.5: 'Other' account for 0.2 % of total GHG emissions in 2004. Between 1990 and 2004, CO_2 emissions from this source decreased by 60 % in the EU-15. The United Kingdom contributed 35 % to these emissions in 2004. Between 1990 and 2004, the largest reduction in absolute terms was reported by Germany, which was partly due to reduced military operations after German reunification.

Table 3.88 Member States' contributions to CO_2 emissions from 1.A.5: 'Other' and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1)]	EF [1)]
Austria	35	107	CS,M	CS
Belgium	166	94	C	C
Denmark	119	239	C	NS
Finland	1.194	1.569	CS,T1	CS
France	0	0	C	CS
Germany	11.826	1.656	CS	CS
Greece	NO	NO	-	-
Ireland	NO	NO	NA	NA
Italy	1.041	1.091	T2	CS
Luxembourg	0	0	C/D	C/D
Netherlands	566	437	T2	D
Portugal	8	0	T2	D+C
Spain	NA	NA	NA	-
Sweden	845	278	NA,T1	CS,NA
United Kingdom	5.285	2.903	T2	CS
EU15	21.085	8.375	C,CS,D,M,T1,T2, NA	C, CS, D,NA

([1]) Information source: CRF Summary Table 3 for 2004.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 3.89 provides information on the contribution of Member States to EU-15 recalculations in CO_2 from 1.A.5 'Other' for 1990 and 2003 and main explanations for the largest recalculaltions in absolute terms.

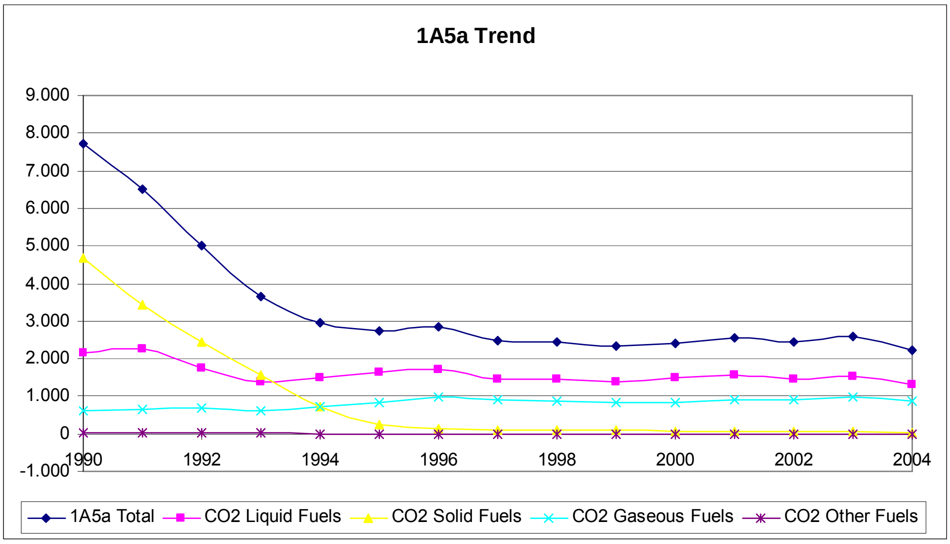
Table 3.89 Contribution of MS to EU-15 recalculations in CO_2 from 1.A.5 'Other' for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

	1990		2003		Main explanations
	Gg	Percent	Gg	Percent	
Austria	0	0,0	53	146,8	
Belgium	0	0,0	-2	-2,1	
Denmark	0	0,0	0	0,0	
Finland	238	24,9	438	30,3	Revised methodology for feedstocks used as fuel (removal of double counting); revised EF and AD
France	0	0,0	0	0,0	
Germany	0	0,0	-120	-5,8	
Greece	0	0,0	0	0,0	
Ireland	0	0,0	0	0,0	
Italy	0	0,0	0	0,0	
Luxembourg	0	0,0	0	0,0	
Netherlands	0	0,0	0	0,0	
Portugal	0	0,0	0	0,0	
Spain	0	0,0	0	0,0	
Sweden	0	0,0	0	0,0	
UK	0	0,0	22	0,8	
EU15	**238**	**1,1**	**392**	**5,0**	

3.2.5.1. Stationary (1A5a)

In this chapter information about emission trends, Member States' contribution, activity data, and emission factors is provided for category 1.A.5.a by fuels. CO_2 emissions from 1.A.5.a: 'Stationary' account for 0.1 % of total EU-15 GHG emissions in 2004. Figure 3.75 shows the emission trend within the categories 1.A.5.a, which is mainly dominated by CO_2 emissions from liquid fuels. The reduction in the early 1990s was driven by CO_2 from solid fuels. Total emissions decreased by 70 %, Mainly due to decreases in emissions from solid fuels (-99 %) and liquid fuels (-39 %).

Figure 3.75: Total and CO_2 emission trends for category 1.A.5.a



In only two Member States (Finland and Germany) emissions from this key source are reported. Between 1990 and 2004 Finland had an increase of 27 % and Germany a decrease of 88 %. This led to an EU-15 decrease of 70 %. Between 2003 and 2004 both Member States reported decreases (Table 3.90).

Table 3.90 Member States' contributions to CO_2 emissions from 1.A.5.a: 'Stationary'

Member State	Greenhouse gas emissions (Gg CO_2			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	NA	NA	NA	-	-	-	-	-
Belgium	0	IE	IE	-	-	-	-	-
Denmark	NA,NO	NA,NO	NA,NO	-	-	-	-	-
Finland	1.136	1.716	1.448	65,1%	-268	-16%	312	27%
France	0	0	0	0,0%	0	-	0	-
Germany	6.329	844	774	34,9%	-69	-8%	-5.555	-88%
Greece	NO	NO	NO	-	-	-	-	-
Ireland	NO	NO	NO	-	-	-	-	-
Italy	0	0	0	0,0%	0	-	0	-
Luxembourg	0	0	0	0,0%	0	-	0	-
Netherlands	0	0	0	0,0%	0	-	0	-
Portugal	8	0	0	0,0%	0	-	-8	-100%
Spain	NA	NA	NA	-	-	-	-	-
Sweden	NO	NO	NO	-	-	-	-	-
United Kingdom	NA	NA	NA	-	-	-	-	-
EU15	7.473	2.560	2.222	100,0%	-338	-13%	-5.251	-70%

Abbreviations explained in the Chapter 'Units and abbreviations'.

1A5a Stationary – Solid Fuels (CO_2)

In 2004 CO_2 from solid fuels had a share of 2 % within source category 1A5a (compared to 60 % in 1990). Between 1990 and 2004 the emissions decreased by 99 % (Table 3.91). In 2004 only Germany reported emissions for this key source and achieved a reduction of 99 %.

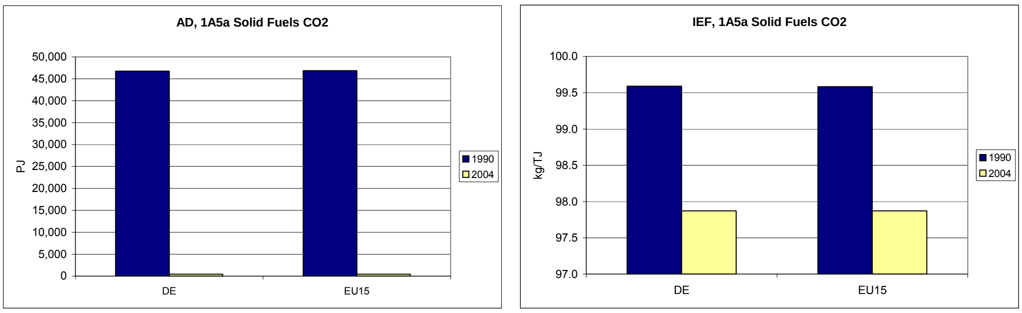
Table 3.91 Member States' contributions to CO_2 emissions from 1.A.5.a 'Stationary': Solid Fuels

Member State	Greenhouse gas emissions (Gg CO_2			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	0	0	0	0,0%	0	-	0	-	M	AS	CS
Belgium	0	0	0	0,0%	0	-	0	-	C	RS	C
Denmark	NO	NO	NO	-	-	-	-	-	C	NS	C
Finland	1	0	0	0,0%	0	-	-1	-100%	T1, T2	NS	D, CS
France	0	0	0	0,0%	0	-	0	-	C	NS	CS
Germany	4.657	46	41	100,0%	-5	-11%	-4.616	-99%	CS	NS	CS
Greece	NO	NO	NO	-	-	-	-	-			
Ireland	NO	NO	NO	-	-	-	-	-			
Italy	0	0	0	0,0%	0	-	0	-	T2	NS	CS
Luxembourg	0	0	0	0,0%	0	-	0	-			
Netherlands	0	0	0	0,0%	0	-	0	-	CS, T2	NS, Q	CS
Portugal	8	0	0	0,0%	0	-	-8	-100%	D	NS	D
Spain	NA	NA	NA	-	-	-	-	-			
Sweden	NO	NO	NO	-	-	-	-	-	T1	NS	CS
United Kingdom	0	0	0	0,0%	0	-	0	-	T2	NS, AS	CS
EU15	4.667	46	41	100,0%	-5	-11%	-4.625	-99%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.76 shows activity data and implied emission factors for CO_2 for EU-15 and for Germany accounting for 100 % of EU-15 CO_2 emissions from this source category in 2004. Fuel combustion in the EU-15 decreased by 99 % between 1990 and 2004. The implied emission factor is 99.6 t/TJ in 2004.

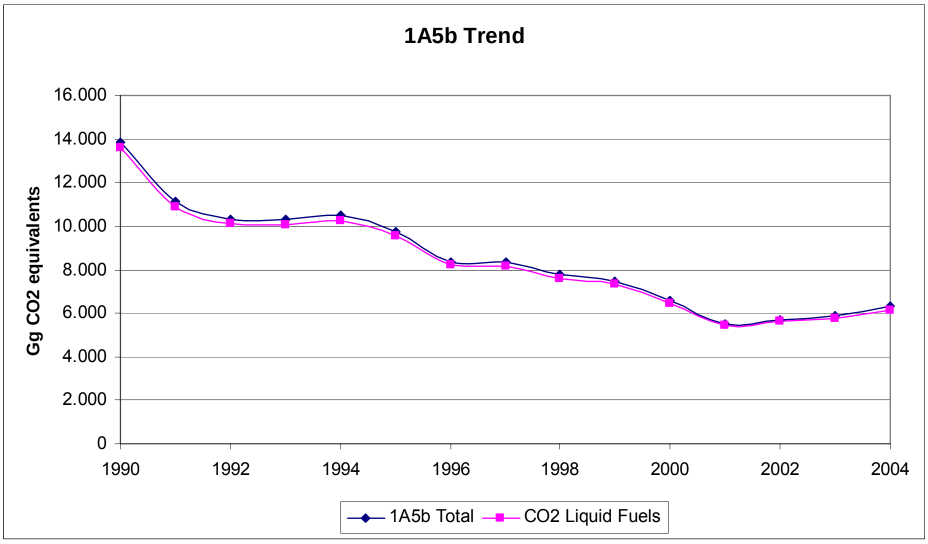
Figure 3.76 Activity Data and Implied Emission Factors for CO_2 from Solid Fuels in 1A5a



3.2.5.2. Mobile (1A5b)

In this chapter information about emission trends, Member States' contribution, activity data, and emission factors is provided for category 1.A.5.a by fuels. CO_2 emissions from 1.A.5.b: 'Mobile' account for 0.2 % of total EU-15 GHG emissions in 2004. Table 3.77 shows the emission trend within the category 1.A.5.b, which is dominated by CO_2 emissions from liquid fuels. Total emissions decreased by 55 %.

Figure 3.77: Total and CO_2 emission trends for category 1.A.5.b



Six Member States report emissions as 'Not occuring', 'Not applicable' or '0'. The United Kingdom has the highest emissions and decreased most between 1990 and 2004. Austria, Denmark and Finland reported a rise of more than 100 %. Between 2003 and 2004 Germany had the largest absolute reduction. The EU-15 emissions increased by 7 % between 2003 and 2004 (Table 3.92).

Table 3.92 Member States' contributions to CO_2 emissions from 1.A.5.b: 'Mobile'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	35	89	107	1,7%	17	19%	72	204%
Belgium	166	94	94	1,5%	0	0%	-72	-43%
Denmark	119	92	239	3,9%	147	160%	120	101%
Finland	58	169	122	2,0%	-47	-28%	64	110%
France	0	0	0	0,0%	0	-	0	-
Germany	5.497	1.089	882	14,3%	-207	-19%	-4.615	-84%
Greece	NO	NO	NO	-	-	-	-	-
Ireland	NO	NO	NO	-	-	-	-	-
Italy	1.041	660	1.091	17,7%	431	65%	50	5%
Luxembourg	0	0	0	0,0%	0	-	0	-
Netherlands	566	437	437	7,1%	0	0%	-129	-23%
Portugal	0	0	0	0,0%	0	-	0	-
Spain	NA	NA	NA	-	-	-	-	-
Sweden	845	299	278	4,5%	-21	-7%	-567	-67%
United Kingdom	5.285	2.815	2.903	47,2%	88	3%	-2.382	-45%
EU15	13.612	5.745	6.153	100,0%	408	7%	-7.459	-55%

Abbreviations explained in the Chapter 'Units and abbreviations'.

1A5b Mobile – Liquid Fuels (CO_2)

In 2004 CO_2 from liquid fuels had a share of 97 % within source category 1A5b (compared to 98 % in 1990). Between 1990 and 2004 the emissions decreased by 55 % (Table 3.93). France, Greece, Ireland, Luxembourg, Portugal and Spain report emissions as 'Not occuring', Not applicable' or '0'. The highest decrease was achieved in Germany (-84 %), while Austria, Denmark and Finland had increases of more than 100 %.

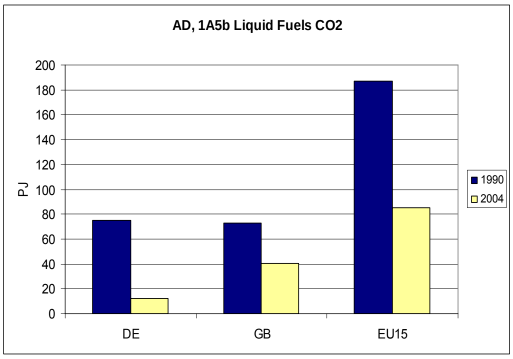
Table 3.93 Member States' contributions to CO_2 emissions from 1.A.5.b 'Mobile': Liquid Fuels

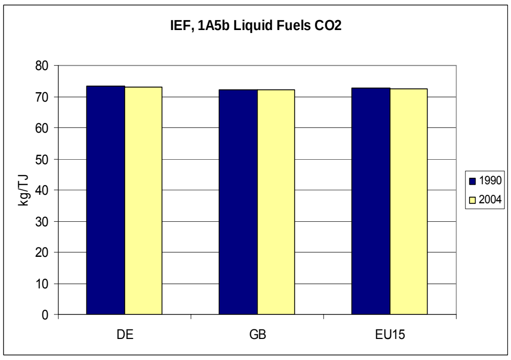
Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	35	89	107	1,7%	17	19%	72	204%	M	AS	CS
Belgium	166	94	94	1,5%	0	0%	-72	-43%	C	RS	C
Denmark	119	92	239	3,9%	147	160%	120	101%	C	NS	C
Finland	58	169	122	2,0%	-47	-28%	64	110%	T1, T2	NS	D, CS
France	NO	NO	NO	-	-	-	-	-	C	NS	CS
Germany	5.497	1.089	882	14,3%	-207	-19%	-4.615	-84%	CS	NS	CS
Greece	NO	NO	NO	-	-	-	-	-			
Ireland	NO	NO	NO	-	-	-	-	-			
Italy	1.041	660	1.091	17,7%	431	65%	50	5%	T2	NS	CS
Luxembourg	0	0	0	0,0%	0	-	0	-			
Netherlands	566	437	437	7,1%	0	0%	-129	-23%	CS, T2	NS, Q	CS
Portugal	0	0	0	0,0%	0	-	0	-	D	NS	D
Spain	NA	NA	NA	-	-	-	-	-			
Sweden	845	299	278	4,5%	-21	-7%	-567	-67%	T1	NS	CS
United Kingdom	5.285	2.815	2.903	47,2%	88	3%	-2.382	-45%	T2	NS, AS	CS
EU15	13.612	5.745	6.153	100,0%	408	7%	-7.459	-55%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.78 shows activity data and implied emission factors for CO_2 for EU-15 and the Member States with the largest emissions – Germany and the United Kingdom; together they cause 79 % (1990) resp. 62 % (2004) of the CO_2 emissions from liquid fuels in 1A5b. Fuel combustion in the EU-15 decreased by 55 % between 1990 and 2004. Implied emission factors of EU-15 Member States range between 70.2 and 73.5 t/TJ in 2004.

Figure 3.78 Activity Data and Implied Emission Factors for CO_2 from Liquid Fuels in 1A5b



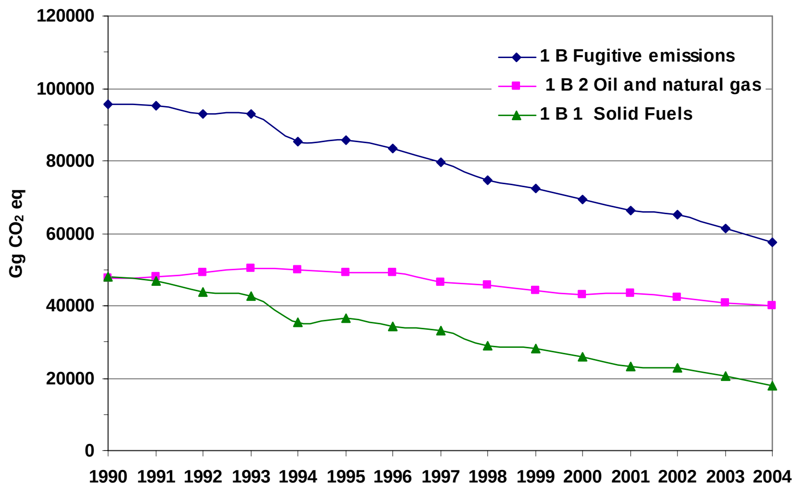


3.2.6. Fugitive emissions from fuels (CRF Source Category 1.B)

This chapter describes gaseous or volatile emissions, mainly CH_4, which occur during extraction, handling and consumption of fossil fuels. Fugitive CO_2 emissions from fuels account for 0.4 % and fugitive CH_4 emissions for 1.0 % of the total GHG emissions in the EU-15.

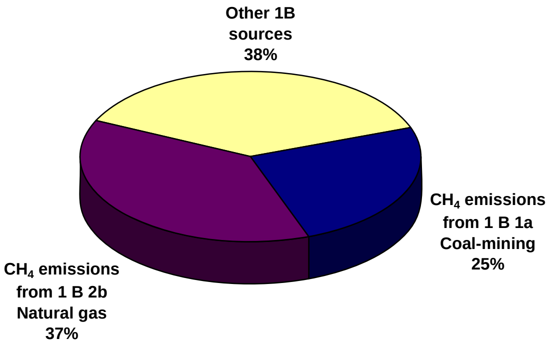
Greenhouse gas emissions are steadily declining as Figure 3.79 shows. Between 1990 and 2004, the GHG emissions decreased by 40 %, mainly caused by the source category 1.B.1 Solid fuels. In 1990 emissions from 1.B.1 Solid Fuels and 1.B.2 Oil and Natural Gas were at about the same level, but then emissions from 1.B.1 Solid Fuels decreased strongly (-63 %) , whereas emissions from 1.B.2 Oil and Natural Gas decreased by 16 %.

Figure 3.79: Greenhouse Gas Emissions from 1.B Fugitive Emissions from Fuel



Fugitive emissions include four key sources: 1.B.1a Coal Mining' (CH_4), 1.B.2.a 'Oil' (CO_2), 1.B.2.a 'Natural Gas' (CH_4) and 1.B.2.c 'Venting and Flaring' (CO_2). Figure 3.80 shows that the two largest key sources, i.e. CH_4 emissions from 1.B.1.a. 'Coal Mining' and CH_4 from "1.B.2.b Natural Gas", account for 62 % of fugitive GHG emissions.

Figure 3.80: Proportion of fugitive emissions within source category 1.B.1



3.2.6.1. Fugitive emissions from Solid Fuels (1.B.1.)

CH_4 emissions of 1.B.1. 'Solid fuels' are a key source. Between 1990 and 2004, the emissions are decreasing steadily, caused by the reduction of coal mining (Figure 3.81). CH_4 emissions from this source category account for 0.4 % of the total GHG emissions.

CH_4 emissions from coal mining determine to a large extent (2004: 81 %) fugitive emissions from solid fuels. The emissions arise by the natural production of methane when coal is formed. Methane is partly stored within the coal seam and escapes when mined. Most CH_4 emissions result from underground mines; surface mines are a smaller source.

Figure 3.81: Fugitive Emissions from 1.B.1 Solid Fuels

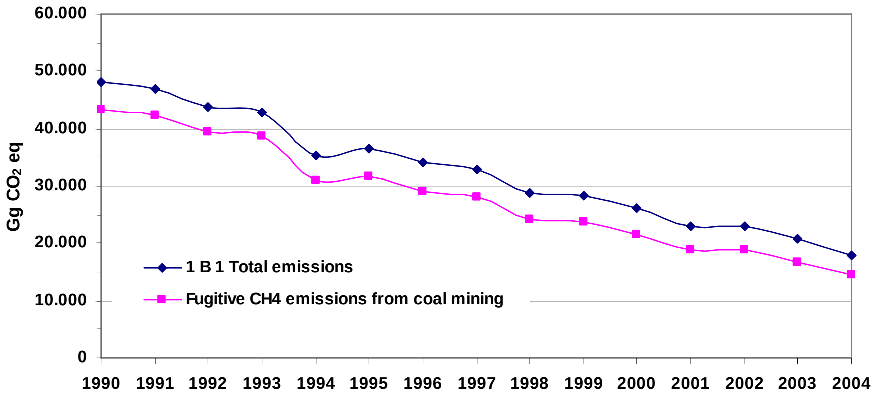


Table 3.94 shows that in six Member States CO_2 emissions from this source are not occurring or not estimated, four other Member States report zero emissions and five Member States report emissions, whereby Sweden and the Netherlands are contributing most.

Table 3.94: Member States Contribution to 1.B.1: "Fugitive CO_2 Emissions from solid fuels" and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1)]	EF [1)]
Austria	IE,NA,NO	IE,NA,NO	NA	NA
Belgium	0	0	NA	NA
Denmark	NA,NO	NA,NO	NA	NA
Finland	NO	NO	NA	NA
France	0	0	C	CS
Germany	NE	NE	NE	NE
Greece	NE,NO	107	-	-
Ireland	NE,NO	NO	NA	NA
Italy	0	0	-	-
Luxembourg	0	0	C/D	C/D
Netherlands	403	509	CS	CS
Portugal	9	0	MB	C
Spain	18	73	PS,CS,NA	CS,NA
Sweden	789	838	T3,NA,T2	CS,NA
United Kingdom	856	168	T3	OTH
EU15	2.074	1.694	C,CS,PS, D,MB,T2,T3,NA,	C,CS,D, NA, NE,OTH

([1]) Information source: CRF Summary Table 3 for 2004.
Emissions of Austria are included in 1.A.2.a
Emissions of Greece for1990 not estimated because of a lack of background data and methodological approach.
Emissions of Ireland for 1990 are not estimated because of negligibility.
Emissions of Germany are not estimated, but improvement is planned.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 3.95 shows that CH_4 emissions from "Fugitive emissions from solid fuels" decreased by 65 % between 1990 and 2004. In relative terms, Portugal had the highest reductions while Greece had the highest increases in emissions from this source. The UK and Germany decreased CH_4 emissions most in absolute terms; they account for 80 % of EU-15 CH_4 emissions from this source category in 2004.

Table 3.95: Member states contribution to 1.B.1" Fugitive CH_4 Emissions from Solid Fuels" and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1)]	EF [1)]
Austria	11	1	T1	CR
Belgium	36	14	C	C
Denmark	0	0	NA	NA
Finland	0	0	NA	NA
France	4.331	615	C	CS
Germany	20.240	7.958	T2,CS	CS
Greece	1.095	1.478	NA,T1	D,NA
Ireland	0	0	NA	NA
Italy	122	64	T1	D, C,CS
Luxembourg	0	0	C/D	C/D
Netherlands	30	23	T1b	D
Portugal	66	0	T2	D+C
Spain	1.820	1.009	CS,CR,T2	CR,CS
Sweden	0	0	T3,NA,T2	CS,NA
United Kingdom	18.290	4.933	T3	OTH
EU15	46.041	16.095	C,CS,D,T1,T1b,T 2,T3,CR,NA	C,CS,D,CR,NA,O TH

([1]) Information source: CRF Summary Table 3 for 2004.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 3.96: Overview about Methodological Issues of source category 1.B.1 in the Member States of the EU-15, all information listed is taken from the Member States' NIR 2006

Member State	Methodology
Austria	**General:** consideration of brown coal **Completeness:** Emissions form solid fuel transformation are included in the energy sector (sub category 'Iron and Steel'), because the only solid fuel transformation occurring in Austria is one coking plat as part of an integrated iron and steel site.

Member State	Methodology
	Activity data: taken form the national energy balance. **Emission factor:** CORINAIR default emission factor 214g CH_4/Mg coal
Belgium	**General:** Emissions result from coke production **Activity data:** delivered by corresponding industry **Emission factor:** from EMEP/CORINAR Handbook 400g CH_4/ton coke
Denmark	**General:** Coal mining not occurring
Finland	**General**: no coal mines
France	**General:** closure of surface mines 2002, closure of underground mines 2004 **Activity data:** bottom up approach according to site specific data, Tier 2/3 depending on site **Emission factor:** specific EF for sites, Tier 2/3 depending on site, EMEP/CORINAIR 350 g CH_4/Mg coke
Germany	**General:** black coal Tier 3, brown coal Tier 2 **Activity data:** national statistics **Emission factor:** country specific EF for all sub source categories
Greece	**General:** only brown coal surface mines **Activity data:** national statistics **Emission factor:** Default
Ireland	**General:** coal mining not existing
Italy	**General**: no NIR
Luxembourg	**General:** no extraction or consumption of solid fuels
Netherlands	**General:** no mines, only coke manufacture **Completeness:** charcoal production not accounted **Activity data:** national energy statistics **Emission factor:** country specific, carbon balance
Portugal	**General:** coal mining activity stopped in 1994 **Activity data**: national energy reports **Emission factor**: Default
Spain	**General:** no NIR
Sweden	**General:** no coal mines, only flaring of coke oven gas **Activity data:** country specific and plant specific **Emission factor:** plant specific
United Kingdom	**Activity data:** national energy statistics **Emission factor:** carbon balance approach

CO_2 from Solid fuel transformation (1B1b)

CO_2 emissions from 1.B.1.b: 'Fugitive CO_2 emissions from solid fuel transformation' account for 0.02 % of total GHG emissions in 2004. Between 1990 and 2004, CO_2 emissions from this source decreased by 41 % in the EU-15 (Table 3.97). Most Member States did not report emissions from this source. Of the two reporting Member States, Spain had emission increases between 1990 and 2004, and the United Kingdom had emission reductions.

Table 3.97: Member States Contribution to 1.B.1.b: "Fugitive CO_2 Emissions from solid fuels transformation

Member State	Greenhouse gas emissions (Gg CO_2			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	IE	IE	IE	-	-	-	-	-
Belgium	0	NA	NA	-	-	-	-	-
Denmark	NO	NO	NO	-	-	-	-	-
Finland	NO	NO	NO	-	-	-	-	-
France	NA	NA	NA	-	-	-	-	-
Germany	NE	NE	NE	-	-	-	-	-
Greece	NE	NE	NE	-	-	-	-	-
Ireland	NO	NO	NO	-	-	-	-	-
Italy	NA	NA	NA	-	-	-	-	-
Luxembourg	0	0	0	0,0%	0	-	0	-
Netherlands	403	464	509	-	-	-	-	-
Portugal	NO	NO	NO	-	-	-	-	-
Spain	18	72	73	9,7%	1	1%	55	313%
Sweden	NA	NA	NA	-	-	-	-	-
United Kingdom	856	112	168	22,4%	56	50%	-688	-80%
EU15	1.277	648	750	100,0%	101	16%	-527	-41%

Emissions of Austria are included in 1.A.2.a.
Emissions of Germany are not estimated, but improvement is planned.
Emissions of Grecce are not estimated, because of lack of information.
Abbreviations explained in the Chapter 'Units and abbreviations'.

CH_4 from Coal Mining (1B1a)

CH_4 emissions from 1.B.1.a: 'Coal-mining' account for less than 0.3 % of total GHG emissions in 2004. Between 1990 and 2004, CH_4 emissions from this source decreased by 67 % in the EU-15 (Table 3.98). Several Member States report emissions from this source as 'Not occuring' or '0'. In 2004, the largest share on total emissions from this source had Germany and the United Kingdom, both together accounting for 79 % of EU-15 emissions. Both Member States reduced their emissions between 1990 and 2004 substantially due to the decline of coal-mining.

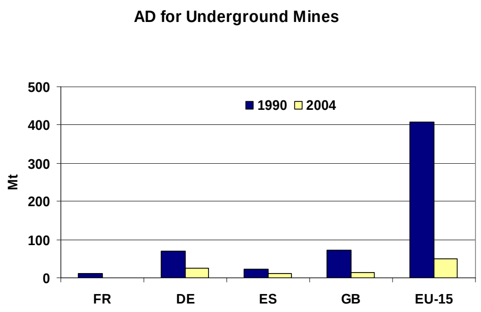
Table 3.98: Member States contribution to 1.B.1a. Fugitive CH_4 Emissions from Coal mining

Member State	Greenhouse gas emissions (Gg CO_2			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	11	5	1	0,0%	-4	-80%	-10	-90%
Belgium	NE	NO	NO	-	-	-	-	-
Denmark	NO	NO	NO	-	-	-	-	-
Finland	NO	NO	NO	-	-	-	-	-
France	3.569	912	571	3,9%	-342	-37%	-2.998	-84%
Germany	18.415	7.899	6.461	44,6%	-1.439	-18%	-11.954	-65%
Greece	1.095	1.441	1.478	10,2%	37	3%	383	35%
Ireland	NO	NO	NO	-	-	-	-	-
Italy	55	54	53	0,4%	-1	-2%	-2	-3%
Luxembourg	0	0	0	0,0%	0	-	0	-
Netherlands	NA	NA	NA	-	-	-	-	-
Portugal	66	0	0	0,0%	0	-	-66	-100%
Spain	1.766	989	989	6,8%	0	0%	-776	-44%
Sweden	NO	NO	NO	-	-	-	-	-
United Kingdom	18.271	5.447	4.922	34,0%	-525	-10%	-13.349	-73%
EU15	43.247	16.749	14.475	100,0%	-2.274	-14%	-28.773	-67%

Abbreviations explained in the Chapter 'Units and abbreviations'.

Figure 3.82 shows how activity data and emission factors for CH_4 emissions from underground coal mines changed between 1990 and 2004. Within the EU-15 coal mining in underground mines decreased substantially, whereas the implied emissions factor increased to 12.4 kg/t coal produced. The sharp increase of the French implied emission factor is mainly the result coal production having almost stopped in 2004.

Figure 3.82: Activity Data and Implied Emission Factors for EU-15 and the emitting countries of CH_4 from Underground Mines



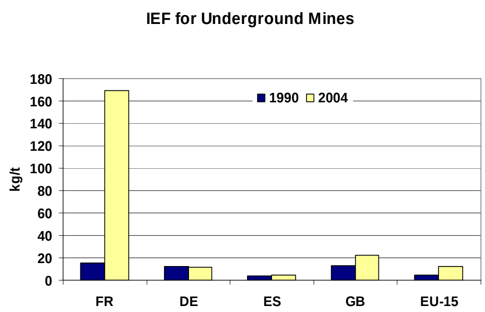


Figure 3.83 shows how activity data and emission factors for CH_4 emissions from surface coal mines changed between 1990 and 2004. Coal mining in surface mines decreased in most Member states except Greece. Overall, in the EU-15 coal production from surface mines decreased by 45 % between 1990 and 2004. The implied emission factor of the EU-15 increased from 0.1 to 0.3 kg/t coal produced between 1990 and 2004. Greece is the only country using a default emission factor, all other countries apply country specific emission factors.

Figure 3.83: Activity Data and Implied Emission Factors for EU-15 and the emitting countries of CH_4 from Surface Mining

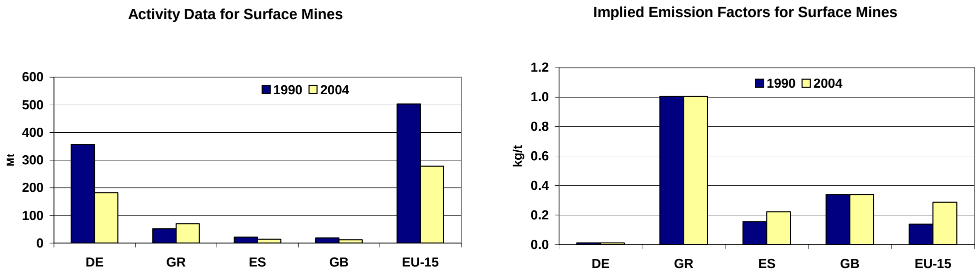


Table 3.99 provides information on the contribution of Member States to EU-15 recalculations in CH_4 from 1.B.1 ‘Solid fuels’ for 1990 and 2003 and main explanations for the largest recalculations in absolute terms.

Table 3.99 Contribution of MS to EU-15 recalculations in CH_4 from 1.B.1 ‘Solid fuels’ for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

	1990		2003		Main explanations
	Gg	Percent	Gg	Percent	
Austria	0	0.0	-3	-36.4	
Belgium	-9	-19.3	-9	-39.5	
Denmark	-72	-100.0	-93	-100.0	
Finland	-5	-100.0	-6	-100.0	
France	0	0.0	0	0.0	
Germany	-5,532	-21.5	3,257	47.3	additional and new data. consolidation and improvements for data sources, statistical and mine specific data, partially new primary data and additional datar eferred information.
Greece	0	0.0	0	0.0	
Ireland	-	-	0	0.0	
Italy	0	0.0	0	0.0	
Luxembourg	0	0.0	0	0.0	
Netherlands	0	0.0	0	0.0	
Portugal	0	0.0	0	0.0	
Spain	31	1.7	34	3.4	
Sweden	0	-8.3	0	-3.4	
UK	3	0.0	667	13.9	
EU15	**-5,584**	**-10.8**	**3,848**	**24.9**	

3.2.6.2. Fugitive emissions from oil and natural gas (1.B.2)

Fugitive emissions from 1.B.2 Oil and natural gas include all emission from exploration, production, processing, transport, and use of oil and natural gas. Total GHG emissions from 1.B.2 decreased by 16 % between 1990 and 2004 (Figure 3.84). CH_4 emissions and CO_2 emissions from 1.B.2 declined by 21 % and by 7 % respectively.

This source category includes three key source: CO_2 from 1.B.2.a ‘Oil’, CH_4 from 1.B2b ‘Natural Gas’ and CO_2 from 1.B.2.c: ‘Venting and flaring’.

Figure 3.84: Fugitive Emissions from 1.B.2 "Oil and Natural Gas"

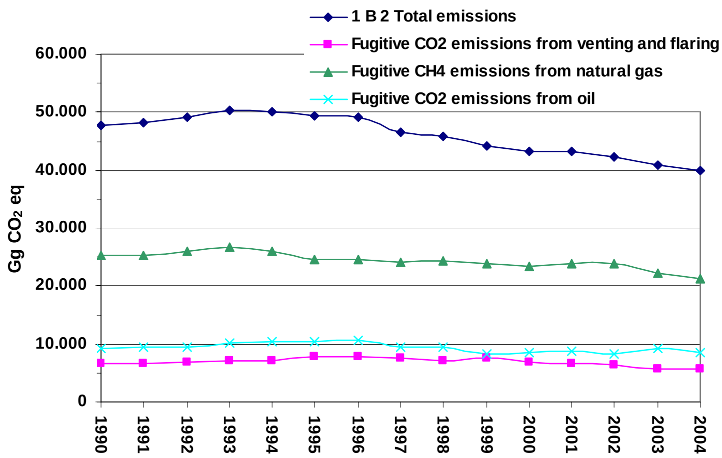


Table 3.100 summarises information by Member State on methodologies and emission factors for the CO_2 emissions from the source 1.B.2: 'Fugitive emissions from oil and natural gas'. CO_2 emissions from 'Fugitive emissions from oil and natural gas' decreased by 7 % between 1990 and 2004. In absolute terms, the UK, Italy and the Netherlands reduced most, whereas Portugal had a major increase (>600 %). In 2004 the UK, Italy and France account for 72 % of the CO_2 emissions.

Table 3.100 Member States' contributions to 1.B.2: 'Fugitive CO_2 emissions from oil and natural gas' and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1]	EF [1]
Austria	102	210	CS,T1	CS,PS
Belgium	85	147	CS	CS
Denmark	263	608	CR	CR
Finland	226	116	CS	CS
France	4.508	4.425	C	CS
Germany	0	0	IE	IE
Greece	70	11	NA,T1	D,NA
Ireland	139	71	CS	CS
Italy	3.048	1.822	T2	CS
Luxembourg	0	0	C/D	C/D
Netherlands	769	124	T2,T3	CS,PS
Portugal	115	833	MB	C+CS
Spain	1.744	2.177	CS,NA,T1,T2	CS,NA,PS
Sweden	93	47	NA,T1,T2	CS,CS,D,NA
United Kingdom	5.760	5.100	T2,T3	CS,PS
EU15	16.923	15.693	C,CS,CR,MB, T1,T2,T3,NA,IE	C,CS,CR,D,PS,NA,IE

([1]) Information source: CRF Summary Table 3 for 2004.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 3.101 summarises information by Member State on methodologies, emission factors, completeness and qualitative uncertainty estimates for the CH_4 emissions from the source 1.B.2: 'Fugitive emissions from oil and natural gas'. CH_4 emissions from 'Fugitive emissions from oil and natural gas' decreased by 21 % between 1990 and 2004. In absolute terms, the UK and Italy reduced most. In relative terms the emissions in Portugal, Luxembourg, Finland and Denmark increased significantly (>100 %).

Figure 3.101: Member states contribution to 1.B.2. "CH_4 emissions from Oil and Gas" and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1)]	EF [1)]
Austria	374	652	T1	CS,D
Belgium	525	412	CS	CS
Denmark	40	102	CR	CR
Finland	11	55	CS,M,T1	CS,D,M
France	2.560	1.906	C	CS
Germany	7.008	7.129	T2,T3,CS	M,CS
Greece	92	145	NA,T1	D,NA
Ireland	151	78	CS	CS
Italy	7.273	5.623	T2, T3	CS
Luxembourg	28	61	C/D	C/D
Netherlands	1.639	704	T1b,T2,T3	CS,D,PS
Portugal	35	416	C+T2	D+C
Spain	631	832	CR,CS,NA,T1	CS,CR,CS,NA
Sweden	5	5	CS,NA,T1,T2	PS,CS,NA
United Kingdom	10.305	6.007	T2,T3	CS,PS
EU15	30.675	24.127	C,CS,D,T1,T1b,T2,T3,CR,MNA	CS,CR,D,M,PS,NA

([1]) Information source: CRF Summary Table 3 for 2004.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 3.102: Overview about Methodological Issues of source category 1.B.2 in the Member States of the EU-15, all information listed is taken from the Member States' NIR 2006

Member State	Methodology
Austria	**General:** Emissions from oil and from gas exploration and production are reported together under oil production (as oil and gas are extracted together at most sites) except CO_2 emissions from sour gas processing which is reported separately under gas extraction. Regarding petroleum refining, all CO_2 emissions thus including flaring, are reported in the Energy Sector, as these are emissions due to combustion. Fugitive CO_2 losses are considered negligible. In category 1B only CH_4 and NMVOC emissions, included venting are considered. **Activity data:** national statistics, Association of the Austrian Petroleum Industry, Austrian Natural Gas and District Heat Association **Emission factor**: according to IPCC GPG
Belgium	**General:** consideration of petroleum refining and gas distribution **Activity data:** country specific **Emission factor:** plant specific, country specific
Denmark	**General:** Emissions from offshore activities include emissions from extraction of oil and gas, on-shore oil tanks. On-shore and off-shore loading of ships. **Activity data**: country specific (Danish Energy Agency) **Emission factor:** EMEP/CORINAIR, country specific (Danish Gas Transmission Company)
Finland	**General**: includes CO_2, CH_4 and N_2O emission from flaring at oil refineries and petrochemical industry, fugitive emissions from oil refining and methane emissions from gas transmission and distribution. **Activity data:** Energy Statistics **Emission factor**: according to IPCC GPG
France	**General:** includes exploration, production, transport, refining **Activity data:** national and plant statistics **Emission factor:** exploration Tier 1, refining Tier 2/3
Germany	**General:** includes exploration, production, transport, refining **Activity data:** National Energy Balance **Emission factor:** Country specific
Greece	**General:** includes extraction, processing, storage, transmission/distribution, venting and flaring only from 1996 to 2004 **Activity data:** National Energy Balance, Public Gas Corporation **Emission factor:** Tier 1
Ireland	**General:** only fugitive emissions of natural gas considered **Activity data:** country specific **Emission factor:** country specific
Italy	**General**: no NIR provided
Luxembourg	**General:** no information provided
Netherlands	**General:** includes flaring and venting emissions from oil and gas production, emission form gas transport/distribution networks, fugitive CO_2 emissions from refineries are included in 1.A.1.b, combustion emissions from exploration and production are reported under 1.A.1.c **Activity data:** country specific **Emission factor:** country specific (decreases according to replacement of cast iron), Tier 3
Portugal	**General:** no extraction of crude oil in Portugal, includes refining, storage, transport **Activity data**: plant and country specific (General Directorate of Geology and Energy)

Member State	Methodology
	Emission factor: IPCC, CONCAWE, US-EPA
Spain	**General:** no NIR provided
Sweden	**General:** includes catalytic cracking, desulphurisation, storage and handling of oil, gasoline distribution and storage **Activity data:** plant specific **Emission factor:** Tier 2, plant specific, CONCAWE
United Kingdom	**General:** oil and gas extraction mostly off-shore **Activity data:** UKOOA (trade organisation), UK Petroleum Industry Association **Emission factor:** plant specific and aggregated

CO_2 from Oil (1B2a)

CO_2 emissions from 1.B.2.a 'Fugitive CO_2 emissions from oil' account for 0.2 % of total GHG emissions in 2004. Between 1990 and 2004, CO_2 emissions from this source decreased by 8 % in the EU-15 (Table 3.103). France is the largest emitter followed by Spain. Portugal had an increase of more than 600 %.

Table 3.103 Member States' contributions to a 1.B.2.a: 'CO_2 emissions from oil'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	43	133	122	-	-	-	79	-	CS	AS	CS
Belgium	0	0	0	0,0%	0	-	0	-	C	RS	C
Denmark	NA	NA	NA	-	-	-	-	-	NA	NA	NA
Finland	1	1	1	0,0%	0	4%	0	33%	T1	PS	D
France	3.428	3.213	3.284	38,4%	71	2%	-143	-4%	-	-	-
Germany	0	0	0	-	-	-	-	-	-	-	-
Greece	0	0	0	0,0%	0	-	0	-	T1	NS	D
Ireland	NE,NO	NE,NO	NE,NO	-	-	-	-	-	NO	NO	NO
Italy	2.367	2.291	1.612	18,9%	-679	-30%	-755	-32%	-	-	-
Luxembourg	0	0	0	0,0%	0	-	0	-	C/D		C/D
Netherlands	IE,NA,NE	IE,NA,NE	IE,NA,NE	-	-	-	-	-	NA	NA	NA
Portugal	65	500	499	5,8%	-1	0%	434	672%	M	AS+NS	CS
Spain	1.564	1.740	1.970	23,1%	230	13%	406	26%	T2	PS	PS
Sweden	22	2	2	0,0%	0	-	-20	-	T1/NA	PS	CS/NA
United Kingdom	1.840	1.271	1.054	12,3%	-216	-17%	-786	-43%	T2	NS	CS
EU15	9.330	9.152	8.545	100,0%	-607	-7%	-785	-8%			

Emissions of Irland are not estimated, because no activity data are available.
Emissions of the Netherlands are not estimated resp. included elswhere, as no data are available (negligible amounts).
Abbreviations explained in the Chapter 'Units and abbreviations'.

CH_4 from Natural gas (1B2b)

CH_4 emissions from 1.B.2.b 'Fugitive CH_4 emissions from natural gas' account for 0.5 % of total GHG emissions in 2004. Between 1990 and 2004, CH_4 emissions from this source decreased by 16 % in the EU-15 (Table 3.104). The United Kingdom, Germany and Italy were jointly responsible for 80 % of the emissions from this source. The emission decrease in the United Kingdom (–39 %) contributed largely to the reduction trend in the EU-15 between 1990 and 2004.

Table 3.106 shows information on activity data, emission factors for CH_4 emissions from 1.B.2:b natural gas for 1990 and 2004. Activity data and implied emission factors cannot be presented at EU-15 level because Member States use different types of activity data.

Table 3.104 Member States' contributions to a 1.B.2.b: 'CH_4 emissions from natural gas'

Member State	Greenhouse gas emissions (Gg CO_2			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	273	515	539	2,5%	24	5%	266	98%	D	AS	D
Belgium	519	393	407	1,9%	15	4%	-112	-22%	CS	AS	CS
Denmark	6	4	7	0,0%	2	60%	1	17%	CS	NS	CS
Finland	4	52	45	0,2%	-7	-13%	41	1160%	M/T1	PS	M/D/CS
France	2.457	1.878	1.868	8,7%	-10	-1%	-590	-24%	C	PS	CS
Germany	6.383	7.214	6.999	32,5%	-215	-3%	616	10%	CS	NS/AS	CS
Greece	10	86	87	0,4%	1	1%	78	813%	T1	NS	D
Ireland	151	638	78	0,4%	-559	-88%	-72	-48%	CS	NS	CS
Italy	7.042	5.514	5.369	24,9%	-146	-3%	-1.673	-24%	T2	NS	CS
Luxembourg	28	59	61	0,3%	3	4%	34	122%	C/D		C/D
Netherlands	373	386	388	1,8%	2	0%	14	4%	CS/T3	AS	CS
Portugal	0	645	373	1,7%	-272	-42%	373	-	T2	NS+AS	CS
Spain	466	447	486	2,3%	38	9%	19	4%	C, CS	NS, AS, Q	C, CS
Sweden	0	0	0	0,0%	0	#DIV/0!	0	-	NA	NA	NA
United Kingdom	7.955	4.689	4.849	22,5%	159	3%	-3.106	-39%	T2	NS/AS	CS
EU15	25.665	22.520	21.555	100,0%	-965	-4%	-4.110	-16%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

CO_2 from Venting and Flaring (1B2c)

Fugitive CO_2 emissions from 1.B.2.c: 'Venting and flaring' account for 0.1 % of total GHG emissions in 2004. Between 1990 and 2004, CO_2 emissions from this source decreased by 10 % in the EU-15 (Table 3.105). The United Kingdom was responsible for 70 % of the emissions from this source. The reductions in the Italy (-69 %) contributed mainly to the reduction trend in the EU-15 between 1990 and 2004. Austria and Germany did not report emissions in this source category, as they included the emissions elsewhere. Austria's emissions are included in 1.B.2. Oil Refining/Storage, as the emission declaration of the refinery includes all emissions from this plant. Ireland states these emissions as not occurring or not estimated. Italy and the Netherlands had a significant reduction in absolute terms.

Table 3.105 Member States' contributions to 1.B.2.c: 'CO_2 emissions from venting and flaring'

Member State	Greenhouse gas emissions (Gg CO_2			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	IE	IE	IE	-	-	-	-	-	IE	IE	IE
Belgium	84	145	145	2,5%	0	0%	61	73%	CS	PS,AS	CS
Denmark	263	550	608	10,4%	59	11%	345	131%	C	NS/PS	CS
Finland	123	63	62	1,1%	-1	-2%	-61	-50%	CS	PS	CS
France	297	314	336	5,8%	22	7%	39	13%	-	-	-
Germany	IE	IE	IE	-	-	-	-	-	-	-	-
Greece	70	12	11	0,2%	0	-	-59	-	T1	NS	D
Ireland	IE,NO	IE,NO	IE,NO	-	-	-	-	-	NO	NO	NO
Italy	681	206	210	3,6%	4	2%	-471	-69%	T2	NS	CS
Luxembourg	0	0	0	0,0%	0	-	0	-	C/D		C/D
Netherlands	769	144	124	2,1%	-20	-	-645	-	NA/T2	NA	NA/PS
Portugal	49	42	42	0,7%	0	0%	-6	-13%	D	PS	CS
Spain	179	174	207	3,5%	32	19%	27	15%	T1, T2, CS	PS	CS
Sweden	71	70	45	0,8%	-25	-	-25	-	T2/NA	PS	CS/D/NA
United Kingdom	3.920	3.980	4.046	69,3%	66	2%	125	3%	T2	NS	CS
EU15	6.505	5.700	5.837	100,0%	136	2%	-669	-10%			

Emissions of Austria are included in 1.B.2.A.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 3.106 Information on activity data, emission factors for 1.B.2.b ‘CH_4 emissions from natural gas’

		1990					2004				
Member State	GHG source category	Activity data: Description	Unit	Value	Implied emission factor (kg/unit)	CH4 emissions (Gg)	Activity data: Description	Unit	Value	Implied emission factor (kg/unit)	CH4 emissions (Gg)
Austria	**Natural Gas**					**12.98**					**25.67**
	i. Exploration			NA	IE	IE			NA	IE	IE
	ii. Production (4) / Processing	Gas throughput (a)	10^6 m^3	1288	IE	IE	Gas throughput (a)	10^6 m^3	1963	IE	IE
	iii. Transmission	Pipelines length (km)	km	1032	2900.00	2.99	Pipelines length (km)	km	1430	2900.00	4.15
	iv. Distribution	Distribution network length	km	15200	657.43	9.99	Distribution network length	km	33800	636.83	21.52
	v. Other Leakage	(e.g. PJ gas consumed)	PJ	1500	NO	NO	(e.g. PJ gas consumed)	PJ	NE	NO	NO
	at industrial plants and power stations			NE	NE	NE			NE	NO	NO
	in residential and commercial sectors			NE	NE	NE			NE	NO	NO
Belgium	**Natural Gas**					**24.71**					**19.39**
	i. Exploration			0	NO	NO		0	0	NO	NO
	ii. Production (4) / Processing	(e.g. PJ gas produced)		0	NE	NE	(e.g. PJ gas produced)	0	0	NE	NE
	iii. Transmission	(e.g. PJ gas consumed)		401	5079.35	2.04	(e.g. PJ gas consumed)	0	624	3756.10	2.34
	iv. Distribution	PJ gas consumed		401	56470.77	22.67	consumption	PJ	624	27300.13	17.04
	v. Other Leakage	(e.g. PJ gas consumed)		0	0.00	0.00	(e.g. PJ gas consumed)	0	0	0.00	0.00
	at industrial plants and power stations			0	0.00	0.00		0	0	0.00	0.00
	in residential and commercial sectors			0	0.00	0.00		0	0	0.00	0.00
Denmark	**Natural Gas**					**0.27**					**0.31**
	i. Exploration			IE	IE	IE			IE	IE	IE
	ii. Production (4) / Processing	Gas produced	10^6 m^3	5137	IE	IE	Gas produced	10^6 m^3	10334	IE	IE
	iii. Transmission	Gas transmission	10^6 m^3	2739	88.62	0.24	Gas transmission	10^6 m^3	7384	23.16	0.17
	iv. Distribution	Gas distributed	10^6 m^3	1574	14.56	0.02	Gas distributed	10^6 m^3	3248	43.41	0.14
	v. Other Leakage	Incl. in transmission		IE	NO	NO	Incl. in transmission		IE	NO	NO
	at industrial plants and power stations			IE	NO	NO			IE	NO	NO
	in residential and commercial sectors			IE	NO	NO			IE	NO	NO
Finland	**Natural Gas**					**0.17**					**2.14**
	i. Exploration			NO	NO	NO			NO	NO	NO
	ii. Production (4) / Processing	(e.g. PJ gas produced)		NO	NO	NO	(e.g. PJ gas produced)		NO	NO	NO
	iii. Transmission	PJ gas consumed	PJ	92	1855.49	0.17	PJ gas consumed	PJ	164	2085.37	0.34
	iv. Distribution	PJ gas distributed via local networks	PJ	5	NO	NO	PJ gas distributed via local networks	PJ	7	240384.62	1.80
	v. Other Leakage	t of natural gas released from pipelines		NE	NO	NO	t of natural gas released from pipelines		NE	NO	NO
	at industrial plants and power stations			NE	NO	NO			NE	NO	NO
	in residential and commercial sectors			NE	NO	NO			NE	NO	NO
France	**Natural Gas**					**117.01**					**88.94**
	i. Exploration		NO	NO	0.00	NO		NO	NO	0.00	NO
	ii. Production (4) / Processing	PJ Production	PJ Production	309	1614.89	0.50	PJ Production	PJ Production	157	665.98	0.10
	iii. Transmission	PJ Consumed	PJ Consumed	1055	110440.22	116.51	PJ Consumed	PJ Consumed	1681	52847.28	88.84
	iv. Distribution	(e.g. PJ gas consumed)	0	0	0.00	0.00	(e.g. PJ gas consumed)	0	0	0.00	0.00
	v. Other Leakage	(e.g. PJ gas consumed)	NO	NO	0.00	NO	(e.g. PJ gas consumed)	NO	NO	0.00	NO
	at industrial plants and power stations		NO	NO	0.00	NO		NO	NO	0.00	NO
	in residential and commercial sectors		NO	NO	0.00	NO		NO	NO	0.00	NO

		1990					2004				
Germany	**Natural Gas**					**303.96**					**333.30**
	i. Exploration	(natural gas)	TJ	556007	28.76	15.99	(natural gas)	TJ	613898	27.00	16.58
	ii. Production (4) / Processing	(natural gas from crude oil extraction)	TJ	563382	64.40	36.28	(natural gas from crude oil extraction)	TJ	613471	62.00	38.04
	iii. Transmission	(total amount of gas consumed)	TJ	2292780	9.74	22.32	(total amount of gas consumed)	TJ	3224000	9.00	29.02
	iv. Distribution	(distribution net)	km	246710	789.14	194.69	(distribution net)	km	416065	439.16	182.72
	v. Other Leakage	(gas consumed)	TJ	825669	42.00	34.68	(gas consumed)	TJ	1594000	42.00	66.95
	at industrial plants and power stations			NO	NO	NO			NO	NO	NO
	in residential and commercial sectors	(gas consumed)	TJ	825669	42.00	34.68	(gas consumed)	TJ	1594000	42.00	66.95
Greece	**Natural Gas**					**0.46**					**4.17**
	i. Exploration			NE	NE	0.00			NE	NE	NE
	ii. Production (4) / Processing	Natural gas production	10^6 m^3	123	3708.46	0.46	Natural gas production	10^6 m^3	25	317.00	0.01
	iii. Transmission	Length of transmission pipeline	km	NO	NO	NO	Length of transmission pipeline	km	960	2569.48	2.47
	iv. Distribution	Length of distribution mains	km	NO	NO	NO	Length of distribution mains	km	2751	615.00	1.69
	v. Other Leakage	(e.g. PJ gas consumed)		NE	NE	NE	(e.g. PJ gas consumed)		0	NE	NE
	at industrial plants and power stations			NE	NE	NE			0	NE	NE
	in residential and commercial sectors			NE	NE	NE			0	NE	NE
Ireland	**Natural Gas**					**7.18**					**3.73**
	i. Exploration			IE	IE	IE			IE	IE	IE
	ii. Production (4) / Processing	PJ of Gas produced	PJ	79	14328.25	1.13	PJ of Gas produced	PJ	29	18344.18	0.53
	iii. Transmission	(e.g. PJ gas consumed)	0	IE	IE	IE	(e.g. PJ gas consumed)	0	IE	IE	IE
	iv. Distribution	PJ of gas consumed	PJ	24	250871.12	6.05	PJ of gas consumed	PJ	56	57552.45	3.20
	v. Other Leakage	(e.g. PJ gas consumed)	PJ	NO	NO	NO	(e.g. PJ gas consumed)	PJ	NO	NO	NO
	at industrial plants and power stations		PJ	NO	NO	NO		PJ	NO	NO	NO
	in residential and commercial sectors		PJ	NO	NO	NO		PJ	NO	NO	NO
Italy	**Natural Gas**					**335.32**					**255.65**
	i. Exploration			0	IE	IE			0	IE	IE
	ii. Production (4) / Processing	(Mm3 gas produced)	Mm3	17296	2910.93	50.35	(Mm3 gas produced)	Mm3	12921	2719.39	35.14
	iii. Transmission	(Mm3 gas transported)	Mm3	45684	827.60	37.81	(Mm3 gas transported)	Mm3	80410	376.64	30.29
	iv. Distribution	(Mm3 gas transported)	Mm3	20632	11979.84	247.17	(Mm3 gas transported)	Mm3	29000	6559.43	190.22
	v. Other Leakage			0	0.00	0.00			0	0.00	0.00
	at industrial plants and power stations			0	IE	IE			0	IE	IE
	in residential and commercial sectors			0	IE	IE			0	IE	IE
Netherlands	**Natural Gas**					**17.79**					**18.45**
	i. Exploration	number of wells drilled/tested	number	79	IE	IE	number of wells drilled/tested	number	34	IE	IE
	ii. Production (4) / Processing	gas produced	PJ	2292	IE	IE	gas produced	PJ	2171	IE	IE
	iii. Transmission	gas transported	PJ	2292	2468.91	5.66	gas transported	PJ	2437	2335.20	5.69
	iv. Distribution	natural gas distribution network	10^3 km	99	122878.44	12.13	natural gas distribution network	10^3 km	118	108491.95	12.76
	v. Other Leakage			IE	IE	IE			IE	IE	IE
	at industrial plants and power stations			IE	IE	IE			IE	IE	IE
	in residential and commercial sectors			IE	IE	IE			IE	IE	IE

		1990					2004				
Portugal	**Natural Gas**					**0.00**					**17.76**
	i. Exploration			NO	0.00				NO	0.00	
	ii. Production (4) / Processing			NO	0.00				NO	0.00	
	iii. Transmission	Gas consumed	kNm3	NO	0.00	NO	Gas consumed	kNm3	4558	3895.21	17.76
	iv. Distribution				0.00					0.00	
	v. Other Leakage			NO	0.00	NE			NE	0.00	NE
	at industrial plants and power stations				0.00					0.00	
	in residential and commercial sectors				0.00					0.00	
Spain	**Natural Gas**					**22.20**					**23.12**
	i. Exploration			NE	NE	NE			NE	NE	NE
	ii. Production (4) / Processing	PJ gas produced (NCV)	PJ	51	70889.00	3.63	PJ gas produced (NCV)	PJ	14	70889.00	1.01
	iii. Transmission	PJ gas (NCV)	PJ	207	802.99	0.17	PJ gas (NCV)	PJ	1085	797.41	0.87
	iv. Distribution	PJ gas consumed (NCV)	PJ	214	86027.02	18.40	PJ gas consumed (NCV)	PJ	1097	19367.02	21.25
	v. Other Leakage	(e.g. PJ gas consumed)	0	NE	NE	NE	(e.g. PJ gas consumed)	0	NE	NE	NE
	at industrial plants and power stations			NE	NE	NE			NE	NE	NE
	in residential and commercial sectors			NE	NE	NE			NE	NE	NE
Sweden	**Natural Gas**					**NO**					**NO**
	i. Exploration			NO	NO	NO			NO	NO	NO
	ii. Production (4) / Processing			NO	NO	NO			NO	NO	NO
	iii. Transmission	Pressure levelling losses	TJ	NO	NO	NO	Pressure levelling losses	TJ	NO	NO	NO
	iv. Distribution	(e.g. PJ gas consumed)		NO	NO	NO	(e.g. PJ gas consumed)		NO	NO	NO
	v. Other Leakage			NO	NO	NO			NO	NO	NO
	at industrial plants and power stations			NE	NE	NE			NO	NO	NO
	in residential and commercial sectors			NE	NE	NE			NO	NO	NO
United Kingdom	**Natural Gas**					**378.80**					**230.88**
	i. Exploration			IE	IE	IE			IE	IE	IE
	ii. Production (4) / Processing	(e.g. PJ gas produced)		IE	IE	IE	(e.g. PJ gas produced)	0	IE	IE	IE
	iii. Transmission	(e.g. PJ gas consumed)		IE	IE	IE	(e.g. PJ gas consumed)	0	IE	IE	IE
	iv. Distribution	Gas consumed	PJ	1573	240742.27	378.80	Gas consumed	PJ	298	774234.38	230.88
	v. Other Leakage	(e.g. PJ gas consumed)		NE	NE	NE	(e.g. PJ gas consumed)	0	0	NE	NE
	at industrial plants and power stations			NE	NE	NE			0	NE	NE
	in residential and commercial sectors			NE	NE	NE			0	NE	NE

Tables 3.107 and 3.108 provide information on the contribution of Member States to EU-15 recalculations in CO_2 and CH_4 from 1.B.2 'Oil and natural gas' for 1990 and 2003 and main explanations for the largest recalculations in absolute terms.

Table 3.107 Contribution of MS to EC recalculations in CO_2 from 1.B.2 'Oil and natural gas' for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

	1990		2003		Main explanations
	Gg	Percent	Gg	Percent	
Austria	0	0,0	0	0,0	
Belgium	-195	-69,6	-139	-48,6	
Denmark	0	0,0	0	0,0	
Finland	103	83,6	59	93,6	
France	203	4,7	82	2,1	
Germany	0	0,0	0	0,0	
Greece	70	-	12	-	
Ireland	0	0,0	0	0,0	
Italy	0	0,0	-2	-0,1	
Luxembourg	0	0,0	0	0,0	
Netherlands	-69	-8,2	-260	-64,3	
Portugal	-2	-2,0	83	11,0	
Spain	0	0,0	0	0,0	
Sweden	-8	-7,6	-8	-9,9	
UK	-1.004	-14,8	25	0,5	Changed carbon emission factor Emission estimates based on 1997 instead of 1995
EU15	**-902**	**-5,1**	**-149**	**-0,9**	

Table 3.108 Contribution of MS to EU-15 recalculations in CH_4 from 1.B.2 'Oil and natural gas' for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

	1990		2003		Main explanations
	Gg	Percent	Gg	Percent	
Austria	107	40,1	290	92,8	
Belgium	8	1,6	6	1,5	
Denmark	1	3,3	1	0,9	
Finland	0	0,4	0	0,0	
France	89	3,6	36	1,9	
Germany	0	0,0	0	0,0	
Greece	52	131,1	-68	-32,0	
Ireland	0	0,0	559	711,6	No information provided
Italy	642	9,7	779	15,6	Revised methodology of of estimation of fugitive emissions from production of gas and oil
Luxembourg	0	0,0	0	0,0	
Netherlands	-406	-19,9	-289	-27,8	
Portugal	0	0,0	401	140,1	Use of emission factors considering the lenght of transportation pipelines
Spain	47	8,1	-122	-15,1	
Sweden	5	15.137,3	5	18.571,9	
UK	-356	-3,3	-395	-6,4	Revised emissions from natural gas losses Revised method
EU15	**189**	**0,6**	**1.203**	**5,1**	

3.3 Methodological issues and uncertainties

The previous section presented for each EU-15 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. Detailed information on national methods and circumstances is available in the Member States' national inventory reports.

Table 3.109 shows the total EU-15 uncertainty estimates for the sector 'Energy' excluding 1.A.3 'Transport' and 1.B 'Fugitive emissions' and the uncertainty estimates for the relevant gases for each source category. For those emissions for which no split by source category was available, uncertainty estimates were made for stationary combustion as a whole. The highest level uncertainty was estimated for N_2O from 1.A.4.c and the lowest for CO_2 from 1A1a and 1A 'Stationary combustion unspecified'. With regard to trend CH_4 from 1A4a shows the highest uncertainty estimates, CO_2 from

1A1a the lowest. For a description of the Tier 1 uncertainty analysis carried out for the EU-15 see Chapter 1.7.

Table 3.109: EU-15 uncertainty estimates for the sector 'Energy' excluding 1.A.3 and 1.B

Source category	Gas	Emissions 1990	Emissions 2004 [1]	Emission trends 1990-2004	Emissions for which MS uncertainty estimates are available [2]	Share of emissions for which MS uncertainty estimates are available	Level uncertainty estimates based on MS uncertainty estimates	Trend uncertainty estimates based on MS uncertainty estimates
1.A.1.a Public electricity and heat production	CO_2	948,449	1,008,230	6%	832,965	83%	2%	0.2
1.A.1.b Petroleum refining	CO_2	106,043	122,193	15%	74,827	61%	3%	0.3
1.A.1.c Manufacture of solid fuels	CO_2	95,997	59,846	-38%	23,298	39%	6%	4
1.A.2 Manufacturing industries and construction	CO_2	608,501	551,910	-9%	388,371	70%	3%	2
1.A.4.a Commercial/institutional	CO_2	161,603	166,833	3%	71,387	43%	6%	4
1.A.4.b Residential	CO_2	406,251	419,540	3%	288,348	69%	3%	3
1.A.4.c Agriculture/Forestry/Fisheries	CO_2	71,028	63,477	-11%	21,329	34%	7%	3
1.A.5 Other	CO_2	21,085	8,375	-60%	2,823	34%	10%	9
1.A stationary combustion unspecified	CO_2				619,402		2%	1
1.A.1.a Public electricity and heat production	CH_4	529	1,177	122%	199	17%	25%	12
1.A.1.b Petroleum refining	CH_4	65	69	7%	9	13%	64%	15
1.A.1.c Manufacture of solid fuels	CH_4	316	167	-47%	9	6%	38%	25
1.A.2 Manufacturing industries and construction	CH_4	1,150	1,047	-9%	229	22%	22%	15
1.A.4.a Commercial/institutional	CH_4	1,427	360	-75%	83	23%	74%	142
1.A.4.b Residential	CH_4	9,558	7,110	-26%	4,999	70%	19%	21
1.A.4.c Agriculture/Forestry/Fisheries	CH_4	389	284	-27%	30	11%	82%	93
1.A.5 Other	CH_4	251	15	-94%	9	60%	37%	45
1.A stationary combustion unspecified	CH_4				3,084		27%	15
1.A.1.a Public electricity and heat production	N_2O	10,548	11,884	13%	4,425	37%	38%	5
1.A.1.b Petroleum refining	N_2O	989	1,072	8%	278	26%	35%	24
1.A.1.c Manufacture of solid fuels	N_2O	879	504	-43%	265	53%	47%	28
1.A.2 Manufacturing industries and construction	N_2O	7,986	7,236	-9%	1,579	22%	35%	18
1.A.4.a Commercial/institutional	N_2O	1,305	1,540	18%	248	16%	196%	44
1.A.4.b Residential	N_2O	5,840	5,192	-11%	1,818	35%	162%	31
1.A.4.c Agriculture/Forestry/Fisheries	N_2O	2,693	2,610	-3%	244	9%	401%	47
1.A.5 Other	N_2O	248	167	-33%	31	19%	126%	49
1.A stationary combustion unspecified	N_2O				16,871		148%	19
Total	**all**	**2,463,129**	**2,440,840**	**-1%**	**2,357,162**	**97%**	**2%**	**1**

Note: Emissions are in Gg CO_2 equivalents; trend uncertainty is presented as percentage points.

1) The sum of the source category emissions may not be the total sector emissions because uncertainty estimates are not available for all source categories.

2) Includes for some countries 2003 data and for Spain 2002 data

Table 3.110 shows the total EU-15 uncertainty estimates for the sector 1.B 'Fugitive emissions' and the uncertainty estimates for the relevant gases for each source category. The highest level uncertainty was estimated for N_2O from 1.B.2 and the lowest for CO_2 from 1.B.2. With regard to trend CH_4 from 1B1 shows the highest uncertainty estimates, CO_2 from 1B2 the lowest.

Table 3.110: EU-15 uncertainty estimates for the source category 1.B 'Fugitive emissions'

Source category	Gas	Emissions 1990	Emissions 2004 [1]	Emission trends 1990-2004	Emissions for which MS uncertainty estimates are available [2]	Share of emissions for which MS uncertainty estimates are available	Level uncertainty estimates based on MS uncertainty estimates	Trend uncertainty estimates based on MS uncertainty estimates
1.B.1 Solid fuels	CO_2	2,074	1,694	-18%	1,515	89%	28%	3
1.B.2 Oil and natural gas	CO_2	16,923	15,693	-7%	15,231	97%	8%	3
1.B.1 Solid fuels	CH_4	46,041	16,095	-65%	14,025	87%	31%	16
1.B.2 Oil and natural gas	CH_4	30,675	24,127	-21%	22,299	92%	15%	3
1.B.1 Solid fuels	N_2O	4	4	-8%	4	100%	56%	9
1.B.2 Oil and natural gas	N_2O	46	45	-3%	43	96%	101%	8
Total	**all**	**95,764**	**57,659**	**-40%**	**53,116**	**92%**	**11%**	**8**

Note: Emissions are in Gg CO_2 equivalents; trend uncertainty is presented as percentage points.

1) The sum of the source category emissions may not be the total sector emissions because uncertainty estimates are not available for all source categories.

2) Includes for some countries 2003 data and for Spain 2002 data

Table 3.111 shows the total EU-15 uncertainty estimates for the sector 1.A.3 'Transport' and the uncertainty estimates for the relevant gases for each source category. The highest uncertainty was estimated for N_2O from 1.A.3.d and the lowest for CO_2 from 1.A.3.b. With regard to trend N_2O from 1A3a shows the highest uncertainty estimates, CO_2 from 1A3b the lowest.

Table 3.111: EU-15 uncertainty estimates for the source category 1.A.3 'Transport'

Source category	Gas	Emissions 1990	Emissions 2004 1)	Emission trends 1990-2004	Emissions for which MS uncertainty estimates are available 2)	Share of emissions for which MS uncertainty estimates are available	Level uncertainty estimates based on MS uncertainty estimates	Trend uncertainty estimates based on MS uncertainty estimates
1.A.3.a Civil aviation	CO_2	17,517	23,342	33%	16,076	69%	20%	10
1.A.3.b Road transport	CO_2	637,400	801,103	26%	767,425	96%	3%	1
1.A.3.c Railways	CO_2	8,338	6,410	-23%	4,920	77%	7%	5
1.A.3.d Navigation	CO_2	19,359	21,087	9%	16,330	77%	8%	3
1.A.3.e Other	CO_2	6,558	7,924	21%	5,266	66%	12%	3
1.A.3.a Civil aviation	CH_4	11	12	9%	7	59%	52%	15
1.A.3.b Road transport	CH_4	4,405	2,250	-49%	1,441	64%	13%	16
1.A.3.c Railways	CH_4	10	7	-35%	5	77%	30%	13
1.A.3.d Navigation	CH_4	55	58	6%	50	87%	38%	5
1.A.3.e Other	CH_4	17	19	12%	17	92%	31%	9
1.A.3.a Civil aviation	N_2O	170	254	49%	565	222%	46%	86
1.A.3.b Road transport	N_2O	7,047	21,155	200%	20,727	98%	49%	83
1.A.3.c Railways	N_2O	460	429	-7%	453	106%	108%	29
1.A.3.d Navigation	N_2O	229	244	7%	186	76%	134%	18
1.A.3.e Other	N_2O	102	140	37%	54	38%	61%	22
Total	**all**	**701,677**	**884,432**	**26.0%**	**833,522**	**94%**	**3%**	**1**

Note: Emissions are in Gg CO_2 equivalents; trend uncertainty is presented as percentage points.

1) The sum of the source category emissions may not be the total sector emissions because uncertainty estimates are not available for all source categories.

2) Includes for some countries 2003 data and for Spain 2002 data

3.4 Sector-specific quality assurance and quality control

The main sector-specific QA/QC activity is the project lead by Eurostat on the harmonisation of the energy data used for energy balances and CO_2 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's 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 1990–2000 ensuring comparable data under the two reporting mechanisms.

By end of 2004, final reports of ten EU-15 Member States were available (Austria, Denmark, France, Germany, Ireland, Italy, Netherlands, Portugal, Sweden and the United Kingdom). The projects results were analysed thoroughly and an additional comparison between the available environmental data and Eurostat data for the period 1990-2002 for each Member State was carried out. The main conclusion of these actions and the use of the more detailed revised annual joint questionnaires led Eurostat to introduce to its work programme for next year to disaggregate of the information stored in its database.

In 2003, a workshop on 'Energy balances and energy-related greenhouse gas emission inventories' was organised under Working Group I of the EC Climate Change Committee, and linked to the Eurostat Energy Statistics Committee. The objectives of the workshop were to: (1) share best practice between countries, both statistical institutes and national GHG inventory compilers; (2) strengthen the links between the reporting mechanisms of energy data (Eurostat/IEA) and GHG inventories (UNFCCC/Commission); (3) make recommendations to improve coherency in the data reported under the two reporting mechanisms. More than 60 experts attended the workshop from almost all EU-15 Member States and accession and candidate countries, the European Commission (DG Environment, Eurostat), the EEA and ETC/ACC. Representatives from the IEA, the UNFCCC Secretariat and the

European non-energy use research network, attended as observers. The workshop report with the recommendations can be downloaded from the ETC/ACC website: http://air-climate.eionet.eu.int/.

A number of these recommendations were addressed by Eurostat this year, namely timelines of energy data (all the annual joint energy questionnaires were available to Eurostat by the middle of March 2006). Another very important recommendation aiming to strength the EU's energy statistics system is the creation of a draft of an EU legal basis on energy statistics. The first draft Regulation was prepared by Eurostat in 2005. EU Member States have already commented this draft that was then circulated for consultation to other European Commission Directorates. Eurostat's Statistical Programming Committee is expected to give also a final opinion on this draft before it is submitted to the European Council and Parliament. The annexes of this Regulation cover all energy quantities statistics (annual and monthly questionnaires) currently collected by Eurostat.

Another workshop recommendation aiming to improve the quality of the basic energy data was the drafting of the Energy Statistics manual. The English version of the book prepared by the IEA, Eurostat and UNECE was translated by Eurostat into the French and German language.

Issues related to the workshop's recommendations on the methodology of energy statistics were also addressed in the Energy Statistics Working Group of November 16-17 in Paris co-organised by Eurostat and the IEA. It was agreed that the 2005 joint Eurostat/IEA/UNECE energy statistics questionnaires will have a more detailed fuel breakdown (inclusion of Anthracite, Tars, etc.) which is more in line with the emissions reporting requirements, calorific values for oil products will be included and definitions of bunker fuels will be improved. More information on the outcome of this Working Group can be found at: http://www.iea.org/Textbase/stats/questionnaire/background.asp. The new questionnaires were used for collecting 2004 energy statistics and with no disruption with respect to the quality of the collected statistics. Some Member States had however difficulties in reporting more detailed energy consumption data. The reporting problems of the Member States will be discussed in the next Energy Statistics meeting of Eurostat in June 2006.

3.5 Sector-specific recalculations

Table 3.112 shows that in the energy sector the largest recalculations in absolute terms were made for CO_2 in 1990 and in 2003. However, in relative terms the recalculations of CO_2 emissions in the energy sector were at 1.5 % or below.

Table 3.112 Recalculations of total greenhouse gas emissions and recalculations of greenhouse gas emissions in CRF Sector 1: 'Energy' for the years 1990 and 2003 by gas in Gg and percentage

1990	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
	Gg	percent	Gg	percent	Gg	percent	Gg	percent	Gg	percent	Gg	percent
Total emissions and removals	36,029	1.2%	-12,408	-2.8%	5,977	1.5%	839	3.1%	1,074	6.8%	569	5.5%
Energy	-41,209	-1.3%	-5,600	-5.6%	-3,090	-7.4%	NO	NO	NO	NO	NO	NO
2003												
Total emissions and removals	63,546	2.0%	-5,239	-1.6%	4,431	1.3%	614	1.2%	1,050	18.8%	-429	-4.6%
Energy	-22,740	-0.7%	4,029	7.6%	-4,105	-7.4%	NO	NO	NO	NO	NO	NO

NO: not occurring

Table 3.113 provides an overview of Member States' contributions to EU-15 recalculations. In absolute terms, Germany had the most influence on CO_2 recalculations in the EU-15. The main reason for these recalculations is that Germany made the split between energy and process related emissions from iron and steel production for the first time and therefore reallocated CO_2 emissions from 1A2 to 2C1. Further explanations for the largest recalculations by Member State are provided in Section 10.1.

Table 3.113 **Contribution of Member States to EU-15 recalculations in CRF Sector 1: 'Energy' for 1990 and 2003 by gas (difference between latest submission and previous submission Gg of CO_2 equivalents)**

	1990						2003					
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6
Austria	517	99	93	NO	NO	NO	1,297	253	27	NO	NO	NO
Belgium	-90	34	-347	NO	NO	NO	286	41	-418	NO	NO	NO
Denmark	-28	-75	-165	NO	NO	NO	137	-89	-169	NO	NO	NO
Finland	-997	-155	-258	NO	NO	NO	-1,807	-182	-330	NO	NO	NO
France	-1,823	101	-5	NO	NO	NO	3,486	47	56	NO	NO	NO
Germany	-43,136	-5,563	-2,592	NO	NO	NO	-28,091	3,260	-2,684	NO	NO	NO
Greece	142	-8	-75	NO	NO	NO	202	-120	14	NO	NO	NO
Ireland	609	4	25	NO	NO	NO	119	560	2	NO	NO	NO
Italy	2,997	642	-3	NO	NO	NO	-447	687	-1	NO	NO	NO
Luxembourg	-118	-1	-6	NO	NO	NO	0	0	0	NO	NO	NO
Netherlands	1,361	-391	-27	NO	NO	NO	1,236	-272	-50	NO	NO	NO
Portugal	-257	17	8	NO	NO	NO	283	416	42	NO	NO	NO
Spain	-125	76	23	NO	NO	NO	1,521	-124	52	NO	NO	NO
Sweden	72	-146	-164	NO	NO	NO	421	-98	-454	NO	NO	NO
UK	-333	-235	404	NO	NO	NO	-1,383	-351	-190	NO	NO	NO
EU15	**-41,209**	**-5,600**	**-3,090**	**NO**	**NO**	**NO**	**-22,740**	**4,029**	**-4,105**	**NO**	**NO**	**NO**

Abbreviations explained in the Chapter 'Units and abbreviations'.

3.6 Comparison between the sectoral approach and the reference approach

The IPCC reference approach for CO_2 from fossil fuels for the EU-15 is based on Eurostat energy data (NewCronos database, March 2006 version). This submission includes the reference approach tables for 1990–2003.

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 CO_2 emissions from fossil fuels by Member State and for the EU-15 as a whole.

The Eurostat data for the EU-15 IPCC reference approach includes activity data, net calorific values and carbon emission factors as available in the Eurostat NewCronos database. In the CRF Table 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 NewCronos database as 'Hard coal' and are included in CRF Table 1.A(b) under 'Other bituminous coal'. 'Sub-bitumenous 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 in the NewCronos database; data on international aviation is added to the reference approach separately from the joint (Eurostat/IEA/UNECE) oil questionnaire. For the calculation of CO_2 emissions, the IPCC default carbon emission factors adjusted for the non-oxidised fraction are used in the Eurostat database.

The IPCC reference approach method at EU-15 level is a four-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 NewCronos 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 EU-15 CRF Table 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 EU-15 in CRF Table 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 EU-15 level.

Step 3: Fuel consumption from international aviation is included in Tables 1.A(b) from the joint (Eurostat/IEA/UNECE) oil questionnaire, as in the Eurostat NewCronos database data at this level of disaggregation are not available.

Step 4: 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 States in the joint questionnaire. For the fraction of carbon stored and carbon emission factors IPCC default values are taken (IPCC, 1997).

Table 3.114 shows the apparent energy consumption from fossil fuel combustion from 1990 to 2004 as provided in Tables 1.A(b). Total fossil fuel energy consumption increased by 10 % between 1990 and 2004. Large increases had gas consumption (+68 %), whereas solid fuel combustion declined by 25 %.

Table 3.115 compares EU-15 CO_2 emissions calculated with the IPCC reference approach based on Eurostat data and the sectoral approach available from Member States. The reference approach and the sectoral approach, increased by 5 % and 4 % respectively between 1990 and 2003; the percentage differences between the two data sets are 0.25 % in 2004.

Table 3.114: Apparent EU-15 energy consumption (in PJ) according to the reference approach (Eurostat data)

Fuel types	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Liquid Fuels	21,853	22,687	22,788	22,535	22,671	22,935	23,363	23,268	23,730	23,455	23,009	23,590	23,254	23,407	23,261
Solid Fuels	12,577	11,896	11,109	10,268	10,130	9,860	9,770	9,315	9,303	8,628	8,959	9,091	9,061	9,301	9,372
Gaseous Fuels	9,355	10,066	9,989	10,556	10,633	11,519	12,791	12,675	13,215	13,787	14,204	14,543	14,636	15,338	15,714
Total	**43,785**	**44,650**	**43,885**	**43,360**	**43,434**	**44,314**	**45,924**	**45,258**	**46,249**	**45,870**	**46,172**	**47,223**	**46,950**	**48,046**	**48,348**

Table 3.115: IPCC reference approach (Eurostat data) and sectoral approach (Member State data) for EU-15 (in Tg)

CO2 emissions	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sectoral approach	3,108	3,144	3,079	3,031	3,016	3,042	3,129	3,070	3,115	3,096	3,113	3,183	3,178	3,245	3,260
Reference approach	3,112	3,138	3,058	3,007	2,997	3,037	3,134	3,064	3,122	3,073	3,088	3,167	3,160	3,230	3,252
Percentage difference	-0.13%	0.18%	0.66%	0.82%	0.64%	0.15%	-0.16%	0.20%	-0.22%	0.77%	0.81%	0.50%	0.57%	0.47%	0.25%

Table 3.116 provides an overview by Member State on differences between the Eurostat and national reference approach for 1990 and 2003/2004, as far as available. The differences can occur due to differences in the basic energy data or due to differences when calculating CO_2 emissions from the basic energy data. The main reasons for diverging energy data are:

- 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 explain and 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 Section 3.4). The main reasons for diverging CO_2 emissions are:

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

Table 3.116 shows the comparison between Eurostat and national reference approach for CO_2 from fuel combustion. If 1990 is taken, apparent consumption of the two approaches is within 2 % for several Member States (Austria, Denmark, France, Hungary, Ireland, Italy, Latvia, Netherlands, Slovenia, Spain and the UK). Differences of more than 5 % can be observed for Belgium, Czech Republic, Finland, Greece, Portugal and Sweden. The differences of CO_2 emissions for 1990 range from 0.2 % (Austria, Spain, UK) to 11.5 % (Greece). A comparison of the differences between 1990 and 2003/2004 shows that about 50% of the Member States have larger differences in 1990 than in 2003/2004.

A comparison of these tables with the tables provided in the 2005 submission shows apparent consumption now shows a better fit than last year (for both 1990 and the latest year), whereas for CO_2 emissions there was not much change.

Table 3.116 Comparison between Eurostat and national reference approach for CO_2 from fuel combustion (CRF 1.A) (16)

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	428,316	28,861	432,880	28,569	1.1%	-1.0%
Solid fossil fuels	169,442	16,144	168,733	15,914	-0.4%	-1.4%
Gaseous fossil fuels	217,048	11,844	219,239	12,238	1.0%	3.3%
Total	**814,806**	**56,849**	**820,853**	**56,722**	**0.7%**	**-0.2%**

2003	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	560,533	38,114	582,487	38,770	3.9%	1.7%
Solid fossil fuels	171,976	16,479	172,512	16,277	0.3%	-1.2%
Gaseous fossil fuels	316,287	17,449	319,481	17,833	1.0%	2.2%
Total	**1,048,796**	**72,042**	**1,074,480**	**72,881**	**2.4%**	**1.2%**

2004	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	557,001	37,747	580,087	38,436	4.1%	1.8%
Solid fossil fuels	165,678	15,840	163,565	15,408	-1.3%	-2.7%
Gaseous fossil fuels	319,038	17,622	322,260	17,988	1.0%	2.1%
Total	**1,041,717**	**71,208**	**1,065,912**	**71,832**	**2.3%**	**0.9%**

Belgium

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	688,879	44,966	747,716	49,182	8.5%	9.4%
Solid fossil fuels	408,855	37,859	443,046	41,148	8.4%	8.7%
Gaseous fossil fuels	342,022	18,768	342,955	18,819	0.3%	0.3%
Total	**1,439,756**	**101,593**	**1,533,717**	**109,149**	**6.5%**	**7.4%**

2003	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	816,632	50,014	962,201	61,702	17.8%	23.4%
Solid fossil fuels	257,432	23,935	260,254	24,159	1.1%	0.9%
Gaseous fossil fuels	602,983	33,007	604,628	33,097	0.3%	0.3%
Total	**1,677,047**	**106,955**	**1,827,083**	**118,958**	**8.9%**	**11.2%**

Cyprus

2003	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	94,712	6,890	91,149	6,586	-3.8%	-4.4%
Solid fossil fuels	1,573	147	1,352	125	-14.0%	-14.5%
Gaseous fossil fuels	0	0	0	0	-	-
Total	**96,285**	**7,036**	**92,501**	**6,711**	**-3.9%**	**-4.6%**

(16) Minus means that Member State-based estimates are lower than the Eurostat-based estimates.

Czech Republic

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	360,714	22,063	347,586	22,941	-3.6%	4.0%
Solid fossil fuels	1,251,487	115,636	1,326,753	127,439	6.0%	10.2%
Gaseous fossil fuels	219,711	12,264	224,667	12,541	2.3%	2.3%
Total	**1,831,911**	**149,963**	**1,899,006**	**162,922**	**3.7%**	**8.6%**

2003	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	343,917	20,839	342,547	22,663	-0.4%	8.8%
Solid fossil fuels	862,535	79,892	875,486	84,743	1.5%	6.1%
Gaseous fossil fuels	328,337	18,328	328,072	18,313	-0.1%	-0.1%
Total	**1,534,789**	**119,059**	**1,546,105**	**125,718**	**0.7%**	**5.6%**

2004	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	370,075	21,627	361,015	24,503	-2.4%	13.3%
Solid fossil fuels	816,115	75,604	856,788	82,943	5.0%	9.7%
Gaseous fossil fuels	326,064	18,201	326,488	18,224	0.1%	0.1%
Total	**1,512,253**	**115,432**	**1,544,291**	**125,671**	**2.1%**	**8.9%**

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	312,348	21,796	318,291	22,415	1.9%	2.8%
Solid fossil fuels	254,881	23,645	254,879	24,129	0.0%	2.0%
Gaseous fossil fuels	76,099	4,248	76,098	4,269	0.0%	0.5%
Total	**643,328**	**49,689**	**649,268**	**50,813**	**0.9%**	**2.3%**

2003	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	314,341	22,340	321,316	23,063	2.2%	3.2%
Solid fossil fuels	237,195	22,001	237,214	22,452	0.0%	2.1%
Gaseous fossil fuels	195,134	10,892	195,133	10,947	0.0%	0.5%
Total	**746,669**	**55,233**	**753,663**	**56,462**	**0.9%**	**2.2%**

2004	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	311,613	22,029	316,491	22,575	1.6%	2.5%
Solid fossil fuels	182,486	16,933	182,454	17,277	0.0%	2.0%
Gaseous fossil fuels	194,007	10,829	194,008	10,884	0.0%	0.5%
Total	**688,106**	**49,792**	**692,953**	**50,735**	**0.7%**	**1.9%**

Estonia

2004	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	44,241	3,069	30,097	2,112	-32.0%	-31.2%
Solid fossil fuels	139,642	13,839	139,017	14,041	-0.4%	1.5%
Gaseous fossil fuels	32,429	1,683	32,458	1,812	0.1%	7.6%
Total	**216,312**	**18,591**	**201,572**	**17,965**	**-6.8%**	**-3.4%**

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	403,739	26,075	441,576	29,436	9.4%	12.9%
Solid fossil fuels	212,396	20,253	223,400	21,943	5.2%	8.3%
Gaseous fossil fuels	94,646	5,265	91,620	5,121	-3.2%	-2.7%
Total	**710,781**	**51,593**	**756,596**	**56,500**	**6.4%**	**9.5%**

2003	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	418,318	28,435	396,436	26,474	-5.2%	-6.9%
Solid fossil fuels	348,141	33,139	343,570	33,024	-1.3%	-0.3%
Gaseous fossil fuels	171,004	9,497	171,432	9,536	0.3%	0.4%
Total	**937,462**	**71,072**	**911,438**	**69,034**	**-2.8%**	**-2.9%**

2004	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	432,752	29,510	421,668	26,769	-2.6%	-9.3%
Solid fossil fuels	314,741	29,947	312,718	28,768	-0.6%	-3.9%
Gaseous fossil fuels	165,401	9,188	165,816	9,181	0.3%	-0.1%
Total	**912,894**	**68,645**	**900,202**	**64,718**	**-1.4%**	**-5.7%**

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	3,534,980	228,129	3,534,399	223,844	0.0%	-1.9%
Solid fossil fuels	824,313	76,822	803,792	74,941	-2.5%	-2.4%
Gaseous fossil fuels	1,089,913	59,368	1,089,913	59,718	0.0%	0.6%
Total	**5,449,206**	**364,318**	**5,428,104**	**358,502**	**-0.4%**	**-1.6%**

2003	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	3,596,938	230,891	3,594,616	224,989	-0.1%	-2.6%
Solid fossil fuels	575,125	53,710	571,815	53,397	-0.6%	-0.6%
Gaseous fossil fuels	1,648,836	90,376	1,648,836	92,500	0.0%	2.3%
Total	**5,820,899**	**374,978**	**5,815,267**	**370,886**	**-0.1%**	**-1.1%**

Greece

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	499,289	35,284	512,864	36,388	2.7%	3.1%
Solid fossil fuels	338,766	33,343	337,788	40,142	-0.3%	20.4%
Gaseous fossil fuels	5,783	248	5,783	261	0.0%	5.2%
Total	**843,839**	**68,876**	**856,435**	**76,792**	**1.5%**	**11.5%**

2003	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	677,201	47,649	707,910	49,985	4.5%	4.9%
Solid fossil fuels	372,505	36,808	372,078	44,823	-0.1%	21.8%
Gaseous fossil fuels	84,835	4,640	84,835	4,644	0.0%	0.1%
Total	**1,134,541**	**89,097**	**1,164,822**	**99,452**	**2.7%**	**11.6%**

2004	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	679,597	47,690	704,555	49,624	3.7%	4.1%
Solid fossil fuels	380,586	37,626	382,242	46,107	0.4%	22.5%
Gaseous fossil fuels	93,314	5,108	93,314	5,111	0.0%	0.1%
Total	**1,153,497**	**90,424**	**1,180,111**	**100,842**	**2.3%**	**11.5%**

Hungary

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	359,290	23,275	337,089	21,191	-6.2%	-9.0%
Solid fossil fuels	249,555	24,262	267,548	26,059	7.2%	7.4%
Gaseous fossil fuels	373,172	20,405	373,173	20,405	0.0%	0.0%
Total	**982,017**	**67,941**	**977,810**	**67,655**	**-0.4%**	**-0.4%**
2003	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	257,899	15,479	247,996	15,553	-3.8%	0.5%
Solid fossil fuels	156,442	15,293	157,938	15,425	1.0%	0.9%
Gaseous fossil fuels	497,645	27,609	493,617	27,385	-0.8%	-0.8%
Total	**911,986**	**58,382**	**899,551**	**58,362**	**-1.4%**	**0.0%**
2004	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	253,883	15,141	248,868	14,776	-2.0%	-2.4%
Solid fossil fuels	144,222	14,035	146,313	14,695	1.4%	4.7%
Gaseous fossil fuels	490,368	27,124	487,071	26,940	-0.7%	-0.7%
Total	**888,473**	**56,300**	**882,252**	**56,411**	**-0.7%**	**0.2%**

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	185,986	13,068	169,032	12,591	-9.1%	-3.7%
Solid fossil fuels	150,303	14,329	147,417	14,334	-1.9%	0.0%
Gaseous fossil fuels	78,417	4,046	78,586	4,318	0.2%	6.7%
Total	**414,706**	**31,443**	**395,035**	**31,243**	**-4.7%**	**-0.6%**
2003	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	317,716	22,699	303,130	22,022	-4.6%	-3.0%
Solid fossil fuels	105,347	9,990	103,381	10,270	-1.9%	2.8%
Gaseous fossil fuels	152,925	8,536	154,271	8,476	0.9%	-0.7%
Total	**575,989**	**41,225**	**560,782**	**40,767**	**-2.6%**	**-1.1%**
2004	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	359,965	25,592	347,433	24,977	-3.5%	-2.4%
Solid fossil fuels	96,881	9,135	93,987	9,559	-3.0%	4.6%
Gaseous fossil fuels	152,609	8,519	152,944	8,683	0.2%	1.9%
Total	**609,455**	**43,245**	**594,363**	**43,219**	**-2.5%**	**-0.1%**

Italy

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	3,717,793	247,998	3,755,112	251,788	1.0%	1.5%
Solid fossil fuels	612,156	56,829	614,758	57,389	0.4%	1.0%
Gaseous fossil fuels	1,632,906	89,854	1,644,135	87,144	0.7%	-3.0%
Total	**5,962,855**	**394,681**	**6,014,005**	**396,321**	**0.9%**	**0.4%**
2003	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	3,601,122	242,741	3,691,496	243,302	2.5%	0.2%
Solid fossil fuels	624,813	58,419	623,076	58,991	-0.3%	1.0%
Gaseous fossil fuels	2,663,682	147,968	2,681,372	146,182	0.7%	-1.2%
Total	**6,889,618**	**449,129**	**6,995,944**	**448,475**	**1.5%**	**-0.1%**
2004	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	3,421,647	228,564	3,687,077	236,931	7.8%	3.7%
Solid fossil fuels	694,277	64,717	695,842	65,805	0.2%	1.7%
Gaseous fossil fuels	2,764,083	153,567	2,782,448	152,465	0.7%	-0.7%
Total	**6,880,007**	**446,847**	**7,165,367**	**455,200**	**4.1%**	**1.9%**

Latvia

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	143,977	10,425	141,957	10,208	-1.4%	-2.1%
Solid fossil fuels	29,791	2,788	30,252	2,821	1.5%	1.2%
Gaseous fossil fuels	99,653	5,563	98,859	5,518	-0.8%	-0.8%
Total	**273,420**	**18,775**	**271,068**	**18,547**	**-0.9%**	**-1.2%**
2003	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	51,506	3,539	50,692	3,351	-1.6%	-5.3%
Solid fossil fuels	3,762	357	3,563	332	-5.3%	-7.1%
Gaseous fossil fuels	56,408	3,149	56,448	3,151	0.1%	0.1%
Total	**111,676**	**7,045**	**110,703**	**6,834**	**-0.9%**	**-3.0%**
2004	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	54,390	3,714	53,689	3,555	-1.3%	-4.3%
Solid fossil fuels	2,831	265	2,660	241	-6.0%	-9.2%
Gaseous fossil fuels	55,785	3,114	55,977	3,125	0.3%	0.3%
Total	**113,005**	**7,094**	**112,325**	**6,921**	**-0.6%**	**-2.4%**

Lithuania

2004	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	101,968	7,139	109,850	7,747	7.7%	8.5%
Solid fossil fuels	7,651	718	7,951	739	3.9%	2.9%
Gaseous fossil fuels	99,302	5,121	99,283	4,251	0.0%	-17.0%
Total	**208,920**	**12,979**	**217,084**	**12,737**	**3.9%**	**-1.9%**

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	929,917	51,135	964,000	49,701	3.7%	-2.8%
Solid fossil fuels	384,249	35,481	368,000	34,034	-4.2%	-4.1%
Gaseous fossil fuels	1,289,950	70,249	1,305,000	71,906	1.2%	2.4%
Total	**2,604,116**	**156,865**	**2,637,000**	**155,641**	**1.3%**	**-0.8%**
2003	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	1,141,379	65,098	1,203,000	55,471	5.4%	-14.8%
Solid fossil fuels	365,564	33,912	367,000	34,148	0.4%	0.7%
Gaseous fossil fuels	1,507,182	82,491	1,508,000	83,645	0.1%	1.4%
Total	**3,014,125**	**181,501**	**3,078,000**	**173,264**	**2.1%**	**-4.5%**
2004	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	1,145,757	64,948	1,204,290	54,940	5.1%	-15.4%
Solid fossil fuels	384,243	35,607	359,650	33,437	-6.4%	-6.1%
Gaseous fossil fuels	1,538,432	84,212	1,539,560	85,302	0.1%	1.3%
Total	**3,068,432**	**184,767**	**3,103,500**	**173,679**	**1.1%**	**-6.0%**

Poland

2004	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	895,120	58,427	880,844	63,216	-1.6%	8.2%
Solid fossil fuels	2,265,849	211,626	2,281,109	215,539	0.7%	1.8%
Gaseous fossil fuels	497,344	26,288	497,369	25,514	0.0%	-2.9%
Total	**3,658,312**	**296,340**	**3,659,321**	**304,269**	**0.0%**	**2.7%**

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	466,742	29,140	491,139	30,430	5.2%	4.4%
Solid fossil fuels	108,009	10,017	115,571	10,463	7.0%	4.5%
Gaseous fossil fuels	0	0	0	0		
Total	**574,750**	**39,157**	**606,709**	**40,892**	**5.6%**	**4.4%**
2003	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	593,022	38,211	638,775	41,099	7.7%	7.6%
Solid fossil fuels	137,381	12,740	140,399	12,665	2.2%	-0.6%
Gaseous fossil fuels	110,376	6,161	122,660	6,847	11.1%	11.1%
Total	**840,779**	**57,112**	**901,834**	**60,611**	**7.3%**	**6.1%**
2004	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	594,800	41,347	645,239	41,296	8.5%	-0.1%
Solid fossil fuels	141,182	13,092	141,306	12,746	0.1%	-2.6%
Gaseous fossil fuels	138,308	7,720	138,854	7,751	0.4%	0.4%
Total	**874,291**	**62,159**	**925,400**	**61,793**	**5.8%**	**-0.6%**

Slovakia

2004	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	133,969	8,049	133,872	7,378	-0.1%	-8.3%
Solid fossil fuels	189,502	17,916	189,484	17,844	0.0%	-0.4%
Gaseous fossil fuels	230,207	12,575	230,207	12,628	0.0%	0.4%
Total	**553,678**	**38,540**	**553,563**	**37,850**	**0.0%**	**-1.8%**

Slovenia

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	72,549	5,200	72,559	5,342	0.0%	2.7%
Solid fossil fuels	68,837	6,710	66,716	6,882	-3.1%	2.6%
Gaseous fossil fuels	31,934	1,783	31,955	1,627	0.1%	-8.7%
Total	**173,320**	**13,693**	**171,231**	**13,851**	**-1.2%**	**1.2%**
2003	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	104,119	7,162	94,902	6,924	-8.9%	-3.3%
Solid fossil fuels	62,328	6,118	62,373	6,349	0.1%	3.8%
Gaseous fossil fuels	37,963	2,024	37,958	1,798	0.0%	-11.2%
Total	**204,410**	**15,304**	**195,232**	**15,071**	**-4.5%**	**-1.5%**
2004	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	101,846	6,914	101,145	7,093	-0.7%	2.6%
Solid fossil fuels	64,262	6,305	63,336	6,448	-1.4%	2.3%
Gaseous fossil fuels	37,628	2,021	37,626	1,813	0.0%	-10.3%
Total	**203,736**	**15,240**	**202,106**	**15,354**	**-0.8%**	**0.8%**

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	1,837,978	119,006	1,867,157	119,188	1.6%	0.2%
Solid fossil fuels	790,770	74,100	790,581	77,094	0.0%	4.0%
Gaseous fossil fuels	208,100	11,327	213,880	11,523	2.8%	1.7%
Total	**2,836,848**	**204,433**	**2,871,619**	**207,806**	**1.2%**	**1.6%**

2003	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	2,681,263	177,951	2,727,191	171,646	1.7%	-3.5%
Solid fossil fuels	844,234	78,501	839,902	80,464	-0.5%	2.5%
Gaseous fossil fuels	894,006	49,540	895,993	49,361	0.2%	-0.4%
Total	**4,419,503**	**305,992**	**4,463,086**	**301,472**	**1.0%**	**-1.5%**

2004	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	2,740,979	184,240	2,782,174	178,619	1.5%	-3.1%
Solid fossil fuels	883,240	81,933	887,903	84,663	0.5%	3.3%
Gaseous fossil fuels	1,053,889	58,488	1,056,231	58,684	0.2%	0.3%
Total	**4,678,108**	**324,661**	**4,726,308**	**321,966**	**1.0%**	**-0.8%**

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	583,716	35,953	628,532	38,897	7.7%	8.2%
Solid fossil fuels	112,065	10,575	121,965	11,204	8.8%	6.0%
Gaseous fossil fuels	24,156	1,348	24,002	1,356	-0.6%	0.6%
Total	**719,937**	**47,876**	**774,499**	**51,458**	**7.6%**	**7.5%**

2003	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	619,488	38,772	632,903	40,967	2.2%	5.7%
Solid fossil fuels	112,124	10,662	106,267	10,126	-5.2%	-5.0%
Gaseous fossil fuels	37,190	2,076	36,999	2,091	-0.5%	0.7%
Total	**768,802**	**51,510**	**776,169**	**53,183**	**1.0%**	**3.2%**

2004	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	606,903	37,838	647,599	42,260	6.7%	11.7%
Solid fossil fuels	123,101	11,669	114,110	10,942	-7.3%	-6.2%
Gaseous fossil fuels	37,028	2,067	36,839	2,082	-0.5%	0.7%
Total	**767,032**	**51,575**	**798,548**	**55,284**	**4.1%**	**7.2%**

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	3,166,458	207,750	3,249,999	213,104	2.6%	2.6%
Solid fossil fuels	2,656,489	246,279	2,630,882	241,988	-1.0%	-1.7%
Gaseous fossil fuels	1,976,312	109,118	1,976,478	109,002	0.0%	-0.1%
Total	**7,799,258**	**563,146**	**7,857,359**	**564,095**	**0.7%**	**0.2%**

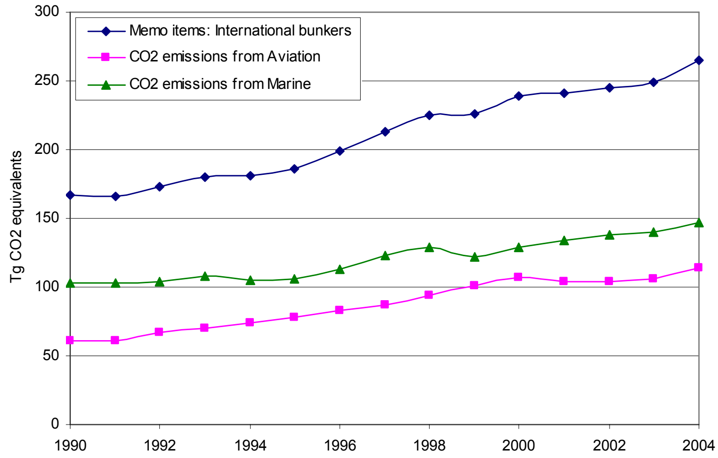
2003	Eurostat reference approach		National reference approach		Percentage difference	
	Apparent consumption (TJ)	CO_2 emissions (Gg)	Apparent consumption (TJ)	CO_2 emissions (Gg)	Apparent consumption (TJ)	CO_2 emissions (Gg)
Liquid fossil fuels	2,916,524	186,634	2,981,505	191,800	2.2%	2.8%
Solid fossil fuels	1,588,334	147,499	1,598,203	146,850	0.6%	-0.4%
Gaseous fossil fuels	3,595,699	200,112	3,575,897	202,903	-0.6%	1.4%
Total	**8,100,556**	**534,245**	**8,155,605**	**541,553**	**0.7%**	**1.4%**

2004	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	2,923,917	190,591	3,577,417	234,950	22.4%	23.3%
Solid fossil fuels	1,587,102	147,402	1,567,414	144,181	-1.2%	-2.2%
Gaseous fossil fuels	3,658,744	203,631	3,661,372	207,032	0.1%	1.7%
Total	**8,169,764**	**541,623**	**8,806,203**	**586,163**	**7.8%**	**8.2%**

3.7 International bunker fuels

International bunker emissions include emissions from Aviation bunkers and Marine bunkers. The emissions of the EC inventory are the sum of the international bunker emissions of the Member States ([17]). Between 1990 and 2004, greenhouse gas emissions form international bunker fuels increased by 50 % in the EU-15. CO_2 emissions from "Marine bunkers" account for 56 % of total greenhouse gas emissions from international bunkers in 2004, CO_2 from "Aviation bunkers" accounts for 43 % (Figure 3.85).

Figure 3.85 GHG emissions from International bunker fuels



3.7.1. Aviation bunkers

CO_2 emissions from "Aviation bunkers" account for 2.7 % of total GHG emissions in 2004 but are not included in the national total GHG emissions. Between 1990 and 2004, CO_2 emissions from Aviation bunkers increased by 86 % in the EU-15 (Table 3.117).

The Member States France, Netherlands, Germany and the United Kingdom contributed the most to the emissions from this source (67 %). All Member States increased emissions from Aviation bunkers between 1990 and 2004. The Member States with the highest increases in absolute terms were Germany, France, Spain and the United Kingdom. The countries with the lowest increase were Finland and Sweden.

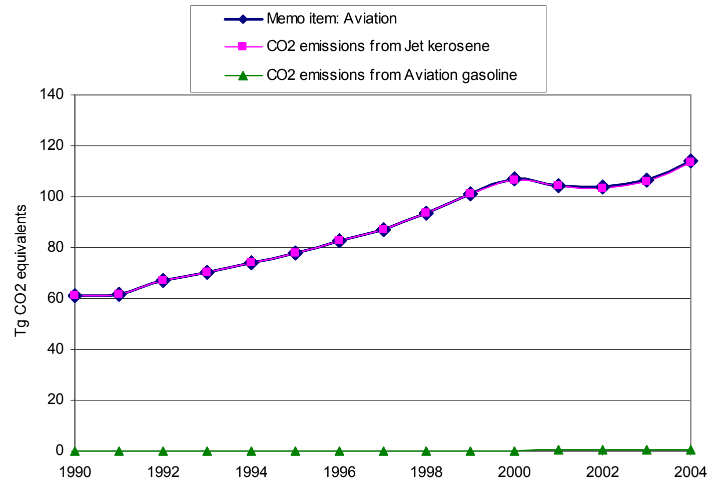
([17]) The definitions in Tables 2.8 and 2.9 of the IPCC good practice guidance are based on activities within 'one country". This means domestic aviation is defined for individual countries. The decision tree in Figure 2.8 of the IPCC good practice guidance considers 'national fuel statistics' for domestic aviation. As the EC is neither a country nor a nation, the EC's interpretation of the good practice guidance is that the emission estimate at EC level has to be the sum of Member States estimates for domestic air or marine transport as they are the countries or nations addressed in the definition and decision trees of the IPCC good practice guidance.

Table 3.117 Member States' contributions to CO_2 emissions from "Aviation bunkers"

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 1990-2004		Change 2003-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	886	1.305	1.532	1,3%	646	73%	227	15%
Belgium	3.096	3.814	3.814	3,3%	718	23%	0	0%
Denmark	1.736	2.142	2.447	2,1%	711	41%	305	12%
Finland	984	1.077	1.252	1,1%	268	27%	176	14%
France	8.618	14.758	15.747	13,8%	7.129	83%	989	6%
Germany	11.589	17.151	17.632	15,4%	6.043	52%	481	3%
Greece	2.448	3.022	3.106	2,7%	659	27%	84	3%
Ireland	1.059	2.249	2.118	1,9%	1.059	100%	-131	-6%
Italy	4.116	8.054	8.068	7,1%	3.952	96%	14	0%
Luxembourg	399	1.187	1.290	1,1%	891	-	104	-
Netherlands	4.540	9.817	10.503	9,2%	5.963	131%	686	7%
Portugal	1.391	2.094	2.374	2,1%	984	71%	280	12%
Spain	3.432	8.552	9.532	8,3%	6.100	178%	980	10%
Sweden	1.335	1.567	1.772	1,5%	436	33%	205	12%
United Kingdom	15.665	29.641	33.123	29,0%	17.458	111%	3.482	11%
EU15	61.293	106.429	114.311	100,0%	53.018	86%	7.882	7%

CO_2 emissions from Jet kerosene account for 99 % of total emissions from "Aviation bunkers" in 2004 (Figure 3.86). All Member States increased emissions from Jet kerosene between 1990 and 2004. Member States with the highest increase in percent were Luxembourg, Netherlands, Spain and the United Kingdom. The countries with the lowest increase were Finland and Belgium.

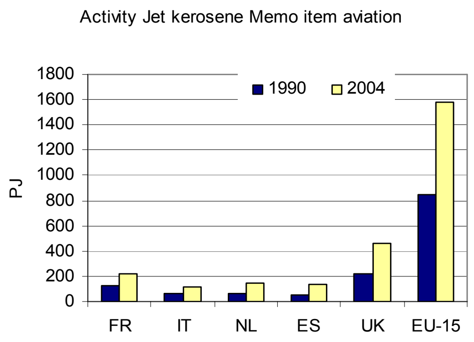
Figure 3.86 CO_2 Aviation bunkers

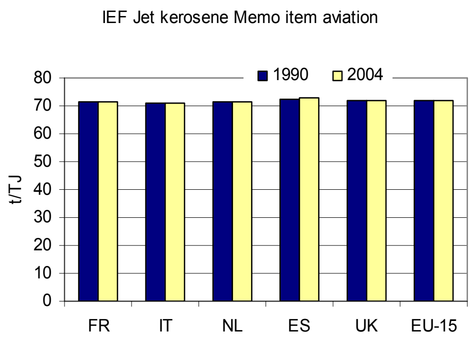


Aviation Bunkers – Jet Kerosene (CO_2)

Figure 3.87 provides an overview of activity data and emission factors for EU-15 and those Member States contributing most to EU-15 emissions. Fuel combustion of EU-15 increased by 86 % between 1990 and 2004. The EU-15 implied emission factor was at 71.9 t/TJ in 2004.

Figure 3.87 Activity Data and Implied Emission Factors for CO_2 from 'Aviation bunkers' - Jet kersoene





3.7.2. Marine bunkers

CO_2 emissions from "Marine bunkers" account for 3.5 % of total GHG emissions in 2004 and are also not included in the national total GHG emissions. Between 1990 and 2004, CO_2 emissions from Marine bunkers increased by 43 % in the EU-15 (Table 3.118).

The Member States Spain, Netherlands and Belgium contributed most to the emissions from this source (64 %). Most Member States increased emissions from Marine bunkers between 1990 and 2004. Denmark, Finland and the UK decreased the emissions from Marine bunkers. The Member States with the highest increase in absolute terms were also Spain, Netherlands and Belgium.

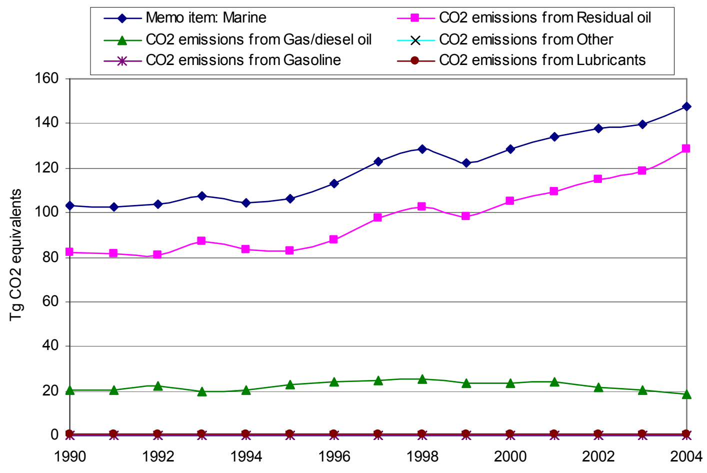
Table 3.118 Member States' contributions to CO_2 emissions from "Marine bunkers"

Member State	Greenhouse gas emissions (Gg CO_2			Share in EU15 emissions in 2003	Change 1990-2004		Change 2003-2004	
	1990	2002	2003		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	NA,NO	NA,NO	NA,NO	-	-	-		
Belgium	13.303	22.970	23.996	16,3%	10.693	80%	1.026	4%
Denmark	3.087	3.130	2.545	1,7%	-543	-18%	-586	-23%
Finland	1.842	2.031	1.679	1,1%	-163	-9%	-352	-21%
France	8.137	8.627	9.787	6,6%	1.651	20%	1.160	12%
Germany	7.980	8.375	8.582	5,8%	602	8%	207	2%
Greece	8.028	10.129	10.221	6,9%	2.193	27%	92	1%
Ireland	56	525	474	0,3%	418	743%	-51	-11%
Italy	4.389	5.603	6.097	4,1%	1.708	39%	495	8%
Luxembourg	-	-	-	0,0%	0	-	0	-
Netherlands	34.235	43.445	46.846	31,8%	12.612	37%	3.402	7%
Portugal	1.780	1.802	1.839	1,2%	60	3%	37	2%
Spain	11.528	22.218	22.904	15,5%	11.376	99%	686	3%
Sweden	2.228	5.520	6.503	4,4%	4.275	192%	983	15%
United Kingdom	6.680	5.135	5.874	4,0%	-806	-12%	739	13%
EU15	103.273	139.511	147.348	100,0%	44.076	43%	7.837	5%

CO_2 emissions from Residual oil account for 87 % of total emissions from "Marine bunkers" in 2004 (Figure 3.88). Most Member States increased emissions from Residual oil between 1990 and 2004. Member States with the highest increase in percent were Ireland and Sweden. The countries with the lowest increase were Finland and Portugal.

CO_2 emissions from Gas/Diesel oil account for 13 % of total emissions from "Marine bunkers" in 2004. Between 1990 and 2004, CO_2 emissions from Gas/Diesel oil decreased by 8 % in the EU-15.

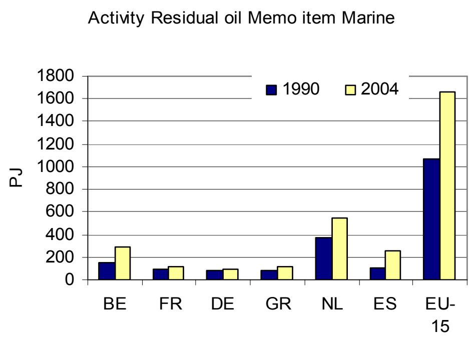
Figure 3.88 CO_2 Marine bunkers

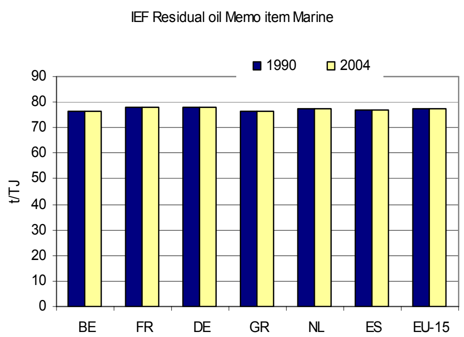


Marine Bunkers – Residual Oil (CO_2)

Figure 3.89 provides an overview of activity data and emission factors for EU-15 and those Member States contributing most to EU-15 emissions. Fuel combustion of EU-15 increased by 56 % between 1990 and 2004. The EU-15 implied emission factor was at 77.2 t/TJ in 2004.

Figure 3.89 Activity Data and Implied Emission Factors for CO_2 from 'Marine bunkers' – Residual Oil

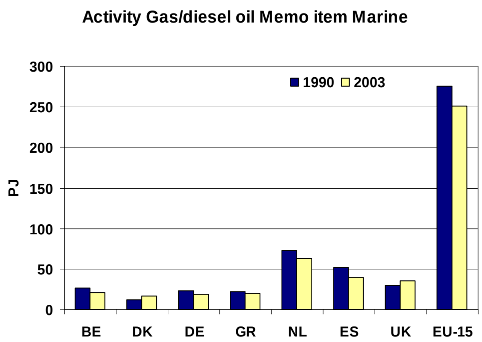


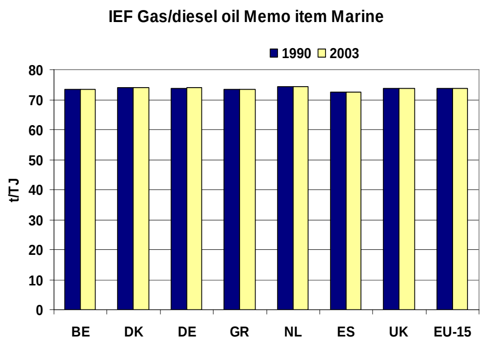


Marine Bunkers – Gas/Diesel Oil (CO_2)

Figure 3.90 provides an overview of activity data and emission factors for EU-15 and those Member States contributing most to EU-15 emissions. Fuel combustion of EU-15 decreased by 9 % between 1990 and 2004. The EU-15 implied emission factor was at 73.7 t/TJ in 2004.

Figure 3.90 Activity Data and Implied Emission Factors for CO_2 from 'Marine bunkers' – Gas/Diesel Oil





QA/QC activities

A project shared between the Commission (Eurostat and DG Environment), Eurocontrol and EEA has been initiated to improve the quality of the estimates of CO_2 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. Several comparisons have been made between energy and emission estimates based on Eurocontrol data on the one hand and data from the energy statistics and GHG inventories on the other hand. The main results of these comparison exercises are:

(1) There are large discrepancies when comparing fuel consumption calculated on the basis of air movement data, with energy statistics. These discrepancies are due to several reasons (a) aircraft carrying fuel reserves - they do not refuel at every landing and take-off (b) the inclusion or exclusion of overseas territories (c) inaccurate coefficients for some older aircraft types (d) ground operations. Discrepancies of up to 20 % were seen as acceptable, but larger differences should be investigated.

(2) A comparison between emissions data provided by Eurostat (calculated on basis of Eurocontrol data) for the years 1996-2001 with data from Member States' GHG inventories revealed that total CO_2 emissions for aviation reported in the 2000 CRF-tables by most Member States are within 10 % of the estimates provided by Eurostat. The share of domestic emissions is usually higher in Member States' estimates, especially as new Member States tend to overestimate the domestic sector.

In May 2004, a 'Workshop on emissions of greenhouse gases from aviation and navigation' was held in Copenhagen. The aim of this workshop was to improve the inventories of GHG emissions from aviation and navigation with special attention to the disaggregation between domestic and international bunker fuels. The workshop brought together the national experts from statistical institutes or other organisations that are responsible for energy balances and/or aviation and navigation transport statistics, the national experts responsible for annual GHG inventories and the experts from international organisations that are performing relevant projects. The workshop report with the recommendations can be downloaded from the ETC/ACC website: http://air-climate.eionet.eu.int/.

4 Industrial processes (CRF Sector 2)

This chapter starts with an overview on emission trends in CRF Sector 2 ‘Industrial processes’. Then for each EU-15 key source overview tables are presented including the Member States’ contributions to the key source in terms of level and trend, and information on methodologies and emission factors. The quantitative uncertainty estimates are summarised in a separate section. Finally, the chapter includes a section on recalculations and on sector-specific QA/QC activities. The main improvement compared to the inventory report 2005 are more detailed information on methods used for the EC key sources and overviews of Member States’ responses to UNFCCC review findings. For HFC emissions from 2F1 ‘Refrigeration and air conditioning’ information on activity data and implied emission factors as included in CRF Table 2(II).F is provided for 2004.

4.1 Overview of sector

CRF Sector 2 ‘Industrial processes’ is the third largest sector contributing 8 % to total EU-15 GHG emissions. The most important GHGs from ‘Industrial processes’ are CO_2 (5 % of total GHG emissions), HFCs and N_2O (1 % each). The emissions from this sector decreased by 14 % from 378 Tg in 1990 to 331 Tg in 2004 (Figure 4.1). In 2004, the emissions increased by 1.8 % compared to 2003. Cement production dominates the trend until 1997. Factors for declining emissions in the early 1990s were low economic activity and cement imports from east European countries. Between 1997 and 1999 the trend is dominated by reduction measures in the adipic acid production in Germany, France and the UK. In addition, between 1998 and 1999 large reductions were achieved in the UK due to reduction measures in HCFC production. The increase in 2004 compared to the previous year is mainly due to emission increases from refrigeration and air conditioning, cement production and iron and steel production.

The key sources in this sector are:

2 A 1 Cement Production: (CO_2)
2 A 2 Lime Production: (CO_2)
2 A 3 Limestone and Dolomite Use: (CO_2)
2 B 1 Ammonia Production: (CO_2)
2 B 2 Nitric Acid Production: (N_2O)
2 B 3 Adipic Acid Production: (N_2O)
2 B 5 Other: (CO_2)
2 B 5 Other: (N_2O)
2 C 1 Iron and Steel Production: (CO_2)
2 C 3 Aluminium production: (PFC)
2 E 1 By-product Emissions: (HFC)
2 F 1 Refrigeration and Air Conditioning Equipment : (HFC)
2 F 4 Aerosols/ Metered Dose Inhalers: (HFC)
2 F 9 Other: (SF_6)

Figure 4.1 shows that the three largest key sources account for about 59 % of total process-related GHG emissions in the EU-15.

Figure 4.1 **EU-15 GHG emissions for 1990–2004 from CRF Sector 2: 'Industrial processes' in CO_2 equivalents (Tg) and share of largest key source categories in 2004**

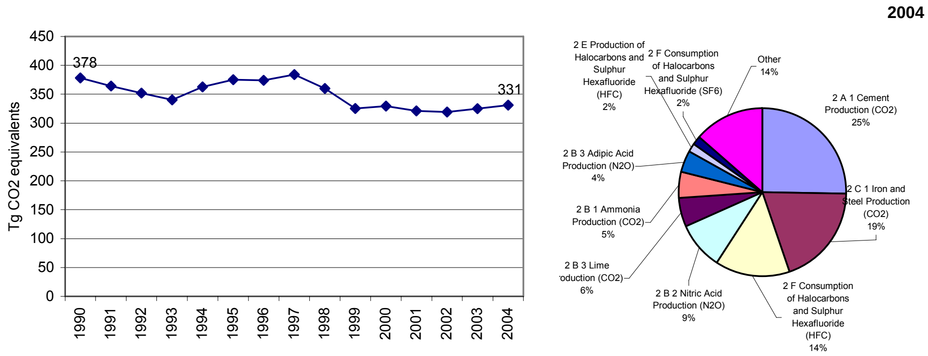
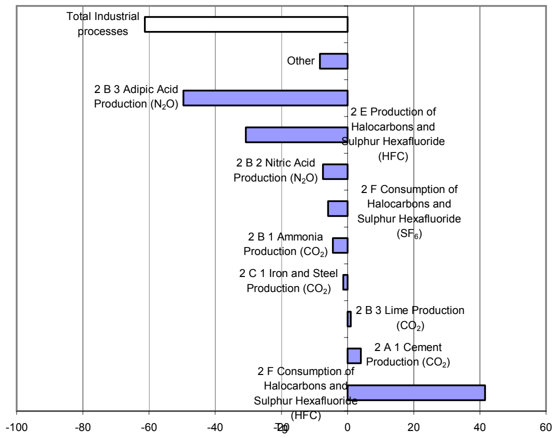


Figure 4.2 shows that large emission reductions occurred in adipic acid production (N_2O) mainly due to reduction measures in Germany, France and the UK and in production of halocarbons and SF_6 (HFCs). Large emission increases can be observed of HFCs from consumption of halocarbons and SF_6.

Figure 4.2 **Absolute change of GHG emissions by large key source categories 1990–2004 in CO_2 equivalents (Tg) in CRF Sector 2: 'Industrial processes'**



4.2 Source categories

4.2.1 Mineral products (CRF Source Category 2.A)

Table 4.1 summarises information by Member State on methodologies, emission factors, completeness and qualitative uncertainty estimates for CO_2 from 2.A: 'Mineral products'. Between 1990 and 2004, CO_2 emission from 'Mineral products' increased by 5 %. The relative decrease was largest in the United Kingdom, the relative growth was largest in Ireland.

This source category includes two key sources: CO_2 from 2.A.1:'Cement production' and CO_2 from 2.A.2:'Lime production'.

Table 4.1 Member States' contributions to CO_2 emissions from 2.A: 'Mineral products' and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1]	EF [1]
Austria	3,265	3,103	CS,T1	CS,D
Belgium	5,335	5,517	CS	CS
Denmark	1,072	1,728	CS	CS
Finland	1,309	1,226	T1,T2	CS,D
France	14,959	12,899	C	CS
Germany	22,973	20,614	D,CS; NE	D,CS
Greece	6,454	7,197	CR,NA,T1,T2	CR,CS,D,NA
Ireland	1,106	2,504	T1,T2	CS,PS
Italy	21,100	23,832	D, T2	CS, PS
Luxembourg	591	504	C/D	C/D
Netherlands	1,000	1,153	CS	CS,D,PS
Portugal	3,384	4,182	D	D+C+CS
Spain	15,669	21,624	CS,D,NA,T2	PS,CS,D,NA
Sweden	1,922	2,001	CS,D,NA,T2	CS,CS,D,NA,PS
United Kingdom	9,470	7,950	T2	CS,D
EU15	109,609	116,035	C,CS,CR,D,T1,T2,NA,NE	C,CS,CR,D,PS,NA

([1]) Information source: CRF Summary Table 3 for 2004.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 4.2 provides information on emission trends of the key source CO_2 from 2.A.1: 'Cement production' by Member State. CO_2 emissions from cement production account for 2.0 % of total EU-15 GHG emissions in 2004. In 2004, CO_2 emissions from cement production were 5 % above 1990 levels in the EU-15.

Germany, France and the United Kingdom had large reductions in absolute terms, whereas especially Spain had large increases. Spain and Italy are the largest emitters accounting for 41 % of EU-15 emissions, followed by Germany (17 %). These results should be interpreted with care as different criteria are used by Member States to decide whether particular emissions are allocated to fossil fuel combustion or to the relevant industrial process.

Table 4.2 Member States' contributions to CO_2 emissions from 2.A.1: 'Cement production'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	2,033	1,754	1,754	2.1%	0	0%	-279	-14%
Belgium	2,824	2,878	2,837	3.4%	-41	-1%	14	0%
Denmark	882	1,370	1,539	1.8%	170	12%	657	74%
Finland	786	500	560	0.7%	60	12%	-226	-29%
France	10,948	8,564	9,007	10.7%	443	5%	-1,941	-18%
Germany	15,146	13,373	13,929	16.6%	556	4%	-1,217	-8%
Greece	5,778	6,386	6,382	7.6%	-4	0%	604	10%
Ireland	884	2,128	2,290	2.7%	162	8%	1,406	159%
Italy	16,084	17,322	17,846	21.3%	525	3%	1,762	11%
Luxembourg	551	405	445	0.5%	40	10%	-106	-19%
Netherlands	416	434	446	0.5%	12	3%	30	7%
Portugal	3,107	3,538	3,538	4.2%	0	0%	432	14%
Spain	12,534	16,371	16,631	19.8%	260	2%	4,097	33%
Sweden	1,272	1,206	1,284	1.5%	78	7%	12	1%
United Kingdom	6,659	5,356	5,456	6.5%	100	2%	-1,204	-18%
EU15	79,905	81,586	83,946	100.0%	2,360	3%	4,041	5%

Table 4.3 shows information on methods applied, activity data, emission factors for CO_2 emissions from 2.A.1: 'Cement production' for 1990 and 2004. The table shows that all MS except Denmark report clinker production as activity data. The implied emission factors per tonne of clinker produced vary slightly from 0.44 for the Netherlands to 0.55 for Austria and Ireland; most MS use country-

specific emission factors. The EU-15 IEF (excluding Denmark) is 0.53 t/t of clinker produced. The table also suggests that more than 95 % of EU-15 emissions are estimated with higher Tier methods.

Table 4.3 Information on methods applied, activity data, emission factors for CO_2 emissions from 2.A.1: 'Cement production' for 1990 and 2004

Member State	Method applied	Activity data	Emission factor	Methodology comment	1990				2004			
					Activity data		Implied emission factor	CO_2 emissions	Activity data		Implied emission factor	CO_2 emissions
					Description	(kt)	(t/t)	(Gg)	Description	(kt)	(t/t)	(Gg)
Austria	T2/CS	PS	PS	Plant-specific AD and EF from all cement production plants, calculation method based on raw meal composition data determined and verified for each plant [NIR 2006]	Clinker production	3694	0.55	2033	Clinker production	3120	0.56	1754
Belgium	CS	PS	CS	Average EF from plant-specific data for 2002 used for 1990-2001, annual average from plant-specific data for years > 2002 available [NIR2006]	Clinker production	5292	0.53	2824	Clinker production	5201	0.55	2837
Denmark	CS/T2	PS	PS	Detailed methodology based on raw material composition. EF determined through ignition loss for different kinds of clinker produced. [NIR 2006]	Cement production	1620	0.54	882	Total cement equivalents	2861	0.54	1539
Finland	T2	PS	PS	Detailed methodology based on CaO and MgO contents of clinker, CDK correction factors applied [NIR2006]	Clinker production	1470	0.53	786	Clinker production	1064	0.53	560
France	T2	AS	CS	Methodology based on national statistics (clinker statistics) from cement association and national emission factors from industry. [NIR2006]	Clinker production	20854	0.53	10948	Clinker production	17157	0.52	9007
Germany	CS/T2	NS	CS	Methodology based on activity data from associations of industries (clinker production) and a CS EF (which is also obtained from associations of industries based on detailed data, average value for 1999-2001) [NIR 2006]	Clinker production	28577	0.53	15146	Clinker production	26281	0.53	13929
Greece	T2	NS	CS	Methodology based on activity data and parameters for emission calcualtions collected from industry, data for 2003 kept constant for 2004 due to lack of updated data [NIR2006]	Clinker production	10645	0.54	5778	Clinker production	11755	0.54	6382
Ireland	T2	PS	PS	Use of plant-specific data for the entire time series [NIR 2006]	Clinker production	1610	0.55	884	Clinker production	4283	0.53	2290
Italy	T2	NS	CS, PS	Methodology based on activity data from national statistics (clinker production) and the IPCC default EF. [NIR2005]	Clinker production	29786	0.54	16084	Clinker production	33049	0.54	17846
Luxembourg				No methodological information provided	Clinker production	1048	0.53	551	Clinker production	847	0.53	445
Netherlands	CS, T2	PS	PS, CS	Method based on environmental reports from plants which used measurements to determine clinker production [NIR2006]	Clinker production	939	0.44	416	Clinker production	804	0.55	446
Portugal	T2	PS	D	Clinker production is obtained from each plant, IPCC default EF is used [NIR 2006]	Clinker production	6128	0.51	3107	Clinker production	6980	0.51	3538
Spain	CS	AS	CS	Clinker production data and the applied EF are obtained from associations of industries [NIR2005]	Clinker production	23212	0.54	12534	Clinker production	30798	0.54	16631
Sweden	T2	PS	PS	AD (clinker production) is obtained from industry, the default value from the GHG protocol of WRI is used. [NIR2005]	Clinker production	2348	0.54	1272	Clinker production	2385	0.54	1284
UK	T2	AS	CS	AD (clinker production) and CS EF is obtained from industry [NIR2006]	Clinker production	13199	0.50	6659	Clinker production	10813	0.50	5456
EU15					**EU15 w/o DK (99%)**	**148,801**	**0.53**	**79,022**	**EU15 w/o DK (98%)**	**154,536**	**0.53**	**82,407**

Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 4.4 summarizes the recommendations from 2005 UNFCCC inventory review in relation to the category 2.A.1 Cement Production. The overview shows that there are few findings that are not resolved and that the remaining unresolved findings are mostly not very significant methodological problems.

Table 4.4 Findings of the 2005 UNFCCC inventory review in relation to CO_2 emissions from 2.A.1 Cement Production and responses in 2006 inventory submissions

Member State	Review findings and responses related to 2.A.1 Cement Production	
	Comment UNFCCC inventory review report 2005	Status in 2006 submission
Austria	Austria has reported the 2002 values for 2003. The ERT recommends that the Party ensure the timely annual reporting of emissions, as well as the corresponding AD.	Not resolved, 2004 data is the same as updated 2003 emissions. In future submissions, data from EU ETS will be used to update the most recent year.
Belgium	Elements of the IPCC good practice guidance can be seen in the method used, but information is lacking on how the country-specific EFs have been developed and updated and how data for clinker production have been obtained. Belgium should provide this information in its future submissions and indicate how the IPCC good practice guidance is followed.	More detailed descriptions provided that include individual elements of IPCC GPG.
Denmark	ERT found method based on cement production not in line with IPCC GPG and encouraged Denmark to use approach based on clinker in future submissions.	Not resolved, emissions still based on cement production. Improvement planned with data from EU ETS and from dialogue with cement producers.
Finland	Source category not addressed by review report 2005	No follow-up necessary
France	ERT recommended that France explain the method used, the reasons for the EF being higher than the default EF and the reasons for the decrease in clinker production.	France explained the method, the decrease in clinker production and that the decomposition of MgO in clinker to CO2 is taken into account which results in a higher EF.
Germany	According to the information provided in the NIR, a source-specific review of the CO2 emissions from Cement Production for the period 1990–1999 will be carried out by the Party. The ERT welcomes the planned review and encourages the Party to check the consistency of the whole time series and to recalculate if necessary.	The review was completed and an improved source for AD identified and used.
Greece	No recommendation for improvement for this source category in 2005 review report.	No follow-up necessary
Ireland	The ERT encouraged Ireland to apply the same methodology derived from EU ETS data for the entire time-series.	Time-series was completely recalculated based on plant-specific data.
Italy	No recommendation for improvement for this source category in 2005 review report.	No follow-up necessary
Luxembourg	not reviewed	
Netherlands	No recommendation for improvement for this source category in 2005 review report.	No follow-up necessary
Portugal	The ERT encouraged Portugal to use a country-specific CaO content as indicated under planned improvements.	Portugal reports that not sufficient information is available to establish a CS EF, because information from plants on CaO contents were not complete.
Spain	The ERT requested further information on the data collection and whether data from the industrial association is complete.	NIR not yet provided
Sweden	To improve the transparency of the submission, the Party is encouraged to conduct plant surveys on non-carbonate feeds to kilns, calcium oxide (CaO) content of the clinker, the amount of dust released and the fraction of dust recycled, and apply the results in the CO2 emissions calculations.	More detailed information on the methods used at plant level are provided.
UK	Source category not addressed by review report 2005	No follow-up necessary

CO_2 emissions from 2.A.2: ‘Lime production’ account for 0.4 % of total GHG emissions in 2004. Between 1990 and 2004, CO_2 emissions from this source increased by 6 % in the EU-15 (Table 4.5). Germany was responsible for 30 % of the emissions from this source. The decreases in Germany (–10%) but also in the UK were offset by emissison increases in other EU-15 Member States between 1990 and 2004.

Table 4.5 Member States' contributions to CO_2 emissions from 2.A.2: 'Lime production'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	396	575	599	3.3%	25	4%	203	51%
Belgium	2,097	2,072	2,228	12.2%	155	8%	131	6%
Denmark	152	112	110	0.6%	-2	-2%	-43	-28%
Finland	383	508	528	2.9%	20	4%	145	38%
France	2,576	2,469	2,534	13.8%	65	3%	-42	-2%
Germany	6,137	5,539	5,529	30.2%	-10	0%	-607	-10%
Greece	367	490	490	2.7%	0	0%	122	33%
Ireland	214	206	202	1.1%	-5	-2%	-13	-6%
Italy	2,042	2,540	2,686	14.7%	146	6%	643	32%
Luxembourg	0	0	0	0.0%	0	-	0	-
Netherlands	NE	NE	NE	-	-	-	-	-
Portugal	178	417	437	2.4%	21	5%	260	146%
Spain	1,123	1,571	1,632	8.9%	61	4%	509	45%
Sweden	498	562	537	2.9%	-24	-4%	39	8%
United Kingdom	1,192	901	815	4.4%	-86	-10%	-376	-32%
EU15	17,355	17,961	18,327	100.0%	366	2%	973	6%

(1) Information source: CRF Summary Table 3 for 2004.
Emissions of the Netherlands are not estimated as there is only a small amount of lime production and data are not available.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 4.6 shows information on methods applied, activity data, emission factors for CO_2 emissions from 2.A.2: 'Lime production' for 1990 to 2004. The table shows that most MS use lime production as activity data for calculating CO_2 emissions. The EU-15 IEF (excluding Denmark and the UK) is 0.77 t/t of lime produced. The implied emission factors per tonne of lime produced vary between 0.66 for Portugal and 0.84 for Ireland. The table also suggests that at least 10 from 15 MS use methodologies that consider different types of lime and corresponding EFs, about 80 % of EU-15 emissions are estimated with methods that could be considered as higher tier methods.

Neither 1996 IPCC Guidelines for Greenhouse Gas inventories nor IPCC Good Practice Guidance (2000) clearly define a lower or higher tier method. Draft 2006 IPCC Guidelines define three tiers, an output-based approach that uses default values (Tier 1), an output-based approach that estimates emissions from CaO and CaO·MgO production and country-specific information for correction factors (Tier 2) and an input-based carbonate approach (Tier 3), the latter requiring plant-specific data. Lime production is covered under the EU emissions trading scheme and monitoring guidelines under the EU ETS (Comission Decision of 29/01/2004 establishing guidelines for the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council) allow methods equivalent to either Tier 2 or Tier 3 above. The use of plant-specific data reported and verified under the EU ETS by Member States therefore can be considered as equivalent to Tier2 or Tier 3 as defined in draft 2006 IPCC Guidelines.

Table 4.6 Information on methods applied, activity data, emission factors for CO_2 emissions from 2.A.2: 'Lime production' for 1990 and 2004

Member State	Method applied	Activity data	Emission factor	Methodology comment	Activity data		Implied emission factor	CO_2 emissions	Activity data		Implied emission factor	CO_2 emissions
					Description	(kt)	(t/t)	(Gg)	Description	(kt)	(t/t)	(Gg)
Austria	CS	PS	PS	Higher tier methodology based on detailed lime composition data from each production plant, considering CaO and MgO content. IEFs from 2001 used for the period 2002-2004. [NIR 2006]	Lime Production	513	0.77	396	Lime Production	789	0.76	599
Belgium	CS	PS	CS	Higher tier methodology considering lime composition or raw material composition, respectively.[NIR2006]	Lime and dolomite production	2661	0.79	2097	Lime Production	2778	0.80	2228
Denmark	D	NS	D, PS	Lower tier methodology based on lime production data, IPCC default emission factor and PS EF for hydrated lime. Estimate includes CO2 emissions from production of bricks and tiles based on a CS method based on the CaCO3 content [NIR2006]	Production of Lime and Bricks	778	0.20	152	Production of Lime and Bricks	738	0.15	110
Finland	T2	PS	PS	Higher tier methodology based on CaO and MgO contents of lime derived from measurements for 1998-2002, average EF used for part of the plants where no detailed data was provided after 2002 [NIR2006]	Lime Production	519	0.74	383	Lime Production	710	0.74	528
France	T2	AS	PS	Higher tier methodology considering types of lime. [NIR2006]	Lime Production	3315	0.78	2576	Lime Production	3258	0.78	2534
Germany	T2	AS	D	Higher tier methodology considering types of lime. AD from association based on plant-specific data [NIR2006]	Lime Production	7719	0.80	6137	Lime Production	6969	0.79	5529
Greece	T2	NS	D	Higher tier methodology considering types of lime based on plant-specific data. Data for 2004 kept constant from 2003 due to lack of updated data [NIR2006]	Lime Production	492	0.75	367	Lime Production	656	0.75	490
Ireland	T2	PS	PS	Use of plant-specific data for the entire time series [NIR 2006]	Lime Production	255	0.84	214	Lime Production	246	0.82	202
Italy	D	NS	D, PS	AD obtained from national statistics and information from associations of industry. IPCC default EF are used [NIR2005]	Lime Production	2583	0.79	2042	Lime Production	3357	0.80	2686
Luxembourg	D	NS	D	no methodological information provided								
Netherlands	NO	NO	NO	not estimated due to lack of AD		NE	NE	NE		NE	NE	NE
Portugal	T2	NS, PS	D	Higher tier methodology considereing different types of lime and using default EF [NIR2006]	Lime Production	268	0.66	178	Lime Production	587	0.74	437
Spain	CS	AS	CS	Higher tier methodology considereing different types of lime and using EF obtained from national association [NIR2005]	Lime Production	1475	0.76	1123	Lime Production	2124	0.77	1632
Sweden	D	PS	D, CS	Higher tier methodology considereing different types of lime and using default EF [NIR2006]	Lime Production	923	0.83	498	Lime Production	1039	0.83	537
UK	CS	AS	CS	Country-specific methodology using limestone consumption data and not distinguishing between types of lime; stochimetric ratio was used as EF (=default) [NIR2006]	Limestone consumption	2708	0.44	1192	Limestone consumption	1853	0.44	815
EU15					**EU15 w/o DK and UK (92%)**	**20,724**	**0.77**	**16,011**	**EU15 w/o DK and UK (95%)**	**22,514**	**0.77**	**17,402**

Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 4.7 summarizes the recommendations from 2005 UNFCCC inventory review in relation to the category 2.A.2 Lime Production. The overview shows that there are few findings that are not resolved and that the remaining unresolved findings are mostly no very significant problems.

Table 4.7 Findings of the 2005 UNFCCC inventory review in relation to CO_2 emissions from 2.A.2 Lime Production and responses in 2006 inventory submissions

Member State	Review findings and responses related to 2.A.2 Lime Production Comment UNFCCC inventory review report 2005	Status in 2006 submission
Austria	Austria reported the 2002 values for 2003 when no updated data were available. The ERT recommends that the Party ensure the timely annual reporting of emissions, as well as the corresponding AD.	resolved, updated values for 2003 and 2004 reported
Belgium	Plant-specific EFs are given, although without relevant details on type of lime and the source of the lime production data. In its future NIRs the Party is encouraged to provide more information on how the IPCC good practice guidance is followed for this key category. To avoid confusion arising from the terminology, it is suggested that the Party use "dolomite lime" instead of "dolomite", since the latter gives the impression that emissions were from dolomite production within the Lime Production emission source.	No further information provided
Denmark	Source category not addressed by review report 2005	No follow-up necessary
Finland	Source category not addressed by review report 2005	No follow-up necessary
France	ERT recommended that France explain the fluctuations in IEFs and include the production of lime by autoproducers in this category (sugar mills, steel, soda ash, calcium carbide etc.)	France explains that emissions from sugar mills and paper industries are of biomass origin and that lime used in steel industry continues to be reported under 2C because emissions are recycled in the process. The issue of allocation of lime production in other sectors is not constently addressed in the review reports and was not raised for other EU countries. There is no clear good practice recommendation from IPCC regarding this allocation.
Germany	Emissions from the decomposition of limestone to produce lime are reported, but emissions from the decomposition of dolomite to produce dolomitic "quick" lime are not estimated. Germany considers these emissions as less significant than emissions from the decomposition of limestone. The ERT encourages Germany to include an estimate of emissions from dolomite decomposition in this category in its next submission in order to improve the completeness of the inventory.	Time-series was completely recalculated and dolomite was included
Greece	Limestone and Dolomite Use – CO2 is identified as a key category according to the trend assessment performed by Greece. Emissions are estimated using the IPCC default method and the default EF. The estimates include limestone use in metal production and ceramics production. Dolomite use is not accounted for, and this is not explained in the NIR.	No clear recommendation provided by the ERT
Ireland	The ERT encouraged to assess time-series consistency when data from national statistics and from EU ETS are used.	Time-series was completely recalculated based on plant-specific data.
Italy	The ERT ecouraged Italy to report limestone and dolomite use as AD in the CRF instead of limestone production data with appropriate explanations in the NIR	No NIR avaialable
Luxembourg	not reviewed	
Netherlands	No recommendation for improvement for this source category in 2005 review report.	No follow-up necessary
Portugal	No recommendation for improvement for this source category in 2005 review report.	No follow-up necessary
Spain	No recommendation for improvement for this source category in 2005 review report.	No follow-up necessary
Sweden	When applying the tier 2 method as prescribed in the IPCC good practice guidance, the NIR is not transparent in how the EFs from each identified industry source was derived. For example, according to the NIR, the amount of CO2 emissions from sugar production is based on the amount of limestone consumed, while the amount of CO2 emissions from pulp and paper production is based on the amount of pulp produced. The Party is encouraged to report the calculation of CaO production and EFs in terms of CaO so as to improve transparency and comparability among Parties.	Very detailed and transparent description is provided in the NIR
UK	The ERT encouraged UK to provide information justifying the assumption of small dolomite calcination.	information not provided

Tables 4.8 provides an overview about the emission sources reported in the category 2.A.7 "Other Mineral Products" as well as total emissions in this category. The most frequent source reported under "Other Mineral Products" is glass production (8 Member States), followed by bricks and tiles production. Germany is the largest contributor to this category with 25%, followed by France (21%) and Italy (11%)

Table 4.8: Emission sources reported under 2.A.7 Other Mineral Products

Member State	2.A.7 Other Mineral Products	CO_2 emissions [Gg]	Share in EU-15 total
Austria	Magnesia sinter production, Bricks and tiles (decarbonizing)	440	9%
Belgium	Glass production, ceramics	452	10%
Denmark	Glass Production (Glass and glass wool)	13	0%
Finland	IE	IE,NO	-
France	Glass Production	993	21%
Germany	Glass Production	1156	25%
Greece	Glass Production	24	1%
Ireland	NE, NO	NE,NO	-
Italy	Glass production	528	11%
Luxembourg	not specified	59	1%
Netherlands	Glass Production (gross)	246	5%
Portugal	Glass Production	171	4%
Spain	Magnesia production, Porous tiles production, Potassium Carbonate, Ferrum Carbonate, Coal as reducing agent in glass industry, Non-porous tiles production, Barium Carbonate	461	10%
Sweden	Light expanded clay aggregates (LECA) production	8	0%
UK	Fletton Brick Production	128	3%
EU-15 Total		**4,679**	**100%**

Table 4.9 provides information on the contribution of Member States to EC recalculations in CO_2 from 2.A 'Mineral products' for 1990 and 2003 and main explanations for the largest recalculaltions in absolute terms.

Table 4.9 Contribution of MS to EC recalculations in CO_2 from 2.A 'Mineral products' for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

	1990		2003		Main explanations
	Gg	Percent	Gg	Percent	
Austria	22	0,7	6	0,2	
Belgium	-47	-0,9	-120	-2,2	
Denmark	35	3,4	85	5,7	
Finland	22	1,7	-2	-0,2	
France	225	1,5	222	1,9	
Germany	3	0,0	-685	-3,3	Reallocation of coke consumption from 2A4 to 1A Differentiated calculation for 6 glass sectors New activity data: only limestone-input, not the production of bricks and tiles
Greece	125	2,0	-105	-1,4	
Ireland	164	17,4	-14	-0,6	
Italy	-775	-3,5	-497	-2,1	Revised emissions from limestone and dolomite Reallocation of emissions from sinter to the metal production sector
Luxembourg	6	1,0	0	0,0	
Netherlands	-216	-17,7	-215	-16,0	
Portugal	9	0,3	21	0,5	
Spain	0	0,0	175	0,8	
Sweden	5	0,2	18	0,9	
UK	-84	-0,9	-14	-0,2	
EU15	**-507**	**-0,5**	**-1.126**	**-1,0**	

4.2.2 *Chemical industry (CRF Source Category 2.B)*

Table 4.10 summarises information by Member State on methodologies, emission factors, completeness and qualitative uncertainty estimates for CO_2 from 2.B: 'Chemical industry'. Between 1990 and 2004, CO_2 emission from 'Chemical industry' increased by 8 %. The relative increase was largest in Denmark, Portugal and Belgium, the relative reduction was largest in France.

This source category includes one key source: CO_2 from 2.B.1:'Ammonia production'.

Table 4.10 Member States' contributions to CO_2 emissions from 2.B: 'Chemical industry' and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1)]	EF [1)]
Austria	582	525	CS	CS,PS
Belgium	918	2,334	CS	CS
Denmark	1	3	-	-
Finland	134	172	T1,T2	CS,D
France	3,537	1,977	C	CS/ PS
Germany	11,823	14,878	CS	CS
Greece	IE,NA,NE,NO	IE,NA,NE,NO	NA	NA
Ireland	989	NO	NA	NA
Italy	2,186	1,328	D	C, PS
Luxembourg	0	0	C/D	C/D
Netherlands	3,813	3,872	CS,T1b	CS,PS
Portugal	634	1,837	MB+D	D+C
Spain	832	706	D,NA	CS,D,NA,PS
Sweden	69	53	D,NA	NA,PS
United Kingdom	1,322	1,329	T1	CS
EU15	26,839	29,016	C,CS,D,MB,T1,T1b,T2,NA	C,CS,D,PS,NA

(1) Information source: CRF Summary Table 3 for 2004.
Emissions of Greece are not reported partly because there is no method in the IPCC guidelines provided.
Abbreviations explained in the Chapter 'Units and abbreviations'.

CO_2 emissions from 2.B.1: 'Ammonia production' account for 0.4 % of total EU-15 GHG emissions in 2004. Between 1990 and 2004, CO_2 emissions from this source decreased by 7 % (Table 4.11). The Netherlands, France, Germany, and Portugal are responsible for 73% of these emissions in the EU-15. The greatest reductions in absolute terms between 1990 and 2004 had France. The largest growth had Portugal.

Table 4.11 Member States' contributions to CO_2 emissions from 2.B.1: 'Ammonia production'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	513	523	464	2.8%	-58	-11%	-49	-10%
Belgium	694	1,274	1,265	7.8%	-9	-1%	571	82%
Denmark	NO	NO	NO	-	-	-	-	-
Finland	44	NO	NO	-	-	-	-44	-100%
France	3,357	2,044	1,953	12.0%	-91	-4%	-1,405	-42%
Germany	4,596	5,255	5,169	31.7%	-86	-2%	573	12%
Greece	IE	IE	IE	-	-	-	-	-
Ireland	989	NO	NO	-	-	-	-989	-100%
Italy	1,710	680	748	4.6%	68	10%	-962	-56%
Luxembourg	0	0	0	0.0%	0	-	0	-
Netherlands	3,096	2,720	3,086	18.9%	366	13%	-10	0%
Portugal	569	1,622	1,715	10.5%	94	6%	1,146	201%
Spain	709	639	592	3.6%	-47	-7%	-116	-16%
Sweden	NO	NO	NO	-	-	-	-	-
United Kingdom	1,322	1,164	1,329	8.1%	165	14%	8	1%
EU15	17,599	15,921	16,322	100.0%	401	3%	-1,277	-7%

Emissions of Greece are reported in Energy - Chemicals.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 4.12 shows information on methods applied, activity data, emission factors for CO_2 emissions from 2.B.1: ‘Ammonia production’ for 1990 to 2004. The table shows that most MS report ammonia production as activity data. The implied emission factors per tonne of ammonia produced vary for 2004 between 0.91 for Austria and 1.82 for Germany. The EU-15 IEF (excluding Belgium, Greece, Netherlands, Portugal and the UK) is 1.40 t/t of ammonia produced. The decrease of the IEF from 1990 to 2004 is rather due to changing ratios of production of the different countries than to emission reduction measures. The table also suggests that more than 75 % of EU-15 emissions are estimated with higher Tier methods.

Table 4.12 Information on methods applied, activity data, emission factors for CO_2 emissions from 2.B.1: ‘Ammonia production’ for 1990 and 2004

					1990				2004			
Member State	Method applied	Activity data	Emission factor	Methodology comment	Activity data: Description	(kt)	Implied emission factor (t/t)	CO_2 emissions (Gg)	Activity data: Description	(kt)	Implied emission factor (t/t)	CO_2 emissions (Gg)
Austria	CS	PS	PS	Estimates based on data reported by ammonia production plant. CH4 emissions based on measurements. Method for CO2 emissions was updated in accordance with IPCC guidelines [NIR2006]	Ammonia Production	461	1.11	513	Ammonia Production	510.02	0.91	464.38
Belgium	CS	PS	CS	Emissions are calculated using natural gas consumption data and the IPCC default EF for natural gas in Walloon region and on plant-specific data in Flanders. [NIR2006]	Ammonia Production	C	C	694	Ammonia Production	C	C	1265
Finland					Ammonia Production	28	1.55	44	Ammonia Production	NO	NO	NO
France	CS(T2)	AS	PS	Emission data obtained partly directly from plants, partly from national statistics [NIR2006]	Ammonia Production	1928	1.74	3357	Ammonia Production	1370	1.43	1953
Germany	D	NS	D	Emissions are estimated from ammonia production data (NS) and the IPCC default EF. [NIR2006]	Ammonia Production	2532	#NAME?	4596	Ammonia Production	2848	1.82	5169
Greece	D	NS	D	Emissions are included in the energy sector to avoid double-counting [NIR 2006]	Ammonia Production	313	IE	IE	Ammonia Production	160	IE	IE
Ireland	D	NS, PS	CS, PS	Emissions are calculated using natural gas consumption data and a CS EF for natural gas. [NIR2004] Ammonia production was closed in 2002 [NIR 2005]	Ammonia Production	430	2.30	989	NO	NO	NO	NO
Italy	D	NS, PS	C, PS		Ammonia Production	1455	1.18	1710	Ammonia Production	648	1.15	748
Netherlands	T1b	NS	PS, CS	Emissions are calculated from the amount of natural gas used as feedstock (equivalent to IPCC Tier 1b) and a CS EF based on a 17% fraction of carbon in the gas-feedstock oxidised during the ammonia manufacture, which was calculated from the carbon not contained in the urea produced. [NIR 2006]	Ammonia Production	C	C	3096	Ammonia Production	C	C	3086
Portugal	T2	NS, PS	PS	Emissions are estimated using natural gas consumption data and a PS emission factor. [NIR2006]	Ammonia Production	C	0.00	569	Ammonia Production	C	0.00	1715
Spain	CS	AS	CS		Ammonia Production	573	1.24	709	Ammonia Production	491	1.21	592
UK	CS	NS, PS	CS	Estimates based on reported data from industry and natural gas consumption [NIR2004]	Natural gas consumption PJ net	45	29.53	1322	Natural gas consumption PJ net	33	39.70	1329
EU15					**EU15 w/o BE, GR, NL, PT and UK (70%)**	**8791**	**1.53**	**13458**	**EU15 w/o BE, GR, NL, PT and UK (58%)**	**7396**	**1.40**	**10319**

Abbreviations explained in the Chapter ‘Units and abbreviations’.

Table 4.13 summarizes the recommendations from 2005 UNFCCC inventory review in relation to the category 2.B.1 Ammonia Production. The overview shows that most recommendations were implemented and that the remaining unresolved findings are mostly no very significant.

Table 4.13 Findings of the 2005 UNFCCC inventory review in relation to CO_2 emissions from 2.B.1 Ammonia Production and responses in 2006 inventory submissions

Member State	Review findings and responses in relation to 2.B.1 Ammonia Production	
	Comment UNFCCC inventory review report 2005	**Status in 2006 submission**
Austria	The CO2 IEF values are among the lowest of reporting Parties and lower than the IPCC default range. The ERT recommends that Austria provide information in the NIR regarding the QA/QC procedures carried out for the emissions reported by the only producer of ammonia in the country.	Method for CO2 emissions at production plant was examined and subsequently changed, emissions for time series were recalculated
Belgium	The NIR mentions use of the IPCC good practice guidance on emissions from ammonia production, but there is currently no IPCC good practice guidance on ammonia production emissions. The Party did report emissions of CO2 from two other plants in the Walloon region; these two plants also use ammonia production process CO2 emission, which is reported by the Party. Belgium has stated that it will improve documentation in its next NIR to improve the transparency of this activity, and to address the double counting issue.	No reference to IPCC GPG. Clearer explanation of double counting issues provided.
Finland	Source category for 1990-1993 not estimated in following submissions	No follow-up necessary
France	ERT encouraged France to include methodological descriptions.	Methodological description was added.
Germany	The ERT encourages the Party to identify and report the reasons for the increase in ammonia production. As indicated in previous 2005 review tages, the IEF value for CO2 from Ammonia Production is not well documented. Germany plans to begin using the IPCC default value range. The ERT recommends that Germany follow this approach.	Reasons for increase provided and IPCC default EF used, therefore time-series was recalculated.
Greece	For its next submission, the Party should check whether emissions and destruction data are available at the plant level. Emissions estimated using AD need to be calculated using AD from the same year.	No plant-specific data are used yet.
Ireland	Source category not addressed by review report 2005	No follow-up necessary
Italy	Source category not addressed by review report 2005	No follow-up necessary
Luxembourg	not reviewed	
Netherlands	The ERT recommended Netherlands include explanations for the decreasing trend of emissions.	Trend not explained in draft NIR 2006.
Portugal	No recommendation for improvement for this source category in 2005 review report.	No follow-up necessary
Spain	No recommendation for improvement for this source category in 2005 review report.	No follow-up necessary
UK	Source category not addressed by review report 2005	No follow-up necessary

Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 4.14 provides information on the contribution of Member States to EC recalculations in CO_2 from 2.B 'Chemical industry' for 1990 and 2003 and main explanations for the largest recalculaltions in absolute terms.

Table 4.14 Contribution of MS to EC recalculations in CO_2 from 2.B 'Chemical industry' for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

	1990		2003		Main explanations
	Gg	Percent	Gg	Percent	
Austria	117	25,3	30	5,3	
Belgium	9	1,0	426	21,0	
Denmark	-1	-54,0	-2	-60,7	
Finland	74	122,8	13	8,9	
France	0	0,0	4	0,2	
Germany	9.632	439,7	12.725	632,0	Addition of new subsources New emission factor
Greece	0	0,0	0	0,0	
Ireland	0	0,0	0	0,0	
Italy	0	0,0	0	0,0	
Luxembourg	0	0,0	0	0,0	
Netherlands	275	7,8	410	14,0	
Portugal	2	0,2	3	0,2	
Spain	159	23,6	158	26,6	
Sweden	0	0,0	0	0,0	
UK	0	0,0	0	0,0	
EU15	**10.267**	**62,0**	**13.767**	**94,8**	

Table 4.15 summarises information by Member State on methodologies, emission factors, completeness and qualitative uncertainty estimates for N_2O from 2.B: 'Chemical industry'. Between 1990 and 2004, N_2O emission from 'Chemical industry' decreased by 56 %. The relative decrease was largest in Ireland, emissions increased in Italy and Portugal.

This source category includes three key sources: N_2O from 2.B.2:'Nitric acid production', N_2O from 2.B.3: 'Adipic acid production', and N_2O from 2.B.5: 'Other'.

Table 4.15 Member States' contributions to N_2O emissions from 2.B: 'Chemical industry' and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1)]	EF [1)]
Austria	912	281	CS	PS
Belgium	3,934	3,396	CS	CS
Denmark	1,043	531	D	PS
Finland	1,656	1,460	T1	PS
France	24,143	6,226	C	CS/ PS
Germany	23,776	12,664	PS, CS	D, PS, CS
Greece	713	352	D,NA	D,NA
Ireland	1,035	0	NA	NA
Italy	6,676	8,443	D	D, PS
Luxembourg	0	0	C/D	C/D
Netherlands	7,570	6,376	T2	PS
Portugal	567	605	D	D+C
Spain	2,884	1,788	D,NA	CS,NA
Sweden	832	444	CS,NA,T2	NA,PS
United Kingdom	29,270	4,026	CS	CS
EU15	105,011	46,591	C,CS,D,PS,T1,T2, NA	C,CS,D,PS,NA

([1]) Information source: CRF Summary Table 3 for 2002.
([2]) Information source: CRF Table 7 for 2002.
Abbreviations explained in the Chapter 'Units and abbreviations'.

N_2O emissions from 2.B.2: 'Nitric acid production' account for 0.7 % of total EU-15 GHG emissions in 2004. Between 1990 and 2004, N_2O emissions from this source decreased by 16% (Table 4.16). The Netherlands, France, Germany and Belgium are responsible for 67 % of these emissions in the EU-15. Nearly all Member States had reductions from this source between 1990 and 2004. France had the greatest reductions in absolute terms. The largest growth was in Germany.

Table 4.16 Member States' contributions to N_2O emissions from 2.B.2: 'Nitric acid production'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	912	883	281	0.9%	-603	-68%	-631	-69%
Belgium	3,562	2,987	3,118	10.0%	131	4%	-444	-12%
Denmark	1,043	895	531	1.7%	-364	-41%	-512	-49%
Finland	1,656	1,420	1,460	4.7%	39	3%	-196	-12%
France	6,570	4,600	4,654	15.0%	55	1%	-1,916	-29%
Germany	4,673	6,589	7,518	24.2%	930	14%	2,845	61%
Greece	713	370	352	1.1%	-18	-5%	-361	-51%
Ireland	1,035	NO	NO	-	-	-	-1,035	-100%
Italy	2,086	1,139	1,805	5.8%	666	58%	-281	-13%
Luxembourg	0	0	0	0.0%	0	-	0	-
Netherlands	6,330	5,060	5,617	18.1%	557	11%	-713	-11%
Portugal	567	597	605	1.9%	7	1%	38	7%
Spain	2,884	1,965	1,788	5.8%	-178	-9%	-1,097	-38%
Sweden	814	431	427	1.4%	-4	-1%	-387	-48%
United Kingdom	4,134	2,606	2,923	9.4%	317	12%	-1,211	-29%
EU15	36,979	29,543	31,078	100.0%	1,535	5%	-5,901	-16%

Table 4.17 shows information on methods applied, activity data, emission factors for N_2O emissions from 2.B.2: 'Nitric acid production' for 1990 to 2004. The table shows that almost all MS report nitric acid production as activity data; for some MS this information is confidential. The implied emission factors per tonne of nitric acid produced vary for 2004 between 0.0016 for Austria and 0.0144 for Belgium. The EU-15 IEF (excluding Netherlands and Portugal) is 0.0063 t/t of nitric acid produced. The decrease of the IEF is mainly due to changing production ratios in the different MS having different technological standards and close down of older plants in some MS rather than due to introduction of emission reduction measures. The table also suggests that more than 95 % of EU-15 emissions are estimated with higher Tier methods.

Table 4.17 Information on methods applied, activity data, emission factors for N_2O emissions from 2.B.2: 'Nitric acid production' for 1990 and 2004

Member State	Method applied	Activity data	Emission factor	Methodology comment	1990 Activity data Description	1990 Activity data (kt)	1990 Implied emission factor (t/t)	1990 N_2O emissions (Gg)	2004 Activity data Description	2004 Activity data (kt)	2004 Implied emission factor (t/t)	2004 N_2O emissions (Gg)
Austria	CS/T2	CS	PS	Emission factors are plant specific and based on measurements. [NIR 2006]	Nitric Acid Production	530	0.0056	2.9	Nitric Acid Production	573	0.0016	0.9
Belgium	CS	PS	CS	Estimates are partly calculated using nitric acid production figures and a french EF and partly reported by industry based on monitoring data [NIR2006]	Nitric Acid Production	1436	0.0080	11.5	Nitric Acid Production	696	0.0144	10.1
Denmark	CS/T2	PS	PS	Estimates are based on PS activity data using the PS EF from measurements for 2002. [NIR2006]	Nitric Acid Production	450	0.0075	3.4	Nitric Acid Production	229	0.0075	1.71
Finland	CS/T2	PS	PS	Emission factors are plant specific and based on periodic measurements and continuous measurements for one plant. [NIR 2006]	Nitric acid production medium pressure plants	549	0.0097	5.3	Nitric acid production medium pressure plants	503	0.0094	4.7
France	CS	AS/PS	PS	Emission data obtained from association based on plant-specific data until 2001. Since 2002 plant-specific information directly reported to authorities available for all sites [NIR2006]	Nitric Acid Production	3200	0.0066	21.2	Nitric Acid Production	2753	0.0055	15.0
Germany	CS	NS	CS	Activity data taken from national statistics, country-specific emission factor is assumed to be constant [NIR 2006]	Nitric Acid Production	2741	#NAME?	15.1	Nitric Acid Production	4410	0.0055	24.3
Greece	D	NS	D	Estimates are based on activity data from industry and average IPCC default EF. No abatement technologies are used [NIR 2006]	Nitric Acid Production	511	0.0045	2.3	Nitric Acid Production	252	0.0045	1.1
Ireland	D	NS, PS	CS, PS	Nitric acid production was closed in 2002	Nitric Acid Production	339	0.0099	3.3	NO	NO	NO	NO
Italy	D	NS, PS	D, PS	Emissions are calculated based on date from EPER and national statistics and plant-specific EF [NIR2005]	Nitric Acid Production	1037	0.0065	6.7	Nitric Acid Production	616	0.0095	5.8
Luxembourg												
Netherlands	T2	Q, NS	PS	Estimates are based on data reported by industry and calculated with Tier 2 method, emission factors are based on plant-specific measured data which are confidential. [NIR 2006]	Nitric Acid Production	C	C	20.4	Nitric Acid Production	C	C	18.1
Portugal	D	NS, PS	PS	Estimates are calculated from nitric acid production data and PS EF [NIR2006]	Nitric Acid Production	C		1.8	Nitric Acid Production	C		2.0
Spain	CS	AS	PS	Emission factor obtained from national business association [NIR 2005]	Nitric Acid Production	1329	0.0070	9.3	Nitric Acid Production	824	0.0070	5.8
Sweden	T2	PS	PS	Estimates are based on activity data and emission factors as reported by industry. [NIR 2006]	Nitric Acid Production	374	0.0070	2.6	Nitric Acid Production	257	0.0054	1.4
UK	T2, T3	PS	CS	Estimates are based on PS data as well as calculated using nitric acid production and the average IPCC default value [NIR 2006]	Nitric Acid Production	2408	0.0055	13.3	Nitric Acid Production	1706	0.0055	9.4
EU15					**EU15 w/o NL and PT (81%)**	**14,904**	**0.0065**	**97**	**EU15 w/o NL and ES (80%)**	**12,818**	**0.0063**	**80**

Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 4.18 summarizes the recommendations from 2005 UNFCCC inventory review in relation to the category 2.B.2 Nitric Acid Production. The overview shows that all recommendations were implemented.

Table 4.18 Findings of the 2005 UNFCCC inventory review in relation to CO_2 emissions from 2.B.2 Nitric Acid Production and responses in 2006 inventory submissions

Member State	Review findings and responses related to 2.B.2 Nitric Acid Production	
	Comment UNFCCC inventory review report 2005	**Status in 2006 submission**
Austria	The ERT encourages the Party to explain the particular operating conditions that caused the sudden increase in the IEFs between 1994 and 1995.	Explanation of operating conditions provided
Belgium	An EF of 5.189 kg/t has been used, but no justification provided on the use of this factor with reference to plant age, technology type and so on, and whether this factor is considered as country industry average throughout the time series. The N2O emissions show a general decreasing trend, but there is no mention of introduction of abatement technology. Belgium is encouraged to provide clear details of the methodological approach used, in line with the IPCC good practice guidance, and understands that plant specific data are available.	More detailed information on abatement technologies provided that explain decreasing trend. It is explained why the EF are considered as appropriate.
Denmark	ERT recommended to include EF of 7.5 kg N2O/ton nitirc acid communicated during the review in the NIR.	EF quoted is available from CRF background data table and was already available in 2004 CRF submission. Review finding unclear/not necessary.
Finland	ERT recommended to obtain and use measurement data in next submission. ERT recommened to explain that no abatement technologies are used for nitric acid production.	Additional measurement devices were installed and measurement data obtained for 2006 submission. No explanation on abatement technologies added.
France	The ERT encouraged France to reference estimation methods used by facilities. The ERT also invited France to assess the consistency of time series as data source changed.	Reference of estimation method provided. France changed from plant-specific data reported to association to plant-specific data reported to national authorities. This should not impact time-series consistency.
Germany	The reasons for changes in volumes of production are not explained, except for the sharp rise value from 2002 to 2003 (the number of production plants rose from four to six). The ERT encourages the Party to verify the changes in production volumes and include this information in the NIR. The six different plants that produce nitric acid in Germany have different emissions abatement techniques. Because N2O from Nitric Acid Production is a key category, the ERT encourages Germany to collect plant-specific data which take into account different production and emissions abatement technologies.	Production volumes are taken from national statistics. It is unclear how the inventory agency should further check these changes, in aprticular as they seem to be within normal changes of production volumes. Data collected is already derived from measured data at plants, no further steps were taken.
Greece	Source category not addressed by review report 2005	No follow-up necessary
Ireland	Source category not addressed by review report 2005	No follow-up necessary
Italy	The ERT welcomes the Party's effort to improve its EFs and AD in future by collecting more information from the operators about N2O emission trends for Nitric Acid Production, especially for the years 1990–2000.	No clear recommendation provided.
Luxembourg	not reviewed	
Netherlands	The ERT recommended Netherlands include explanations for the decreasing trend of emissions.	The reduction in 2001 was explained by technical control measures implemented. Emissions decrease in 2002 was due to lower production. In 2004 production increased.
Portugal	The ERT recommended that Portugal develop CS EF from each plant.	Plant-specific EFs are used
Spain	The ERT recommended that Spain verify the EF used.	No updated NIR provided.
Sweden	In order to improve transparency, the Party is encouraged to provide in its NIR a summary of available plant-specific information.	Summary is provided
UK	Review report welcomed improvements reported in previous inventory submission.	No follow-up necessary

N_2O emissions from 2.B.3: 'Adipic acid production' account for 0.3 % of total EU-15 GHG emissions in 2004. Between 1990 and 2004, N_2O emissions from this source decreased by 78 % (Table 4.19). Italy is responsible for 48 % of these emissions in the EU-15 and it had increases in emissions from this source between 1990 and 2004. All other Member States that reported emissions from this source had large emissions reductions between 1990 and 2004 due to reduction measures in adipic acid production.

Table 4.19 Member States' contributions to N_2O emissions from 2.B.3: 'Adipic acid production'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	NO	NO	NO	-	-	-	-	-
Belgium	NO	NO	NO	-	-	-	-	-
Denmark	NO	NO	NO	-	-	-	-	-
Finland	NO	NO	NO	-	-	-	-	-
France	14,806	4,140	1,176	8.6%	-2,964	-72%	-13,630	-92%
Germany	18,805	3,778	4,781	34.9%	1,003	27%	-14,024	-75%
Greece	NO	NO	NO	-	-	-	-	-
Ireland	NO	NO	NO	-	-	-	-	-
Italy	4,579	6,417	6,638	48.5%	221	3%	2,058	45%
Luxembourg	0	0	0	0.0%	0	-	0	-
Netherlands	NO	NO	NO	-	-	-	-	-
Portugal	NO	NO	NO	-	-	-	-	-
Spain	NO	NO	NO	-	-	-	-	-
Sweden	NO	NO	NO	-	-	-	-	-
United Kingdom	25,136	582	1,103	8.1%	522	90%	-24,033	-96%
EU15	63,326	14,917	13,697	100.0%	-1,219	-8%	-49,628	-78%

Table 4.20 shows information on methods applied, activity data, emission factors for N_2O emissions from 2.B.3: 'Adipic acid production' for 1990 to 2004. The table shows that in 2004 adipic acid was produced in four MS only. Two MS report adipic acid production as activity data; for France and Germany this information is confidential. The implied emission factors per tonne of adipic acid produced vary for 2004 between 0.02 for the UK and 0.3 for Italy. The EU-15 IEF (excluding France and Germany) is 0.09 t/t of adipic acid produced. With the exception of Italy the implied emission factors have been reduced substantially due to emission reduction measures. The table suggests that 100 % of EU-15 emissions are estimated with higher Tier methods.

Table 4.20 Information on methods applied, activity data, emission factors for N_2O emissions from 2.B.3: 'Adipic acid production' for 1990 and 2004

					1990				2004			
Member State	Method applied	Activity data	Emission factor	Methodology comment	Activity data		Implied emission factor (t/t)	N_2O emissions (Gg)	Activity data		Implied emission factor (t/t)	N_2O emissions (Gg)
					Description	(kt)			Description	(kt)		
France	PS	PS	PS	Emission data obtained from industry on plant level and verified with other declarations reported by the plant to other national authorities [NIR 2006] Estimation method used by plant is provided.	Adipic acid production	C	0.00	47.8	Adipic acid production	C	0.00	3.8
Germany	PS	PS	PS, D	Estimates are based on PS data since mid90ies, before emissions are calculated using nitric acid production and the IPCC default value [NIR 2006]	Adipic acid production	C	#NAME?	60.7	Adipic acid production	C	C	15.4
Italy	D	PS	PS	Emission data obtained from industry on plant level [NIR 2004]	Adipic acid production	49	0.30	14.8	Adipic acid production	74	0.30	22.2
UK	T2, T3	PS	CS	Emission data obtained from industry on plant level based on continuous measurements [NIR 2006]	Adipic acid production	265	0.31	81.1	Adipic acid production	200	0.02	3.6
EU15					**EU15 w/o DE and FR (38%)**	**315**	**0.30**	**96**	**EU15 w/o DE and FR (78%)**	**274**	**0.09**	**26**

Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 4.21 summarizes the recommendations from 2005 UNFCCC inventory review in relation to the category 2.B.3 Adipic Acid Production. For France it has to be argued whether the review finding is correct and should be implemented as it would reduce transparency. UK did not include results from research programmes in the NIR. However, it is not the essentail function of the NIR to communicate research results. Scientific publications maybe better suited for this purpose and countries should also strieve to concentrate on the essential information in the NIR. The recommendations that are not implemented are not essential for the quality of the estimation.

Table 4.21 Findings of the 2005 UNFCCC inventory review in relation to CO_2 emissions from 2.B.3 Adipic Acid Production and responses in 2006 inventory submissions

Member State	Review findings and responses related to 2.B.3 Adipic Acid Production	
	Comment UNFCCC inventory review report 2005	Status in 2006 submission
France	The ERT critizised France for having reported confidential AD expressed as an index instead of using the notation key C without any further information in order to increase transparency.	In the view of the compilers of this report France had chosen a transparent way to show changes in data when the absolute values are confidential. Fortunately France has kept the more transparent way of reporting in the NIR while the CRF uses correct notation keys. Portugal used a similar way of reporting confidential data for ammonia production and was commended for this in the review report.
Germany	Source category not addressed by review report 2005	No follow-up necessary
Italy	The ERT welcomed effforts to improve EFs and AD in the future by collecting more data from operators for the years 1990-2000.	No follow-up necessary
UK	The ERT encouraged UK to reports results of a research programme on adipic acid production.	Results from research programme not addressed

N_2O emissions from 2.B.5: ‘Other’ account for 0.04 % of total EU-15 GHG emissions in 2004. Between 1990 and 2004, N_2O emissions from this source decreased by 61 % (Table 4.22). The Netherlands and France are responsible for 64 % of these emissions in the EU-15. Their decreases had the most influence on the reductions in the EU-15.

Table 4.22 Member States’ contributions to N_2O emissions from 2.B.5: ‘Other’

Member State	Greenhouse gas emissions (Gg CO_2			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	NA,NE,NO	NA,NE,NO	NA,NE,NO	-	-	-	-	-
Belgium	372	215	278	15.3%	63	29%	-94	-25%
Denmark	NA,NO	NA,NO	NA,NO	-	-	-	-	-
Finland	NE,NO	NE,NO	NE,NO	-	-	-	-	-
France	2,767	345	397	21.8%	52	15%	-2,370	-86%
Germany	298	365	365	20.1%	0	0%	66	22%
Greece	NA,NO	NA,NO	NA,NO	-	-	-	-	-
Ireland	NO	NO	NO	-	-	-	-	-
Italy	11	1	0	0.0%	-1	-	-11	-
Luxembourg	0	0	0	0.0%	0		0	-
Netherlands	1,240	954	759	41.8%	-195	-20%	-481	-39%
Portugal	0.0	0.1	0.1	0.0%	0	4%	0	109%
Spain	0	0	0	0.0%	0	-	0	-
Sweden	18	15	17	0.9%	3	17%	-1	-3%
United Kingdom	0	0	0	0.0%	0	-	0	-
EU15	4,707	1,894	1,815	100.0%	-79	-4%	-2,891	-61%

Emissions of Finland are not estimated because of lack of emission factor.
Abbreviations explained in the Chapter ‘Units and abbreviations’.

Table 4.23 provides an overview of all sources reported under 2.B.5 Other Chemical Production by EU-15 Member States. The largest contributor is Germany with 69 %.

Table 4.23 Overview of sources reported under 2.B.5 "Other Chemical Production

Member State	6.B.5 Other Chemical Industry	CO_2 emissions [Gg]	CH_4 emissions [Gg]	N_2O emissions [Gg]	Total emissions [Gg]	Share in EU-15 Total
Austria	Other chemical industry	25	0.29	NA,NE,NO	31	0.2%
Belgium	Caprolactam Production, Other chemical production	1069	0.00	0.90	1347	9.2%
Denmark	Catalysts/Fertilizers, Pesticides and Sulphuric acid	3	NA,NO	NA,NO	3	0.0%
Finland	Ethylene, Hydrogen, chemicals production	172	0.33	NE,NO	179	1.2%
France	Glyoxylic acid production and other	24	0.00	1.28	421	2.9%
Germany	Carbon black production, N2O use, Hydroylamine, N-Dodecandiacid	9691	0.01	1.18	10056	68.7%
Greece	Organic chemicals production	NA,NE,NO	0.04	NA,NO	1	0.0%
Ireland	NE, NO	NO	NO	NO	0	0.0%
Italy	Dioxide titanium, carbon black, organic chemical, sulfuric acid, caprolactame	580	0.33	0.00	587	4.0%
Luxembourg		0	0.00	0.00	0	0.0%
Netherlands	Carbon black, Ethylene, Styrene, Methanol, Graphite, Caprolactam, Other chemical industry, carbon electrodes	786	12.31	2.45	1803	12.3%
Portugal	Carbon black, Ethylene and derivates, Ammonium sulphate, Monomere production, explosives & phtalic anhydrite	122	0.53	0.0002	133	0.9%
Spain	Carbon black production	NE	1.00	NE	21	0.1%
Sweden	Other organic chamical production	NA,NE	0.04	0.06	18	0.1%
UK	All chemical industry	IE,NO	1.57	IE,NO	33	0.2%
EU-15 Total		12473	16.45	5.86	14634	100.0%

Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 4.24 provides information on the contribution of Member States to EC recalculations in N_2O from 2.B 'Chemical industry' for 1990 and 2003 and main explanations for the largest recalculaltions in absolute terms.

Table 4.24 Contribution of MS to EC recalculations in N_2O from 2.B 'Chemical industry' for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

	1990		2003		Main explanations
	Gg	Percent	Gg	Percent	
Austria	0	0,0	0	0,0	
Belgium	0	0,0	65	2,1	
Denmark	0	0,0	0	0,0	
Finland	60	3,8	25	1,8	
France	0	0,0	0	0,0	
Germany	293	1,2	359	3,5	No information provided.
Greece	0	0,0	-31	-7,7	
Ireland	0	0,0	0	0,0	
Italy	-72	-1,1	496	7,0	Revised activity data
Luxembourg	0	0,0	0	0,0	
Netherlands	0	0,0	0	0,0	
Portugal	0	0,0	0	0,0	
Spain	0	0,0	0	0,0	
Sweden	2	0,3	0	0,0	
UK	0	0,0	-11	-0,4	
EU15	**283**	**0,3**	**903**	**2,0**	

4.2.3 Metal production (CRF Source Category 2.C)

Table 4.25 summarises information by Member State on methodologies, emission factors, completeness and qualitative uncertainty estimates for CO_2 from 2.C: 'Metal production'. Between 1990 and 2004, CO_2 emission from 'Metal production' decreased by 10 %. The relative decrease was largest in Luxembourg, the relative growth was largest in Greece.

This source category includes one key source: CO_2 from 2.C.1: 'Iron and steel production'.

Table4.25 Member States' contributions to CO_2 emissions from 2.C: 'Metal production' and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1]
Austria	3,725	4,432	CS,T2
Belgium	1,946	1,652	CS
Denmark	28	NA,NO	T2
Finland	1,858	2,552	CS,T2,T3
France	4,486	4,040	C
Germany	49,712	45,207	T3,CS
Greece	482	807	CR,NA,T1,T2
Ireland	NO	NO	NA
Italy	3,983	1,611	D
Luxembourg	962	240	C/D
Netherlands	2,909	1,583	T1a,T2
Portugal	29	38	D
Spain	2,846	3,409	D,NA,T2
Sweden	2,591	2,522	CS,D,NA,T1
United Kingdom	2,310	2,089	T2,T3
EU15	77,867	70,182	C,CS,D,T1,T2,T3, CR,NA

([1]) Information source: CRF Summary Table 3 for 2002.
Abbreviations explained in the Chapter 'Units and abbreviations'.

CO_2 emissions from 2.C.1: 'Iron and steel production' account for 2% of total EU-15 GHG emissions in 2004. Between 1990 and 2004, CO_2 emissions from this source decreased by 10 % (Table 4.26). Germany is responsible for 69% of these emissions in the EU-15. Germany had the largest decreases in absolute terms between 1990 and 2004 while the largest increases were in Austria.

Table 4.26 Member States' contributions to CO_2 emissions from 2.C.1: 'Iron and steel production'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	3,546	4,523	4,415	6.8%	-108	-2%	869	25%	T2	NS	CS,D
Belgium	1,946	1,700	1,652	2.6%	-48	-3%	-294	-15%	CS	PS	CS
Denmark	28	NA,NO	NA,NO	-	-	-	-28	-100%	T2	PS	D
Finland	1,858	2,459	2,551	4.0%	92	4%	693	37%	CS	PS	PS
France	3,952	2,843	3,326	5.2%	483	17%	-627	-16%	C	NS	CS
Germany	48,271	43,226	44,291	68.7%	1,064	2%	-3,981	-8%	T2	NS/AS	CS
Greece	203	399	476	0.7%	77	19%	274	135%	T2	NS	CS
Ireland	NO	NO	NO	-	-	-	-	-	NO	NO	NO
Italy	3,124	1,125	1,179	1.8%	53	5%	-1,945	-62%	D	NS	C, CS
Luxembourg	962	263	240	0.4%	-22	-9%	-721	-75%	C/D		C/D
Netherlands	2,514	1,558	1,105	1.7%	-453	-29%	-1,410	-56%	NA/T2	PS	NA/CS
Portugal	27	23	35	0.1%	12	51%	9	32%	T2	PS	NO
Spain	1,825	1,655	1,879	2.9%	224	14%	54	3%	T2	PS; AS	PS, CS
Sweden	1,796	1,912	1,798	2.8%	-113	-6%	2	0%	CS/T1	PS	CS/PS
United Kingdom	1,860	1,320	1,535	2.4%	215	16%	-324	-17%	T2,T3	NS/AS	CS
EU15	71,912	63,007	64,482	100.0%	1,475	2%	-7,430	-10%			

Table 4.27 shows information on activity data, emission factors for CO_2 emissions from 2.C.1: 'Iron and steel production' for 1990 and 2004. For 2.C.1 'Iron and steel production' it is not useful to give an average IEF for the EU-15 because the allocation of emissions (the split between process and combustion related emissions for pig iron production, which is the most important sub category) is very different in different MS. It ranges from including all emissions in the energy sector (e.g. Portugal, Italy) to reporting all emissions related to carbon input in blast furnaces in the industrial processes sector (e.g. UK, Sweden) or using a split based on country-specific information (e.g. Austria).

Table 4.27 Information on activity data, emission factors for CO_2 emissions from 2.C.1: 'Iron and steel production' for 1990 and 2004

	1990				2004			
Member State	Activity data		Implied emission factor (t/t)	CO2 emissions (Gg)	Activity data		Implied emission factor (t/t)	CO2 emissions (Gg)
	Description	(kt)			Description	(kt)		
Austria	**Iron and steel production**	**0**	**0.26**	**3546**	**Iron and steel production**	**0**	**0.27**	**4415**
	Steel Production [kt]	4291	0.11	484	Steel Production [kt]	6515	0.10	680
	Iron Production [kt]	3444	0.88	3043	Iron Production [kt]	4861	0.76	3702
	Sinter Production [kt]	4384	IE	IE	Sinter Production [kt]	3528	IE	IE
	Coke Production [kt]	1725	IE	IE	Coke Production [kt]	1400	IE	IE
	Other	0	0.00	20	Other	0	0.00	32
Belgium	**Iron and steel production**	**0**	**0.00**	**1946**	**Iron and steel production**	**0**	**0.00**	**1652**
	Steel	7621	0.13	1019	Steel	7043	0.10	733
	Pig Iron	9415	0.06	546	Pig Iron	8208	0.08	679
	Sinter	13735	0.03	381	Sinter	12794	0.02	228
	Coke	IE	IE	IE	Coke	IE	IE	0
	Other	0	0.00	0	Other	0	0.00	11
Denmark	**Iron and steel production**	**0**	**0.05**	**28**	**Iron and steel production**	**0**	**NA,NO**	**NA,NO**
	Steel	614	0.05	28	Steel	NO	NO	NO
	Pig Iron	NO	NO	NO	Pig Iron	NO	NO	NO
	Sinter	NO	NO	NO	Sinter	NO	NO	NO
	Coke	NO	NO	NO	Coke	NO	NO	NO
	Other	0	0.00	NA	Other	0	0.00	NA
Finland	**Iron and steel production**	**0**	**0.56**	**1858**	**Iron and steel production**	**0**	**0.45**	**2551**
	Steel	2861	0.65	1855	Steel	4830	0.53	2547
	Pig Iron	IE	IE	IE	Pig Iron	IE	IE	IE
	Sinter	IE	IE	IE	Sinter	IE	IE	IE
	Coke	487	0.00	1	Coke	820	0.00	1
	Other	0	0.00	3	Other	0	0.00	3
France	**Iron and steel production**	**0**	**0.00**	**3952**	**Iron and steel production**	**0**	**0.00**	**3326**
	kt Production	19073	0.08	1487	kt Production	20937	0.06	1338
	kt Production	14088	0.14	1972	kt Production	13200	0.12	1590
	kt Production	IE	0.00	IE	kt Production	IE	0.00	IE
	Coke	IE	0.00	IE	Coke	IE	0.00	IE
	Other	0	0.00	493	Other	0	0.00	397
	Rolling mills, blast furnast charging	16848	0.03	493	Rolling mills, blast furnast charging	19128	0.02	397
Germany	**Iron and steel production**	**0**	**NE**	**48271**	**Iron and steel production**	**0**	**NE**	**44291**
	Steel	43914	1.10	48271	Steel	46364	0.96	44291
	Pig Iron	32263	NE	NE	Pig Iron	30018	NE	NE
	Sinter	29869	NE	NE	Sinter	NE	NE	NE
	Coke	NE	NE	NE	Coke	NE	NE	NE
	Other	0	0.00	0	Other	0	0.00	0
Greece	**Iron and steel production**	**0**	**0.20**	**203**	**Iron and steel production**	**0**	**0.24**	**476**
	steel production in EAF	999	0.20	203	steel production in EAF	1966	0.24	476
	NO	NO	NO	NO	NO	NO	NO	NO
	NO	NO	NO	NO	NO	NO	NO	NO
	NO	NO	NO	NO	NO	NO	NO	NO
	Other	0	0.00	NO	Other	0	0.00	NO

Member State	1990 Activity data: Description	1990 (kt)	1990 Implied emission factor (t/t)	1990 CO2 emissions (Gg)	2004 Activity data: Description	2004 (kt)	2004 Implied emission factor (t/t)	2004 CO2 emissions (Gg)
Ireland	**Iron and steel production**	**0**	**NO**	**NO**	**Iron and steel production**	**0**	**NO**	**NO**
	Steel	NO	NO	NO	Steel	NO	NO	NO
	Pig Iron	NO	NO	NO	Pig Iron	NO	NO	NO
	Sinter	NO	NO	NO	Sinter	NO	NO	NO
	Coke	NO	NO	NO	Coke	NO	NO	NO
	Other	0	0.00	NO	Other	0	0.00	NO
Italy	**Iron and steel production**	**0**	**0.00**	**3124**	**Iron and steel production**	**0**	**0.00**	**1179**
	Steel	25467	0.05	1346	Steel	28385	0.02	619
	Pig Iron	11852	0.15	1778	Pig Iron	10566	0.05	560
	Sinter	13577	NA	NA	Sinter	8557	NA	NA
	Coke	0	NA	NA	Coke	0	NA	NA
	Other	0	0.00	0	Other	0	0.00	0
Netherlands	**Iron and steel production**	**0**	**0.49**	**2514**	**Iron and steel production**	**0**	**0.16**	**1105**
	Crude steel production	5162	0.01	43	Crude steel production	6870	0.01	57
	Pig Iron	NO	NO	NO	Pig Iron	NO	NO	NO
	Sinter	NO	NA	NA	Sinter	NO	NA	NA
	See 1B1b	IE	IE	IE	See 1B1b	IE	IE	IE
	Other	0	0.00	2471	Other	0	0.00	1048
	Carbon input	2298	0.97	2223	Carbon input	2689	0.27	738
	Limestone equiv. use	595	0.42	249	Limestone equiv. use	718	0.43	310
Portugal	**Iron and steel production**	**0**	**0.08**	**27**	**Iron and steel production**	**0**	**24.76**	**35**
	Steel	IE	0.00		Steel	IE	0.00	
	Pig Iron	NO	0.00		Pig Iron	NO	0.00	
	Sinter	IE	0.00		Sinter	IE	0.00	
	Coke	IE	0.00		Coke	IE	0.00	
	Other	0	0.00	27	Other	0	0.00	35
Spain	**Iron and steel production**	**0**	**0.06**	**1825**	**Iron and steel production**	**0**	**0.06**	**1879**
	Steel production	13163	0.08	1041	Steel	17979	0.07	1272
	Pig iron production	5588	0.04	246	Pig Iron	4095	0.08	347
	Sinter production	6947	0.08	538	Sinter	5467	0.05	259
	Coke production	3211	IE	IE	Coke	2839	IE	IE
	Other	0	0.00	NA	Other	0	0.00	NA
Sweden	**Iron and steel production**	**0**	**0.39**	**1796**	**Iron and steel production**	**0**	**0.31**	**1798**
	Production of secondary steel	1743	0.07	129	Production of secondary steel	1872	0.08	144
	Production of primary iron	2845	0.59	1667	Production of primary iron	3992	0.41	1654
	Sinter	IE	IE	IE	Sinter	IE	IE	IE
	Coke	IE	IE	IE	Coke	IE	IE	IE
	Other	0	0.00	NA	Other	0	0.00	NA
UK	**Iron and steel production**	**0**	**0.08**	**1860**	**Iron and steel production**	**0**	**0.09**	**1535**
	Steel production (EAF) (kt)	4546	0.01	37	Steel production (EAF) (kt)	3099	0.01	23
	Pig iron production (BF) (kt)	12463	NA	NA	Pig iron production (BF) (kt)	10169	NA	NA
	Sinter	NA	NA	NA	Sinter	NA	NA	NA
	Coke consumed in blast furnaces (kt)	5180	NA	NA	Coke consumed in blast furnaces (kt)	4171	NA	NA
	Other	0	0.00	1823	Other	0	0.00	1512
	Blast furnace gas flared (PJ)	7	275.69	1805	Blast furnace gas flared (PJ)	6	267.56	1500
	Pig Iron Production (ISW)	12463	#BEZUG!	NA	Pig Iron Production (ISW)	NA	NA	NA
	Steel Production (OC)	13169	0.00	18	Steel Production (OC)	10667	0.00	13

Table 4.28 summarises information by Member State on methods used for estimating CO_2 emissions from 2.C.1: 'Iron and steel production'.

Table 4.28 Information on activity data and methods used for CO_2 emissions from 2.C.1: 'Iron and steel production' for 1990 and 2004

Member states	Description of methods
Austria	Total CO_2 emissions from the two main integrated iron and steel production sites in Austria are reported directly by industry until 2002. They are calculated by applying a very detailed mass balance approach for carbon. For the years 2003 and 2004 total CO_2 emissions were not reported by industry, thus they were estimated using information from the national energy balance and from the years before. Process specific emissions are calculated by the Umweltbundesamt according to the IPCC good practice guidance; these emissions are subtracted from total CO_2 emissions reported by the company. The remaining emissions are reported in the energy sector as emissions due to combustion in category 1 A 2 a Iron and Steel. CO_2 emissions from pig iron production were calculated following closely the IPCC GPG guidelines Tier 2 approach, applying the default emission factor of table 3.6 of the IPCC GPG. CO_2 emissions from steel production (which corresponds to steel production at the two integrated sites operating basic oxygen furnaces) were calculated following the IPCC GPG guidelines Tier 2 approach. CO_2 emissions from electric steel production were estimated using a country specific methodology.
Belgium	In Flanders, the calculation of the process CO_2 emissions from iron and steel production is based on the production figures of fluid steel and pig iron and on the consumption of electrodes of the only two industrial plants in this sector in Flanders and with an emission factor approved by these plants (% carbon blown off and an emission factor of 158 kg CO_2/ton pig iron). In the Walloon region, iron is produced through the reduction of iron oxides (ore) with metallurgical coke (as the reducing agent) in a blast furnace to produce pig iron. Steel is made from pig iron and/or scrap steel using electric arc or basic oxygen. The method used is the Tier 2 method.
Denmark	The CO_2 emission from the consumption of metallurgical coke at steelworks has been estimated from the annual production of steel sheets and steel bars combined with the consumption of metallurgical coke per produced amount (Stålvalseværket, 2002). The carbon source is assumed to be coke and all the carbon is assumed to be converted to CO_2 as the carbon content in the products is assumed to be the same as in the iron scrap. The emission factor (3.6 tonnes CO_2/ton metallurgical coke) is based on values in the IPCC-guideline (IPCC (1996), vol. 3, p. 2.26). Emissions of CO_2 for 1990-1991 and for 1993 have been determined with extrapolation and interpolation, respectively.
Finland	The calculation method of CO_2 emission from iron and steel industry is country specific. Both fuel based emissions and process emissions are calculated in connection with the ILMARI calculation system (see chapter 3.2 Emissions from fuel combustion) using plant/process level (bottom-up) data. The methodology is slightly plant-specific, because all plants are different from each other. The main common feature for all plants is, that fuel-based emissions for each installation are calculated in ILMARI system from the use of fuels, excluding coke and heavy bottom oil used in blast furnaces, and subtracted from total CO_2 emissions (described below). Fuel-based emissions are allocated to CRF 1.A 2a and CRF1.A 1c (coke ovens) The rest of emissions are allocated to process emissions in CRF 2.C 1 (and CRF 2.A 1 in the case of lime kilns).
France	IPCC Tier 2 Data sources: Annual pollutant emission reports; French Iron Association.
Germany	IPCC Tier 2 Für die Bestimmung der prozessbedingten Emissionen wird die Menge des Reduktionsmittels, das im Hochofen eingesetzt wird, multipliziert mit dem Emissionsfaktor. Da der im Roheisen gelöste Kohlenstoff im Oxygenstahlwerk durch das Aufblasen ausgetrieben wird, ist es nicht notwendig, die während des Aufblasens frei werdenden Emissionen getrennt zu berichten, da der gesamte Kohlenstoffgehalt der Reduktionsmittel während der Stahlherstellung an die Atmosphäre abgegeben wird. Die CO_2-Emissionen aus der Elektrostahlherstellung werden zu den prozessbedingten Emissionen gerechnet und ergeben sich aus dem Standardemissionsfaktor für den Elektrodenabbrand multipliziert mit der Menge des Elektrodenabbrands. Als Datengrundlage dient die Auswertung der Verbandsstatistik des VDEh, die zum Teil im Statistischen Jahrbuch der Stahlindustrie (Wirtschaftsvereinigung Stahl, VDEh, 2005) veröffentlicht werden wird. Um Kongruenz mit den Daten der Deutschen Emissionshandelsstelle zu gewähren, werden im Sektor 2.C.1 „Eisen und Stahlindustrie" die prozessbedingten CO_2-Emissionen aus der Stahlherstellung mit Hilfe des aus der Zuteilungsverordnung hervorgehende Emissionsfaktors von 1,307 CO_2 / t Produkt (ergibt sich aus 0,3565 * 44/12) herangezogen. Die darüber hinaus entstehenden CO_2-Emissionen werden im Sektor 1.A.2.a „Eisenschaffende Industrie" berichtet. Die Vorgehensweise über die Ermittlung der Emissionen wird im entsprechenden Kapitel dokumentiert.
Greece	Steel production in Greece is based on the use of electric arc furnaces (EAF). There are no integrated iron and steel plants for primary production as no units for primary production of iron exist, but there are several iron and steel foundries. CO_2 emissions from iron and steel production are calculated using a tier 2 methodology that is based on tracking carbon through the production process according to the equation (IPCC 2000)
Ireland	NO
Italy	CO_2 and CH_4 emissions from the sector have been estimated on the basis of activity data published in the national statistical yearbooks (ISTAT, several years) and industrial reports and emission factors used are those reported in the EMEP/CORINAIR Guidebook (EMEP/CORINAIR, 2001), in sectoral studies (ANPA, 2000; CTN/ACE, 2000) or supplied directly by industry. [NIR 2005]
Luxembourg	No further information provided

Member states	Description of methods
Netherlands	CO_2 emissions are estimated using a Tier 2 IPCC method and country-specific carbon contents of the fuels. Carbon losses are calculated from coke and coal input used as reducing agent in blast and oxygen furnaces , including other carbon sources such as limestone and the carbon contents in the iron ore (corrected for the fraction that ultimately remains in the steel produced). The same emission factors for blast furnace (BF) gas and oxygen furnace (OF) gas are used (see *Annex 2.*). Since Corus does not report the specific amounts of materials used as additional carbon source (s.a. limestone and others), a multiplication factor (MF) is used to convert this C into amounts of pure limestone-eq. (MF = Molecular weight of limestone/Mol weight of C). To calculate CO_2 from the C fractions in ore and crude steel, both the C content in the amount of pig iron purchased (i.e. not on-site produced) and produced is assumed very small or nil, respectively. Therefore, it is neglected in the overall calculation. Only the net carbon losses are reported in category 2C1. The carbon contained in the blast furnace gas and oxygen furnace gas produced as by-products and subsequently used as fuels for energy purposes is subtracted from the carbon balance and is included in the Energy sector (1A1a and 1A2a, see *Sections 3.2.2 and 3.2.3*).
Portugal	Emissions are simply calculated from multiplication of activity levels by a suitable emission factor. To avoid double counting, carbon dioxide emissions in coquerie and blast furnace, from oxidation of the carbon that was used as a reducing agent were not estimated from steel or coke production data but simply from use of coke derivative fuels (coke gas and blast furnace gas) in all combustion equipments. Methodology to estimate emissions from combustion of coke gas and blast furnace gas were already discussed in chapter 3.2A – Energy Industries and emissions are included in source sector 1A.2 - manufacturing industries and construction – and 1A.1.c.1 - Manufacture of Solid Fuels. Although in EAF there is a further reduction in carbon content that is accounted as CO_2 emissions, nevertheless the carbon dioxide emissions from anodes in EAF is still not contemplated in the inventory.
Spain	The estimation of the CO_2 emissions for each of the processes mentioned above (steel, sinter and pig iron) has been inferred from the respective carbon mass balances in the corresponding input-output materials. [NIR 2005]
Sweden	Steel: The emissions include secondary steel plants using reducing agents such as coke, coal and electrodes in electric arc furnaces. In most cases data from the Swedish inquiry for the Swedish national allocation plan (NAP) for the EU emissions trading scheme could be used for the years 1998-2002. Data for remaining years (1990-1997 and 2003-2004) has been collected directly from the plants. Iron powder: In Sweden there is one producer of iron ore based iron powder. The emissions of CO_2 are calculated by using the Good Practice Guidance method Tier 2. The method includes plant specific activity data on emissions from carbon-containing input materials such as coke and anthracite and also specific carbon-contents of output iron and rest products for all years. Pig iron: Another way to make the correct calculations of process emissions from blast furnaces, as Sweden has done, is to base the calculations on the consumed amount of blast furnace gas, as all emissions from the blast furnace are collected in this gas and emitted when combusting it. The amount of blast furnace gas is used in the cowpers as activity data when calculating all emissions. Emissions are calculated as the product of fuel consumption, thermal value and emission factors (EF) in the same way as in the Energy sector.
United Kingdom	The methodology for the prediction of carbon dioxide emissions from fuel combustion, fuel transformation, and processes at integrated steelworks is based on a detailed carbon balance (this methodology is described in more detail within the section on CRF sector 1A2a). Carbon emissions from electric arc furnaces are calculated using an emission factor provided by BISPA (1997).

Source: NIR 2006 unless stated otherwise

Table 4.29 provides information on the contribution of Member States to EC recalculations in CO_2 from 2.C 'Metal production' for 1990 and 2003 and main explanations for the largest recalculaltions in absolute terms.

Table 4.29 Contribution of MS to EC recalculations in CO_2 from 2.C 'Metal production' for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

	1990		2003		Main explanations
	Gg	Percent	Gg	Percent	
Austria	0	0,0	8	0,2	
Belgium	73	3,9	-209	-10,9	
Denmark	0	0,0	0	0,0	
Finland	1.858	-	2.459	-	Reallocation of process-related CO_2 emissions from iron and steel production from the energy sector to 2.C.1 Revised method
France	-33	-0,7	79	2,2	
Germany	48.700	4.814,3	43.229	4.784,1	New method for 2C1 Addition of subsources
Greece	47	10,9	72	11,0	
Ireland	0	0,0	0	0,0	
Italy	1.778	80,6	-258	-14,3	Revised emissions from iron and steel
Luxembourg	111	13,1	0	0,0	
Netherlands	0	0,0	0	0,0	
Portugal	0	0,0	0	0,0	
Spain	61	2,2	282	9,9	
Sweden	325	14,3	66	2,6	
UK	6	0,3	4	0,2	
EU15	**52.928**	**212,2**	**45.733**	**200,6**	

Table 4.30, Table 4.31, Table 4.32 and Table 4.33 summarise information by Member State on emission trends, methodologies and emission factors for the key source PFCs from 2.C: 'Metal production'.

Table 4.30 Member States' contributions to PFC emissions from 2.C: 'Metal production' and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1)]	EF [1)]
Austria	1,050	NO	NA	NA
Belgium	0	0	-	-
Denmark	NA,NO	NA,NO	-	-
Finland	NO	NO	-	-
France	3,032	1,239	C/ T2	PS
Germany	2,489	446	T3	CS
Greece	258	72	NA,T3	NA,PS
Ireland	NO	NO	NA	NA
Italy	1,673	157	T1, T2	PS
Luxembourg	0	0	-	-
Netherlands	2,246	106	T2	PS
Portugal	0	0	-	-
Spain	883	183	NA,T2	NA,PS
Sweden	440	263	NA,T2	CS,NA
United Kingdom	1,333	152	CS	CS,PS
EU15	13,404	2,618	C,CS,T1,T2,T3,NA	CS,PS,NA

([1]) Information source: CRF Summary Table 3 for 2004.
Abbreviations explained in the Chapter 'Units and abbreviations'.

PFC emissions from 2.C.3 'Aluminium production' account for 0.1 % of total EU-15 GHG emissions in 2004. Between 1990 and 2004, PFC emissions from this source decreased by 80 %. France and Germany are responsible for 64 % of these emissions in the EU-15. All Member States reduced their emissions from this source between 1990 and 2004. The Netherlands had the largest decreases in absolute terms.

Table 4.31 Member States' contributions to PFC emissions from 2.C:3 'Aluminium production'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	1,050	NO	NO	-	-	-	-1,050	-100%
Belgium	NO	NO	NO	-	-	-	-	-
Denmark	NO	NO	NO	-	-	-	-	-
Finland	NO	NO	NO	-	-	-	-	-
France	3,032	2,155	1,239	47.3%	-916	-42%	-1,792	-59%
Germany	2,489	475	446	17.0%	-29	-6%	-2,044	-82%
Greece	258	77	72	2.7%	-6	-7%	-186	-72%
Ireland	NO	NO	NO	-	-	-	-	-
Italy	1,673	268	157	6.0%	-110	-41%	-1,516	-91%
Luxembourg	0	0	0	0.0%	0	-	0	-
Netherlands	2,246	439	106	4.0%	-334	-76%	-2,141	-95%
Portugal	NO	NO	NO	-	-	-	-	-
Spain	883	190	183	7.0%	-7	-4%	-700	-79%
Sweden	440	282	263	10.1%	-19	-7%	-177	-40%
United Kingdom	1,333	126	152	5.8%	26	21%	-1,180	-89%
EU15	13,404	4,013	2,618	100.0%	-1,395	-35%	-10,786	-80%

Table 4.32 shows information on activity data and emission factors for PFC emissions from 2.C. 'Metal production' for 1990 to 2004. The table shows that in 2004 aluminium production was reported by most MS as activity data; for some MS this information is confidential. The implied emission factors for CF_4 per tonne of aluminium produced vary for 2004 between 0.04 kg/t for the Netherlands and 0.35 kg/t for Sweden. The EU-15 IEF (excluding Germany, Greece and the UK) is 0.16 kg/t. The decrease of the IEF from 1990 to 2004 is mainly due to emission reduction measures that have been implemented. The table suggests that 100 % of

EU-15 emissions are estimated with higher Tier methods. The implied emission factors for C_2F_6 per tonne of aluminium produced vary for 2004 between 0.01 kg/t for Italy and the Netherlands and 0.08 kg/t for France. The EU-15 IEF (excluding Germany, Greece and the UK) is 0.03 kg/t. The table suggests that for 2004 all reported emissions are estimated using higher tier methods (based on plant specific data). For 1990 Italy used a T1 approach to estimate emissions.

Table 4.32 Information on methods applied, activity data, emission factors for PFC emissions from 2.C. 'Metal production' for 1990 and 2004

Member State	Gas	1990				2004			
		Activity data		Implied emission factor (kg/t)	Emissions (t)	Activity data		Implied emission factor (kg/t)	Emissions (t)
		Description	(t)			Description	(t)		
Austria	CF_4	Aluminium production	88021	1.56	137	Aluminium production	NO	NO	NO
	C_2F_6	Aluminium production	88021	0.19	17	Aluminium production	NO	NO	NO
France	CF_4	Aluminium production	325900	1.13	369	Aluminium production	446698	0.31	140
	C_2F_6	Aluminium production	325900	0.21	69	Aluminium production	446698	0.08	36
Germany	CF_4	Anode effects	740251	0.00	336	Anode effects	668834	0.00	60
	C_2F_6	Anode effects	740251	0.00	34	Anode effects	668834	0.00	6
Greece	CF_4	Aluminium production	C	C	35	Aluminium production	C	C	10
	C_2F_6	Aluminium production	C	C	3	Aluminium production	C	C	1
Italy	CF_4	Aluminium production	231800	0.86	198	Aluminium production	195633	0.10	20
	C_2F_6	Aluminium production	231800	0.18	42	Aluminium production	195633	0.01	3
Netherlands	CF_4	Aluminium production	272122	1.02	277	Aluminium production	330200	0.04	14
	C_2F_6	Aluminium production	272122	0.18	48	Aluminium production	330200	0.01	2
Spain	CF_4	Aluminium production	355301	0.34	122	Aluminium production	394863	0.06	25
	C_2F_6	Aluminium production	355301	0.03	10	Aluminium production	394863	0.00	2
Sweden	CF_4	Aluminium production	96300	0.61	59	Aluminium production	100742	0.35	35
	C_2F_6	Aluminium production	96300	0.07	7	Aluminium production	100742	0.04	4
UK	$CF_4 + C_2F_6$	Aluminium production	1101	IE	IE	Aluminium production	1299	IE	IE
		Aluminium production	1101	NE	NE	Aluminium production	1299	IE	IE
EU15	**CF_4**	**EU15 w/o DE,GR,UK (76%)**	**1369444**	**0.85**	**1162**	**EU15 w/o DE,GR,UK (77%)**	**1468136**	**0.16**	**235**
	C_2F_6	**EU15 w/o DE,GR,UK (84%)**	**1369444**	**0.14**	**192**	**EU15 w/o DE,GR,UK (87%)**	**1468136**	**0.03**	**46**

Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 4.33 Description of national methods used for estimating PFC emissions from Aluminium Production

Member States	Description of methods
Austria	PFC emissions were estimated using the IPCC Tier 3b methodology. The specific CF4 emissions (and C2F6 emissions respectively) of the anode effect were calculated by applying the following formula (BARBER 1996), (GIBBS & JACOBS 1996), (TABERAUX 1996): kg CF4/tAl = (1.7 x AE/pot/day x F x AEmin)/CE For the aluminium production in Austria the rate of C2F6 is about 8% and the current efficiency (CE) about 85.4%. Activity data were taken from national statistics (1990 to 1992). Primary aluminium production in Austria was

Member States	Description of methods
	terminated in 1992.
Belgium	NO
Denmark	NO
Finland	NO
France	IPCC Tier 2
Germany	Die Produktionsmenge für das Jahr 2004 ist dem Monitoring-Bericht der Aluminiumindustrie für das Jahr 2004 entnommen. Für die FKW-Emissionen aus Primäraluminiumhütten liegen aufgrund einer Selbstverpflichtung der Aluminiumindustrie jährliche Emissionsangaben seit 1997 vor. Die Messdaten werden nicht veröffentlicht, liegen dem Umweltbundesamt aber vor. Basis für Berechnungen der CF4 Emissionen sind die in den Jahren 1996 und 2001 in allen deutschen Hütten durchgeführten Messungen. Hierbei wurden je nach Technologie spezifische CF4- Emissionswerte pro Anodeneffekt ermittelt. Die Zahl der Anodeneffekte wird in den Hütten erfasst und dokumentiert. Die CF4-Gesamtemission 2004 wurde durch Multiplikation der gesamten Anodeneffekte in 2004 mit der in 2001 ermittelten spezifischen CF4-Emission pro Anodeneffekt errechnet. Der Gesamtemissionsfaktor für CF4 ergibt sich durch Addition der CF4-Emissionen der fünf Hütten dividiert durch die Gesamtaluminiumproduktion der Hütten. C2F6 und CF4 entstehen im festen Verhältnis von etwa 1:10. Die oben genannte Methode wurde auf die gesamte Zeitreihe angewendet, durch Rückrechnungen wurden die Emissionen für die Jahre 1990 bis 1996 ergänzt.
Greece	PFC emissions estimates are based on measurements data made by the aluminium industry according to the PESHINEY methodology (Tier 3b methodology, IPCC 2000)
Ireland	NO
Italy	For the estimation of PFC emissions from aluminium production, both IPCC Tier 1 and Tier 2 methods are used. These emissions, specifically CF4 and C2F6, have been calculated on the basis of the information provided by the national primary aluminium producer, with reference to the document drawn up by International Aluminium Institute (IAI, 2003) and the IPCC Good Practice Guidance (IPCC, 2000). The Tier 1 has been used to calculate PFC emissions relating to the entire period 1990-1999. As from the year 2000, the more accurate Tier 2 method has been followed, based on default technology specific slope and overvoltage coefficients. As concerns the Tier 1 methodology, the emission factors for CF4 and C2F6 were provided, whereas for the Tier 2 site specific values and, where they were not available, default coefficients were provided. [NIR 2005]
Luxembourg	NO
Netherlands	PFC emissions from primary aluminium production reported by the two facilities are based on the IPCC Tier 2 method for the complete period 1990-2004. Emission factors are plant specific and are based on measured data.
Portugal	NO
Spain	From the information received a distinction is drawn by plants and the series of manufacturing method used (prebaked anodes with side or central worked and the vertical studs Söderberg process). Within each series, information was obtained on the number of anode effects per pot and day and the duration of the anode effect in minutes. Using this information, the emissions are estimated by application of the Tier 2 method referred to in the IPCC Good Practice Guidance. [NIR 2005]
Sweden	Calculations of emissions of PFCs (CF_4+C_2F_6) are made by the company, according to a formula from EAA (European Aluminium Association). Emissions of PFC in kg/Mg Al=K*Anode effects in min/oven day, where K=0.12 for Pre-baked and K=0.08 for Söderberg. The PFC emissions are assumed to consist of 90% CF4 and 10% C2F6.
United Kingdom	The estimates were based on actual emissions data provided by the aluminium-smelting sector. There are two main aluminium smelting operators in the UK. One operator uses a Tier 2 methodology Smelter-specific relationship between emissions and operating parameters based on default technology-based slope and over-voltage coefficients, using the default factors for the CWPB (Centre Worked Prebaked) plant. However, in the near future they are looking to move to Tier 3b methodology, once on-site equipment is in place to make the relevant field measurements. The other operator uses a Tier 3b methodology (as outlined in the IPCC guidance) Smelter-specific relationship between emissions and operating parameters based on field measurements. The methodology used for estimating emissions, based on IPCC Good Practice Guidance (2000), was 'Tier 2 Method – smelter-specific relationship between emissions and operating parameters based on default technology-based slope and over-voltage coefficients'. Emissions estimates were based on input parameters, including frequency and duration of anode effects, and number of cells operating. Emission factors were then used to derive the type of PFC produced.

Source: NIR 2006 unless stated otherwise

Table 4.34 provides information on the contribution of Member States to EC recalculations in PFC from 2.C.3 'Aluminium production' for 1990 and 2003 and main explanations for the largest recalculaltions in absolute terms.

Table 4.34 Contribution of MS to EC recalculations in PFC from 2.C.3 'Aluminium production' for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

	1990		2003		Main explanations
	Gg	Percent	Gg	Percent	
Austria	0	0,0	0	0,0	
Belgium	0	0,0	0	0,0	
Denmark	0	0,0	0	0,0	
Finland	0	0,0	0	0,0	
France	742	32,4	1.417	191,8	New method from IAI for PFC from aluminium production Updated activity data from magnesium production industry
Germany	3	0,1	44	10,2	
Greece	0	0,0	0	0,0	
Ireland	0	0,0	0	0,0	
Italy	0	0,0	-9	-3,3	
Luxembourg	0	0,0	0	0,0	
Netherlands	149	7,1	-764	-63,5	
Portugal	0	0,0	0	0,0	
Spain	0	0,0	0	0,0	
Sweden	0	0,0	0	0,0	
UK	6	0,4	-77	-38,1	
EU15	**900**	**7,2**	**610**	**17,9**	

Table 4.35 and Table 4.36 summarise information by Member State on emission trends, methodologies and emission factors for the source category SF_6 from 2.C: 'Metal production'.

Table 4.35 Member States' contributions to SF_6 emissions from 2.C: 'Metal production' and information on methods and emission factors applied

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1)]
Austria	253	NO	NA
Belgium	NE	0	-
Denmark	31	NO	NA
Finland	NO	NO	NA
France	880	514	C
Germany	189	1,682	D
Greece	NE, NO	NE, NO	NA
Ireland	NO	NO	NA
Italy	0	94	D
Luxembourg	0	0	-
Netherlands	NO	NO	NA
Portugal	0	0	-
Spain	NE	NE	NA
Sweden	24	40	D,NA
United Kingdom	426	388	
EU15	1,803	2,719	C,D,NA

(1) Information source: CRF Summary Table 3 for 2004.
Emissions of Greece are not estimated because of lack of activity data.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 4.36 Description of national methods used for estimating SF_6 emissions from Aluminium and Magnesium Foundries

Member states	Description of methods
Austria	Emissions were estimated following the IPCC methodology. Information about the amount of SF_6 used was obtained directly from the aluminium producers in Austria and thus represent plant-specific data (for verification data was checked against data from SF_6 suppliers). Actual emissions of SF_6 equal potential emissions and correspond to the annual consumption of SF_6.
Belgium	NO
Denmark	no activity on Magnesium Foundry exists any longer (2004)
Finland	Direct reporting method, Tier 1a. Tier 1b is not applicable to this category because all SF_6 used is imported in bulk. Emissions from this source are not reported separately due to confidentiality (Included in 2 F).
France	
Germany	Die in Deutschland zur Reinigung von Aluminiumschmelzen eingesetzte SF_6–Menge emittiert vollständig beim Gebrauch (Verbrauch = Emission; EF = 1). Die Gleichsetzung von Verbrauch (AR) und Emission entspricht der IPCC-Methode (IPCC, 1996a: 2.34). Der SF_6-Verbrauch wurde durch direkte Befragung der wenigen Anbieter der SF_6-haltigen Gasemischung nach ihrem Verkauf ermittelt, wobei die Abfrage für das Berichtsjahr 2000

	ergeben hat, dass die Gasemischung seit dem Jahr 2000 nicht mehr vermarktet wird. Die in der Magnesiumgussproduktion eingesetzte Menge an SF_6 (Verbrauch = AR) wird in Einklang mit den überarbeiteten IPCC Guidelines (IPPC, 1996a: 2.34) den Emissionen gleichgesetzt. Der SF_6-Verbrauch wird durch direkte Befragung der Gießereien nach ihrem jährlichen Verbrauch ermittelt. Dies ist möglich, da die Anzahl der Gießereien überschaubar ist. Die ermittelten Einsatzdaten werden mit den ebenfalls erfragten Verkaufsmengen der Gasehändler in diesem Sektor abgeglichen.
Greece	NO
Ireland	NO
Italy	For SF_6 used in magnesium foundries, according to the IPCC Guidelines (IPCC, 1997), emissions are estimated from consumption data made available by the company which operates the only magnesium foundry located in Italy (Magnesium products of Italy, 2005). The plant started its activity in September 1995. [NIR 2005]
Luxembourg	NO
Netherlands	NO
Portugal	NO
Spain	NE
Sweden	The total annual amount of SF_6 used in the magnesium foundries is reported as emissions, according to the IPCC Guidelines and Good Practice Guidance. Data is obtained from companies using SF_6.
United Kingdom	For magnesium alloy production, emissions from 1998-2004 were estimated based on the emission data reported by the company to the UK's Pollution Inventory. This data is considered reasonably robust whilst earlier data (pre-1998) are estimated based on consultation with the manufacturer. For the casting operations, emission estimates made in previous years (as documented in AEAT (2004)) used a previous model from the March (1999) study for the casting sector. In order to improve the quality of this data this estimate has been revised based on consultation with all of the casting operators. Each operator was asked to supply annual SF_6 usage data for 1990 – 2004 – all responded to this request. The data supplied has been aggregated with the magnesium alloy production sector, to produce a single estimate for the whole sector, thus avoiding disclosure of company specific data. Actual emissions of SF_6 and HFC134a for this sector are reported under 2C5 for practical reasons under 2C5 'Other metal production' as the CRF Reporter does not allow reporting of HFC emissions under the 2C4 sector category.

4.2.4 Production of halocarbons and SF_6 (CRF Source Category 2.E)

Table 4.37, Table 4.38 and Table 4.39 summarise information by Member State on emission trends, methodologies, emission factors, completeness and qualitative uncertainty estimates for the key source HFCs from 2.E: 'Production of halocarbons and SF_6'.

Table 4.37 Member States' contributions to HFC emissions from 2.E: 'Production of halocarbons and SF_6' and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1)]	EF [1)]
Austria	NA,NO	NA	NO	NA
Belgium	0	0	-	-
Denmark	NA,NO	NA,NO	-	-
Finland	NA,NO	NA,NO	NO	-
France	3,635	571	-	CS/ PS
Germany	4,329	511	CS	CS
Greece	935	2,551	T1	D
Ireland	NA,NO	NA,NO	NO	-
Italy	351	18	CS	PS
Luxembourg	0	0	C/D	-
Netherlands	4,432	454	NA/T2	PS
Portugal	0	0	NO	-
Spain	2,403	787	T1, T2	PS
Sweden	NO	NO	NA	NA
United Kingdom	11,374	283	T2	CS
EU15	27,459	5,175	CS,D,T1,T2,NA	CS,D,PS,NA

([1]) Information source: CRF Summary Table 3 for 2004.
Abbreviations explained in the Chapter 'Units and abbreviations'.

HFC emissions from 2.E: ‘Production of halocarbons and SF_6’ account for 0.1 % of total EU-15 GHG emissions in 2004. Between 1990 and 2004, HFC emissions from this source decreased by 81 %. Greece and Spain are responsible for 64 % of these emissions in the EU-15. Greece was the only Member State with emission increases from this source between 1990 and 2004.

Table 4.38 Member States’ contributions to HFC emissions from 2.E: ‘Production of halocarbons and SF_6’

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	NA,NO	NA,NO	NA	-	-	-	-	-
Belgium	NO	NO	NO	-	-	-	-	-
Denmark	NO	NO	NO	-	-	-	-	-
Finland	NO	NO	NO	-	-	-	-	-
France	3,635	477	571	11.0%	94	20%	-3,064	-84%
Germany	4,329	533	511	9.9%	-22	-4%	-3,818	-88%
Greece	935	2,661	2,551	49.3%	-110	-4%	1,616	173%
Ireland	NO	NO	NO	-	-	-	-	-
Italy	351	23	18	0.4%	-5	-20%	-333	-95%
Luxembourg	0	0	0	0.0%	-	-	0	-
Netherlands	4,432	455	454	8.8%	-2	0%	-3,978	-90%
Portugal	NO	NO	NO	-	-	-	-	-
Spain	2,403	1,749	787	15.2%	-963	-55%	-1,617	-67%
Sweden	NO	NO	NO	-	-	-	-	-
United Kingdom	11,374	1,852	283	5.5%	-1,568	-85%	-11,090	-98%
EU15	27,459	7,750	5,175	100.0%	-2,576	-33%	-22,284	-81%

Abbreviations explained in the Chapter ‘Units and abbreviations’.

Table 4.39 shows information on methods used for HFC emissions from 2.E. ‘Production of halocarbons and SF_6’ for 1990 tand 2004. For Production of Halocarbons it is not possible to give an average IEF for the EU-15 because for most countries activity data is confidential. Exept for Greece, all reported emissions are estimated with higher Tier methods.

Table 4.39 Description of national methods used for estimating HFC emissions from Production of halocarbons

Member States	Description of methods
Austria	NO
Belgium	NO
Denmark	NO
Finland	NO
France	IPCC Tier 2
Germany	By-product: Für die Berichtsjahre 1995 bis 2003 sind die Emissionen des zuletzt genannten Herstellers anhand der HFCKW-22 Produktionsmenge, einer jährlichen Messung der HFKW-23-Konzentration im Abgas, der HFKW-23 Verkaufsmenge und der Menge an HFKW-23, welche der Spaltanlage zugeführt wurde, berechnet worden (über eine Massenbilanz), wobei für das Berichtsjahr 1995 bei der ersten Produktionsanlage seit Jahresmitte Maßnahmen (Spaltanlage) zur Vermeidung von Emissionen zu Grunde gelegt wurden. Der IPCC Default-Emissionsfaktor wird aufgrund der ergriffenen Emissionsminderungsmaßnahmen (Spaltanlage) nicht verwendet. Herstellungsbedingt: Der Betreiber teilt die Emissionen für 134a, 227ea und SF_6 mit. Aus diesen Angaben und der Produktionsmenge (beide Angaben werden vertraulich mitgeteilt) kann eine implizite Rate der flüchtigen Emissionen errechnet werden, die relativ konstant ist. Sie ist für SF_6 mit etwa 0,5% höher als bei der Produktion von HFKW-134a (0,3%) und bei der Aufreinigung des HFKW-227ea (0,3%).
Greece	According to the IPCC Good Practice Guidance, the analytical methodology (Tier 2) should be applied for the calculation of HFC-23 emissions from HCFC-22 production, as it constitutes a key source. This methodology is based on the collection and elaboration of on site measurement data. However, due to the lack of such data, calculation of emissions is based on production statistics and a reference emission factor. It should be noticed that data on the production of HCFC-22 are confidential and therefore are not presented in the current report.
Ireland	NO
Italy	For source category "HFC-23 emissions from HCFC-22 manufacture", the IPCC Tier 2 method is used, based on plant-level data communicated by the national producer (Solvay-Solexis, 2005); since 1996, data are adjusted for HCFC-22 destruction. Also for source category "Fugitive emissions", emission estimates are based on plant-level data communicated by the national producer (Solvay-Solexis, 2005). [NIR 2005]
Luxembourg	NO
Netherlands	*Production of HCFC-22*(2E1): To comply with the IPCC Good Practice Guidance (IPCC, 2001) an IPCC Tier 2 method is used to estimate emission of this source category. HFC-23 emissions are calculated, based on (measured) data on the mass flow of HFC23 produced in the process and a destruction factor to estimate the reduction of this HFC 23 flow by the afterburner; *Handling activities (HFCs)* (2E3): Tier 1 country-specific methodologies are used to estimate the *handling* emissions of HFCs, based on emissions data reported by the manufacturing and sales companies.
Portugal	NO
Spain	The information on HFC-23 emissions is based on the estimates made by the centres themselves, complemented for certain years by a default emission factor. Therefore, the estimation methodology applied in this case is a combination of Tier 1 and Tier 2 in the IPCC's terminology. [NIR 2005]
Sweden	NO
United Kingdom	Within the model, manufacturing emissions from UK production of HFCs, PFCs and HFC 23 (by-product of HCFC 22 manufacture) are estimated from reported data from the respective manufacturers. Manufacturers have reported both production and emissions data, but only for certain years, and for a different range of years for different manufacturers. Therefore the emissions model is based on implied emission factors, and production estimates are used to calculate emissions in those years for which reported data was not available.

Source: NIR 2006 unless stated otherwise

Table 4.40 provides information on the contribution of Member States to EC recalculations in HFC from 2.E 'Production of halocarbons' for 1990 and 2003 and main explanations for the largest recalculaltions in absolute terms.

Table 4.40 Contribution of MS to EC recalculations in HFC from 2.E 'Production of halocarbons' for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

	1990		2003		Main explanations
	Gg	Percent	Gg	Percent	
Austria	0	0,0	0	0,0	
Belgium	0	0,0	0	0,0	
Denmark	0	0,0	0	0,0	
Finland	0	0,0	0	0,0	
France	30	0,8	113	31,1	
Germany	819	23,3	-679	-56,0	Total recalculations for all HFC from 1990-2004
Greece	0	0,0	-534	-16,7	Updated information regarding the penetration rate of HFC in the Greek market and the estimation of emissions from "new' sources
Ireland	0	0,0	0	0,0	
Italy	0	0,0	0	0,0	
Luxembourg	0	0,0	0	0,0	
Netherlands	0	0,0	-105	-18,7	
Portugal	0	0,0	0	0,0	
Spain	0	0,0	39	2,3	
Sweden	0	0,0	0	0,0	
UK	0	0,0	-339	-15,5	
EU15	**849**	**3,2**	**-1.504**	**-16,3**	

4.2.5 Consumption of halocarbons and SF_6 (CRF Source Category 2.F)

Table 4.41 and Table 4.42 summarise information by Member State on emission trends, methodologies, emission factors, completeness and qualitative uncertainty estimates for the key source HFCs from 2.F: 'Consumption of halocarbons and SF_6'.

Table 4.41 Member States' contributions to HFC emissions from 2.F: 'Consumption of halocarbons and SF_6' and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1]	EF [1]
Austria	23	904	CS	CS
Belgium	434	1,468	T2, CS	CS
Denmark	NA,NE,NO	749	T2	CS
Finland	0	695	T1a/T2b/T2	D
France	24	11,028	C, M, T2	CS
Germany	40	8,293	CS, T2, T2a	CS,D,M
Greece	NE,NO	3,159	T2a	D,NA
Ireland	1	399	T1, T2, T3	CS
Italy	0	5,681	T2a, CS	D, CS, PS
Luxembourg	14	43	C/D	C/D
Netherlands	NO	1,023	NA	CS
Portugal	0	355	T2a	D+CS
Spain	NA,NO	3,826	T1, T2, D	D,NA
Sweden	4	743	CS/T1/NA	CS,D,NA,PS
United Kingdom	2	8,573	T1,T2,T3	CS
EU15	541	46,939	C,CS,D,M,T1a,T2,T2a,T2b,T3,NA	C,CS,D,M,PS,

([1]) Information source: CRF Summary Table 3 for 2004.
Abbreviations explained in the Chapter 'Units and abbreviations'.

HFC emissions from 2.F: ‘Consumption of halocarbons and SF_6’ account for 1.1 % of total EU-15 GHG emissions in 2004. HFC emissions in 2004 were 87 times higher than in 1990. The main reason for this is the phase-out of ozone-depleting substances such as chlorofluorocarbons under the Montreal Protocol and the replacement of these substances with HFCs (mainly in refrigeration, air conditioning, foam production and as aerosol propellants). France, Italy and the UK had the most significant absolute increases from this source between 1990 and 2004.

Table 4.42 shows the sub-categories of HFC emissions from 2.F. ‘Consumption of halocarbons and SF_6’ by Member State. It shows that ‘Refrigeration and air conditioning equipment’ is by far the largest sub-category accounting for 73 % of HFC emissions in source category 2.F. ‘Aerosols/metered dose inhalers’ and foam blowing account for 15 % and 6 % respectively.

Table 4.42 Member States’ sub-categories of HFC emissions from 2.F: ‘Consumption of halocarbons and SF_6’ for 2004 (Gg CO_2 equivalents)

Member State	**Consumption of Halocarbons and SF_6**	Refrigeration and Air Conditioning Equipment	Foam Blowing	Fire Extinguishers	Aerosols/ Metered Dose Inhalers	Solvents	Other applications using ODS substitutes	Semiconductor Manufacture	Electrical Equipment	Other (please specify)
Austria	**904**	525	294	27	52	2	NO	4	NO	NO
Belgium	**1,468**	1,113	210	8	137	0	0	0	NO	0
Denmark	**749**	596	144	NO	9	NO	NO	NO	NA	NA
Finland	**695**	589	43	C,NO	61	NO	NO	C,NO	NO	3
France	**11,028**	6,942	511	108	3,211	242	0	12	NA	0
Germany	**8,293**	6,735	907	12	604	C	0	C	NO	35
Greece	**3,159**	3,159	NE	NE	NE	NE	NO	NE	0	NO
Ireland	**399**	257	16	12	113	NO	NO	1	NO	NO
Italy	**5,189**	4,859	66	43	212	0	0	10	0	0
Luxembourg	**43**	34	6	0	3	0	0	0	0	0
Netherlands	**1,023**	851	NO	NO	NO	NO	NO	NO	NO	171
Portugal	**368**	293	56	19	0	0	0	0	0	0
Spain	**3,754**	2,273	0	1,294	187	0	0	0	0	0
Sweden	**743**	601	107	6	30	NO	NO	0	NA	NA,NO
UK	**8,573**	5,046	509	291	2,586	34	NA	IE	IE	107
EU15	**46,389**	33,875	2,868	1,820	7,204	277	0	28	0	317

Abbreviations explained in the Chapter ‘Units and abbreviations’.

Table 4.43 and Table 4.44 show MS contribution to EU-15 HFC emissions from 2.F.1 and EU-15 activity data and implied emission factors.

Table 4.43 Member States’ contributions to HFC emissions from 2.F.1: ‘Refrigeration and Air conditioning’

Member State	Greenhouse gas emissions (Gg CO_2			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	23	865	904	1.9%	39	5%	881	3827%
Belgium	434	1,406	1,468	3.2%	62	4%	1,034	238%
Denmark	NA,NE,NO	695	749	1.6%	53	8%	-	-
Finland	0	652	695	1.5%	43	7%	695	3075425%
France	24	10,325	11,028	23.8%	703	7%	11,004	45713%
Germany	40	7,953	8,293	17.9%	339	4%	-	-
Greece	NE,NO	2,898	3,159	6.8%	261	9%	-	-
Ireland	1	358	399	0.9%	41	12%	399	-
Italy	0	4,553	5,189	11.2%	637	14%	5,189	-
Luxembourg	14	43	43	0.1%	0	0%	29	216%
Netherlands	NO	863	1,023	2.2%	159	18%	-	-
Portugal	0	313	368	0.8%	56	18%	368	-
Spain	0	3,253	3,754	8.1%	501	15%	3,754	-
Sweden	4	686	743	1.6%	58	8%	739	19231%
UK	2	8,335	8,573	18.5%	238	3%	8,572	515408%
EU15	541	43,199	46,389	100.0%	3,190	7%	45,848	8479%

([1]) Information source: CRF Summary Table 3 for 2004.
Emissions of Greece are not reported partly because of lack of data.
Abbreviations explained in the Chapter ‘Units and abbreviations’.

Table 4.44 Activity data and implied emission factors for 2.F.1: 'Refrigeration and Air conditioning' for EU-15

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	ACTIVITY DATA *Amount of fluid*			IMPLIED EMISSION FACTORS			EMISSIONS		
	Filled into new manufactured products	In operating systems (average annual stocks)	Remaining in products at decommissioning	Product manufacturing factor	Product life factor	Disposal loss factor	From manufacturing	From stocks	From disposal
	(t)			(% per annum)			(t)		
1. Refrigeration[(1)]									
Air Conditioning Equipment									
Domestic Refrigeration (Specify chemical)(2)									
HFC-23	17.93	62.61	IE	0.50	1.00	NA	0.09	0.63	IE
HFC-32	1,871.58	4,626.83	IE	3.00	10.00	NA	56.15	462.68	IE
HFC-125	3,050.05	8,723.54	0.00	0.00	0.00	846.89	91.47	674.50	0.00
HFC-134a	6,247.31	25,827.80	23.66	2.53	2.31	0.00	157.75	597.12	0.00
HFC-143a	1,290.99	4,451.78	0.00	3.00	4.96	NA	38.70	220.97	0.00
Unspecified mix of HFCs (t CO2e)	89,545.90	4,251,256.72	44,934.51	1.00	0.85	15.00	895.46	36,229.88	6,740.18
Commercial Refrigeration									
HFC-23	17.36	122.82	1.00	0.20	9.79	30.00	0.03	12.03	0.30
HFC-32	64.81	350.83	19.49	1.71	9.33	0.00	1.11	32.74	0.00
HFC-125	925.40	6,843.12	169.76	2.39	13.11	29.82	22.16	896.82	50.63
HFC-134a	5,948.77	30,242.86	381.40	0.81	9.91	32.93	48.01	2,997.35	125.59
HFC-143a	991.69	7,045.72	101.99	2.43	13.81	27.38	24.06	973.26	27.93
HFC-152a	1.46	325.00	14.31	3.50	10.47	62.61	0.05	34.04	8.96
C2F6	3.50	24.24	0.00	0.20	10.00	NA	0.01	2.42	0.00
C3F8	26.97	221.71	4.27	3.48	12.08	33.95	0.94	26.77	1.45
Unspecified mix of HFCs (t CO2e)	1,016,830.08	14,443,577.12	1,454,872.45	1.90	16.78	5.40	19,325.27	2,423,525.39	78,522.68
Transport Refrigeration									
HFC-32	2.13	16.75	0.00	0.06	15.00	NA	0.00	2.51	0.00
HFC-125	76.05	338.63	4.77	3.93	15.86	5.06	2.99	53.70	0.24
HFC-134a	81.07	947.93	6.37	3.93	18.34	411.54	3.19	173.84	26.23
HFC-152a	0.00	0.63	0.09		25.00	100.00	0.00	0.16	0.09
HFC-143a	87.36	388.07	5.63	4.04	15.86	21.73	3.53	61.55	1.22
C3F8	0.00	0.14	0.08		100.00	100.00	0.00	0.14	0.08
Unspecified mix of HFCs (t CO2e)	177,794.89	1,221,122.17	37,905.00	1.00	9.57	8.00	1,777.95	116,814.77	3,032.40
Industrial Refrigeration									
HFC-32	10.58	68.73	0.00	0.10	7.26	NA	0.01	4.99	0.00
HFC-125	658.17	2,794.52	5.40	0.85	11.88	119.53	5.62	332.04	6.46
HFC-134a	751.21	3,457.24	7.10	0.98	12.72	129.33	7.37	439.85	9.19
HFC-152a	1.17	10.10	0.00	0.00	8.00	NA	0.00	0.81	0.00
HFC-143a	591.55	2,977.07	5.46	0.96	11.36	105.71	5.70	338.08	5.78
HFC-23	9.50	81.25	0.00	0.15	7.00	NA	0.01	5.69	0.00
HFC-227ea	7.30	62.50	0.00	0.15	7.00	NA	0.01	4.38	0.00
C2F6	1.00	7.10	0.00	0.15	7.00	NA	0.00	0.50	0.00
Unspecified mix of HFCs (t CO2e)	597,262.50	5,244,562.01	0.00	2.00	12.53	NA	11,945.25	657,405.35	0.00
Stationary Air-Conditioning									
HFC-32	550.46	2,507.09	9.18	2.77	4.36	0.00	15.24	109.30	0.00
HFC-125	602.51	2,637.59	9.87	1.95	4.40	0.00	11.76	116.06	0.00
HFC-134a	2,173.34	5,405.94	34.13	1.82	6.16	0.24	39.61	333.03	0.08
HFC-143a	8.12	25.64	0.00	0.02	3.04	NA	0.00	0.78	0.00
Unspecified mix of HFCs (t CO2e)	753,537.50	3,709,734.57	NO	1.51	8.93	NO	11,382.75	331,372.85	NO
Mobile Air-Conditioning									
HFC-32	0.63	4.08	0.03	5.00	9.38	0.00	0.03	0.38	0.00
HFC-125	0.68	4.44	0.03	5.00	9.38	0.00	0.03	0.42	0.00
HFC-134a	10,208.75	47,955.43	1,683.32	2.40	12.77	4.47	244.68	6,125.55	75.17
HFC-152a	0.00	2.97	0.00	0.00	17.25	0.00	0.00	0.51	0.44
Unspecified mix of HFCs (t CO2e)	1,695,408.00	12,505,097.28	NO	1.00	10.71	NO	16,954.08	1,339,189.69	NO

Table 4.45 and Table 4.46 provide descriptions on methods used for estimating HFC, PFC and SF_6 emissions from 2.F. 'Consumption of halocarbons and SF_6'.

Table 4.45 General description of national methods used for estimating emissions from Consumption of halocarbons and SF_6

Member States	Description of methods
Austria	A study has been contracted out to determine the consumption data and emissions from 1990-2000 for all uses of FCs (BICHLER ET AL. 2001). In this study, bottom up data for consumption per sector were compared with top-down data from importers and retailers of FCs as well as with data from the national statistics (import/export statistics). The study also included projections until 2010, these were used to estimate emissions from 2001-2004 for the subcategories 2 F 1 Refrigeration and Air conditioning equipment, 2 F 3 Fire Extinguishers and 2 F 9 Other sources of SF_6. For the sub-categories 2 F 7 Semiconductor Manufacture and 2 F 8 Electrical Equipment data for these years were available due to the Austrian reporting obligation (see below). The sub-category 2 F 2 Foam blowing was reevaluated in a new contracted study (results from this study also lead to recalculations in the whole time-series). The sub-categories 2 F 4 Aerosols and 2 F 5 Solvents have been estimated for the first time in this submission for the whole time-series. Data about consumption of HFC, PFC and SF_6 were determined from the following sources: • data from national statistics • data from associations of industry • direct information from importers and end users Since 2004 there is also a reporting obligation under the Austrian FC-regulation for users of FCs in the following applications: refrigeration and air-conditioning, foam blowing, semiconductor manufacture, electrical equipment, fire extinguishers and aerosols.

Member States	Description of methods
	Emissions for all subcategories were estimated using a country specific methodology, emission factors are based on information of experts from the respective industries. For most sources emissions are calculated from annual stocks using emission factors.
Belgium	For estimating the emissions of the F-gases described in Annex A to the Kyoto Protocol (hydrofluorocarbons HFCs, perfluorocarbons PFCs, sulphur hexafluoride SF_6), a country-specific methodology was developed by 2 consultancies (ECONOTEC and ECOLAS) in 1999 based on the IPCC Guidelines [34][35][10][28] and since then updated every year and further optimised by ECONOTEC, the last time in collaboration with VITO [45]. Emissions of fluorinated greenhouse gases are mainly estimated on the basis of the consumption of the different substances for each application, the consumption of products containing such substances, figures on external trade in substances or products containing substances, as well as on emission modelling by application and assumptions on leakage rates.
Denmark	The data for emissions of HFCs, PFCs, and SF_6 has been obtained in continuation on work on inventories for previous years. The determination includes the quantification and determination of any import and export of HFCs, PFCs, and SF_6 contained in products and substances in stock form. This is in accordance with the IPCC-guideline (IPCC (1996), vol. 3, p. 2.43ff) as well as the relevant decision trees from the IPCC Good Practice Guidance (GPG, IPCC (1999) p. 3.53ff). For the Danish inventories of F-gases basically a Tier 2 bottom up approach is used. As for verification using import/export data a Tier 2 top down approach is applied. The following sources of information have been used: • Importers, agency enterprises, wholesalers, and suppliers • Consuming enterprises, and trade and industry associations • Recycling enterprises and chemical waste recycling plants • Statistics Denmark • Danish Refrigeration Installers' Environmental Scheme (KMO) • Previous evaluations of HFCs, PFCs, and SF_6 Suppliers and/or producers provide consumption data of F-gases. Emission factors are primarily defaults from GPG, which are assessed to be applicable in a national context.
Finland	Detailed sector-specific approach. No further information on general methodology provided.
France	IPCC Tier 2
Germany	Detailed CS approach (Tier 2).
Greece	In order to obtain a reliable estimation of F-gases emissions, collection of detailed data for all activities mentioned above (e.g. number of refrigerators, type and amount of refrigerant used by each market label, substitutions of refrigerants that took place the late years etc.) is required. The availability of official data in Greece is limited and, therefore, the estimations presented hereafter cover only a part of the materials/equipments mentioned above. Specifically: (a) only HFC emissions from refrigerating and air conditioning (including mobile air conditioning) equipment are included, which, however, are considered to represent the basic source of the respective emissions (b) emissions from the use of SF_6 in electrical equipment.
Ireland	In 2000, the EPA commissioned special studies on HFC, PFC and SF_6 emissions, led by the Clean Technology Centre (CTC) at Cork Institute of Technology that were designed to identify the important sources in Ireland and to quantify the emissions in 1998 on the basis of separate bottom-up and top-down methodologies. The reports on these studies (O'Doherty and McCulloch, 2002 and O'Leary et al, 2002) describe a very comprehensive investigation into the emissions of fluorinated gases in Ireland and the bottom-up method provided a readily applicable approach that could be used for developing inventories of these gases for other years. The bottom-up approach took full account of the available IPCC methodologies and IPCC good practice guidance in developing the 1998 emissions estimates for HFC, PFC and SF_6. Tier 2 methods were used for estimating the emissions from the majority of sources that have non-zero emissions. The actual and potential emissions in 1998 were compiled in the CRF tables, with table modifications where necessary to facilitate transparent reporting of the country-specific data. The methodological approach adopted in the special study for 1998 was subsequently used in early 2002, again under contract with CTC (O'Leary, 2002), to compile emissions estimates for HFC, PFC and SF_6 for the timeseries 1995 through 2000, which were incorporated in the recalculated inventories submitted in 2002. The inventory agency subsequently continued reporting for the years up to 2003, based broadly on the CTC approach used for the 1995-2000 time-series.
Italy	Methodology used is IPCC Tier 2a, except for SF_6 emissions from electrical equipment (2F7), where it is IPCC Tier 3c. [NIR 2005]
Luxembourg	No further information provided
Netherlands	To comply with the IPCC Good Practice Guidance (IPCC, 2001) IPCC Tier 2 methods are used to estimate emissions of the sub-sources *stationary refrigeration, mobile air-conditioning, aerosols* and *Semiconductor manufacturing*. The country-specific methods for the sources *Electrical equipment, Sound-proof windows and Electron microscopes* are equivalent to IPCC Tier 2 methods.
Portugal	For those sources for which sufficient data was available, actual emissions where estimated with a Tier 2 (advanced or actual method) approach which is considered Good Practice in accordance with GPG. As a general rule bottom-up methodologies were used, and in fact overall methodology should be classified as Tier 2a. This approach departs from the knowledge of the number of equipments using HFC compounds and estimates emissions to atmosphere from charge (amount of chemical used in the equipment), service life, emission rate during the various periods of the equipment life and possible recovery of emissions.
Spain	No further information on general methodology provided.
Sweden	In estimating the actual emissions, as far as possible, a Tier 2 approach has been used. Potential emissions: Data on bulk imports and exports are obtained from the Products register hosted by the Swedish Chemicals Inspectorate, which did not register these substances until 1995. Previously, potential emissions for the years before 1995 were not estimated for bulk imports and exports, due to lack of information. Estimates of potential emissions for imports and exports have, however, been made for all years to submission

Member States	Description of methods
	2006.
United Kingdom	The calculation methodology within the model is considered to provide a relatively conservative approach to the estimation of emissions. The bank of fluid is estimated by considering the consumption of fluid in each sector, together with corrections for imports, exports, disposal and emissions. Once the size of the bank in a given year is known, the emission can be estimated by application of a suitable emission factor. Emissions are also estimated from the production stage of the equipment and during disposal. The methodology corresponds to the IPCC Tier 2 'bottom-up' approach.

Source: NIR 2006 unless stated otherwise

Table 4.46 Description of national methods used for estimating HFC emissions from sub-category 2F1 Refrigeration and Air-conditioning equipment

Member States	Description of methods
Austria	See also General description of national methods used for estimating emissions from Consumption of halocarbons and SF_6. Refrigeration and Air Conditioning: Consumption data was obtained directly from the most important importers of refrigerants. The stocks of the different subcategories were estimated using information from the most important refrigerant retailers/ importers and experts from the refrigeration branch.
Belgium	See also General description of national methods used for estimating emissions from Consumption of halocarbons and SF_6. For the refrigeration sector, the consumption and emission of refrigerants are modelled on the basis of an annual inquiry among refrigerant distributors on their national supply by refrigerant mixture, as well as on assumptions on average loss rates. The refrigerant consumption and emissions of the transportation sector are estimated by modelling the number of vehicles and the penetration of air conditioning or refrigerated transport, by category of vehicles.
Denmark	See General description of national methods used for estimating emissions from Consumption of halocarbons and SF_6.
Finland	Refrigeration and air conditioning (CRF 2.F.1) Top-down Tier 2, Tier 1a, Tier 1b Tier 2 top-down method is used for all sources in this category, both stationary and mobile. Data is not collected for separate sub-categories because such statistics are either not available or the preparation of such statistics would entail a very high reporting burden on companies, given that such a task would be taken seriously. There is also some evidence that simpler questionnaires lead to better response activity. HFC-23 emissions from this source are not reported separately due to confidentiality.
France	IPCC Tier 2
Germany	Die Gesamtemissionen für jede Unterquellgruppe und jedes Kältemittel setzen sich aus den Teilemissionen Herstellungs-, Nutzungs- und Entsorgungsemissionen zusammen. Diese werden separat erhoben. Entsorgungsemissionen traten erstmals im Jahr 2003 auf. Für die Berechnung der HFKW-Emissionen aus den Untergruppen der Kälte- und stationären Klimaanlagen werden je nach Gruppe Einzeldaten erhoben/geschätzt oder Kältemittel-Modelle genutzt. Die Gesamtemissionen der Fahrzeugklimaanlagen je Fahrzeugtyp und Kältemittel setzen sich aus den Teilemissionen Herstellungs-, Nutzungs- und Entsorgungsemissionen zusammen. Diese werden separat erhoben.
Greece	Refrigeration and air-conditioning: F-gases emissions are estimated according to the Tier 2a methodology described in the IPCC Good Practice Guidance. It is a bottom-up approach based on detailed equipment data and emission factors representing various types of leakage per equipment category. Data sources: • Market survey • EUROSTAT data • Official data on new vehicles
Ireland	See General description of national methods used for estimating emissions from Consumption of halocarbons and SF_6.
Italy	Refrigeration and air-conditioning: IPCC Tier 2a Basic data have been supplied by industry: specifically, for the air conditioning equipment the national motor company and the agent's union of foreign motor-cars vehicles has provided the yearly consumptions (FIAT, 2005; IVECO, 2005; UNRAE, 2005) [NIR 2005]
Luxembourg	No further information provided
Netherlands	To comply with the IPCC Good Practice Guidance (IPCC, 2001) IPCC Tier 2 methods are used to estimate emissions of the sub-sources *stationary refrigeration, mobile air-conditioning, aerosols* and *Semiconductor manufacturing*.
Portugal	CFC, HCFC and HFC emissions from operation and disposal of Domestic Refrigeration Equipments, non domestic Refrigeration Equipments, transport refrigeration equipments, Stationary and Industrial Air conditioning equipments and Mobile Air Conditioning were estimated using the bottom-up approach (Tier 2 or actual method) as proposed in chapter 3.7.4 of the GPG
Spain	With respect to refrigeration and air conditioning, information has been supplied for certain years by the business associations for this sector. These data have been extrapolated for recent years by the inventory working party with the help of information on evolution proxies taken from the automobile industry, which has also provided data on plants for the main gas under consideration (HFC-134a). For the national production of motor vehicles, the emission factors are those derived from the data obtained in questionnaires from the manufacturing plants, and are taken from the IPCC Guidelines for the other sub-sectors. [NIR 2005]
Sweden	See also General description of national methods used for estimating emissions from Consumption of

Member States	Description of methods
	halocarbons and SF_6. Refrigeration and air conditioning equipment: Input data for the calculation of actual emissions consists of information from various sources. For heat pumps, air conditioning, mobile air conditioning, refrigeration and freezing equipment, the equipment producers and importers were contacted and have provided information of varying quality. Estimates have been checked with trade associations (KYS and SVEP) and with experts at the Swedish EPA (Ujfalusi, Bernekorn, Björsell).
United Kingdom	Emissions from the domestic refrigeration sector were estimated based on a bottom-up approach using UK stock estimates of refrigerators, fridge-freezers, chest-freezers and upright freezers from the UK Market Transformation Programme (MTP, 2002). For the commercial refrigeration sub-sectors, emissions for these sectors were based on the activity data supplied by industry and used in previous emission estimates by March (1999) and WS Atkins (2000). Consultation with a range of stakeholders was used to determine appropriate country-specific emission factors; these generally fell within the ranges given in IPCC guidance (IPCC 2000).

Source: NIR 2006 unless stated otherwise

Table 4.47 provides information on the contribution of Member States to EC recalculations in HFC from 2.F 'Consumption of halocarbons' for 1990 and 2003 and main explanations for the largest recalculaltions in absolute terms.

Table 4.47 Contribution of MS to EC recalculations in HFC from 2.F 'Consumption of halocarbons' for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

	1990		2003		Main explanations
	Gg	Percent	Gg	Percent	
Austria	-196	-89,5	-443	-33,9	
Belgium	179	70,1	84	6,3	
Denmark	0	0,0	0	0,0	
Finland	0	27,7	0	0,0	
France	-4	-12,9	-723	-6,5	
Germany	40	-	918	13,0	
Greece	0	0,0	1.953	206,6	Updated information regarding the penetration rate of HFC in the Greek market and the estimation of emissions from "new' sources
Ireland	1	-	70	24,1	
Italy	0	0,0	14	0,3	
Luxembourg	-29	-68,4	0	0,0	
Netherlands	0	0,0	-26	-2,9	
Portugal	0	0,0	237	380,6	
Spain	0	0,0	-7	-0,2	
Sweden	0	-0,1	215	45,6	
UK	0	0,0	-173	-2,0	
EU15	**-10**	**-1,8**	**2.118**	**5,2**	

Table 4.48, Table 4.49 and Table 4.50 summarise information by Member State on emission trends, methodologies, emission factors, completeness and qualitative uncertainty estimates for the key sources from 2.F: 'Consumption of halocarbons and SF_6'.

Table 4.48 Member States' contributions to SF_6 emissions from 2.F: 'Consumption of halocarbons and SF_6' and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1)]	EF [1)]
Austria	249	513	CS	CS
Belgium	103	66	T2, CS	CS
Denmark	13	33	T2	CS
Finland	94	23	T1b/T3	D
France	1,060	746	C, T2	CS
Germany	4,245	2,335	M, CS, T1, T2	D, CS
Greece	3	4	CS	-
Ireland	35	70	T2	CR,CS
Italy	213	508	CS, T3c	CS, PS
Luxembourg	3	4	C/D	C/D
Netherlands	217	328	NA/CS/T2	D,PS
Portugal	2	3	T2a	CS
Spain	67	255	T2	D,NA
Sweden	84	42	T1a/T1b/NA	PS,CS,D,NA
United Kingdom	604	739	T1,T2	CS
EU15	6,993	5,671	C,CS,D,M,T1, T1a,T1b,T2,T3c	C, CS, D, PS

([1]) Information source: CRF Summary Table 3 for 2004.
Abbreviations explained in the Chapter 'Units and abbreviations'.

SF_6 emissions from 2.F: 'Consumption of halocarbons and SF_6' account for 0.1 % of total EU-15 GHG emissions in 2004. Between 1990 and 2004, SF_6 emissions from this source decreased by 19 %. Germany and France are responsible for 54 % of total EU-15 emissions from this source. In absolute terms, Germany had also the most significant decreases from this source between 1990 and 2004.

Table 4. 49 Member States' contributions to SF_6 emissions from 2.F: 'Consumption of halocarbons and SF_6'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	249	594	513	9.0%	-81	-14%	263	106%
Belgium	103	75	66	1.2%	-9	-12%	-37	-36%
Denmark	13	31	33	0.6%	2	6%	20	148%
Finland	94	42	23	0.4%	-19	-44%	-71	-75%
France	1,060	843	746	13.2%	-97	-12%	-314	-30%
Germany	4,245	2,327	2,335	41.2%	8	0%	-1,909	-45%
Greece	3	4	4	0.1%	0	5%	1	46%
Ireland	35	119	70	1.2%	-49	-41%	35	98%
Italy	213	350	508	9.0%	158	45%	295	138%
Luxembourg	3	4	4	0.1%	0	0%	1	21%
Netherlands	217	309	328	5.8%	19	6%	111	51%
Portugal	2	5	3	0.1%	-1	-25%	2	-
Spain	67	208	255	4.5%	47	23%	188	281%
Sweden	84	34	42	0.7%	8	24%	-41	-49%
United Kingdom	604	651	739	13.0%	88	14%	135	22%
EU15	6,993	5,596	5,671	100.0%	75	1%	-1,323	-19%

Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 4.50 Description of national methods used for estimating SF_6 emissions from Consumption of halocarbons and SF_6

Member States	Description of methods
Austria	Semiconductors: All consumption data and data about actual emissions from semiconductor manufacture were based on direct information from industry. Electrical Equipment: Information on SF_6 stocks in electrical equipment in 2003 and 2004 were obtained from energy suppliers and industrial facilities SF_6 emissions were calculated based on the assumption that there are no emissions during first filling on site (furthermore, smaller equipment is already filled during manufacture); based on information from experts from industry, it was thus estimated that emissions during service and leakage are 1% of annual stocks. Noise insulating windows: Activity data were estimated based upon information from experts from industry. The actual emissions are the sum of emissions during production and leakage, which is estimated to be 1% of the original SF_6 filling.

Member States	Description of methods
	Tyres: Information on the amount of SF_6 used for filling tyres was obtained from SF_6 retailers. Emissions were calculated as one third per year for the three years following consumption. Shoes: Emissions from the imported amount of shoes with SF_6 filling was obtained from the producer. It was assumed that all SF_6 is emitted at the end of the lifetime of these shoes, which was estimated to be 3 years. Research: SF_6 is used in research in electron microscope and other equipment, the annual consumption was estimated to be 100 kg per year until the total estimated stock of 500 kg was reached (1996), emissions are estimated to be 20 kg per year (after 1996 consumption = emissions).
Belgium	See also General description of national methods used for estimating emissions from Consumption of halocarbons and SF_6. The SF_6 emissions originate from the production and the stock of soundproof double-glazing and to a minor extent from the electricity sector.
Denmark	See also General description of national methods used for estimating emissions from Consumption of halocarbons and SF_6.
Finland	Electrical equipment (CRF 2.F. 8) Tier 3c (country-level mass-balance), Tier 1b Tier 1a estimates can not be calculated for this source because of lack of historical data. Tier 1b estimates have been calculated, however, based on survey and emissions data, cf. section 3.1 of Oinonen (2003). Running shoes (CRF 2.F. 9) Method for adiabatic property applications, Tier 1b Tier 1a is not applicable to this category because all SF_6 used is imported not in bulk, but in products (i.e. shoes). Emissions from this source are not reported separately due to confidentiality.
France	IPCC Tier 2
Germany	Electrical equipment: Die Emissionen werden seit 1996 nach einem vom Umweltbundesamt gemeinsam mit den Herstellern und Betreibern entwickelten, sehr detaillierten Konzept ermittelt. Die Daten werden vom Zentralverband Elektrotechnik- und Elektronikindustrie e.V. (ZVEI), vom Verband der Netzbetreiber e.V. (VDN) und seit 2004 vom Verband der industriellen Energie und Kraftwirtschaft e.V. (VIK) ermittelt. Es werden die installierte Menge am Ende eines Jahres und die Emissionen an den einzelnen Quellen (Werksverluste der Hersteller, Montageverluste der Hersteller, Leckagen bei Betreibern - einschließlich Wartung – und Entsorgung) ermittelt. Other: Die eingesetzten Mengen können den Emissionen gleichgesetzt werden, wobei analog zur IPCC-Methode (IPCC, 2000: Gleichung 3.23) bei Autoreifen eine Zeitverzögerung von drei Jahren angenommen wird.
Greece	Electrical equipment The available information is not sufficient in order to apply the methodologies suggested by the IPCC Good Practice Guidance. CS: emissions are estimated on the basis of information provided by PPC regarding losses in the transmission and in the distribution system.
Ireland	See also General description of national methods used for estimating emissions from Consumption of halocarbons and SF_6.
Italy	SF_6 emissions from electrical equipment from 1990 to 1994 have been estimated according to IPCC Tier 2a approach. SF_6 leaks from installed equipment have been estimated on the basis of the total amount of sulphur hexafluoride accumulated and of average leakage rates; leakage data published in environmental reports have also been used for major electricity producers (ANIE, 2005). IPCC Tier 1a method has been used to calculate potential emissions, using production, import, export and destruction data provided by the national producer (ANIE, 2005) [NIR 2005]
Luxembourg	No further information provided
Netherlands	To comply with the IPCC Good Practice Guidance (IPCC, 2001) IPCC Tier 2 methods are used to estimate emissions of the sub-sources *stationary refrigeration, mobile airconditioning, aerosols* and *Semiconductor manufacturing*. The country-specific methods for the sources *Electrical equipment, Sound-proof windows and Electron microscopes* are equivalent to IPCC Tier 2 methods.
Portugal	Actual emissions of SF_6 from electrical equipment were estimated with a tier 2b method and using a country-specific emission factor.
Spain	Category 2F7 includes the SF_6 emissions from electrical equipment. In the case of Spain, this is the only source generating emissions of this gas. [NIR 2005]
Sweden	In 2001-2002, a questionnaire was sent out to power companies from the trade association Swedenergy[18] (Svensk Energi) asking for the installed amounts of SF_6 in operating equipment, and the replaced amounts of SF_6 during service. The results of the questionnaire showed an installed accumulated amount of approximately 80 Mg and an annual leakage rate of 0.6% (equals the amount replaced from the questionnaire) and these were used as input data in the inventory. For 2003, data on replaced amounts of SF_6 in operating systems results in a calculated annual leakage rate of 0.5% (Swedenergy and power distribution companies). For jogging shoes, a more or less rough estimate has been made. It has not been possible to obtain any national data, so a Norwegian estimate was scaled to the Swedish population. According to the results from a study performed in early 2004 a phasing out of SF_6 and replacement with PFC-218 was started in 2003. Manufacturers of windows have provided data on the amount of SF_6 used in the manufacture of barrier gas windows. The manufacturers have also provided estimates of the share of SF_6 emitted in production. These estimates vary considerably between manufacturers, from 5-50%. Calculating a weighted average of the emission factor at production results in a national figure in the order of 30%, which is in line with the point estimate of 33% given in the IPCC Good Practice Guidance.
United Kingdom	SF_6 emission from electrical transmission and distribution were based on industry data from BEAMA (for equipment manufacturers) and the Electricity Association (for electricity transmission and distribution), who provided emission estimates based on Tier 3b, but only for recent years. Tier 3a estimates were available for the electricity distribution and transmission industry for 1995. In order to estimate a historical time series and

[18] Swedenergy. Matz Tapper. Personal communication. 2005.

Member States	Description of methods
	projections, these emission estimates together with fluid bank estimates provided by the utilities were extrapolated using the March study methodology (March, 1999). This involved estimating leakage factors based on the collected data and using the March model to estimate the time series. Emissions prior to 1995 used the March SF_6 consumption data to extrapolate backwards to 1990 from the 1995 estimates. Emissions of PFC and SF_6 emissions from electronics are based on data supplied by UK MEAC – the UK Microelectronics Environmental Advisory Committee. UK MEAC gave total PFC consumption for the UK electronics sector based on purchases of PFCs as reported by individual companies. Emissions were then calculated using the IPCC Tier 1 methodology, which subtracts the amount of gas left in the shipping container (10%), the amount converted to other products (between 20% and 80% depending on the gas) and the amount removed by abatement (currently assumed to be zero). Emissions for previous years were extrapolated backwards assuming an annual 15% growth in the production of semiconductors in the UK up until 1999.

Source: NIR 2006 unless stated otherwise

Table 4.51 provides information on the contribution of Member States to EC recalculations in SF_6 from 2.F 'Consumption of halocarbons' for 1990 and 2003 and main explanations for the largest recalculaltions in absolute terms.

Table 4.51 Contribution of MS to EC recalculations in SF_6 from 2.F 'Consumption of halocarbons' for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

	1990		2003		Main explanations
	Gg	Percent	Gg	Percent	
Austria	0	0,0	0	0,0	
Belgium	0	0,0	0	0,0	
Denmark	0	0,0	0	0,0	
Finland	0	0,0	0	0,0	
France	0	0,0	-3	-0,3	
Germany	516	13,9	-236	-9,2	No information available.
Greece	0	-11,5	1	22,6	
Ireland	-78	-68,7	18	18,4	
Italy	0	0,0	0	0,0	
Luxembourg	-1	-17,3	0	0,3	
Netherlands	0	0,0	-25	-7,5	
Portugal	2	-	-3	-38,8	
Spain	0	-0,3	-88	-29,8	
Sweden	0	0,2	3	8,4	
UK	0	0,0	0	0,0	
EU15	**440**	**6,7**	**-334**	**-5,6**	

4.2 Methodological issues and uncertainties

The previous section presented for each EU-15 key source in CRF Sector 2 an overview of the Member States' contributions to the key source in terms of level and trend, information on methodologies, emission factors, completeness and qualitative uncertainty estimates. Detailed information on national methods and circumstances is available in the Member States' national inventory reports.

Table 4.52 shows the total EU-15 uncertainty estimates for the sector 'Industrial processes' and the uncertainty estimates for the relevant gases of each source category. The highest level uncertainty was estimated for CH_4 from 2.B and the lowest for CO_2 from 2.A.1. With regard to trend SF_6 from 2C shows the highest uncertainty estimates, CO_2 from 2A2 the lowest. For a description of the Tier 1 uncertainty analysis carried out for the EU-15 see Chapter 1.7.

Table 4.52: EU-15 uncertainty estimates for the sector 'Industrial processes'

Source category	Gas	Emissions 1990	Emissions 2004 [1]	Emission trends 1990-2004	Emissions for which MS uncertainty estimates are available [2]	Share of emissions for which MS uncertainty estimates are available	Level uncertainty estimates based on MS uncertainty estimates	Trend uncertainty estimates based on MS uncertainty estimates
2.A.1 Cement production	CO_2	79,905	83,946	5%	82,742	99%	4%	2
2.A.2 Lime production	CO_2	17,355	18,327	6%	13,804	75%	15%	1
2.A.3 Limestone and dolomite use	CO_2	5,932	7,347	24%	7,586	103%	7%	11
2.A.4 Soda ash production and use	CO_2	1,577	1,721	9%	746	43%	15%	-21
2.A.7 Other	CO_2	4,814	4,679	-3%	2,724	58%	12%	4
2.B Chemical industry	CO_2	26,839	29,016	8%	14,542	50%	5%	3
2.C Metal production	CO_2	77,867	70,182	-10%	26,356	38%	8%	1
2.G Other	CO_2	690	617	-11%	620	100%	11%	1
2.B Chemical industry	CH_4	507	364	-28%	446	122%	138%	24
2.C Metal production	CH_4	104	103	-1%	83	80%	36%	19
2.G Other	CH_4	47	44	-7%	316	722%	50%	2
2.B Chemical industry	N_2O	105,011	46,591	-56%	42,269	91%	22%	6
2.E Production of halocarbons and SF_6	HFC	27,459	5,175	-81%	4,810	93%	43%	13
2.F Consumption of halocarbons and SF_6	HFC	541	46,939	8581%	43,426	93%	35%	94
2.C Metal production	PFC	13,404	2,618	-80%	2,740	105%	10%	8
2.F Consumption of halocarbons and SF_6	PFC	585	1,892	223%	1,037	55%	40%	113
2.C Metal production	SF_6	1,803	2,719	51%	1,393	51%	93%	251
2.F Consumption of halocarbons and SF_6	SF_6	6,993	5,671	-19%	6,060	107%	48%	14
Total	**all**	**378,334**	**330,924**	**-12.5%**	**251,700**	**76%**	**8%**	**5**

Note: Emissions are in Gg CO_2 equivalents; trend uncertainty is presented as percentage points.

1) The sum of the source category emissions may not be the total sector emissions because uncertainty estimates are not available for all source categories.

2) Includes for some countries 2003 data and for Spain 2002 data

4.3 Sector-specific quality assurance and quality control

Apart from the general QA/QC checks performed before the compilation of the EC GHG inventory (in particular checks of implied emission factors, checks of internal consistency), there are no sector-specific QA/QC procedures for this sector. However, the internal review activities of the EC GHG inventory planned for the second half-year of 2006 will focus on this sector.

4.4 Sector-specific recalculations

Table 4.53 shows that in the industrial processes sector the largest recalculations in absolute terms were made for CO_2. Large recalculations in relative terms were also made for CH_4.

Table 4.53 Recalculations of total greenhouse gas emissions and recalculations of greenhouse gas emissions in CRF Sector 2: 'Industrial processes', for 1990 and 2003 by gas (Gg and percentage)

1990	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
	Gg	percent	Gg	percent	Gg	percent	Gg	percent	Gg	percent	Gg	percent
Total emissions and removals	36.029	1,2%	-12.408	-2,8%	5.977	1,5%	839	3,1%	1074	6,8%	569	5,5%
Industrial Processes	62.593	40,9%	-367	-35,0%	308	0,3%	839	3,1%	1074	6,8%	569	5,5%
2003												
Total emissions and removals	63.546	2,0%	-5.239	-1,6%	4.431	1,3%	614	1,2%	1050	18,8%	-429	-4,6%
Industrial Processes	58.253	38,2%	-446	-45,2%	903	2,0%	614	1,2%	1050	18,8%	-429	-4,6%

Table 4.54 provides an overview of Member States' contributions to EU-15 recalculations. Germany had by far the most influence on the CO_2 recalculations of the EC inventory. The main reason for these recalculations is that Germany made the split between energy and process related emissions from iron and steel production for the first time and therefore reallocated CO_2 emissions from 1A2 to 2C1.

Table 4.54 Contribution of Member States to EU-15 recalculations in CRF Sector 2: 'Industrial processes' for 1990 and 2003 by gas (difference between latest submission and previous submission Gg of CO_2 equivalents)

	1990						2003					
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6
Austria	139	0	0	-196	0	0	44	0	0	-436	0	0
Belgium	163	-33	0	179	0	0	259	-33	65	101	-26	0
Denmark	34	0	0	0	0	0	84	0	0	0	0	0
Finland	1.971	0	60	0	0	0	2.487	0	25	0	0	0
France	-14	0	0	26	835	-120	98	0	0	-300	1.869	-289
Germany	58.335	-331	293	859	82	818	55.269	-405	359	400	9	4
Greece	172	1	0	0	0	0	-33	1	-31	1.289	0	1
Ireland	164	0	0	1	0	-78	-14	0	0	36	5	-1
Italy	1.003	0	-72	0	0	0	-756	0	496	8	0	0
Luxembourg	117	0	0	-29	0	-1	0	0	0	0	0	0
Netherlands	27	0	0	0	149	0	101	0	0	-25	769	-27
Portugal	11	0	0	0	0	2	23	0	0	161	0	-2
Spain	220	0	0	0	0	0	615	0	0	0	0	-48
Sweden	330	1	27	0	0	0	84	0	0	182	-4	1
UK	-78	-5	0	0	8	-52	-10	-9	-11	-524	-61	-85
EU15	**62.593**	**-367**	**308**	**839**	**1.074**	**569**	**58.253**	**-446**	**903**	**890**	**2.561**	**-446**

5 Solvent and other product use (CRF Sector 3)

This chapter provides sections on emission trends, methods and on recalculations in CRF Sector 3 ‘Solvent and other product use’. In response to the UNFCCC review findings this report for the first time includes more detailed descriptions of methods used by Member States.

5.1 Overview of sector

CRF Sector 3 ‘Solvent and other product use’ contributes 0.24 % to the total EU-15 GHG emissions (Table. 5.4). The EU-15 Member states jointly arrchieved a emissions reduction of about 20 % from 10.2 Tg in 1990 to 8.2 Tg in 2004 (Figure 5.1 and Table 5.1).

As it is shown in Table 5.1 and Figure 5.2, in the period 1990 to 2004 an emission reduction in this sector could be archieved by The Netherland (-57 %), Germany (-44 %), Finnland (-41 %), and France (- 6 %). The Member States Austria, Denmark, Italy and Sweden arrchieved a emissions reduction between 11 % and 18 % while Greece and Ireland archieved a reduction of 8 % each. The Member States with the highest increase in emission in this sector are Portugal with 46 % and Spain with 9 %.

Figure 5.1 EU-15 GHG emissions for 1990–2004 from CRF Sector 3: ‘Solvent and other product use’ in CO_2 equivalents (Tg)

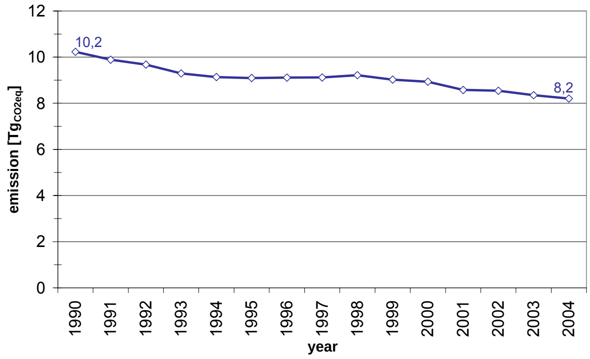
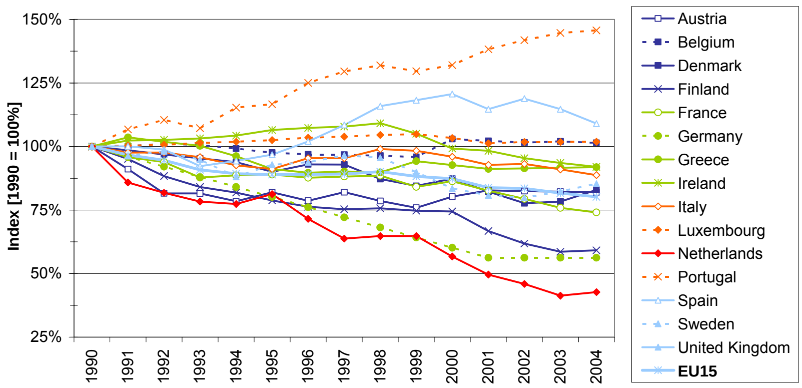


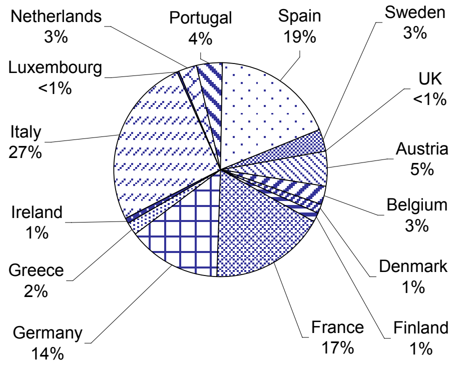
Figure 5.2 EU-15 GHG emissions for 1990–2004 from CRF Sector 3: ‘Solvent and other product use’



In 2004, the emissions decreased by 1.7 % compared to 2003 % (Table 5.1 and Figure 5.2). In this period an emission reduction in this sector could be archieved by Spain (-5 %), Italy (3 %), and France (2 %). The Member States Ireland, Belgium and Austria arrchieved a emissions reduction each of about 1 % or even less. The Member States with an increase in emission in this sector are United

Kingdom (6 %), Denmark (4 %) and The Netherlands (4 %). In all other Member States the emission in this sector increased a little from 2003 to 2004.

Figure 5.3 GHG emissions for 2004 from CRF Sector 3: 'Solvent and other product use' in percentage



As it is shown in Table 5.1 and Figure 5.3 the Member States Italy and Spain are jointly responsible for 46 % of the total GHG emissions in this sector and Germany and France are jointly responsible for 31 % of the total emissions in this sector. The remaining GHG emissions of this sector emanate from all other EU-15 Member States each with shares of 5 % or even less.

Table 5.1 Member States' contributions to greenhouse gas emissions from CRF Sector 3: 'Solvent and other product use'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004	
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	515	424	422	5.0%	-1	0%	-93	-18%
Belgium	246	120	250	3.0%	130	108%	4	1%
Denmark	137	107	113	1.3%	6	6%	-23	-17%
Finland	178	104	105	1.2%	1	1%	-73	-41%
France	1,928	1,463	1,428	16.9%	-35	-2%	-500	-26%
Germany	2,089	1,174	1,174	13.9%	0	0%	-915	-44%
Greece	170	155	156	1.8%	0	0%	-14	-8%
Ireland	81	76	74	0.9%	-1	-2%	-6	-8%
Italy	2,544	2,180	2,113	25.0%	-67	-3%	-430	-17%
Luxembourg	9	9	28	0.3%	18	200%	19	206%
Netherlands	541	223	231	2.7%	8	3%	-310	-57%
Portugal	220	318	320	3.8%	2	1%	100	46%
Spain	1,329	1,672	1,739	20.6%	67	4%	410	31%
Sweden	332	274	284	3.4%	10	4%	-49	-15%
United Kingdom	0	0	0	0.0%	0	-	0	-
EU15	10,318	8,300	8,438	100.0%	138	2%	-1,880	-18%

This sector does not contain any key source.

In the sector 'Solvent and other product use' in addition to CO_2 emission NMVOC and N_2O emission are identified. The most important GHG from 'Solvent and other product use' is CO_2. In 2004 the CO_2 emissions have a share of 0.16 % of the total CO_2 Emissions and Removals' and a share of 0.15 % of the total GHG emissions (Table 5.2). In 2004 the N_2O emissions have a share of 0.94 % of the total N_2O Emissions and Removals and a share of 0.09 % of the total GHG emissions (Table 5.3).

Table. 5.2 EU-15 CO_2 emissions as well as their share for 1990 and 2004 from CRF Sector 3: 'Solvent and other product use'

	Unit	1990	2004
CO_2 emission in 'Solvent and Other Product Use'	[Gg]	6135.8	5216.1
Total GHG emission in 'Solvent and Other Product Use'	[Gg COT2Teq]	10318.1	8382.5
Share of CO_2 emission in Total GHG in 'Solvent and Other Product Use'		*59.47%*	*62.23%*
Total National CO_2 Emissions and Removals	[Gg]	3 160 646.0	3 206 146.6
Share of CO_2 emission from 'Solvent and Other Product Use' in Total CO_2 Emissions and Removals		*0.19%*	*0.16%*
Total National GHG Emissions and Removals	[Gg COT2Teq]	3 575 097.3	3 542 843.8
Share of CO_2 emission from 'Solvent and Other Product Use' in Total GHG Emissions and Removals		*0.17%*	*0.15%*

Table. 5.3 EU-15 N_2O emissions as well as their share for 1990 and 2004 from CRF Sector 3: 'Solvent and other product use'

	Unit	1990	2004
N_2O emission in 'Solvent and Other Product Use'	[Gg]	13.5	10.2
Total GHG emission in 'Solvent and Other Product Use'	[Gg COT2Teq]	10318.1	8382.5
Share of N_2O emission in Total GHG in 'Solvent and Other Product Use'		*40.53%*	*37.77%*
Total National N_2O Emissions and Removals	[Gg]	1 336.9	1 086.1
Share of N_2O emission from 'Solvent and Other Product Use' in Total N_2O Emissions and Removals		*1.01%*	*0.94%*
Total National GHG Emissions and Removals	[Gg COT2Teq]	3 575 097.3	3 542 843.8
Share of N_2O emission from 'Solvent and Other Product Use' in Total GHG Emissions and Removals		*0.12%*	*0.09%*

Table. 5.4 EU-15 GHG emissions as well as their share for 1990 and 2004 from CRF Sector 3: 'Solvent and other product use'

	Unit	1990	2004
GHG emission in 'Solvent and Other Product Use'	[Gg]	10 318.1	8 382.5
Total National GHG Emissions and Removals	[Gg COT2Teq]	3 575 097.3	3 542 843.8
Share of GHG emission from 'Solvent and Other Product Use' in Total GHG Emissions and Removals		*0.29%*	*0.24%*

5.2 Methodological issues and uncertainties

This sector does not contain any key source. An overview information on methodologies used by the Member States is given in Table. 5.5. For estimation the emission in this sector the methodologies used by the Member States can be devided roughly in three groups:

- Methodology provided by IPPC Guidelines and CORINAIR;
- Bottom up and top down approach / consumption-based emissions estimating;
- plant specific surveys / expert judgment.

Furthermore a couple of Member States changed their methodology in the last 2 years.

No additional overview information on qualitative uncertainty estimates is provided. Alltogether it can be noted that very high uncertainties are reported because of lack of information and rough assumptions.

Table. 5.5 Methodological issues for estimation emissions from CRF Sector 3: 'Solvent and other product use'

MS	Methodololy description	
Austria	CO_2 emissions from solvent use were calculated from NMVOC emissions of this sector. So as a first step the quantity of solvents used and the solvent emissions were calculated. To determine the quantity of solvents used in Austria in the various applications, a bottom up and a top down approach were combined. The top down approach provided total quantities of solvents used in Austria. The share of the solvents used for the different applications and the solvent emission factors have been calculated on the basis of the bottom up approach. By linking the results of bottom up and top down approach, quantities of solvents annually used and solvent emissions for the different applications were obtained. Emission estimates only based on the top down approach overestimated emissions because a large amount of solvent substances is used for "non-solvent-applications" (applications where substances usually are used as feed stock in chemical, pharmaceutical or petrochemical industry). However, there might be emissions from the use of the produced products, such as MTBE which is used as fuel additive and finally combusted, these emissions for example are considered in the transport sector. Additionally the comparison of the top-down and the bottom-up approach helped to identify several quantitatively important applications like windscreens wiper fluids, antifreeze, moonlighting, hospitals, de-icing agents of aeroplanes, tourism, cement- respectively pulp industry, which were not considered in the top-down approach. The top-down approach is based on (A) import-export statistics, (B) production statistics on solvents in Austria, (C) survey on non-solvent-applications in companies, (D) survey on the solvent content in products and preparations at producers & retailers. The bottom up approach is based on an extensive survey on the use of solvents in the year 2000. In this survey data about the solvent content of paints, cleaning agents etc. and on solvents used (both substances and substance categories) like acetone or alcohols were collected. Information about the type of application of the solvents was gathered, divided into the three categories 'final application', 'cleaner' and 'product preparation' as well as the actual type of waste gas treatment, which was divided into the categories 'open application', 'waste gas collection' and 'waste gas treatment'. For every category of application and waste gas treatment an emission factor was estimated to calculate solvent emissions in the year 2000. In a second step a survey in 1800 households was made for estimating the domestic solvent use. Also, solvent use in the context of moonlighting besides commercial work and do-it-yourself was calculated.	NIR AT 2006
Belgium	In Belgium the emissions of NMVOC in this source category include paint application, production of medicines, paints, inks and glues, domestic use of other products, coating processes, printing industry, wood conservation, treatment of rubber, storage and handling of products, recuperation of solvents and extraction of oil, cleaning and degreasing and dry cleaning. No estimation of the CO_2 equi. emissions of the solvent consumption is carried out in Belgium; except in the Flemish region (from non-energy use of lubricants and solvents wich are reported under category 2.G). The regions in Belgium are using comparable methodologies to estimate the emissions in their region. The emissions of NMVOC in Flanders are estimated by using the results of a study (University of Gent (1998) / Flemish Environment Agency (VMM)). In Wallonia, the calculation is based on a methodology established by Econotec. In the Brussels region, the emissions are calculated by using the results of research projects. Emissions of NMVOC are estimated in Belgium as follows : • All emissions of category 3.A (emissions for Paint Application…), and some of category 3.C (production of paints, inks and glues) as well as some of category 3.D (other domestic use, wood and textile coating, printing industry, wood conservation, recovery of solvents, treatment of rubber, coating of synthetic material and paper) are estimated based on production figures that are given by the specific industry or professional federations. The emission factors used are mainly the solvent content of the product. • The remaining emissions of category 3.D (storage/handling of products, assembly of automobiles, extraction of oil seeds) are estimated based on information gathered in the industrial databases (originating from reporting obligations of industrial companies). • The emission calculation for the emission of N_2O from anaesthesia (3D) is based on the number of hospital beds in Belgium and the average consumption of anaesthetics per bed. It has been assumed that all of the nitrous oxide used for anaesthetics will eventually be released to the atmosphere. The number of beds used for the emissions calculations was obtained from the DGASS (General Directorate for Health and Social Action). • There is no estimation carried out in Belgium of the CO_2 equivalents calculated out of the emissions of NMVOC of the solvent consumption because of the unreliability of this factors proposed in literature.	NIR BE 2006
Denmark	Use of solvents and other organic compounds in industrial processes and households are important sources of evaporation of non-methane volatile hydrocarbons (NMVOC), and are related to the source cate-gories Paint application, Degreasing and dry clean-ing, Chemical products, manufacture and processing and Other. A new approach has been introduced, focusing on single chemicals instead of activities. The method is based on a chemical approach, and this implies that the SNAP category system is not applicable. Instead emissions will be related to specific chemicals, products, industrial sectors and house-holds and to the CRF sectors mentioned before. This will lead to a clearer picture of the influence from each specific chemical, which will enable a more detailed differentiation on products and the influence of product use on emissions. The procedure is to quantify the use of the chemicals and estimate the fraction of the chemicals that is emitted as a consequence of use. Mass balances are simple and functional methods for calculating the use and emissions of chemicals by the equations (A) Use = production + import – export – destruction/disposal – hold up and (B) emission = use * emission factor where "hold up" is the difference in the amount in stock in the beginning and at the end of the year of inventory. A mass balance can be made for single substances or groups of substances, and the total amount of emitted chemical is obtained by summing up the individual contributions. It is important to perform an in-depth investigation in order to include all relevant emissions from the large amount of chemicals. The tasks in a chemical focused approach are (1) Definition of chemicals to be included (2) Quantification of use amounts from Eq.(A) (3) Quantification of emission factors for each chemical.	NIR DK 2006

MS	Methodololy description	
Finland	The solvent and other product use contribute a small amount to GHG emissions in Finland. The only direct GHG source in the solvent and other product use is use of N_2O in industrial, medical and other applications reported under CRF category 3.D (Other). In Finland, N_2O is used in hospitals and by dentists to relieve pain and for detoxification. Under CRF categories 3.A (Paint application), 3.B (Degreasing and dry cleaning), 3.C (Chemical products, manufacture and processing) and 3.D (Other) Finland reports indirect GHG emissions (NMVOCs) and also indirect CO_2 emissions from NMVOC emissions. CRF category 3.A includes NMVOC emissions arising from the use of paints in industry and households. CRF category 3.B includes emissions from degreasing in metal and electronics industries and dry-cleaners. Under CRF category 3.C Finland reports NMVOC emissions from pharmaceutical, leather, plastic, textile industries, rubber conversion and manufacture of paints. The activities reported under CRF category 3.D (Other) causing NMVOC emissions are printing industry, preservation of wood, use of pesticides, glass and mineral wool enduction, domestic solvent use and fat and oil extraction in the Finnish inventory. Emissions are estimated using the following informations: $emission_{COT2T}$ = $Emissions_{NMVOC}$*Percent in NMVOCs by mass*44/12 *Paint application 3.A:* NMVOC emissions are based on the emissions calculated by the Association for Finnish Paint Industry, a questionnaire sent to non-members and other of this association and emission data from the Regional Environment Centres´ VAHTI database.) *Degreasing and dry cleaning 3.B:* NMVOC emissions are based on import statistics of pure chlorinated solvents, amount of products containing chlorinated organic solvents & amounts of solvent waste processed in hazardous waste treatment plant. *Chemical products, manufacture and processing 3.C:* The emissions are foremost from emission data of the Regional Environment Centres' VAHTI database. There are also sent questionnaires to companies in textile, plastic and paint industry in which they inform either amount of used solvent or emissions of their production processes. *Other 3.D:* The N_2O emissions are calculated by Statistics Finland. Tier 2 calculation method is consistent with the IPCC Guidelines. For estimation of N_2O emissions sales data is obtained from a few companies for the years 1990 and 1998. The emission estimation is base on assumption that all used N_2O is emitted to atmosphere the same year it is used. Very small part of emissions is estimated due to non response. The NMVOC emissions are based on the emission data of the Regional Environment Centres' VAHTI database, a questionnaire to presses and oil mills that do not report their emissions to VAHTI database, activity data from the Finnish Environment Institute's Chemical Divisions database and emission calculation of the Finnish Cosmetics, Toiletry and Detergents Association. Indirect CO_2 emissions from this category have been calculated using same equation as mentioned above.	NIR FI 2006
France	The activities of this category are important sources of NMVOC emissions. There are also N_2O emissions from the use of N_2O as anaesthesia estimated. The procedure to calculate the emisions from solvent use is based on statistics of paint and varnish consumption, adhesive consumption, tabac consumption, number of fireworks, capita data, national emission factors. The content of solvents is given by the industries.	NIR FR 2006
Germany	In this category emissions from the use of chemical products are summarised. At the present data are provided regarding the emission of solvents used in industry, trading and household as well as data regarding N_2O emissions. Up to now any emissions through direct use of CO_2 products are reported. Also atmospheric-chemical transformation processes like NMVOC to CO_2 are not reported. This source category comprises emissions from the use of chemical products. At present, it includes a calculation of emissions from the use of N_2O for narcotic purposes and data on the release of solvents from their use in industry, commerce and private households. The calculation of the emission is on basis of a "consumption-based emissions estimating".NMVOC emissions are calculated in keeping with a product-consumption-oriented approach. In this approach, the NMVOC quantities introduced into the source categories, via solvents or solvent-containing products, are determined and then NMVOC emissions are calculated via specific emission factors. This method is explicitly listed, under "consumption-based emissions estimating", as one of two methods that are to be used for emissions calculation for Sector 3. Use of this method is possible only with valid input figures – differentiated by source categories – in the following areas: • Quantities of VOC-containing (pre-) products and agents used in the reporting year, • The VOC concentrations in these products (substances and preparations), • The relevant application and emission conditions (or the resulting specific emission factor). To take account of the highly diverse internal structures of the 4 sub-categories 3A – 3D, these input figures are determined on the level of 37 differentiated source areas (in a manner similar to that used for SNAP Level 3), and the calculated NMVOC emissions are then aggregated. The product / substance quantities used are determined at the product-group level with the help of production and foreign-trade statistics. The so-determined domestic consumption quantities are then further verified via cross-checking with industry statistics, where such statistics are available. The average VOC concentrations and emission factors used are based on experts' assessments (expert opinions and industry dialog) relative to the various source categories and source-category areas. Other - N_2O (3.D): Calculation of N_2O emissions from the use of narcotics is based on an extrapolation of the statistical plant survey conducted in 1990. At the time, it was ascertained that one plant for the production of N_2O for narcotic purposes had existed in the former GDR. At the time, the plant had not yet been operational for long (it was constructed in 1988). The annual production capacity was approximately 1200 t. Research indicated that there were no exports or imports of this substance, and thus it was assumed that all of the substance was used for domestic consumption. Via the per-capita emission calculated from this for the former GDR, and assuming identical conditions, an N_2O emission of 6200 t for Germany was roughly estimated. Since then, this figure has been constantly updated.	NIR DE 2006

MS	Methodololy description	
Greece	Most solvents are part of a final product, e.g. paint, and will sooner or later evaporate to the atmosphere. This evaporation of solvent and other products containing volatile organic compounds represents a major source of NMVOC emissions that, once released into the atmosphere, will react with reactive molecules (mainly HO-radicals) or high energetic light to finally form CO_2. This sector also includes evaporative emissions of greenhouse gases arising from other types of product use (e.g. N_2O emissions from medical use). The calculation of NMVOC emissions requires a very detailed analysis of the use of solvents and other products containing volatile organic compounds. There are two basic approaches for the estimation of emissions from Solvent and Other Product Use, which depend on the availability of data on the activities producing emissions and the emission factors. • Production-based. In cases that solvent or coating use is associated with centralised industrial production activities (e.g. automobile and ship production), it is generally possible to develop NMVOC emission factors based on unit of product output. Next, annual emissions are estimated on the basis of production data. • Consumption-based. In many applications of paints, solvents and similar products, the end uses are too small-scale, diverse, and dispersed to be tracked directly. Therefore, emission estimates are generally based on total consumption (i.e. sales) of the solvents, paints, etc. used in these applications. The assumption is that once these products are sold to end users, they are applied and emissions generate relatively rapidly. Emission factors developed on the basis of this assumption can then be applied to data from sales for the specific solvent or paint products. The application of both approaches needs detailed activity data, concerning either e.g. the amount of pure solvent consumed or the amount of solvent containing products consumed. The availability of such activity data in Greece is limited and as a result the default CORINAIR methodology is applied for the estimation of NMVOC emissions. It should be mentioned that evaporative emissions of GHG arising from other types of product use (e.g. N_2O emissions from medical use), are not estimated since appropriate methodologies have not been developed yet. Carbon dioxide emissions are calculated from NMVOC emissions, assuming that the carbon content of NMVOC is 85%.	NIR GR 2006
Ireland	This source category is considered separately because of its importance in relation to the emissions of NMVOC which result from the use of solvents and various other volatile compounds. However, some minor direct uses of N_2O (such as anaesthesia) are covered in this source category and the IPCC reporting format also explicitly provides for the inclusion of CO_2 emissions that result from the oxidation of the carbon in VOC emissions. This is consistent with the overall approach adopted for estimating CO_2 from the combustion of fuels using the sectoral approach, where the CO_2 emissions are based on the full carbon content of the fuel even though some of the carbon is usually emitted as NMVOC or CO. The Irish inventories include an estimate of CO_2 emissions in this way but emissions associated with the direct use of N_2O are not estimated. The activity data used for computing estimates of CO_2 emissions in Solvent and Other Product Use are the mass emissions of NMVOC computed for the relevant source categories (3.A Paint Application, 3.B Degreasing and Dry Cleaning, 3.C Chemical Products and 3.D Other Solvent Uses). The Irish data used for this purpose are the VOC emissions compiled according to the CORINAIR methodology. The CO_2 emissions were derived by assuming that 85 percent of the mass emissions of NMVOC in the four categories is converted to CO_2.	NIR IE 2006
Italy	In this sector all non-combustion emissions from other industrial sectors than the manufacturing and energy industry are reported. The indirect CO_2 emissions, related to NMVOC emissions from solvent use in paint application, degreasing and dry cleaning, chemical products manufacturing or processing and other use, have been estimated. N_2O emissions have been included in the submission of this year. These emissions arise from the use of N_2O in medical applications, such as anaesthesia, and in food industry, where N_2O is used as a propelling agent in aerosol cans, specifically those used for whipped cream. Emissions of NMVOC from solvent use have been estimated according to the CORINAIR methodology with a bottom-up approach, applying both national and international emission factors. All the activities in the SNAP97 have been estimated. Country specific emission factors provided by several accredited sources have been used extensively, in particular for paint application, solvent use in dry cleaning, solvent use in textile finishing and in the tanning industries. Basic information from industry on percentage reduction of solvent content in paints and other products has been applied to EMEP/CORINAIR emission factors in order to evaluate the reduction in emissions during the considered period. The conversion of NMVOC emissions into CO_2 emissions has been carried out considering specific factor calculated on the basis of molecular weights and suggested by the EEA, except for emissions from the 3C sub-sector (double-counting). Emissions of N_2O have been estimated taking into account information made available by industrial associations. Specifically, the manufacturers and distributors association of N_2O products has supplied data on the use of N_2O for anaesthesia. For previous years, data have been estimated by the number of surgical beds published by national statistics. The Italian Association of Aerosol Producers has provided data on the annual production of aerosol cans.	NIR IT 2005
Luxembourg	The total amount of NMVOC emissions from solvents and other product use has been taken as a basis to calculate resulting CO_2 emissions. The following VOC emission estimates from this source categroy were done for 1990. Part of these data are based on estimations of various solvent application activities in Luxembourg as they were at the beginning of the 1990ies. In some sub-sectors, no statistical data on consumption of solvent containing products were available. Therefore part of the estimations are based on typical consumption estimates of products containing solvents for the neighbour countries of Luxembourg and/or for Europe. An update of these estimations of VOC emissions from solvents could lead to an improvement of the emission data.	NIR LU

MS	Methodololy description	
Netherlands	This sector comprises all non-combustion emissions from other sectors than the manufacturing and energy industry, except emissions from (A) Indirect CO_2 emissions from 3C chemical products, manufacture and processing; (B) Use of F-gases (HFCs, PFCs and SF_6); (C) Direct non-energy use of fuels (e.g. lubricants, waxes, etc.); (D) Several minor sources of CH_4 emissions from non-industrial, non-combustion sources. Country-specific carbon contents of the NMVOC emissions from 3A Paint application, 3B Degreasing and Dry Cleaning and 3D Other Product use are used to estimate indirect CO_2 emissions, as well as country-specific methods for estimating NMVOC emissions from these sources. The indirect CO_2 emissions from NMVOC are calculated from the average carbon contents of the NMVOC emissions reported in categories 3A, 3B and 3D. The carbon contents are based on the composition of compounds responsible for 85-95% of the total NMVOC emission within the category. Because of lack of data for 3C, the weigthed average of the other three is used to estimate the carbon fraction. The fractions are calculated based on the 1990 and 2000 emissions. This simplification is justified due to the small contribution of these emissions to the total inventory of national NMVOC emissions. Country-specific methodologies are used for the N_2O sources in sector 3. Since the emissions in this source category are from non-key sources for N_2O, the present methodology complies with the IPCC GPG.	NIR NL 2006
Portugal	Solvents and related compounds are a significant source of emissions of NMVOC. Although emissions of N_2O should also be included in this source, if resulting from use of this compound as component in specific applications, estimate for these sources are still un-available for Portugal. No emissions of methane are included in this source sector. *Paint Application (CRF 3A):* NMVOC emissions from use of coating materials are simply estimated using the following informations: (A) NMVOC emissions resulting from use/application of coating substances; (B) Use of coating substance p in economic activity; (C) NMVOV emission factor (solvent content) resulting from application of substance. Ultimate CO_2 emissions were calculated assuming that 85 percent of the mass emissions of NMVOC is carbon and it is converted to carbon dioxide in the atmosphere. *Degreasing and dry cleaning (CRF 3B):* emission will be equal to the amount of solvents used. If it is considered that annual consumption of solvents in an economic activity is used to replenish the quantity of solvent that was lost, them annual NMVOC emissions may be estimated from the annual consumption of solvent. This methodology overcomes the need of being aware of the portion of solvent that is recovered. In the case of the dry-cleaning activity it was assumed that either the solvent is lost directly to atmosphere, or if it is conveyed to water or retained in clothes, but it will eventually reach atmosphere by evaporation. For the dry cleaning sector other methodologies, based on quantities of washed cloths, are recommended by several authors (USEPA, 1981; EMEP/CORINAIR). However, in Portugal there is no sufficient information to use this other approach. *Chemical products, manufacture and processing (CRF 3C):* Emissions were estimated by the use of emission factors that are multiplied by the quantity of material produced: ActivityRate - Indicator of activity in the production process. Quantity of product produced per year as a general rule for this emission source sector; EF - emission factor *Other use of solvents and related activities (CRF 3D):* (A) *Ink:* Emissions were estimated by the use of emission factors that are multiplied by the quantity of material produced: Use of ink for printing product using technology during year and the Emission Factor (solvent content) of ink. (B) *edible and non edible oil extraction* Emissions of NMVOC were estimated considering that the annual hexane consumption by the industrial plant, hexane make-up, is due to losses to the air by using the information 'annual consumption of solvent in edible and non-edible oil industry, to replenish looses' (C) *glues and adhesives:* Emissions were estimated by the use of the information Consumption of Glues and Adhesives produced in Portugal, Emission factor for Glues and Adhesives produced in Portugal, Importation of Glues and Adhesives, Emission factor associated to the use of imported Glues and Adhesives. (D) wood preservation: Emissions were estimated by the use of the information Consumption of wood preservation products and Emission factor associated to the consumption of wood preservation products. (E) *perfumes and cosmetics use/waxes and polishing products/soaps and detergents:*Emissions are estimated from Information regarding use of perfumes and emission factor associated to the production and use of perfumes (F) *use of solvents from biomass:* Emissions are therefore estimated from: Total consumption of biological solvent in all activities and Consumption of biological solvents in activities where solvents are not emitted to atmosphere (For rosin derivatives total consumption is obtained from industrial production corrected from imports and exports); (G) *other uses of synthetic solvents from fossil fuels* by using the quantity of produced solvents.	NIR PT 2006
Spain	-	

MS	Methodololy description	
Sweden	Estimates reported in this sector include emissions from paint application (CRF 3A), degreasing and dry-cleaning (CRF 3B), chemical products, manufacture and processing (CRF 3C) and other solvent use (CRF 3D). A new method was developed during 2005 in order to obtain all activity data concerning solvent and other product use from the Products register hosted by the Swedish Chemicals Inspectorate. The Products register is a register over chemical products imported to or manufactured in Sweden. Emissions of NMVOC from glues manufacturing have been allocated to CRF 2B5, of which parts should probably be allocated to 3C, due to industries that produce glue often produce other chemical products as well, and therefore they have been classified as chemical industry in the Products register. Reliably activity data, for this purpose, can only be obtained from 1995. A list of substances that are defined as NMVOC, and can be found in the Products register in a quantity over 100 tonnes, has been compiled. The certain definition of NMVOC has been used (Council Directive 1999/13/EC of 11 March 1999 and UNECE Emission Reporting Guidelines) The list includes 344 substances (Cas-nr, name, carbon contents for each substance). The substance list has been used to extract quantities of NMVOC and C in substances that can be found in the Products register. Data extractions have been made for each year from 1995 to 2003. The extractions show for each year: (A) The intended use of the product, the type of product; (B) Industry to which the product is sold; (C) Quantity NMVOC; (D) Quantity C A connection diagram has been compiled in order to combine all combinations of "product codes" and "industry categories" for all years. For all combinations a judgment has been made to select if the combination should be included in the reporting or not. If the combination should be included it has been given a specific CRF code. An Excel macro has been written in order to compile time series with quantities of NMVOC and C for each CRF code. The quantities of NMVOC used as raw material in processes have been identified and treated separately from the other quantities for each CRF code, because most of the solvents used as raw material will not be emitted. The sold amount of solvent is not always identical to the amount of solvent used and therefore the time series has been recalculated using a running average over three years. This means that reported emissions for two years need to be updated in every new submission. Country specific emission factors have been developed for each CRF code, one for quantities defined as raw material and one for the other quantities. The emission factors for raw material have been set very low, since most of the solvents will end up in the product and will not be emitted during production.	NIR SE 2006
United Kingdom	*3A – Paint Application:* NMVOC Emission estimates for most types of coatings are based on annual consumption data and emission factors provided by the British Coatings Federation. Emission estimates for drum coatings, metal packaging and OEM coatings are estimated instead using a combination of consumption data and emission factors and estimates made on a plant by plant basis using information supplied by the Metal Packaging Manufacturers Association and the regulators of individual sites. *3B – Degreasing and Dry Cleaning:* NMVOC Emission estimates for surface cleaning processes are based on estimates of annual consumption and emission factors. Consumption estimates are based on data from UK industry sources and UK and European trade associations, together with some published data. Some extrapolation of data is necessary, using Index of Output data produced annually by the Office for National Statistics (ONS), although this is not expected to introduce significant uncertainty into the estimates. Emission factors assume that all hydrocarbon and oxygenated solvent is emitted, while emission factors for chlorinated solvents are lower, reflecting the fact that some solvent is sent for disposal rather than emitted. Emission estimates for dry cleaning are based on estimates of solvent consumption by the sector. Industry-sourced data are available for some years and estimates for the remaining years are based on a model of the sector, which takes account of changes in the UK population and the numbers of machines of different types and with different emission levels. Emission estimates for leather degreasing are based on a single estimate of solvent use extrapolated to all years using the Index of Output for the leather industry, which is produced annually by the ONS. *3C – Chemical Products, Manufacture and Processing:* NMVOC Emission estimates for coating of film, leather, and textiles as well as estimates for tyre manufacture are based on plant-by-plant emission estimates, made on the basis of information available from regulators. Emissions from coating manufacture are calculated from the solvent contained in coatings produced in the UK, by assuming that an additional 2.5% of solvent was lost during manufacture. Emissions from the manufacture of rubber goods other than tyres are based on solvent consumption estimates provided by the British Rubber Manufacturers Association (BRMA), which are extrapolated to other years on the basis of the Index of Output figures for the rubber industry which are published each year by the ONS. *3D – OTHER:* Emission estimates are based on one of three approaches: 1. Estimates are made based on activity data and emission factors supplied by industry sources (printing processes, consumer products, wood preservation) 2. Estimates are made for each process in a sector based on information provided by regulators or process operators (seed oil extraction, pressure sensitive tapes, paper coating) 3. Estimates are based on estimates of solvent consumption supplied by industry sources (adhesives, aerosols, agrochemicals, miscellaneous solvent use).	NIR GB 2006

5.3 Sector-specific quality assurance and quality control

There are no sector-specific QA/QC procedures for this sector.

5.4 Sector-specific recalculations

Table 5.6 shows that in the solvent sector only minor recalculations were made (in particular in absolute terms). In relative terms, the highest recalculation was made for N_2O.

Table 5.6 Recalculations of total greenhouse gas emissions and recalculations of greenhouse gas emissions in CRF Sector 3, 'Solvent and other product use', for 1990 and 2003 by gas (Gg and %)

1990	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
	Gg	percent	Gg	percent	Gg	percent	Gg	percent	Gg	percent	Gg	percent
Total emissions and removals	36,029	1.2%	-12,408	-2.8%	5,977	1.5%	839	3.1%	1,074	6.8%	569	5.5%
Solvent and other product use	-248	-3.9%	0	0.0%	159	4.0%	NO	NO	NO	NO	NO	NO
2003												
Total emissions and removals	63,546	2.0%	-5,239	-1.6%	4,431	1.3%	614	1.2%	1,050	18.8%	-429	-4.6%
Solvent and other product use	-168	-3.2%	0	0.0%	-887	-22.4%	NO	NO	NO	NO	NO	NO

Table 5.7 provides an overview of Member States' contributions to EU-15 recalculations. Germany, Denmark and Belgium contributed the most to the EC recalculations.

Table5.7 Contribution of Member States to EU-15 recalculations in CRF Sector 3: 'Solvent and other product use' for 1990 and 2003 by gas (difference between latest submission and previous submission Gg of CO_2 equivalents)

	1990						2003					
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6
Austria	0	0	0	NO	NO	NO	-3	0	0	NO	NO	NO
Belgium	NE	0	-7	NO	NO	NO	NE	0	-133	NO	NO	NO
Denmark	-180	0	0	NO	NO	NO	-98	0	0	NO	NO	NO
Finland	116	0	0	NO	NO	NO	64	0	0	NO	NO	NO
France	-6	0	0	NO	NO	NO	34	0	0	NO	NO	NO
Germany	NE	0	167	NO	NO	NO	NE	0	-748	NO	NO	NO
Greece	-1	0	0	NO	NO	NO	0	0	0	NO	NO	NO
Ireland	-11	0	0	NO	NO	NO	-35	0	0	NO	NO	NO
Italy	-149	0	0	NO	NO	NO	-2	0	0	NO	NO	NO
Luxembourg	-3	0	0	NO	NO	NO	0	0	0	NO	NO	NO
Netherlands	0	0	0	NO	NO	NO	-20	0	-7	NO	NO	NO
Portugal	0	0	0	NO	NO	NO	0	0	0	NO	NO	NO
Spain	62	0	0	NO	NO	NO	-76	0	0	NO	NO	NO
Sweden	-78	0	0	NO	NO	NO	-31	0	0	NO	NO	NO
UK	NE	0	0	NO	NO	NO	NE	0	0	NO	NO	NO
EU15	**-248**	**0**	**159**	**NO**	**NO**	**NO**	**-168**	**0**	**-887**	**NO**	**NO**	**NO**

Abbreviations explained in the Chapter 'Units and abbreviations'.

6 Agriculture (CRF Sector 4)

Half of the European Union's land is farmed. This fact alone highlights the importance of farming for the EU's natural environment. Farming and nature exercise a profound influence over each other. Farming has contributed over the centuries to creating and maintaining a variety of valuable semi-natural habitats. Today these shape the majority of the EU's landscapes and are home to many of the EU's richest wildlife. Farming also supports a diverse rural community that is not only a fundamental asset of European culture, but also plays an essential role in maintaining the environment in a healthy state[19].

The links between the richness of the natural environment and farming practices are complex. While many valuable habitats in Europe are maintained by extensive farming, and a wide range of wild species rely on this for their survival, agricultural practices can also have an adverse impact on natural resources. Pollution of soil, water and air, fragmentation of habitats and loss of wildlife can be the result of inappropriate agricultural practices and land use.

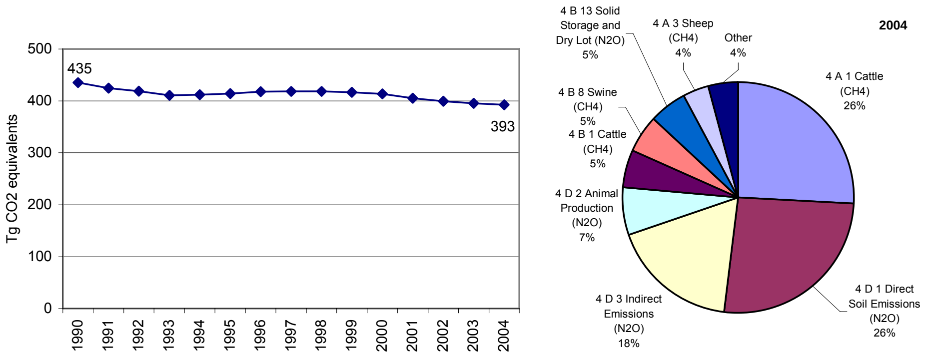
6.1 Overview of the sector

CRF Sector 4 ‘Agriculture’ contributes 9 % to total EU-15 GHG emissions, making it the second largest sector after ‘Energy’. The most important GHGs from ‘Agriculture’ are N_2O and CH_4 accounting for 5 % and 4 % of the total GHG emissions respectively. The emissions from this sector decreased by 10 % from 435 Tg in 1990 to 393 Tg in 2004 (Figure 6.1). In 2004, the emissions decreased by 0.7 % compared to 2003. The key sources in this sector are:

4 A 1 Cattle: (CH_4)
4 A 3 Sheep: (CH_4)
4 B 1 Cattle: (CH_4)
4 B 13 Solid Storage and Dry Lot: (N_2O)
4 B 8 Swine: (CH_4)
4 D 1 Direct Soil Emissions: (N_2O)
4 D 2 Pasture, Range and Paddock Manure: (N_2O)
4 D 3 Indirect Emissions: (N_2O)

Figure 6.1 shows that the three largest key sources account for about 70% of agricultural GHG emissions of the EU-15.

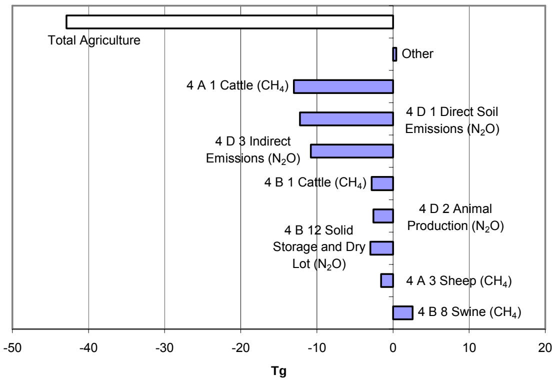
Figure 6.1 EU-15 GHG emissions for 1990–2004 from CRF Sector 4: ‘Agriculture’ in CO_2 equivalents (Tg) and share of largest key source categories in 2004



[19] http://europa.eu.int/comm/agriculture/envir/index_en.htm

Figure 6.2 shows that large reductions occurred in the largest key sources CH_4 from 4.A.1: 'Cattle' and N_2O from 4.D.1: 'Direct soil emissions'. The main reasons for this are declining cattle numbers and decreasing use of fertiliser and manure in most Member States.

Figure 6.2 Absolute change of GHG emissions by large key source categories 1990–2004 in CO_2 equivalents (Tg) in CRF Sector 4: 'Agriculture'



6.2 Source Categories

6.2.1 Enteric fermentation (CRF Source Category 4.A)

Table 6.1 summarises information by Member State on methodologies, emission factors, completeness and qualitative uncertainty estimates for CH_4 from 4.A: 'Enteric fermentation'. Between 1990 and 2004, CH_4 emission from 'Enteric fermentation' decreased by 10 %. The relative decrease was largest in Germany, the relative increase was largest in Spain.

This source category includes two key sources: CH_4 from 4.A.1: 'Cattle' and CH_4 from 4.A.3: 'Sheep'.

Table 6.1 Member States' contributions to CH_4 emissions from 4.A: 'Enteric fermentation' and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1]	EF [1]
Austria	3.762	3.275	T1,T2	CS,D
Belgium	4.556	3.908	M	CS
Denmark	3.259	2.711	T1	CS
Finland	1.918	1.590	CS,D,T1,T2	CS,D
France	30.872	27.834	C	CS
Germany	24.424	18.544	T1, CS, C, D	T1, CS, C, D
Greece	2.866	2.886	NA,T1,T2	CS,D,NA
Ireland	9.338	9.233	T1,T2	CS,D
Italy	12.178	10.831	T1, T2	D, CS
Luxembourg	346	301	C/D	C/D
Netherlands	7.525	6.348	T1,T2	CS,D
Portugal	2.622	3.012	T2	D+CS
Spain	11.780	13.706	CS,NA,T1,T2	CS,D,NA
Sweden	3.020	2.835	CS,NA,T1,T2	CS,D,NA
United Kingdom	18.173	16.114	T1	CS,D
EU15	136.638	123.127	C, CS, D, M, T1, T2,NA	C,CS,D,T1,NA

([1]) Information source: CRF Summary Table 3 for 2004.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Enteric fermentation from cattle is the largest single source of CH_4 emissions in the EU-15 accounting for 2.4 % of total GHG emissions in 2004. Between 1990 and 2004, CH_4 emissions from enteric fermentation from cattle declined by 11 % in the EU-15 (Table 6.2). In 2004, the emissions were 1,3 % lower compared to 2003. The main driving force of CH_4 emissions from enteric fermentation is the number of cattle, which was 14 % below 1990 levels in 2004. The Member States with most emissions from this source were France and Germany (42%). All Member States except Ireland, Spain and Portugal reduced CH_4 emissions from enteric fermentation of cattle between 1990 and 2004.

Table 6.2 Member States' contributions to CH_4 emissions from 4.A.1: 'Cattle'

Member State	Greenhouse gas emissions (Gg CO_2			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	3.561	3.061	3.072	3,0%	11	0%	-489	-14%	T2	NS	CS
Belgium	4.301	3.717	3.665	3,6%	-52	-1%	-636	-15%	M	NS	CS
Denmark	2.950	2.400	2.305	2,3%	-95	-4%	-645	-22%	T2	NS	CS
Finland	999	815	805	0,8%	-10	-1%	-195	-19%	T2	NS	CS
France	28.364	26.054	25.653	25,2%	-400	-2%	-2.711	-10%	C	NS	CS
Germany	22.913	17.680	17.151	16,9%	-529	-3%	-5.762	-25%	T2	RS	CS
Greece	866	811	807	0,8%	-4	0%	-59	-7%	T1	NS	D
Ireland	8.269	8.299	8.327	8,2%	28	0%	57	1%	T2	NS	CS
Italy	10.039	8.878	8.641	8,5%	-237	-3%	-1.398	-14%	T2	NS	D, CS
Luxembourg	342	311	295	0,3%	-17	-5%	-47	-14%	C/D		C/D
Netherlands	6.767	5.721	5.712	5,6%	-9	0%	-1.055	-16%	T2	NS	CS
Portugal	1.814	2.059	2.111	2,1%	51	2%	296	16%	T2	NS	CS
Spain	6.473	8.500	8.388	8,2%	-113	-1%	1.914	30%	T2, CS	NS	D, CS
Sweden	2.729	2.514	2.554	2,5%	40	2%	-176	-6%	CS	NS	CS
United Kingdom	13.484	12.165	12.185	12,0%	20	0%	-1.299	-10%	T2	NS	CS/D
EU15	113.874	102.986	101.669	100,0%	-1.316	-1%	-12.204	-11%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Enteric fermentation from sheep is the seventh largest single source of CH_4 emissions in the EU-15 and accounts for 0.3 % of total GHG emissions in 2004. Between 1990 and 2004, CH_4 emissions from enteric fermentation of sheep declined by 10% in the EU-15 (Table 6.3). In 2004, the emissions were 1 % lower compared to 2003. The main driving force of CH_4 emissions from enteric fermentation is the number of sheep, which was 13 % below 1990 levels in 2004. The Member States with most emissions from this source were Spain and the United Kingdom (53 %). Nine Member States reduced CH_4 emissions from enteric fermentation of sheep, six states did not.

Table 6.3 Member States' contributions to CH_4 emissions from 4.A.3: 'Sheep'

Member State	Greenhouse gas emissions (Gg CO_2			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	52	55	55	0,4%	0	1%	3	6%	T1	NS	D
Belgium	33	25	26	0,2%	1	3%	-8	-22%	M	NS	CS
Denmark	33	30	29	0,2%	-1	-5%	-5	-14%	T2	NS	CS
Finland	15	15	17	0,1%	2	11%	2	13%	T1	NS	CS
France	1.923	1.565	1.548	10,7%	-17	-1%	-375	-19%	C	NS	D
Germany	630	462	462	3,2%	0	0%	-168	-27%	T1	RS	D
Greece	1.350	1.411	1.416	9,8%	5	0%	66	5%	T2	NS	CS
Ireland	1.032	861	861	5,9%	0	0%	-172	-17%	T2	NS	D
Italy	1.468	1.336	1.362	9,4%	26	2%	-106	-7%	T1	NS	D, CS
Luxembourg	1	1	2	0,0%	0	14%	0	33%	C/D		C/D
Netherlands	286	200	208	1,4%	8	4%	-78	-27%	T1	NS	D
Portugal	560	646	696	4,8%	50	8%	136	24%	T2	NS	CS
Spain	4.258	4.321	4.119	28,4%	-202	-5%	-139	-3%	T2, CS	NS	D, CS
Sweden	68	75	78	0,5%	3	4%	10	15%	T1	NS	D
United Kingdom	4.354	3.616	3.627	25,0%	11	0%	-727	-17%	T2	NS	CS/D
EU15	16.063	14.619	14.504	100,0%	-115	-1%	-1.559	-10%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 6.4 provides information on the contribution of Member States to EC recalculations in CH_4 from 4.A 'Enteric fermentation' for 1990 and 2003 and main explanations for the largest recalculaltions in absolute terms.

Table 6.4 Contribution of MS to EC recalculations in CH_4 from 4.A 'Enteric fermentation' for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

	1990		2003		Main explanations
	Gg	Percent	Gg	Percent	
Austria	188	5,3	173	5,6	
Belgium	62	1,4	-52	-1,3	
Denmark	149	4,8	67	2,5	
Finland	50	2,7	73	4,7	
France	-18	-0,1	-52	-0,2	
Germany	-9.869	-28,8	-6.096	-24,2	Update of provisional activity data Revised emissions factor (Tier 2) Animal number after 1998 was recalculated due to changes in German census system in 1999
Greece	5	0,2	0	0,0	
Ireland	158	1,7	-90	-1,0	
Italy	-164	-1,3	122	1,1	
Luxembourg	0	0,0	0	0,0	
Netherlands	203	2,8	289	4,8	
Portugal	28	1,1	419	16,8	
Spain	-872	-6,9	-924	-6,2	
Sweden	-6	-0,2	-23	-0,8	
UK	0	0,0	-102	-0,6	
EU15	**-10.085**	**-6,9**	**-6.196**	**-4,7**	

6.2.2 Manure management (CRF Source Category 4.B)

Table 6.5 summarises information by Member State on methodologies, emission factors, completeness and qualitative uncertainty estimates for CH_4 from 4.B: 'Manure management'. Between 1990 and 2004, CH_4 emission from 'Manure management' did not change. The relative decrease was largest in the Netherlands and Austria, the relative increase was largest in Spain.

This source category includes two key sources: CH_4 from 4.B.1: 'Cattle' and CH_4 from 4.B.8: 'Swine'.

Table 6.5 Member States' contributions to CH_4 emissions from 4.B: 'Manure management' and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1]	EF [1]
Austria	1.060	880	T1,T2	CS,D
Belgium	2.686	2.418	M	CS
Denmark	752	1.030	T2	CS
Finland	231	250	T2	CS
France	13.799	13.057	C/ T1	D/ CS
Germany	6.071	5.209	C, D, T1	C,D
Greece	497	487	T1	D
Ireland	2.226	2.165	T1,T2	CS,D
Italy	3.462	3.235	T1, T2	D, CS
Luxembourg	24	21	C/D	C/D
Netherlands	2.969	2.466	T2	CS
Portugal	1.176	1.158	T2	D (CS)
Spain	6.231	8.896	CS,NA,T1,T2	CS,D,NA
Sweden	354	457	NA,T1,T2	CS,D,NA
United Kingdom	2.923	2.568	T1,T2	CS,D
EU15	44.461	44.295	C, CS, D, M, T1, T2,NA	C,CS,D,NA

([1]) Information source: CRF Summary Table 3 for 2004.
Abbreviations explained in the Chapter 'Units and abbreviations'.

CH_4 emissions from 4.B.1: 'Cattle' account for 0.5 % of total EU-15 GHG emissions in 2004. Between 1990 and 2004, CH_4 emissions from this source decreased by 12 % (Table 6.6). Germany and France are responsible for 55% of the total EU-15 emissions from this source. All Member States except Portugal and Sweden had reductions between 1990 and 2004. In absolute terms, France had the most significant decreases from this source.

Table 6.6 Member States' contributions to CH_4 emissions from 4.B.1: 'Cattle'

Member State	Greenhouse gas emissions (Gg CO_2			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	587	471	469	2,3%	-2	0%	-118	-20%	T2	NS	CS
Belgium	1.131	951	932	4,6%	-19	-2%	-199	-18%	M	NS	CS
Denmark	282	280	272	1,3%	-8	-3%	-10	-4%	T2	NS	CS
Finland	66	66	64	0,3%	-2	-4%	-2	-3%	T2	NS	CS
France	8.773	7.860	7.902	38,8%	42	1%	-871	-10%	C/T1	NS	CS, D
Germany	4.217	3.502	3.395	16,7%	-107	-3%	-821	-19%	T2/CS	RS	CS
Greece	202	189	188	0,9%	-1	0%	-14	-7%	T1	NS	D
Ireland	1.850	1.669	1.667	8,2%	-3	0%	-183	-10%	T2	NS	CS
Italy	1.636	1.346	1.306	6,4%	-39	-3%	-330	-20%	T2	NS	D, CS
Luxembourg	22	21	19	0,1%	-1	-6%	-3	-14%	C/D		C/D
Netherlands	1.574	1.432	1.475	7,2%	43	3%	-99	-6%	T2	NS	CS
Portugal	47	65	68	0,3%	2	4%	21	45%	T2	NS	CS
Spain	473	475	462	2,3%	-13	-3%	-10	-2%	T2, CS	NS	D, CS
Sweden	218	296	300	1,5%	4	1%	82	37%	T2	NS	CS
United Kingdom	2.114	1.884	1.867	9,2%	-17	-1%	-247	-12%	T2	NS	CS/D
EU15	23.192	20.508	20.385	100,0%	-122	-1%	-2.806	-12%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

CH_4 emissions from 4.B.8: 'Swine' account for 0.5 % of total EU-15 GHG emissions in 2004. Between 1990 and 2004, CH_4 emissions from this source increased by 14% (Table 6.7). France and Spain are responsible for 59% of the total EU-15 emissions from this source. In absolute terms, Spain had the most significant increases from this source while the UK had the largest reductions.

Table 6.7 Member States' contributions to CH_4 emissions from 4.B.8: 'Swine'

Member State	Greenhouse gas emissions (Gg CO_2			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	448	410	385	1,8%	-25	-6%	-62	-14%	T2	NS	CS
Belgium	1.432	1.384	1.356	6,5%	-28	-2%	-76	-5%	M	NS	CS
Denmark	448	705	720	3,4%	15	2%	271	61%	T2	NS	CS
Finland	81	102	101	0,5%	-1	-1%	20	24%	T2	NS	CS
France	4.268	4.502	4.418	21,1%	-84	-2%	150	4%	C/T1	NS	D, CS
Germany	1.616	1.581	1.539	7,4%	-42	-3%	-77	-5%	T2/CS	RS	CS
Greece	146	142	141	0,7%	0	0%	-5	-3%	T1	NS	D
Ireland	328	445	444	2,1%	-1	0%	117	36%	T1	NS	D
Italy	1.432	1.504	1.472	7,0%	-32	-2%	40	3%	T2	NS	D, CS
Luxembourg	1	1	1	0,0%	0	40%	0	40%	C/D		C/D
Netherlands	1.141	918	919	4,4%	1	0%	-222	-19%	T2	NS	CS
Portugal	1.087	1.037	1.035	4,9%	-2	0%	-52	-5%	T2	NS	CS
Spain	5.329	7.412	7.937	38,0%	525	7%	2.608	49%	T2, CS	NS	D, CS
Sweden	99	122	117	0,6%	-5	-4%	18	18%	T2	NS	CS
United Kingdom	476	318	325	1,6%	7	2%	-150	-32%	T2	NS	CS/D
EU15	18.332	20.582	20.911	100,0%	329	2%	2.579	14%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 6.8 provides information on the contribution of Member States to EC recalculations in CH_4 from 4.B 'Manure management' for 1990 and 2003 and main explanations for the largest recalculations in absolute terms.

Table 6.8 Contribution of MS to EC recalculations in CH_4 from 4.B 'Manure management' for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

	1990		2003		Main explanations
	Gg	Percent	Gg	Percent	
Austria	40	3,9	21	2,4	
Belgium	120	4,7	11	0,5	
Denmark	9	1,2	48	5,0	
Finland	16	7,3	33	15,0	
France	5	0,0	25	0,2	
Germany	-21.027	-77,6	-17.751	-76,8	Update of provisional activity data Revised emissions factor (Tier 2) Animal number after 1998 was recalculated due to changes in German census system in 1999
Greece	0	0,0	0	0,0	
Ireland	965	76,6	822	60,9	
Italy	-564	-14,0	-503	-13,2	
Luxembourg	0	-1,7	0	0,0	
Netherlands	0	0,0	-2	-0,1	
Portugal	-382	-24,5	-233	-16,8	
Spain	10	0,2	-268	-3,1	
Sweden	-6	-1,7	-3	-0,7	
UK	0	0,0	-25	-1,0	
EU15	**-20.814**	**-31,9**	**-17.823**	**-28,8**	

Table 6.9 summarises information by Member State on methodologies, emission factors, completeness and qualitative uncertainty estimates for N_2O from 4.B: 'Manure management'. Between 1990 and 2004, N_2O emission from 'Manure management' decreased by 11 %. The relative decrease was largest in Germany and Sweden, the relative increase was largest in Spain.

This source category includes one key source: N_2O from 4.B.12: 'Solid storage.

Table 6.9 Member States' contributions to N_2O emissions from 4.B: 'Manure management' and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1)]	EF [1)]
Austria	1.005	886	T1	CS
Belgium	964	873	D	D
Denmark	685	561	CS	D
Finland	666	554	D	D
France	6.894	6.117	C/ T1	D/ CS
Germany	4.128	2.840	C,CS	D
Greece	301	281	D,NA	D,NA
Ireland	406	412	T1	D
Italy	4.518	4.125	D	D, CS
Luxembourg	0	0	C/D	C/D
Netherlands	694	707	T2	D
Portugal	563	577	T2	D (CS)
Spain	2.465	2.962	CS,D,NA	D,NA
Sweden	743	544	NA,T2	D,NA
United Kingdom	1.514	1.254	T1	D
EU15	25.547	22.695	C,CS,D,T1,T2,NA	C, CS, D,NA

([1]) Information source: CRF Summary Table 3 for 2004.
Abbreviations explained in the Chapter 'Units and abbreviations'.

N_2O emissions from 4.B.13 : 'Solid storage and dry lot' account for 0.5 % of total EU-15 GHG emissions in 2004. Between 1990 and 2004, N_2O emissions from this source decreased by 12 % (Table 6.10). Italy and France are responsible for 46 % of the total EU-15 emissions from this source. In absolute terms, Germany had the most significant decrease from this source while Spain had the largest increases. In relative terms, Sweden had the largest decrease from 1990-2004.

Table 6.10 Member States' contributions to N_2O emissions from 4.B.13: 'Solid storage and dry lot'

Member State	Greenhouse gas emissions (Gg CO_2			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	965	852	849	4,1%	-3	0%	-116	-12%	T1	NS	D, CS
Belgium	897	793	807	3,9%	14	2%	-90	-10%	D	NS	D
Denmark	589	481	484	2,3%	3	1%	-105	-18%	T1	NS	D
Finland	653	536	538	2,6%	2	0%	-115	-18%	T1	NS/AS	D
France	6.660	6.042	5.888	28,2%	-154	-3%	-771	-12%	C/T1	NS	D, CS
Germany	3.685	2.521	2.462	11,8%	-59	-2%	-1.222	-33%	-	-	-
Greece	282	262	261	1,2%	-1	-1%	-21	-7%	D	NS	D
Ireland	350	357	356	1,7%	-1	0%	6	2%	T1	NS	D
Italy	4.356	3.859	3.715	17,8%	-144	-4%	-641	-15%	D	NS	D, CS
Luxembourg	0	0	0	0,0%	0	-	0	-	C/D		C/D
Netherlands	515	505	577	2,8%	71	14%	62	12%	T2	NS	D
Portugal	548	568	562	2,7%	-6	-1%	14	3%	D	NS	D+CS
Spain	2.387	2.819	2.855	13,7%	36	1%	468	20%	D, CS	NS	D
Sweden	663	415	420	2,0%	5	1%	-243	-37%	T2	NS	D
United Kingdom	1.280	1.082	1.094	5,2%	12	1%	-186	-15%	T2	NS	CS/D
EU15	23.829	21.092	20.868	100,0%	-225	-1%	-2.962	-12%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

N_2O emissions from 4.B.14: 'Other' account for 0.01 % of total EU-15 GHG emissions in 2004. Between 1990 and 2004, N_2O emissions from this source decreased by 94 % (Table 6.11). Italy is responsible for 52 % of the total EU-15 emissions from this source and had the most significant increases from this source in absolute terms.

Table 6.11 Member States' contributions to N_2O emissions from 4.B.14: 'Other'

Member State	Greenhouse gas emissions (Gg CO_2			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	17	16	16	3,1%	0	0%	-1	-3%	T1	NS	D
Belgium	3	9	10	1,8%	1	10%	7	205%	D	NS	D
Denmark	NO	NO	NO	-	-	-	-	-	NO	NO	NO
Finland	NE	NE	NE	-	-	-	-	-	D	AS, Q	D
France	0	0	0	0,0%	0	-	0	-	C, T1	NS	D, CS
Germany	0	0	0	0,0%	0	-	0	-			
Greece	13	14	14	2,6%	0	1%	1	11%	D	NS	D
Ireland	NO	NO	NO	-	-	-	-	-	T1	NS	CS, D
Italy	0	275	275	51,9%	0	0%	275	-			
Luxembourg	0	0	0	0,0%	0	-	0	-			
Netherlands	NO	NO	NO	-	-	-	-	-	CS	NS	CS
Portugal	0	0	0	0,0%	0	-	0	-	D	NS	D, CS
Spain	0	0	0	0,0%	0	-	0	-	D, CS	NS	D
Sweden	65	100	102	19,3%	2	2%	37	57%	T1	NS	D
United Kingdom	175	174	113	21,3%	-61	-35%	-62	-36%	T1	NS, RS	D, CS
EU15	273	589	530	100,0%	-58	-10%	257	94%			

Abbreviations explained in the Chapter 'Units and abbreviations'.
Emissions of Finland were not estimated due to lack of data.

Table 6.12 provides information on the contribution of Member States to EC recalculations in N_2O from 4.B 'Manure management' for 1990 and 2003 and main explanations for the largest recalculations in absolute terms.

Table 6.12 Contribution of MS to EC recalculations in N_2O from 4.B 'Manure management' for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

	1990		2003		Main explanations
	Gg	Percent	Gg	Percent	
Austria	219	27,8	186	26,4	
Belgium	-11	-1,1	-31	-3,5	
Denmark	0	0,0	-2	-0,4	
Finland	43	6,8	91	19,6	
France	-4	-0,1	-25	-0,4	
Germany	-347	-7,8	-24	-0,8	
Greece	0	0,0	0	0,0	
Ireland	-221	-35,3	-246	-37,3	
Italy	689	18,0	300	7,5	Updated nitrogen excretion rates and average weight from different livestock categories
Luxembourg	0	0,0	0	0,0	
Netherlands	25	3,7	40	6,7	
Portugal	-380	-40,3	-449	-43,5	
Spain	833	51,1	1.312	81,7	No information available
Sweden	-55	-6,9	-23	-4,0	
UK	0	0,0	-16	-1,2	
EU15	**790**	**3,2**	**1.113**	**5,1**	

6.2.3 Agricultural soils (CRF Source Category 4.D)

Table 6.13 summarises information by Member State on methodologies, emission factors, completeness and qualitative uncertainty estimates for N_2O from 4.D: 'Agricultural soils'. N_2O emissions from 4.D: 'Agricultural soils' decreased by 11 % between 1990 and 2004. Most EU-15 Member States decreased emissions.

This source category includes three key sources: N_2O from 4.D.1:'Direct soil emissions', N_2O from 4.D.2:' Animal production', and N_2O from 4.D.3: 'Indirect emissions'.

Table 6.13 Member States' contributions to N_2O emissions from 4.D: 'Agricultural soils' and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1)]	EF [1)]
Austria	3.287	2.812	T1	D
Belgium	4.597	3.929	D	CS
Denmark	8.352	5.699	CS	CS
Finland	4.293	3.241	D	CS,D
France	56.087	49.373	C/ T1	D/ CS
Germany	44.351	38.023	C,CS	C,D
Greece	9.749	8.146	D,NA,T1a,T1b	D,NA
Ireland	7.271	7.171	T1a,T1b	CS,D
Italy	19.441	18.626	D	D, CS
Luxembourg	146	146	C/D	C/D
Netherlands	10.791	8.708	T1,T1b,T2,T3	CS,D
Portugal	3.225	3.472	D	D+CS
Spain	19.064	21.042	CS, T1b,NA,T1a	D,NA
Sweden	5.251	4.811	T1a/T1b/CS	CS,D
United Kingdom	30.407	25.281	T1,T1a,T2	CS,D
EU15	226.311	200.480	C,CS,D,T1, T1a,T1b,T2,NA	C,CS,D,NA

([1]) Information source: CRF Summary Table 3 for 2004.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 6.14 provides information on emission trends of the key source from 4.D.1: 'Direct soil emissions' by Member State. Direct N_2O emissions from agricultural soils is the largest source category of N_2O emissions and accounts for 2.4 % of total EU-15 GHG emissions in 2004. Direct N_2O emissions from agricultural soils occur from the application of mineral nitrogen fertilisers and organic nitrogen from animal manure. Between 1990 and 2004, emissions declined by 11 % in the EU-15, compared to 2003 they dereased by 0.3 %. The Member States with most emissions from this source were France and Germany. All Member States except Portugal, Spain and the Netherlands reduced N_2O emissions from agricultural soils.

The main driving force of direct N_2O emissions from agricultural soils is the use of nitrogen fertiliser and animal manure, which were 16 % and 9 % respectively below 1990 levels in 2004. N_2O emissions from agricultural land can be decreased by overall efficiency improvements of nitrogen uptake by crops, which should lead to lower fertiliser consumption on agricultural land. The decrease of fertiliser use is partly due to the effects of the 1992 reform of the common agricultural policy and the resulting shift from production-based support mechanisms to direct area payments in arable production. This has tended to lead to an optimisation and overall reduction in fertiliser use. In addition, reduction in fertiliser use is also due to directives such as the nitrate directive and to the extensification measures included in the agro-environment programmes (EC, 2001).

Table 6.14 Member States' contributions to N_2O emissions from 4.D.1: 'Direct soil emissions'

Member State	Greenhouse gas emissions (Gg CO_2			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	1.751	1.563	1.496	1,5%	-66	-4%	-255	-15%	T1a,b	NS	D
Belgium	2.471	2.214	2.166	2,1%	-47	-2%	-304	-12%	D	NS	CS
Denmark	4.225	2.929	2.942	2,9%	13	0%	-1.283	-30%	D/CS	NS	D
Finland	3.361	2.567	2.494	2,4%	-73	-3%	-867	-26%	T1a	NS/AS	D/CS
France	26.498	22.525	23.248	22,6%	723	3%	-3.250	-12%	C/T1	NS	D, CS
Germany	28.401	24.420	24.539	23,9%	118	0%	-3.862	-14%	T1	RS	D
Greece	2.760	1.751	1.704	1,7%	-47	-3%	-1.056	-38%	T1a,T1b[6]	NS/IS	D
Ireland	3.048	3.126	2.986	2,9%	-140	-4%	-62	-2%	T1a, T1b	NS	D
Italy	9.609	9.170	9.308	9,1%	138	2%	-300	-3%	D	NS	D, CS
Luxembourg	146	146	146	0,1%	0	-	0	-	C/D		C/D
Netherlands	4.597	4.842	4.839	4,7%	-3	0%	242	5%	NA/T1b/T2	NS	NA/CS
Portugal	1.382	1.466	1.448	1,4%	-18	-1%	66	5%	T1b	NS	D+CS
Spain	10.080	11.222	10.553	10,3%	-669	-6%	473	5%	T1a, T1b, CS	NS	D
Sweden	3.191	2.976	2.975	2,9%	-1	0%	-216	-7%	T1a/T1b/CS	NS	CS/D
United Kingdom	14.262	12.187	11.922	11,6%	-264	-2%	-2.340	-16%	T1a/T1b	NS	D
EU15	115.782	103.103	102.766	100,0%	-337	0%	-13.016	-11%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

N_2O emissions from 4.D.2: 'Animal production' account for 0.6 % of total EU-15 GHG emissions in 2004. Between 1990 and 2004, N_2O emissions from this source decreased by 9 % (Table 6.15). France, the United Kingdom and Greece are responsible for 60 % of the total EU-15 emissions from this source. France had the greatest reduction in absolute terms while Spain had the largest increases.

Table 6.15 Member States' contributions to N_2O emissions from 4.D.2: 'Animal production'

Member State	Greenhouse gas emissions (Gg CO_2			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	218	220	220	0,8%	0	0%	1	1%	T1b	NS	D
Belgium	941	828	823	3,2%	-5	-1%	-118	-13%	D	NS,AS	CS
Denmark	312	291	288	1,1%	-3	-1%	-24	-8%	D/CS	NS	D
Finland	165	145	145	0,6%	0	0%	-20	-12%	T1	NS/AS	D
France	8.539	7.645	7.453	28,6%	-193	-3%	-1.086	-13%	C/T1	NS	D, CS
Germany	1.707	1.425	1.397	5,4%	-28	-2%	-310	-18%	T1	RS	D
Greece	3.383	3.547	3.562	13,7%	15	0%	179	5%	D	NS	D
Ireland	2.836	2.817	2.815	10,8%	-2	0%	-21	-1%	T1a	NS	D
Italy	1.736	1.529	1.545	5,9%	15	1%	-191	-11%	D	NS	D, CS
Luxembourg	0	0	0	0,0%	0	-	0	-	C/D		C/D
Netherlands	1.308	707	651	2,5%	-56	-8%	-657	-50%	T1b	NS	CS
Portugal	623	679	690	2,6%	11	2%	66	11%	T1a	NS	D+CS
Spain	1.366	1.676	1.604	6,2%	-72	-4%	238	17%	T1a, T1b, CS	NS	D
Sweden	286	312	317	1,2%	6	2%	31	11%	T2	NS	CS
United Kingdom	5.223	4.537	4.568	17,5%	31	1%	-655	-13%	NO	NO	NO
EU15	28.644	26.358	26.077	100,0%	-281	-1%	-2.567	-9%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

N_2O emissions from 4.D.3: 'Indirect emissions' account for 1.6 % of total EU-15 GHG emissions in 2004. Between 1990 and 2004, N_2O emissions from this source decreased by 13 % (Table 6.16).

France, Germany, Italy, Spain and the UK are responsible for 79 % of the total EU-15 emissions from this source. France, Germany and the UK had large absolute reductions between 1990 and 2004.

Table 6.16 Member States' contributions to N_2O emissions from 4.D.3: 'Indirect emissions'

Member State	Greenhouse gas emissions (Gg CO_2			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	1.310	1.142	1.086	1,6%	-56	-5%	-224	-17%	T1a,b	NS	D
Belgium	1.184	934	940	1,4%	5	1%	-244	-21%	D	NS	CS
Denmark	3.787	2.362	2.390	3,4%	28	1%	-1.397	-37%	CS/M	NS	D
Finland	758	610	599	0,9%	-11	-2%	-159	-21%	T1a/T1b	NS/AS	D
France	20.330	18.011	18.029	26,0%	18	0%	-2.301	-11%	C/T1	NS	D, CS
Germany	14.243	11.826	11.823	17,0%	-4	0%	-2.421	-17%	T1	RS	D
Greece	3.606	2.917	2.880	4,2%	-37	-1%	-726	-20%	T1a	NS/IS	D
Ireland	1.387	1.406	1.371	2,0%	-35	-2%	-16	-1%	T1b	NS	CS
Italy	8.096	7.814	7.773	11,2%	-41	-1%	-323	-4%	D	NS	D, CS
Luxembourg	0	0	0	0,0%	0	-	0	-	C/D		C/D
Netherlands	4.861	3.230	3.209	4,6%	-22	-1%	-1.652	-34%	T1/T3	NS	D
Portugal	1.220	1.341	1.334	1,9%	-7	-1%	115	9%	D	NS	D+CS
Spain	7.515	8.876	8.393	12,1%	-483	-5%	877	12%	T1a, T1b, CS	NS	D
Sweden	1.142	932	932	1,3%	0	0%	-210	-18%	CS/T1	NS	D
United Kingdom	10.754	8.677	8.624	12,4%	-54	-1%	-2.130	-20%	NO	NO	NO
EU15	80.193	70.079	69.381	100,0%	-698	-1%	-10.812	-13%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

N_2O emissions from 4.D.4: 'Other' account for 0.1 % of total EU-15 GHG emissions in 2004. Between 1990 and 2004, N_2O emissions from this source increased by 33 % (Table 6.17). France, Spain and Sweden are responsible for 76 % of the total EU-15 emissions from this source.

Table 6.17 Member States' contributions to N_2O emissions from 4.D.4: 'Other'

Member State	Greenhouse gas emissions (Gg CO_2			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	7	9	10	0,4%	0	3%	2	28%	T1b	NS	D
Belgium	0	0	0	0,0%	0	0%	0	1%	D	NS	CS
Denmark	28	70	79	3,5%	9	13%	51	184%	D, CS	NS	D
Finland	9	3	3	0,1%	0	0%	-6	-66%	D	NS, AS	D
France	720	639	643	28,5%	4	1%	-77	-11%	C, T1	NS	D, CS
Germany	0	265	265	11,7%	0	-	265	-	C, CS	NS	C, D
Greece	NO	NO	NO	-	-	-	-	-			
Ireland	NO	NO	NO	-	-	-	-	-	T1a	NS	D
Italy	0	0	0	0,0%	0	-	0	-			
Luxembourg	0	0	0	0,0%	0	-	0	-			
Netherlands	25	9	9	0,4%	0	-	-16	-			
Portugal	0	0	0	0,0%	0	-	0	-	NO	NO	NO
Spain	102	480	493	21,8%	12	3%	391	382%	D, CS	NS	D, CS
Sweden	631	588	587	26,0%	-2	0%	-45	-7%	D, C	NS	CS, T1
United Kingdom	169	168	167	7,4%	0	0%	-1	-1%	T1a, T1b	NS, RS	D
EU15	1.692	2.232	2.256	100,0%	24	1%	564	33%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 6.18 provides information on the contribution of Member States to EC recalculations in N_2O from 4.D 'Agricultural soils' for 1990 and 2003 and main explanations for the largest recalculations in absolute terms.

Table 6.18 Contribution of MS to EC recalculations in N_2O from 4.D 'Agricultural soils' for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

	1990		2003		Main explanations
	Gg	Percent	Gg	Percent	
Austria	219	7,1	278	10,5	
Belgium	192	4,4	100	2,6	
Denmark	45	0,5	20	0,4	
Finland	72	1,7	125	3,9	
France	36	0,1	-1.328	-2,6	Updated animal population and sludge spreading Removal of natural N_2O emissions from soil
Germany	475	1,1	1.183	3,2	
Greece	0	0,0	0	0,0	
Ireland	-24	-0,3	-96	-1,3	
Italy	574	3,0	70	0,4	
Luxembourg	0	0,0	146	-	
Netherlands	-87	-0,8	28	0,3	
Portugal	-290	-8,2	317	10,0	
Spain	2.800	17,2	3.735	20,2	No information available
Sweden	-144	-2,7	-80	-1,6	
UK	-3	0,0	-181	-0,7	
EU15	**3.866**	**1,7**	**4.317**	**2,2**	

6.3 Methodological issues

All Member States consider their greenhouse gas inventories in the agricultural sector for complete for those categories that are reported to occur in the countries. For categories 4.A, 4.B (both methane and nitrous oxide) and 4.D (nitrous oxide) emissions in all relevant sub-categories are considered (CRF Tables 7s2). CH_4 emissions from rice fields are reported for France, Greece, Italy, Portugal and Spain. There were no changes in the evaluation of the completeness of Member States agricultural inventory since 2003; no information is available for Belgium, and Luxembourg.

There were also no changes in Member State's evaluation of the quality of the inventory in the agricultural sector since the submission in 2004. Table 6.19 shows the quality of the emission estimates for the categories 4.A through 4.D. Only Germany and Italy (2003 submission) are considering the emission estimates of all categories as high quality; in most cases the emission estimates have been evaluated as medium quality. Generally, a lower quality is assumed for N_2O emission estimates, with 5 countries evaluating the estimate in category 4.D as being of low quality.

Table 6.19: Quality of the emission estimates in Member State's inventory for the sector agriculture

Member State	4A. Enteric Fermentation	4B(a). Manure Management CH4	4B(b). Manure Management N2O	4C. Rice Cultivation	4D. Agricultural soils
Austria	M	M	M	NO	M
Belgium					
Denmark	H	M	M		M
Finland	M	M	L	NO	L
France	M	M	M	L	L
Germany	H	H	H		H
Greece					
Ireland	M	M	M	NA	M
Italy	H	H	H	H	H
Luxembourg					
Netherlands	M	L	L		L
Portugal	M	M	M	M	M
Spain					
Sweden	H	H	M		M
United Kingdom	M	M	M		L

Information on source: CRF Tables7s2 for 2004, submitted in 2006

6.3.1 Enteric Fermentation (CRF source category 4.A)

6.3.1.1. Source category description

CH_4 emissions in the source category Enteric Fermentation stem for 10 Member States to over 85% from the sub-category "Cattle". Substantial emissions from the sub-category "Sheep" (23% - 49% of emissions in category 4.A.) are reported by Greece, Portugal, and United Kingdom). Emissions accounting for more than 5% of the emissions in this category are further reported by one Member State for the sub-category "Goats" (21%) and for the sub-category "Swine" (11%), respectively.

An overview of the CH_4 emissions, animal population and the corresponding implied emission factors for CH_4 emissions from enteric fermentation for the most important categories cattle and sheep (key source at EC-level) and also goats and swine are given in Table 6.20. Data are given for 2004 as the last inventory year and the base year 1990. The table shows that there is a general trend of decreasing animal numbers which are partly compensated by higher emissions per head due to intensification of livestock production in Europe.

Table 6.20: Total CH_4 emissions in category 4A and implied Emission Factor at EU-15 level for the years 1990 and 2004

1990[1)]	Dairy Cattle	Non-dairy cattle	Sheep	Goats	Swine
CH_4 emissions [Gg CH_4]	2569	2907	765	65	151
Animal population [1000 heads]	26351	61653	114983	12757	113151
Implied EF (kg CH_4/head/yr)	97	47	6.7	5.1	1.3
2004[1)]	Dairy Cattle	Non-dairy cattle	Sheep	Goats	Swine
CH_4 emissions [Gg CH_4]	2109	2803	699	63	155
Animal population [1000 heads]	19236	57022	100999	12410	114956
Implied EF (kg CH_4/head/yr)	110	49	6.9	5.1	1.3
2004 value in percent of 1990	Dairy Cattle	Non-dairy cattle	Sheep	Goats	Swine
CH4 emissions [Gg CH4]	82%	96%	91%	97%	102%
Animal population [1000 heads]	73%	92%	88%	97%	102%
Implied EF (kg CH4/head/yr)	112%	104%	104%	99%	101%

[1)] Information source: CRF Table 4.A for 1990 and 2004, submitted in 2006

6.3.1.2. Methodological Issues

CH_4 emissions from enteric fermentation is a key source category for cattle and sheep. For cattle, this is also true for all member states. Accordingly, most Member States have used Tier 2 methodology for calculating enteric CH_4 emissions, as shown in Table 6.21. Beside the methodology applied by the Member States for calculating CH_4 emissions, the table indicates also the total emissions in the category "enteric fermentation", the contribution of the animal types considered (dairy and non-dairy cattle and sheep) to the total emissions, and if the emissions from animal class are belonging to the key source categories in the different Member States. Only few countries are applying Tier 1 methodology for dairy cattle. Interestingly, more countries are applying Tier 1 methodology for non-dairy cattle, even though this category generally causes higher CH_4 emissions than dairy cattle. This is due obviously to the larger demand of input data for the Tier 2 methodology. However, many countries do not disaggregate between dairy and non-dairy cattle in the assessment of key-source categories. Sheep is no key source category for most countries, even though several Member States did not report disaggregated key source categories for category 4A. However, considerable emissions from this category are reported by 3 countries only. Therefore, most countries are applying Tier 1 methodology.

Those Member States where sheep emissions are belonging to the key source categories, have indeed developed a Tier 2 approach.

On EU-15 level, 78% of the CH_4 emissions in category 4.A have been estimated with a Tier 2 approach. As Table 6.21 shows, this percentage was especially high for dairy cattle, where 95% have been estimated using the Tier 2 methodology. The situation can be considered satisfying for sheep with 67% of the emissions being calculated with a Tier 2 approach, but must still be improved for non-dairy cattle, where as much as 32% of the emissions are still being calculated with the Tier 1 methodology.

Table 6.21: Total emissions, contribution of the main sub-categories to CH_4 emissions in category 4A, methodology applied and key source assessment by Member States for the sub-categories dairy cattle, non-dairy cattle and sheep.

	Total	Dairy Cattle			Non-dairy cattle			Sheep		
Member State	Gg CO_2-eq	a	b	c	a	b	c	a	b	c
Austria	3,275	40%	Tier 2	y 1)	54%	Tier 2		2%	Tier 1	n
Belgium	3,908	42%	Tier 1	y 1)	52%	Tier 1		1%	Tier 1	n
Denmark	2,711	55%	Tier 2	y 2)	30%	Tier 2		1%	Tier 2	
Finland	1,590	51%	Tier 2	y 2)	39%	Tier 2		1%	Tier 1	
France	27,834	32%	Tier 2	y	60%	Tier 1	y	6%	Tier 1	n
Germany	18,544	54%	Tier 2	y	38%	Tier 2	y	2%	Tier 1	n
Greece	2,886	13%	Tier 1	y 2)	15%	Tier 1		49%	Tier 2	
Ireland	9,233	29%	Tier 2	y 2)	62%	Tier 2		9%	Tier 1	
Italy	10,831	40%	Tier 2	y	40%	Tier 2	y	13%	Tier 1	
Luxembourg	301	50%	Tier 1		48%	Tier 1		1%	Tier 1	
Netherlands	6,348	61%	Tier 2	y	29%	Tier 2	y	3%	Tier 1	n
Portugal	3,012	26%	Tier 2	y	44%	Tier 2	y	23%	Tier 2	y
Spain	13,706	15%	Tier 2	y 1)	46%	Tier 2		30%	Tier 2	y
Sw eden	2,835	39%	Tier 2	y 2)	51%	Tier 2		3%	Tier 1	
United Kingdom	16,114	28%	Tier 2	y 2)	47%	Tier 2		23%	Tier 2	
EU-15: Tier 1	**22%**	**5%**			**33%**			**32%**		
EU-15: Tier 2	**78%**	**95%**			**67%**			**68%**		

a Contribution to CH_4 emissions from enteric fermentation
b Tier 1: default methodology; Tier 2: country-specific methodology
c Source category is key in the Member State's inventory (y/n)
1) Key source assessment made for cattle w ithout disaggregation for dairy/non-dairy
2) Key source assessment made for category 4A as a w hole w ithout disaggregation

Details on the applied methodologies for the estimation of CH_4 emissions from enteric fermentation are given in Table 6.22.

Table 6.22: Methodology used by Member States for calculating CH_4 emissions in category 4A

Member State	Methodology
Austria NIR 2006, p. 193-203	The IPCC Tier 1 Method was applied for Swine, Sheep, Goats, Horses and Other Animals. For Cattle the more detailed Tier 2 method was applied.
Belgium NIR 2006 p. 71	CH_4 emissions from enteric fermentation from animal husbandry are estimated using the Tier 1 methodology. Belgium does not use a Tier 2 methodology because data such as gross energy intake are not available and the use of Tier 2 without reliable activity data does not appear likely to reduce the overall uncertainty of the estimate.
Denmark NIR 2006, p. 200-203	The emissions from the agricultural sector are calculated in a comprehensive agricultural model complex called DIEMA (Danish Integrated Emission Model for Agriculture) (Mikkelsen, 2005). The category Non-Dairy Cattle includes Calves, Heifer, Bulls and Suckler Cows and the implied emission factor is a weighted average of these different subcategories. Data given for Non-Dairy Cattle covers data for heifer older than ½ year. The category Swine includes the subcategories Sows, Piglets and Slaughtering Pigs.
Finland NIR 2006, p. 118-124	Tier 1 for Horses, Swine and Goats. Tier 2 method for Cattle, since emissions from cattle (key source in Finnish inventory. CH_4 emissions from enteric fermentation of Reindeer have been calculated by estimating the GE on the basis of literature (McDonald, 1988) by using national data for estimating dry matter intake and its composition (hay and lichen) and calculating the respective emission factor. The same methodology has been used for estimating GE and EF for Sheep.
France NIR 2005, p. 93-94	Emissions from Dairy Cattle are calculated using an equation developed at INRA (Tier 2+). Tier 1 other animal types. Heifers are included in Other Cattle.
Greece NIR 2006 p. 130-133	The Tier 2 methodology is applied for the estimation of methane emissions from enteric fermentation of Sheep, according to the recommendation of the IPCC Good Practice Guidance. The first step is the "enhanced" livestock characterization, which intends to define livestock sub-categories based on the age of animals, their sex, weight, feeding situation and on the various management systems of animals. Additionally, the estimation of feed intake in terms of energy (MJ/day) is required for each sub-category and each activity animals perform, such as growth, lactation and pregnancy. The Tier 1 methodology and the default emission factors suggested by the IPCC Guidelines are used for the rest of animal species.
Ireland NIR 2006 p. 52-55	Tier 2 for cattle. For Dairy cows and Suckler Cows, the country was divided into three regions: (1) south and east, (2) west and midlands, and (3) north west, coinciding with regions used for implementing the Nitrates Directive based on slurry storage requirements of local planning authorities. The daily energy requirement of cows in each region was calculated by month based on maintenance requirements, milk yield and composition, requirements for foetal growth, and gain or loss of bodyweight. Given data for live weight and live weight gain, energy requirements of animals were estimated during the winter housing periods and grazing seasons of the animal's lifetime using the INRAtion computer programme, version 3.0. This programme is devised by the French research organisation INRA, and is based on the net energy system for Cattle. Other animals: Tier 1 Methodology, EFs IPCC default.
Italy CRF_2004_2006 Table 4.A	The Tier 2 IPCC GPG approach has been followed for Dairy, Non-Dairy and Buffalo.
Netherlands NIR 2006, ch. 6-2 - 6-6	The emission factors for Cattle are based on a country specific Tier 2 procedure and vary in time. The calculation of the methane production via enteric fermentation by dairy cows is performed using dynamic modelling (Smink, 2005). The methane emission factor (EF) for enteric fermentation by Non-dairy and Young cattle is calculated by multiplying the gross energy uptake with a methane conversion factor. Changes are based on changes in gross energy uptake that depend on factors such as feed intake and weight gain. Emission factors for the source categories Swine, Sheep, Horses and Goats are based on default IPCC Tier 1 emission factors.
Portugal NIR 2006 p. 333-354	Emissions were estimated for each animal type (for most animal types an enhanced characterization of livestock, with subdivision per age, sex and management conditions was used) by multiplication of the number of animals by the respective emission factor, in accordance to Tier 2 method.
Spain NIR 2005, p. 127	Cattle and Sheep: Tier 2. Other animal categories: Tier 1. If Tier 1 was used, the default emission factor for developed countries was reduced by 20% for young animals. If Tier 2 was used, some of the activity data required are not available in Spain.
Sweden NIR 2006, p. 175	Significant Cattle subgroups: national emission factor (Tier 1). Reindeer: according to Tier 2 methodology using a Finnish value of gross energy requirements. Other animal categories: Tier 1. The national methodology for Dairy Cows, Beef Cows and Other Cattle.
United Kingdom NIR 2006, p.113-114	Apart from Cattle, Lambs and Deer, the methane emission factors are IPCC Tier 1 default and do not change from year to year. The Dairy Cattle emission factors are estimated following the IPCC Tier 2 procedure and vary from year to year.

Activity Data

Animal population of dairy and non-dairy cattle, sheep, goat, swine, and poultry in 2004 are given in Table 6.23. The characterization of the livestock population across the background tables 4.A, 4.B(a), and 4.B(b) is done in a consistent way by all Member States and will therefore be discussed only here. Only the number of poultry differs in the Belgian inventory between Table4.B(b) and Table4.A/Table4.B(a) as the N_2O emission inventory for poultry includes more animal categories such as ostriches for which no CH_4 emission factor is known and therefore a larger poultry population is reported in Table4.B(b).

Regarding animal numbers, some major changes occurred since 1990. In all countries, the numbers of cattle and sheep are considerably reduced, on the average by 37% for dairy cattle and 9% for non-dairy cattle, and by 13% for sheep. An increase in the number of cattle has only been observed in the category of non-dairy cattle in Sweden (7%), Ireland (7%), Portugal (10%) and Spain (59%). Largest decrease of the number of dairy cattle occurred in Austria (2004 at 59% of the 1990 level). For non-dairy cattle, largest decrease occurred in Germany (2004 at 67%).

The picture is a little bit different for the categories Goats and Swine, as some countries have encountered a significant increase of the populations, for example the goat population in Belgium in 2004 increased by 193% respective to the population in 1990; in the Netherlands this figure amounts to 364%. However, due to a decrease of the goat number in other countries with a high population (mainly Spain with a decrease), the goat population at EU-15 level was rather stable (2004 at 95% level).

The swine population was increasing especially in Denmark (39%), Spain (54%), and Ireland (39%). Poultry numbers were increasing in almost all countries moderately with an average increase of 15% between 1990 and 2004; only Austria reported CH_4 emissions from enteric fermentation of poultry.

Other animal types reported in Table4.A are deer (Austria and United Kingdom), reindeer (Finland and Sweden), fur farming (Denmark, Finland) and rabbits (Portugal), other poultry (Spain), and other non-specified animals (Greece, Ireland, and Italy).

Some information on the source of the animal numbers for the different Member States is given in Table 6.24.

Table 6.23: Animal population [1000 heads] in 2004

Member State	Dairy Cattle	Non-dairy cattle	Sheep	Goats	Sw ine	Poultry
Austria	538	1,513	327	56	3,125	13,027
Belgium	761	1,977	151	25	6,355	35,598
Denmark	563	1,082	91	24	13,233	16,598
Finland	324	645	109	7	1,365	10,405
France	4,056	15,518	9,215	1,367	10,044	NO
Germany	4,285	8,795	2,714	160	23,406	123,408
Greece	215	376	9,117	5,777	962	32,064
Ireland	1,136	5,860	6,903	8	1,702	16,589
Italy	1,838	4,466	8,106	978	8,972	191,316
Luxembourg[2)]	40	147	10		85	73
Netherlands[3)]	1,471	2,296	1,236	282	11,153	88,462
Portugal	336	1,073	3,340	484	2,314	39,125
Spain	1,069	5,532	22,757	2,833	25,232	161,342
Sw eden	404	1,225	466	6	1,818	17,392
United Kingdom	538	1,513	327	56	3,125	13,027
EU-15	19,168	58,972	100,423	12,098	114,924	915,863

[1)] Information source: CRF Table 4.A for 2004, submitted in 2006

[2)] Information source: background information submitted by Luxembourg in 2003 and extrapolated (linear regression gap filling from the trend in 1999-2003)

[3)] For non-dairy cattle, the number represents the sum of mature non-dairy and young cattle

Table 6.24: Information on the source of the activity data for category 4A

Member State	Activity Data
Austria NIR 2006, p. 193-203	The Austrian official statistics (Statistic Austria, 2004) provides national data of annual livestock numbers on a very detailed level. In 1998-2002 increasing/ decreasing swine numbers: The production of Swine has a high elasticity to prices: Swine numbers are changing due to changing market prices very rapidly.
Belgium NIR 2006 p. 71	The main activity data are the land-use and the livestock figures. The National Institute of Statistics (NIS) publishes these numbers yearly. Mules and Asses are included in the category Horses.
Denmark NIR 2006, p. 200-203	The Agricultural census does not include farms less than 5 ha. In the Danish emission inventory is chosen to add number of Sheep, Goats and Horses on small farms based on information from DAAC.
Finland NIR 2006, p. 118-124	The number of Cattle, Sheep, Swine, Poultry and Goats was received from the Matilda-database maintained by the Information Centre of the Ministry of Agriculture and Forestry as well as from the Yearbook of Farm Statistics published annually by the Ministry of Agriculture and Forestry. Cattle category has been divided into the following sub-categories: Dairy cows, Suckler cows, Bulls, Heifers and Calves for which separate emission factors have been calculated. Cattle is not used for work in Finland.
France NIR 2005, p. 93-94	Agricultural statistics are issued by the ministry of agriculture (SCEES/AGRESTE). Calculation of methane emissions according the population numbers. Activity data is a one year average.
Germany NIR 2006 p. 304-313	A complete animal census at the "Kreise" level is available for every second year in the official agricultural statistics. For the other years, animal numbers are available at the "Länder" level. Both, DC and OC, are housed of the time, some graze during summer. The share of grazing varies with subcategory, region, and time.
Greece NIR 2006 p. 130-133	Data on animal population, agricultural production and cultivated areas used for the emissions calculation were provided by the NSSG. As far as animal population for years 2002 – 2004 is concerned, data are calculated by extrapolation based on the existed data of the previous 10 years, as no provisional estimations exist. Animal population except Sheep, is a 3-year average. Because of the analytic methodology used for Sheep, data on disaggrated population are the actual reported in the Statistics for each year. Milk yield derives from data of the annual Agricultural Statistics.
Ireland NIR 2006 p. 52-55	The Irish cattle herd is now characterised by 11 principal animal categories for which annual census data are published by CSO. The number of Cows in each category given by CSO statistics was allocated to the regions using CMMS reports published by the Department of Agriculture and Food (DAF, 2005). The most important parameter is liveweight gain as it directly affects the energy requirement and thus feed intake. There is little statistical information on the liveweight gain of the different types of Cattle in the Irish Cattle herd, but the weight of carcasses of all slaughtered cattle is recorded by the Department of Agriculture and Food.
Netherlands NIR 2006, ch. 6-2 - 6-6	Activity data for the animal population are based on the annual agricultural survey, performed by Statistics Netherlands (CBS). Data can be found on www.cbs.nl; and in background documents (Smink, 2005; van der Hoek, 2005). For Cattle three categories are distinguished: Dairy cattle; Non-dairy cattle; Young cattle.
Portugal, NIR 2006 p. 333-354	Activity data are 3-years average except for last year. Annual livestock numbers were available from the statistical databases of the National Statistics Institute (INE) from 1987 to 2004 for Cattle, Swine, Sheep, Goats, Horses, Mules and Donkeys, dissagregated per region 96, age and sex. The number of Rabbits, Hens, Broilers, Turkeys, Ducks, Geese and Guinea-fowl, is only available for 1999 – from the national agriculture census that is done every ten years.
Sweden NIR 2006, p. 175, 183	The information on livestock refer to the situation prevailing in mid-June of that year and thus is considered to be equivalent to a one-year average. Most of the information on livestock numbers comes from the Farm Register. The Register is administered by the Swedish Board of Agriculture and Statistics Sweden and provides annual information on the total number of animals of different categories on Swedish farms.
United Kingdom NIR 2006, p.113-114	The animal population data are collected in an annual census, published by Defra. Dairy Cattle - changed animal weights with data from Steve Walton, Defra stats. Pre-1995 is corrected home killed slaughter weights (UK livestock Slaughter Statistics, Defra, SERAD, WAG and DARDNI and their predecessors, 1995 and onwards are weights from the over 30 months scheme (courtesy of Rural Payments Agency).

Emission Factors and other parameters

Considerable variation is found in the IEF for dairy and non-dairy cattle with values between 81 kg CH_4 head^{-1} yr^{-1} (Greece) and 129 kg CH_4 head^{-1} yr^{-1} (Sweden) for dairy cattle, and 36 kg CH_4 head^{-1} yr^{-1} (Denmark) and 58 CH_4 head^{-1} yr^{-1} (Portugal) for non-dairy cattle. The difference can mainly be explained by the different levels of intensity for dairy production and will be discussed below. The IEF for the EU-15 Member States and the CH_4 conversion factors used are given in Table 6.25.

At the aggregated level for EU-15, the implied emission factor for dairy cattle increase from 96 kg CH_4 head^{-1} yr^{-1} to 109 kg CH_4 head^{-1} yr^{-1} while at the same time the animal number of dairy cattle decreased by 37%, resulting in a decrease of European CH_4 emissions from enteric fermentation in the category of dairy cattle by Dairy Cattle.

Note however, that the increase of the implied emission factor of 13% is due to changes reported in 13 countries, whereas only 10 countries have calculated a time-varying emission factor for non-dairy cattle, which also was more stable than the IEF for dairy cattle, increasing only by 2% during 1990 and 2004 (from 45 to 47 kg CH_4 head^{-1} yr^{-1}). The only country where the IEF for cattle (in the sub-category of non-dairy cattle) decreased (by 3%) between 1990 and 2004 are the Luxembourg, Netherlands and Spain,; in some countries (Denmark, Ireland, Italy) the IEF remained with a change at about 1% close to the level in the base year.

For sheep, the implied emission factors changed since 1990 in three countries (Belgium, Spain, and UK) by 2%, 3%, and 3%, respectively. Note that the IEF for sheep and goats used in Denmark (Tier 2 methodology) is with 14.9 kg CH_4 head^{-1} yr^{-1} and 6.6 kg CH_4 head^{-1} yr^{-1} considerably higher than the IPCC default values and the numbers used in other Member States. The CH_4 conversion factor is IPCC default for most Member States.

More detailed information on the development of the emission factors for category 4A is given in Table 6.26.

Table 6.25: Implied Emission factors for CH_4 emissions from enteric fermentation and CH_4 conversion factors used in Member State's inventory

Member State	Implied EF (kg CH_4/head/yr) [1]					CH_4 conversion (%) [1]				
	Dairy Cattle	Non-dairy cattle	Sheep	Goats	Sw ine	Dairy Cattle	Non-dairy cattle	Sheep	Goats	Sw ine
Austria	115	56	8.0	5.0	1.5	6.0	6.0	NE	NE	NE
Belgium	103	49	8.2	8.6	1.5	NE	NE	NE	NE	NE
Denmark	126	36	14.9	6.6	1.1	5.9	5.9	6.0	5.0	0.6
Finland[2]	118	IE	7.3	5.0	1.5	6.0	6.0	NA	NA	NA
France	104	52	8.0	5.0	1.5	NA	NA	NA	NA	NA
Germany	112	39	8.1	5.0	1.3	6.0	5.5	NE	NE	0.6
Greece	81	56	7.4	5.0	1.5	NE	NE	5.1	NE	NE
Ireland[4]	110	46	5.9	5.0	0.4	6.0	6.0	7.0	NE	NE
Italy	111	46	8.0	5.0	1.5	6.0	4.4			
Luxembourg	178	47	8.2		1.5					
Netherlands[3]	126	38	8.0	5.0	1.5	IE	IE	NE	NE	NE
Portugal	113	58	9.9	7.6	1.4	6.0	5.9	6.0	5.0	0.6
Spain[4]	93	54	8.6	5.0	1.5	5.5	5.3	6.6	NA	NA
Sw eden	129	57	8.0	5.0	1.5	6.7	7.0	6.0	5.0	0.6
United Kingdom	115	56	8	5	2	6.0	6.0	NE	NE	NE
EU-15	109	47	7	5	1	5.0	4.0	1.7	5.0	0.6

NA: Not Applicable - NE: Not Estimated

[1] Information source: CRF Table 4.A for 2004, submitted in 2006

[2] Finland reports non-dairy cattle under "other" in the follow ing categories: bulls, cow s, heifers, and calves. The IEF has been calculated as a w eighted average

[3] The IEF for the Netherlands has been calculated as a w eighted average has been calculated using the values given under option B (mature non-dairy and young cattle)

4) The values for the CH4 conversion w ere given as a fraction for Ireland and Spain and have been multiplied by 100.

Table 6.26: Member State's background information for the EFs of CH_4 emissions in category 4.A. Emission Factor and other parameters

Member State	Emission Factor and other parameters
Austria NIR 2006, p. 193-203	Country specific emission factors for Cattle were used. They were calculated from the specific gross energy intake and the methane conversion rate. As Sheep is the most similar animal category to Deer, emissions from deer were estimated applying the default emission factor of Sheep. For the calculation of emissions from Poultry the IPCC Tier 2 method with Swiss emission factors (Gross Energy Intake, Methane Conversion Rate) was used. It is assumed that Swiss conditions are very similar to Austrian conditions. Swiss values are based on the study (Minonzio, 1998).
Belgium NIR 2006 p. 71	The IPCC emission factors are used for most animal categories. In Wallonia, the emission factor for Dairy Cattle is adjusted regarding the increasing milk production. Further harmonisation of the emission factors between the regions is foreseen. Flanders formerly used the IPCC-emission factors from 1994.
Denmark NIR 2006, p. 200-203	The implied emission factors for all animal categories are based on a Tier 2 approach. The feeding consumptions for all animal categories are based on the Danish normative figures (Mikkelsen, 2005). Due to changed data for feeding consumption and allocation of subcategories the implied emission factor may vary between the years. The Danish IEF for Non-Dairy Cattle is lower compared to the default value given in IPCC, this is due to lower weight and lower feed intake and a higher digestibility of feed compared to the values given in IPCC.
Finland NIR 2006, p. 118-124	IPCC default emission factors were used for calculating CH_4 emissions from enteric fermentation of Swine, Goats and Horses (Tier 1 method). National emission factors were calculated with the Tier 2 method for Cattle by using IPCC equations. The emission factor for Reindeer has been calculated by using national methodology for estimating gross energy intake of Reindeer from the basis of their forage. The same equation has been used for Sheep also (Nousiainen, 2005).
France, OMINEA B.2.3.2.1.	Emission Factors: values IPCC for each type of the Cattle. The EF for Dairy Cattle, is depending to the milk production.
Germany NIR 2006 p. 304-313	The calculation of the EF for Dairy Cattle is based on a regression approach based on milk production, animal weight (derived from milk production data), and animal feed. The latter (grass/grass silage or maize/maize silage) is derived from the regional approach.
Greece NIR 2006 p. 130-133	The calculation of the emission factors for each animal sub-category and activity is based on the gross energy intake (MJ/head/day) and methane conversion rate which is the fraction of gross energy in feed converted to CH_4. In certain cases the emission factor was not calculated for a full year period, but rather for the period that actually corresponds to the given activity. In certain cases the emission factor was not calculated for a full year period, but rather for the period that actually corresponds to the given activity.
Ireland NIR 2006 p. 52-55	The Tier 2 emission factors for the 11 animal categories was initially carried out for the 2003 herd and then repeated for 1990 and 1994. The study and analysis underlying the new emission factors is available (O'Mara, 2006). Emission factors for the Beef cattle categories were determined by calculating lifetime emissions for the animal and by partitioning between the first, second and third years of the animal's life.
Netherlands NIR 2006, ch. 6-2 - 6-6	For deriving emission factors, following data is used: Milk yield and composition of milk (Annual Agricultural Survey: CBS, 2005 on www.cbs.nl); Zoo technical indicators to estimate feed intake (Van Bruggen, 2006), Nutrient composition of feed (Smink, 2005, Van Bruggen, 2006). Due to the new method applied, the implied emission factor for adult female dairy cattle is higher than the IPPC default since 2001, but lower in the period 1990-2000. This is explained by a shift in feed intake.
Portugal NIR 2004, p. 231-232	For the emission factor for Rabbit, the default EF for Horse has been downscaled to the average weight of a rabbit according to the scaling equation in IPCC GPG. Default EF for Horses, Mules and Asses, due to the unavailability of a more detailed livestock characterization and specific characterization of national populations. For all other animal types the existence of an enhanced livestock population and animal characteristics allowed the use of a higher methodology level, Tier 2. Following the recommendations from previous review processes, a tier 2 analysis was seeked for the most significant animal types.
Sweden NIR 2006, p. 175, 192	A national methodology based on feed energy requirements expressed as metabolisable energy is used in the Swedish inventory to estimate emission factors for Dairy Cows, Beef Cows and Other Cattle. The calculations for Dairy Cows were revised some years ago. The emission factors for Other Cattle groups were also re-evaluated, using the same methodology. For Reindeer, where the IPCC Guidelines do not provide default values, an emission factor is calculated according to the IPCC Guidelines methodology using a Finnish value of gross energy requirements.
United Kingdom NIR 2006, p.113-114	The emission factors for Beef and Other Cattle were calculated using the IPCC Tier 2 procedure but do not vary from year to year. The enteric emission factors for Beef cattle were almost identical to the IPCC Tier 1 default so the default was used in the estimates. The emission factor for Lambs is assumed to be 40% of that for adult Sheep (Sneath, 1997).

Milk productivity is one of the most important factors determining the level of CH_4 emissions by dairy cattle. Several countries have reported milk productivity, which are reproduced in Table 6.27 and Table 6.28 beside information on feed intake, animal weight, and feed digestibility. The data show clearly a strong intensification of the milk yield, ranging from 19% (Ireland) to 53% (Austria). This is thus more than the increase in the CH_4 emission factor. This can be explained that the increased production was only partly achieved by increased energy intake (up to a maximum of 28%, but some countries report also a stable feed intake), and partly by an improved feed efficiency. This is expressed in the feed digestibility, which for some countries increased by up to 6%. Higher feed digestibility reduces the portion of carbon intake that is transformed to methane in ruminants. It must be noted, however, that dairy production in Europe is more intensive than the IPCC *Guidelines* suggest. Calculating the average for those countries which have reported data, the milk yield was higher by 11% than the default value for Western Europe (11.5 kg/day) in 1990, and increased to a level which was 50% above IPCC default in 2004. Even though feed digestibility for dairy cattle was not separately estimated for each year by all countries, the level is 15% to 17% above IPCC default (60%) digestibility for the whole time series.

Table 6.27: Additional background information for calculating CH_4 emissions from enteric fermentation from dairy cattle

Member State	Dairy Cattle			
2004	Feed Intake (MJ / day)	Animal Weight (kg)	Milk productivity (kg / day)	Feed Digestibility (%)
Austria	292	700	16	70
Belgium	NE			
Denmark	324	575	22	71
Finland	300	568	21	70
France	NA	NA	NA	NA
Germany	284	588	18	66
Greece	NE	NE	14	
Ireland	227	535	14	NE
Italy	283	603	17	65
Luxembourg				
Netherlands	IE	IE	IE	IE
Portugal	288	NE	16	
Spain	257	648	17	71
Sweden	339	NE	NE	NE
United Kingdom	292	700	16	70
EU-15	276	593	17	68

NA: Not Applicable - NE: Not Estimated - IE: Implied Elsewhere
1) Information source: CRF Table 4.A for 2004, submitted in 2006

Member State	Dairy Cattle			
1990	Feed Intake (MJ / day)	Animal Weight (kg)	Milk productivity (kg / day)	Feed Digestibility (%)
Austria	248	700	10	66
Belgium	NE			
Denmark	278	575	17	71
Finland	247	503	16	70
France	NA	NA	NA	NA
Germany	241	539	13	63
Greece	NE	NE	9	
Ireland	227	535	11	NE
Italy	236	603	12	65
Luxembourg				
Netherlands	IE	IE	IE	IE
Portugal	241	NE	12	
Spain	200	642	10	71
Sweden	339	NE	NE	NE
United Kingdom	248	700	10	66
EU-15	238	570	13	67

NA: Not Applicable - NE: Not Estimated - IE: Implied Elsewhere
1) Information source: CRF Table 4.A for 1990 submitted in 2006

Table 6.28: Additional background information for calculating CH_4 emissions from enteric fermentation from non-dairy

2004	Feed Intake (MJ / day)	Animal Weight (kg)	Milk productivity (kg / day)	Feed Digestibility (%)
Austria	142	427	NO	72
Belgium	NE			
Denmark	95	325	NO	78
Finland	116	NA	NA	70
France	NA	NA	NA	NA
Germany	98	NE	NA	70
Greece	NE	NE	NE	NE
Ireland	139	500	14	NE
Italy	140	384		
Luxembourg				
Netherlands	IE	IE	IE	IE
Portugal	151	442	3	
Spain	154	469	1	70
Sweden	181	NE	NE	NE
United Kingdom	142	427	NO	72
EU-15	143	446	7	71

NA: Not Applicable - NE: Not Estimated - IE: Implied Elsewhere
1) Information source: CRF Table 4A for 2004, submitted in 2006

1990	Feed Intake (MJ / day)	Animal Weight (kg)	Milk productivity (kg / day)	Feed Digestibility (%)
Austria	123	364	NO	72
Belgium	NE			
Denmark	96	325	NO	78
Finland	103	NA	NA	70
France	NA	NA	NA	NA
Germany	95	NE	NA	71
Greece	NE	NE	NE	NE
Ireland	139	500	11	NE
Italy	141	376		
Luxembourg				
Netherlands	IE	IE	IE	IE
Portugal	130	355	2	
Spain	155	460	1	69
Sweden	181	NE	NE	NE
United Kingdom	123	364	NO	72
EU-15	136	423	7	71

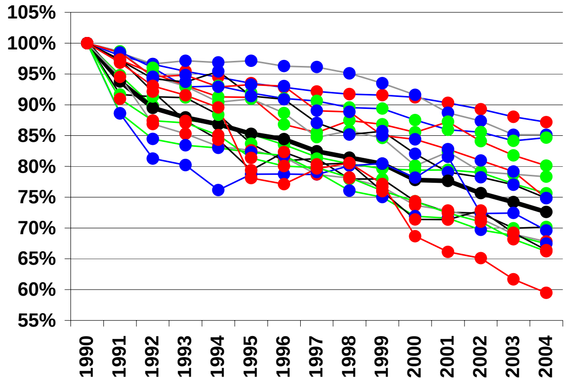
NA: Not Applicable - NE: Not Estimated - IE: Implied Elsewhere
1) Information source: CRF Table 4A for 1990 submitted in 2006

Trends

Figure 6.3 through Figure 6.9 show the trend in the activity data for the key source in the category of enteric fermentation as well as the trend of one important indicator for animal productivity, the average daily gross energy intake for dairy and non-dairy cattle and sheep.

Figure 6.3. Trend of activity data for:

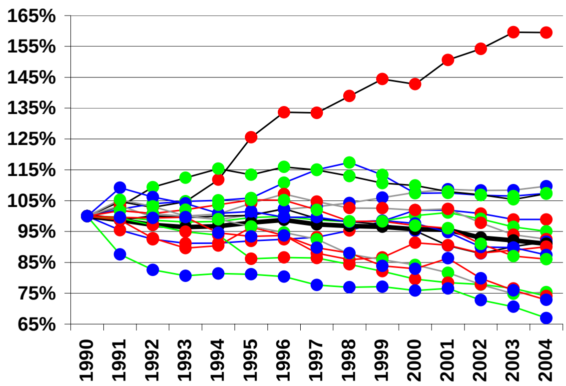
Dairy Cattle: Population size (1000 head)



	1990	Trend (%) 1990-2004	2004
Greece	246	87%	215
Portugal	394	85%	336
Ireland	1342	85%	1136
Belgium	950	80%	761
Netherlands	1878	78%	1471
France	5363	76%	4056
United Kingdom	2847	75%	2131
Denmark	753	75%	563
EU-15	26410	73%	19168
Sweden	576	70%	404
Italy	2642	70%	1838
Luxembourg	59	68%	40
Germany	6355	67%	4285
Spain	1611	66%	1069
Finland	490	66%	324
Austria	905	60%	538

Figure 6.4. Trend of activity data for:

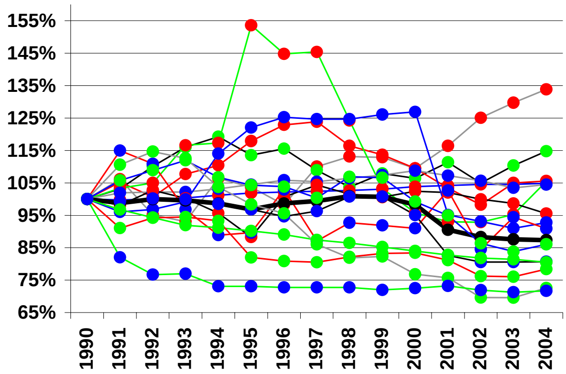
Non-dairy cattle: Population size (1000 head)



	1990	Trend (%) 1990-2004	2004
Spain	3469	160%	5532
Portugal	978	110%	1073
Ireland	5456	107%	5860
Sweden	1142	107%	1225
Greece	380	99%	376
France	16313	95%	15518
Luxembourg	159	93%	147
United Kingdom	9232	92%	8467
EU-15	64755	91%	58972
Austria	1679	90%	1513
Italy	5110	87%	4466
Belgium	2298	86%	1977
Netherlands	3048	75%	2296
Finland	870	74%	645
Denmark	1486	73%	1082
Germany	13133	67%	8795

Figure 6.5. Trend of activity data for:

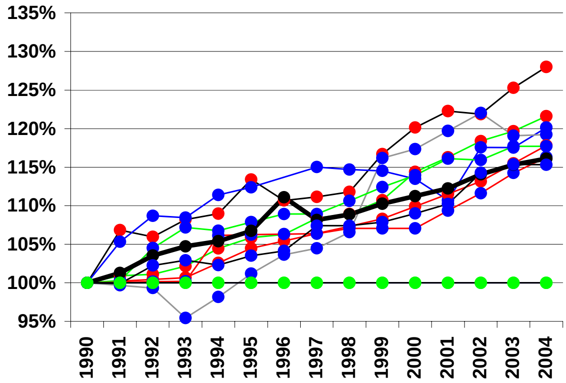
Sheep: Population size (1000 head)



	1990	Trend (%) 1990-2004	2004
Luxembourg	7	134%	10
Sweden	406	115%	466
Austria	310	106%	327
Finland	103	106%	109
Greece	8692	105%	9117
Portugal	3197	105%	3340
Spain	23822	96%	22757
Italy	8739	93%	8106
Denmark	100	91%	91
EU-15	114990	87%	100423
Ireland	8021	86%	6903
United Kingdom	44469	81%	35881
France	11446	81%	9215
Belgium	192	78%	151
Netherlands	1702	73%	1236
Germany	3784	72%	2714

Figure 6.6. Trend of activity data for:

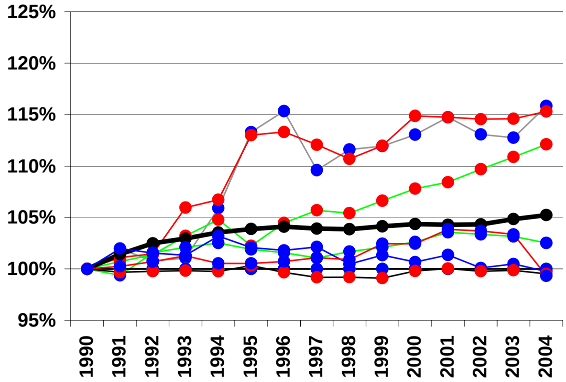
Dairy Cattle: Average gross energy intake (GE) (MJ/head/day)



	1990	Trend (%) 1990-2004	2004
Spain	200	128%	257
Finland	247	122%	300
Italy	236	120%	283
Portugal	241	119%	288
Austria	248	118%	292
Germany	241	118%	284
Denmark	278	116%	324
EU-15	238	116%	276
United Kingdom	224	115%	258
Ireland	227	100%	227
Sweden	339	100%	339
Belgium			
France			
Greece			
Luxembourg			
Netherlands			

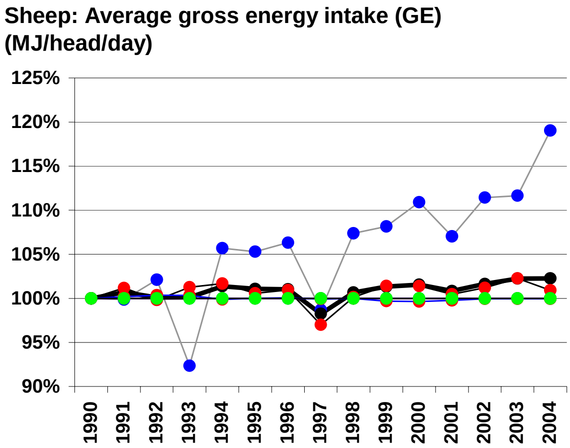
Figure 6.7 Trend of activity data for:

Sheep: Average gross energy intake (GE) (MJ/head/day)



	1990	Trend (%) 1990-2004	2004
Portugal	130	116%	151
Austria	123	115%	142
Finland	103	112%	116
EU-15	136	105%	143
Germany	95	103%	98
Ireland	139	100%	139
Sweden	181	100%	181
United Kingdom	189	100%	189
Italy	141	100%	140
Spain	155	100%	154
Denmark	96	99%	95
Belgium			
France			
Greece			
Luxembourg			
Netherlands			

Figure 6.8. Trend of activity data for:



	1990	Trend (%) 1990-2004	2004
Portugal	21	119%	25
EU-15	20	102%	21
Spain	19	101%	19
Denmark	44	100%	44
Greece	22	100%	22
Ireland	20	100%	20
Sweden	20	100%	20
Austria			
Belgium			
Finland			
France			
Germany			
Italy			
Luxembourg			
Netherlands			
United Kingdom			

6.3.1.3. Uncertainty and time series consistency

CH_4 emissions from enteric fermentation belong to the source category in agriculture, which are less uncertain. Animal numbers are assumed to be correct with a maximum uncertainty of 10%, and also the emission factor, which is calculated to a large extent with the Tier 2 methodology, is estimated to be known with a precision better than 20% for most countries, with 40% being the highest uncertainty estimate (Belgium and France).

The contribution of enteric fermentation to the overall inventory uncertainty is generally less than 1%, only Ireland reports a contribution of 1.6% to the total inventory uncertainty.

Information on the consistency of the time series from the NIR of some countries is summarized below:

Belgium:	In 2005, the number of agricultural and horticultural businesses amounted to 51.540. This number had dropped by 17 % in 5 years, the disappearing of small businesses being a general trend in the sector, also reinforced by the successive crises that have hit the agricultural sector (BSE [Bovine Spongiform Encephalitis], dioxin). Additionally in Flanders, this partly can be explained due to the subsidized cut down of the number of Cattle. This counted in 2001 and 2002 only for Swine, in 2003 also for bovine and poultry.
Denmark:	From 1990 to 2004 the emission has decreased by 17%, which is primarily related to a decrease in the number of Dairy Cattle from 1990 to 2004. Changed data for feeding consumption and allocation of subcategories the implied emission factor may vary between the years. The increase for the implied emission factor for Dairy cattle from 1990-2004 is a result of an increasing feed consumption due to a rising milk yield. For Non-Dairy Cattle there has been an increase in IEF. This is due to change in allocation of the subcategories.
Finland:	As there are no changes in calculation methods during 1990-2004, time series can be considered consistent.
Germany:	There is some inconsistency in the time series of animal numbers due to the modification of the "Agrarstatistikgesetzes" with a rupture between 1998 and 1999. This applies particularly to sheep and horses, for both animal categories an approach for correction has been developed and applied (Daemmgen, 2006).
Ireland:	The Tier 2 approach for enteric fermentation in cattle fully captures the evolution in CH_4 emissions from this important source since 1990 due to changes in population, Dairy cattle productivity, Beef cattle production systems and other factors.
Netherlands:	Increased poultry animal numbers after recovery from the avian flu in 2004, a country specific method, increasing CH_4 emission factors to estimate enteric fermentation esp. of Dairy Cattle. In addition, by regulating the amount of manure production and manure application, the Dutch policy on manure management is directly influencing livestock numbers in the Netherlands. As a result, numbers of (Dairy and Non-dairy) young Cattle and Swine reduced 27 and 19% respectively.
Sweden:	The time series in the agricultural sector are calculated consistently but the data needed are not always available for every year covered by the inventory. In cases where statistics are not produced annually, interpolation and extrapolation are necessary tools for the imputation of estimates.
United Kingdom:	The time-series consistency of these activity data is very good due to the continuity in data provided.

6.3.2 Manure Management (CH_4) (CRF source category 4.B(a))

6.3.2.1. Source category description

Table 6.29 shows that at the European level, swine and cattle contribute more or less equally to CH_4 emissions from manure management (46% and 47% of total emissions in category 4B(a), respectively). For cattle, the contributions of non-dairy cattle are prevailing with percentages of total emissions in this category amounting to 27% and 18%, respectively. The highest contribution of cattle to CH_4 emissions from manure management are observed in Luxembourg (91%) and Ireland (77%); the lowest in Portugal and Spain, where cattle contribute with only 6%. This is compensated with the emissions from swine manure with 89% of the total CH_4 from manure management. As also for enteric fermentation, significant emissions from sheep and goat occur in Greece with 11% and 4.5% of total CH_4 from manure management, respectively. Greece has also the highest contribution of poultry to CH_4 emissions from manure management with 16%.

At the EU-15 level, CH_4 emissions from manure management have decreased for cattle and sheep, but have increased for swine, which is mainly due to an intensification of swine production resulting in a higher IEF. Emissions from goats and poultry remained more or less stable.

Table 6.29: Total CH_4 emissions in category 4B(a) and implied Emission Factor at EU-15 level for the years 1990 and 2004

	Dairy Cattle	Non-dairy cattle	Swine
	1990		
Total Emissions of CH_4 [Gg CH_4]	453	651	873
Total Population [1000 heads]	26410	64755	112627
Implied Emission Factor [kg CH_4 / head / year]	17.2	10.1	7.8
	Dairy Cattle	Non-dairy cattle	Swine
	2004		
Total Emissions of CH_4 [Gg CH_4]	390	581	996
Total Population [1000 heads]	19168	58972	114924
Implied Emission Factor [kg CH_4 / head / year]	20.4	9.9	8.7
	Dairy Cattle	Non-dairy cattle	Swine
Total Emissions of CH_4 [Gg CH_4]	86%	89%	114%
Total Population [1000 heads]	73%	91%	102%
Implied Emission Factor [kg CH_4 / head / year]	119%	98%	112%

Source of information: CRF Table4s1 and 4.B(a) for 1990 and 2004, submitted in 2006.
Dairy cattle includes Mature Dairy cattle, Non-dairy cattle includes Mature Non-Dairy Cattle and Young Cattle

6.3.2.2. Methodological Issues

Methods

CH_4 emissions from manure management are a key source category for cattle and swine at EU-15 level. This is true also for many Member States, even though at a country-scale the contribution of the two animal categories are not as evenly as at the European scale; in some Member States emissions from swine are most important (Portugal, Spain, Denmark), while in others (Luxembourg, Ireland, United Kingdom) emissions from cattle are more important. Table 6.30 shows the total emissions in category 4.B(a), how this is composed and the methodology used for calculating the emissions for cattle and swine by Member States. Also, it is given whether the source category is key for the Member States, whereby one has to note that some countries do not disaggregate by animal type or by dairy and non-dairy cattle.

The method for calculation of CH_4 emissions from manure management implies the need to estimate for each animal category the excretion of volatile organic solids (VS) and a maximum methane producing capacity (B_0); furthermore, for each animal category and manure management system, a methane conversion factor, which is dependent on the climate region, which is multiplied with a fraction of the respective, and then summed over all, manure management systems – climate region combination that occur within a country. The IPCC *Guidelines* list default values for all these parameters. Each country must determine the fractions of the manure managed in AWMS-climate region combination. In Table 6.30 the following approach was applied to assign to each country/animal type the Tier 1 or Tier 2 methodology: if one of the parameters used (VS, B_0, or MCF) is different than the IPCC default value. According to this definition, more than two third of the emissions in category 4.B(a). However, two observations in the submissions of the Member States has to be added; (i) national-specific numbers are mostly used for the quantification of the excretion of volatile organic solids and (ii) only in rare cases it is possible to reconstruct the estimated IEF from the numbers reported in the background table.

Table 6.30: Total emissions and contribution of the main sub-categories to CH_4 emissions in category 4B(a), methodology applied and key source assessment by Member States for the sub-categories dairy cattle, non-dairy cattle and swine.

	Total	Dairy Cattle			Non-dairy cattle			Swine		
Member State	Gg CO_2-eq	a	b	c	a	b	c	a	b	c
Austria	880	26%	Tier 2	y[1]	27%	Tier 2		44%	Tier 2	y
Belgium	2,418	15%	Tier 2	y[1]	24%	Tier 2		56%	Tier 2	y
Denmark	1,030	23%	Tier 2	y[2]	4%	Tier 2		70%	Tier 2	
Finland	250	26%	Tier 2	n	14%	Tier 2	n	40%	Tier 2	n
France	13,057	12%	Tier 1	y[1]	49%	Tier 2		34%	Tier 1	n
Germany	5,209	34%	Tier 2	n	31%	Tier 2	n	30%	Tier 2	n
Greece	487	18%	Tier 1	n	21%	Tier 1	n	29%	Tier 1	n
Ireland	2,165	23%	Tier 2	y	54%	Tier 2	y	21%	Tier 1	y
Italy	3,235	18%	Tier 2	y[2]	22%	Tier 2		45%	Tier 2	
Luxembourg 1)	21	59%	Tier 1		32%	Tier 1		7%	Tier 1	
Netherlands 2)	2,466	47%	Tier 2	y[1]	13%	Tier 2		37%	Tier 2	y
Portugal	1,158	3%	Tier 2	n	3%	Tier 2	n	89%	Tier 2	y
Spain	8,896	4%	Tier 2	y[1]	2%	Tier 2		89%	Tier 2	y
Sw eden	457	32%	Tier 2	y[2]	33%	Tier 2		26%	Tier 2	
United Kingdom	2,568	43%	Tier 2	n	29%	Tier 2	n	13%	Tier 2	n
EU-15: Tier 1	**16%**	**20%**			**1%**			**24%**		
EU-15: Tier 2	**84%**	**80%**			**99%**			**76%**		

a Contribution to CH_4 emissions from enteric fermentation
b Tier 1: default methodology; Tier 2: country-specific methodology
c Source category is key in the Member State's inventory (y/n)
1) Key source assessment made for cattle w ithout disaggregation for dairy/non-
2) Key source assessment made for category 4B(a) as a w hole w ithout

Some additional information on the methodological approaches for some Member States is given in Table 6.31.

Table 6.31: Member State's background information for the calculation of CH_4 emissions in category 4.B(a)

Member State	Methods
Belgium NIR 2006 p. 71-73	CH_4 emissions from manure management in Flanders are estimated using the Tier 2 method. Because of the availability of detailed statistics on livestock composition in Flanders, including data on e.g. slaughter weights, a more extended variant of the IPCC methodology has been applied, integrating country-specific data.
Denmark NIR 2006 p. 203-204	The emissions from the agricultural sector are calculated in a comprehensive agricultural model complex called DIEMA (Danish Integrated Emission Model for Agriculture). The amount of manure is calculated for each combination of livestock subcategory and stable type. The estimation is based on national data for feed consumption (Mikkelsen, 2005) and standards for ash content and digestibility. Biogas plants using animal slurry reduce the emissions of CH_4 and N_2O (Sommer, 2001).
Finland NIR 2006, p. 125-132	The Tier 2 is used for all animal categories, which requires developing national emission factors for calculations on the basis of detailed data on animal characteristics and manure management systems. Cattle category includes emissions from Dairy. Emissions from Non-dairy are reported under other livestock (Suckler Cows, Bulls, Heifers, Calves).
France NIR 2005 p. 94	Tier 1+. AWMS distribution national on the basis of a survey carried out in 1994. Milk heifers are counted with Non-dairy cattle. But heifers more than 2 years old (40% of the total heifer livestock) are considered as Dairy cattle. Other parameters are from IPCC.
Germany NIR 2006, p. 313-326	As detailed data for the application of the Tier 2 methodology are missing, emissions are estimated using the "simple" CORINAIR (EMEP, 2003) methodology. The emission factors represent the general situation in Germany. Calculations are done at the district level.
Greece, NIR 2006 p. 134-135	IPCC Tier 1 methodology.
Ireland NIR 2006 p. 56	The analysis of the feeding regime for cattle included a full evaluation of the organic matter content of the feeds applicable to the 11 categories that characterise the national herd, which facilitated the estimation of their respective levels of organic matter excretion.
Netherlands NIR 2006, chapter 6	Tier 2 methodology for all animal categories distinguishing three manure management systems: liquid manure, solid manure and pasture. Country-specific EFs expressed in kg CH_4 per kg of manure and are base on volatile solids and maximum methane producing capacity for all AWMS and additionally on storage temperature and storage period for liquid manure systems. The amount of manure produced per animal category are taken as the starting point for calculating CH_4 emissions in the Netherlands, whereas the IPCC method is based on the total numbers of animals per animal category. The amount of manure produced is calculated by multiplying manure production factors (in kg per head per year) by animal numbers. Detailed descriptions of the methods can be found on www.greenhousegases.nl.
Portugal	Emission factors by animal type and climatic conditions.
Spain	Tier 2 for beef and pork herds, Tier 1 for other animal categories using smooth temperature functions for the MCF and EF (modification accepted by IPCC). Management systems: own expert calculation.
Sweden, NIR 2006, p. 176-177	Tier 2 for Cattle and Swine, Tier 1 methodology is used for other animal groups.
United Kingdom NIR 2006, p. 114	For Dairy cattle, the calculations are based on the population of the 'dairy breeding herd' rather than 'Dairy cattle in milk' used in earlier inventories. The former definition includes 'cows in calf but not in milk'. The waste factors used for beef and other cattle are now calculated from the IPCC Tier 2 procedure but do not vary from year to year. Emissions of methane from animal manures are calculated from animal population data (Defra, 2005a) in the same way as the enteric emissions. Apart from Cattle, Lambs and Deer, these are all IPCC Tier 1 defaults (IPCC, 1997) and do not change from year to year.

Activity Data

Table 6.32 and Table 6.32 summarize the allocation of the produced manure over the animal wastes management systems 'liquid systems', 'solid storage and dry lot' and 'pasture, range and paddock' for the animal categories dairy and non-dairy cattle and swine in 2004 and 1990, respectively. The table shows, that in all countries more manure is managed in liquid systems for swine than for cattle, whereby in Italy and Ireland 100% of the swine manure is managed in liquid systems. Only in the UK more manure is managed in solid than in liquid systems. In the category cattle, generally more manure is managed in liquid systems for dairy cattle than for non-dairy cattle, expressed in relative numbers, with the exception of Austria and France.

Substantial changes in the allocation of manure to manure management systems are reported for Sweden, Germany, Finland, and Denmark, however, with different signs of the direction of the changes. For example, liquid systems were more frequently used to manage manure from dairy cattle in Sweden (from 23% in 1990 to 47% in 2004). The trend for non-dairy cattle goes into the other direction in Sweden with a decreasing portion of manure managed in liquid systems (18% in 1990 and 15% in 2004) and increasing use of solid storage systems.

Table 6.32: Member State's Allocation of Animal Waste Management Systems over liquid systems, solid storage and dry lot, and pasture range and paddock in 2004

Member State	Dairy Cattle - Allocation of AWMS (%) [1]			Non-Dairy Cattle - Allocation of AWMS (%) [1]			Swine - Allocation of AWMS (%) [1]		
	Liquid system[2]	Solid storage and dry lot	Pasture range paddock	Liquid system[2]	Solid storage and dry lot	Pasture range paddock	Liquid system[2]	Solid storage and dry lot	Pasture range paddock
Austria	19%	70%	11%	24%	66%	9%	71%	29%	
Belgium									
Denmark									
Finland	28%	44%	28%	IE	IE	IE	60%	40%	
France[3]	11%	42%		37%	23%		83%	17%	
Germany	84%	17%		56%	46%		91%	9%	
Greece		90%	8%		62%	33%	90%	10%	
Ireland	41%	3%	56%	22%	9%	68%	100%		
Italy	0%	1%	0%	0%	1%		1%		
Luxembourg									
Netherlands									
Portugal	46%	25%	14%		20%		94%	2%	
Spain									
Sweden	47%	28%	24%	15%	25%	41%	74%	22%	
United Kingdom	31%	10%	46%	6%	21%	51%	31%	55%	7%

NA: Not Applicable - NE: Not Estimated. The portion lacking for 100% are reported as daily spread (Greece and UK) and 'other'.
[1] Information source: CRF Table 4.B.(a) for 2004, submitted in 2006
[2] Anaerobic lagoon + Liquid system. Anaerobic lagoon contributes only in Ireland with 2% of the manure managed.
[3] Only temperate was considered

Table 6.33: Member State's Allocation of Animal Waste Management Systems over liquid systems, solid storage and dry lot, and pasture range and paddock in 1990

Member State	Dairy Cattle - Allocation of AWMS (%) [1]			Non-Dairy Cattle - Allocation of AWMS (%) [1]			Swine - Allocation of AWMS (%) [1]		
	Liquid system[2]	Solid storage and dry lot	Pasture range paddock	Liquid system[2]	Solid storage and dry lot	Pasture range paddock	Liquid system[2]	Solid storage and dry lot	Pasture range paddock
Austria	19%	70%	11%	25%	66%	9%	71%	29%	
Belgium	30%	27%	43%	16%	40%		75%	24%	
Denmark									
Finland	22%	50%	28%				45%	55%	
France[3]	11%	42%		37%	23%		83%	17%	
Germany	66%	34%		56%	44%		85%	15%	
Greece		90%	8%		62%	33%	90%	10%	
Ireland	41%	3%	56%	22%	9%	68%	100%		
Italy	0%	1%	0%	0%	1%		1%		
Luxembourg									
Netherlands									
Portugal	35%	35%	14%		28%		95%	3%	
Spain									
Sweden	23%	54%	22%	18%	33%	39%	44%	52%	
United Kingdom	31%	10%	46%	6%	21%	51%	31%	55%	7%

NA: Not Applicable - NE: Not Estimated. The portion lacking for 100% are reported as daily spread (Greece and UK) and 'other'.
[1] Information source: CRF Table 4.B.(a) for 2004, submitted in 2006
[2] Anaerobic lagoon + Liquid system. Anaerobic lagoon contributes only in Ireland with 2% of the manure managed.
[3] Only temperate was considered

For some countries, background information in addition to what is reported in Table 6.24 on the activity data used for the estimation of CH_4 emissions from manure management is given in the respective National Inventory Reports and is listed in Table 6.34.

Table 6.34: Member State's background information on the activity data used for the calculation of CH_4 emissions in category 4.B(a)

Member State	Activity data
Austria, NIR 2006, p. 204-209	Statistic Austria, 2003 provides national data of annual livestock numbers on a very detailed level. Manure management systems are distinguished for Dairy Cattle, Suckling Cows and Cattle 1–2 years in "summer situation" and "winter situation". During the summer months, a part of the manure from these livestock categories is managed in "pasture/range/paddock". The value for "pasture/range/paddock" is estimated as follows: During summer, 14.1% of Austrian Dairy cows and Suckling cows are on alpine pastures 24 hours a day. 43.6 % are on pasture for 4 hours a day and 42.3 % stay in the housing for the whole year (Konrad, 1995).
Belgium, NIR 2006 p. 71-73	The main activity data are the land-use and the livestock figures. The National Institute of Statistics publishes these numbers yearly. All agricultural businesses have to fill a form each year about the situation at 1 may of that year and sent it to the NIS. Further details on the agricultural census methodology and QA/QC issues can be found on the NIS website: www.statbel.fgov.be.
Denmark NIR 2006 p. 203-204	The livestock production is primarily based on the agricultural census from the Statistics Denmark. The emission from slaughter pigs and poultry is based on slaughter data. There exist no official statistics concerning the distribution of animal between stable types. This distribution is therefore based on an expert judgement from the Danish Agricultural Advisory Centre (DAAC).
Finland NIR 2006, p. 125-132	The distribution of different manure management systems was received from published literature (Seppänen, 1998) and was updated for this submission with the help of experts from Rural Advisory Centres (ProAgria) (Kyntäjä, 2005) and MTT Agrifood Research Finland, Economics (Lehtonen, 2004). Anaerobic lagoons and daily spread not used in Finland.
France, OMINEA 2006 B.2.3.2.2	Source of information: SCEES - AGRESTE - Statistic agricole annuelle.
Ireland NIR 2006 p. 56	Because of the importance of agriculture in the country, Ireland has very extensive and up-to-date statistical data on all aspects of the sector, compiled and published by the Central Statistics Office. The allocation to animal waste management system is based on the farm facilities survey.
Netherlands, NIR 2006, chapter 6	Activity data of Dairy and Non-dairy are included in National Total Excretion; no data on individual animal species available.
Portugal, NIR 2006 p. 354-363	Livestock numbers per animal type were available at Concelho level from two detailed agriculture surveys: RGA89 and RGA99. Livestock numbers in each Concelho area were allocated to each climate region, for year 1999, according to the land are percentage, and always assuming an homogeneous distribution of animals in the Concelho territorial area. Number of animals were summed at each Administrative Region (Região). Livestock population in each climate region and by Região was estimated annually from total livestock population in Região and considering the constant share and, finally, the total national livestock population for each region was calculated.
Sweden NIR 2006, p. 176-177	The Swedish Board of Agriculture (SJV) provides data from a national database on manure production from Cattle and Swine. Three manure management systems are considered apart from grazing animals: liquid systems (including semi-liquid manure), solid storage and deep litter (sometimes categorised as "other" in the national inventory). National estimates of stable periods for cattle are collected from the statistical report on use of fertilisers and animal manure in agriculture.
United Kingdom NIR 2006, p. 114	Animal population data are taken from Agricultural Statistics (Defra, 2005a).

Emission Factors and other parameters

The implied emission factors for CH_4 emissions from manure management vary substantially among the Member States, as shown in Table 6.35. The range of the implied emission factors for dairy cattle, non-dairy cattle and swine covers about one order of magnitude, which is more than the range proposed in the IPCC *Guidelines* for different climate regions (for dairy cattle in Western Europe, for example, an emission factor of 14 kg CH_4 head^{-1} y^{-1} is proposed for cool climate regions and a factor of 81kg CH_4 head^{-1} y^{-1} of warm climate regions), but less than the ratio of the methane conversion factors of liquid (39% - 72%) and solid (1% – 2%) manure. The ratio of the highest and the smallest IEF used by the Member States is 8 for dairy cattle, and 12 for non-dairy cattle and 12, 11, and 8 for sheep, goats and swine, respectively. The highest IEF for dairy cattle is used by Netherlands with 36 kg CH_4/head/year and the smallest by Portugal with 4 kg CH_4/head/year.

As mentioned above, the two most important factors influencing the amount of CH_4 emitted from manure management systems are the climate region and if solid or liquid systems are dominating. We have already discussed the large range of systems used in the EU-15 Member States. Roughly speaking and because of the almost negligible methane conversion rate for manure managed in solid systems, if one country in the temperate climate region and using default MCF is managing, in relative terms, twice as much manure in liquid systems than another country, total emissions will also be almost twice as big. For the range of AWMS composition encountered in Europe (see Table 6.32), this makes such large differences in the IEF plausible.

However, as noted above, the information provided by the Member States in the CRFs does not suffice to explain satisfactorily all individual implied emission factors, and raises some questions that need to be addressed in the coming years.

Table 6.35: Implied Emission factors for CH_4 emissions from manure management used in Member State's inventory 2004

Member State	Implied EF (kg CH_4/head/yr) 1)				
	Dairy Cattle	Non-dairy cattle	Sheep	Goats	Swine
Austria	20.4	7.5	0.19	0.12	5.9
Belgium	22.5	13.8	1.43	1.36	10.2
Denmark	19.7	1.7	0.27	0.13	2.6
Finland 2)	9.4	2.5	0.19	0.12	3.5
France	18.4	19.4	0.28	0.18	20.9
Germany	19.8	8.7	0.19	NE	3.1
Greece	19.0	13.0	0.28	0.18	7.0
Ireland	20.9	9.5	0.17	0.12	12.4
Italy	15.0	7.7	0.22	0.15	7.8
Luxembourg	15.0	2.2			0.8
Netherlands 3)	IE	IE	0.18	0.35	3.9
Portugal	4.3	1.6	0.32	0.24	21.3
Spain	14.5	1.2	0.23	0.16	15.0
Sweden	17.3	5.9	0.19	0.12	3.1
United Kingdom	24.9	4.2	0.11	0.12	3.0
EU-15	20.35	9.87	0.20	0.18	8.66

NA: Not Applicable - NE: Not Estimated
1) Information source: CRF Table 4.B.(a) for 2004, submitted in 2006
2) Finland reports non-dairy cattle under "other" in the following categories: bulls, cows, heifers, and calves. The IEF has been calculated as a weighted average

The parameter of interest are the allocation of manure to climate regions (Table 6.36) and methane conversion factor used (Table 6.37). Most of Europe falls into the cool climate region with average annual temperatures below 15°C. Accordingly, most countries are allocating 100% of the animal population to the cool climate region, with Italy, Portugal and France allocating a part of the population into the temperate region (for dairy cattle for example 11%, 36%, and 53%, respectively) and only Greece allocating 100% of the animals to the temperate climate region. France assumes 53% of the dairy cattle in the temperate and 53% of the cattle in the warm climate region, which is due to the extra-territorial regions. The distribution of the animals over the climate regions is somewhat different for different animal types; in Spain, for example, the portion of animals living in the temperate region increases from dairy cattle over non-dairy cattle to swine[20].

For the categories dairy cattle, non-dairy cattle and swine, only in few cases is the allocation of animal population to climate regions reported to be dynamic. However, in Portugal, for example, a general shift of livestock production to warmer climate regions has been observed increasing the percentage of manure managed in the temperate region by 36%, 16%, and 76% for dairy cattle, non-dairy cattle, and swine, respectively.

[20] Data taken from the submission in 2005.

The MCF used by the Member States are in most cases the IPCC default values, in Table 6.36 averaged over the climate regions, if a country manages manure in more than one regions (weighted average). The potential methane producing factor is IPCC default or close to IPCC default for most countries (Table 6.38); the amount of volatile organic solid excreted per animal (Table 6.39) and year varies across the countries on the basis of the animal characterization with a ratio of highest to lowest average VS excretion rate between 2.0 (dairy cattle) and 11 (swine).

Table 6.36: Member State's allocation of dairy cattle, non-dairy cattle and swine to the climate regions "cool", "temperate" and "warm" in 2004

Member State	Dairy Cattle - Allocation by climate region[1]			Non-Dairy Cattle - Allocation by climate region[1]			Sw ine - Allocation by climate region[1]		
	Allocation by climate region			Allocation by climate region			Allocation by climate region		
	Cool (%)	Temperate (%)	Warm (%)	Cool (%)	Temperate (%)	Warm (%)	Cool (%)	Temperate (%)	Warm (%)
Austria	100	NO	NO	100	NO	NO	100	NO	NO
Belgium	100	NO	NO	55	NO	NO	100	NO	NO
Denmark	NO	NO	NO	NO	NO	NO	NO	NO	NO
Finland	100	NO	NO	NO	NO	NO	100	NO	NO
France	NO	53	53	NO	60	38	NO	100	100
Germany	100	NO	NO	100	NO	NO	100	NO	NO
Greece	NO	100	NO	NO	100	NO	NO	100	NO
Ireland	100	NO	NO	100	NO	NO	100	NO	NO
Italy	89	11	NO	87	11	NO	95	5	NO
Luxembourg	NO	NO	NO	NO	NO	NO	NO	NO	NO
Netherlands	NO	NO	NO	NO	NO	NO	NO	NO	NO
Portugal	48	36	NO	12	16	NO	22	76	NO
Spain[2]	72	28	0	56	44	0	38	62	0
Sw eden	100	NO	NO	98	NO	NO	100	NO	NO
United Kingdom	100	NO	NO	100	NO	NO	100	NO	NO

NA: Not Applicable - NE: Not Estimated. The portion lacking for 100% are reported as daily spread (only UK) and 'other'.
1) Information source: CRF Table 4.B.(a) for 2004, submitted in 2006
2) Data for Spain from the submission in 2005

Table 6.37: Member State's Methane Conversion Factor used for dairy cattle, non-dairy cattle and swine for the different animal waste management systems in 2004

Member State	Dairy Cattle - Methane Conversion Factor (%) [1]				Non-dairy Cattle - Methane Conversion Factor (%) [1]				Sw ine - Methane Conversion Factor (%) [1]			
	Anaerobic lagoon	Liquid system	Solid storage and dry lot	Pasture range paddock	Anaerobic lagoon	Liquid system	Solid storage and dry lot	Pasture range paddock	Anaerobic lagoon	Liquid system	Solid storage and dry lot	Pasture range paddock
Austria	90%	39%	1%	1%	90%	39%	1%	1%	90%	39%	1%	1%
Belgium												
Denmark		10%	1%	1%		10%	1%	1%		10%	1%	1%
Finland		10%	1%	1%		10%	1%	1%		10%	1%	1%
France		45%	2%	3%		45%	2%	3%		45%	2%	3%
Germany		39%	1%			39%	1%			39%	1%	
Greece												
Ireland		39%	1%	1%		39%	1%	1%		39%		
Italy		32%	6%			32%	6%			51%		
Luxembourg												
Netherlands												
Portugal	84%		3%				3%		84%		3%	
Spain												
Sw eden[3]		10%	1%	0%		10%	1%	1%		10%	1%	0%
United Kingdom		39%	1%	1%								

NA: Not Applicable - NE: Not Estimated. The portion lacking for 100% are reported as daily spread (only UK) and 'other'.
1) Information source: CRF Table 4B(a) for 2004, submitted in 2006
2) Anaerobic lagoon + Liquid system. Anaerobic lagoon contributes only in Ireland with 2% of the manure managed.
3) Values reported by Sweden have been multiplied with a factor of 100.

Table 6.38: Member State's methane producing potential for emissions from manure management for the main animal types in 2004

Member State	CH4 producing potential (Bo)(3) (CH4 m3/kg VS)				
	Dairy Cattle	Non-dairy cattle	Sheep	Goats	Swine
Austria	0.24	0.17	0.19	0.17	0.45
Belgium	NE	NE	NE	NE	NE
Denmark	0.24	0.17	0.19	0.17	0.45
Finland	0.24	0.17	0.19	0.17	0.45
France	0.24	0.17	0.19	0.17	0.45
Germany	0.20	0.20	0.20	NE	0.50
Greece	NE	NE	NE	NE	NE
Ireland	6.00	6.00	6.00	5.00	0.45
Italy	0.18	0.15	0.19	0.17	0.42
Luxembourg					
Netherlands	IE	IE	NE	NE	NE
Portugal	0.24	0.17	0.19	0.17	0.45
Spain	0.24	0.17	NA	NA	0.45
Sweden	0.24	0.17	0.20	0.20	0.45
United Kingdom	0.24	0.24	NE	NE	NE
EU-15	0.22	0.19			0.46

NA: Not Applicable - NE: Not Estimated
1) Information source: CRF Table 4.B(a) for 2004, submitted in 2006

Table 6.39: Member State's volatile solid excretion from managed manure for the main animal types in 2004

Member State	VS excretion (kg dm/head/yr)				
	Dairy Cattle	Non-dairy cattle	Sheep	Goats	Swine
Austria	1544	705	146	102	147
Belgium	NE	NE	NE	NE	NE
Denmark	1600	300	86	84	22
Finland[2)]	1639	633	146	102	183
France[2)]	1862	792	146	102	183
Germany	1596	530	146	NE	113
Greece	NE	NE	NE	NE	NE
Ireland[2)]	1655	989	146	102	183
Italy[2)]	2326	1040	146	102	126
Luxembourg					
Netherlands	IE	IE	NE	NE	NE
Portugal	2094	1057	184	159	193
Spain	1345	877	NA	NA	497
Sweden[2)]	1940	531	146	102	91
United Kingdom[3)]	1242	967	NE	NE	NE
EU-15	1769	784	0	0	220

NA: Not Applicable - NE: Not Estimated
1) Information source: CRF Table 4.B(a) for 2004, submitted in 2006
2) Values have been multiplied by 365 to convert from day to year
3) Values have been multiplied by 365*365

Some additional background information on the factors and parameters used by the Member States is given in Table 6.40.

Table 6.40: Member State's background information on the emission factors and other parameters used for the calculation of CH_4 emissions in category 4.B(a)

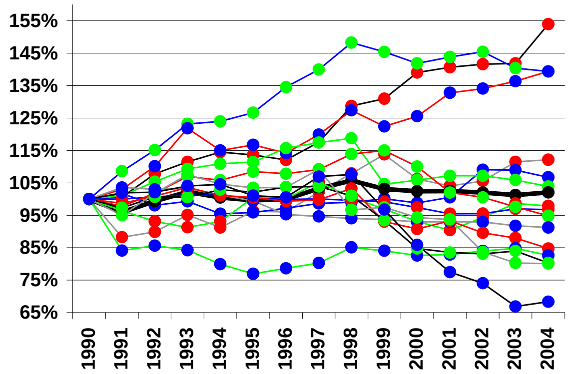
Member State	Emission Factors and other parameters
Austria NIR 2006, p. 204-209	Austrian specific values for Dairy cows were calculated in dependency of annual milk yields and corresponding feed intake data (gross energy intake, feed digestibility, ash content. Austrian specific values on VS excretion for all Other cattle categories were calculated from typical Austrian diets under organic and conventional management. From Manure Management for Sheep, Goats, Horses, Poultry and Other Livestock / Deer - default emission factors were taken from the IPCC guidelines
Belgium NIR 2006 p. 71-73	Emission factors for each animal category have been developed by (Siterem, 2001). Those factors take into account the type and volume of manure produced during the time spent in stables, its density and carbon content, and its carbon volatilisation ratio. For Non-dairy cattle and Swine, the implied EF in the CRF tables for Wallonia is a weighted average of specific EF for further disagregated animal categories
Denmark NIR 2006 p. 203-204	IEF for Dairy Cattle has increased as a result of an increasing milk yield, but also because of change in stable types. For Non-dairy Cattle an increasing part of the bull-calves is raised in stables with deep litter, where the MCF is lower than liquid manure. Sheep and Goats is including Lamb and Kid: IEF corresponds the Danish normative data. This explains why the Danish IEF is nearly twice as big compared to the IPCC default value. MCF for liquid systems national (10%).
Finland NIR 2006, p. 125-132	For Reindeer it is assumed that all manure is deposited on pastures and for fur animals it is assumed that all manure is managed as solid.
France, OMINEA 2006 B.2.3.2.2	IPCC EFs, only some specific national conditions were considered.
Greece NIR 2006 p. 134-135	The choice of emission factors follows the same criteria as for the case of enteric fermentation.
Netherlands, NIR 2006, chapter 6	Country-specific data on manure characteristics (volatile solids and maximum methane producing potential). Country-specific data on manure management system conditions (storage temperature and period) are also taken into account for liquid manure systems, determining the methane conversion factor. For the other manure systems (solid manure and manure produced in the meadow), IPCC default values for the methane conversion factor are used.
Sweden, NIR 2006, p. 181	The B_0i and MCF factors used are the default values in the Good Practice Guidande, except for the revised MCF for liquid manure, where the value of 10% given by IPCC Guidelines, is adopted as a national value. This value is considered to be a more appropriate for Swedish conditions, firstly because of Sweden's cold climate, and secondly because of the fact that the slurry containers usually have a surface cover.
United Kingdom NIR 2006, p. 114	Apart from Cattle, Lambs and Deer, these are all IPCC Tier 1 defaults and do not change from year to year. The emission factors for Lambs are assumed to be 40% of that for adult Sheep (Sneath, 1997). Emission factors for Dairy Cattle were calculated from the IPCC Tier 2.

Trends

Figure 6.9 through Figure 6.12 show the trend of the swine population in the Member States and the development of animal productivity in terms of volatile solid excretion for dairy and non-dairy cattle and swine. These figures show how the different development of the animal sectors in the various countries affects the average characteristics at EU level. Spain is the country with the largest increase in the Swine population and also the country which estimates the highest estimated volatile solid excretion rate. Thus the trend observed at EU-15 level (steepest increase in volatile solid excretion) can entirely be explained by a shift of the weight towards Spanish conditions.

Figure 6.9. Trend of the population size for swine

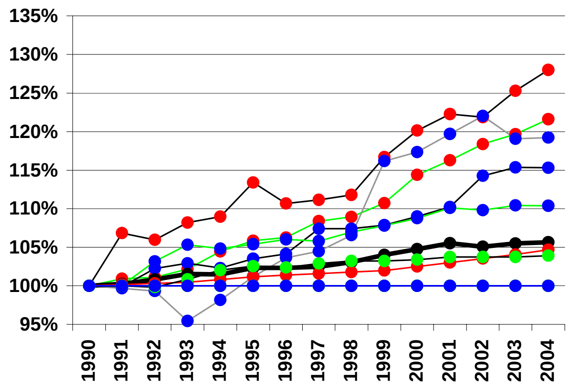
Swine: Population size (1000 head)



	1990	Trend (%) 1990-2004	2004
Spain	16393	154%	25232
Ireland	1221	139%	1702
Denmark	9497	139%	13233
Luxembourg	75	112%	85
Italy	8407	107%	8972
France	9669	104%	10044
EU-15	112627	102%	114924
Finland	1394	98%	1365
Greece	994	97%	962
Belgium	6700	95%	6355
Portugal	2536	91%	2314
Austria	3688	85%	3125
Germany	28326	83%	23406
Sweden	2264	80%	1818
Netherlands	13915	80%	11152
United Kingdom	7548	68%	5160

Figure 6.10. Trend of volatile solid excretion for dairy cattle

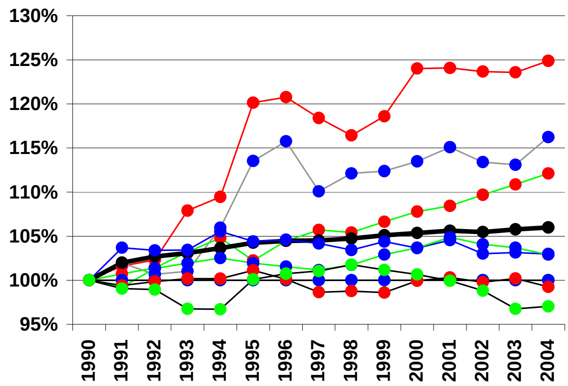
Dairy cattle: Volatide solid excretion (kg dm/head/day)



	1990	Trend (%) 1990-2004	2004
Spain	2.88	128%	3.68
Finland	3.69	122%	4.49
Portugal	4.81	119%	5.74
United Kingdom	2.95	115%	3.40
Germany	3.96	110%	4.37
EU-15	4.59	106%	4.85
Austria	4.04	105%	4.23
Sweden	5.12	104%	5.32
Denmark	4.38	100%	4.38
France	5.10	100%	5.10
Ireland	4.53	100%	4.53
Italy	6.37	100%	6.37
Belgium			
Greece			
Luxembourg			
Netherlands			

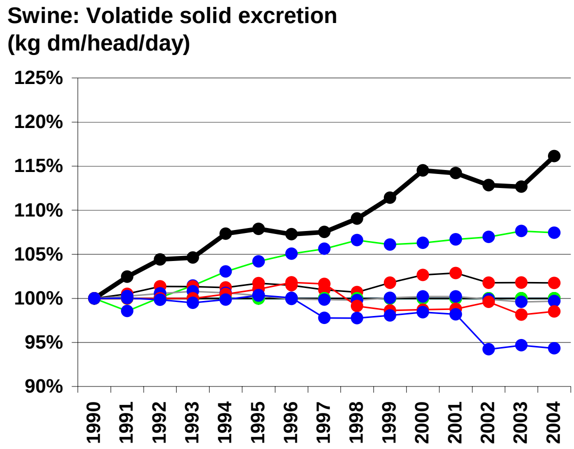
Figure 6.11. Trend of volatile solid excretion for non-dairy cattle

Non-dairy cattle: Volatide solid excretion (kg dm/head/day)



	1990	Trend (%) 1990-2004	2004
Austria	1.55	125%	1.93
Portugal	2.49	116%	2.89
Finland	1.55	112%	1.73
EU-15	2.03	106%	2.15
Italy	2.77	103%	2.85
Germany	1.41	103%	1.45
Denmark	0.82	100%	0.82
France	2.17	100%	2.17
Ireland	2.71	100%	2.71
United Kingdom	2.65	100%	2.65
Spain	2.42	99%	2.40
Sweden	1.50	97%	1.45
Belgium			
Greece			
Luxembourg			
Netherlands			

Figure 6.12. Trend of activity data for:



	1990	Trend (%) 1990-2004	2004
EU-15	0.52	116%	0.60
Germany	0.29	107%	0.31
Spain	1.34	102%	1.36
Denmark	0.06	100%	0.06
Finland	0.50	100%	0.50
France	0.50	100%	0.50
Ireland	0.50	100%	0.50
Sweden	0.25	100%	0.25
Portugal	0.53	100%	0.53
Austria	0.41	99%	0.40
Italy	0.37	94%	0.34
Belgium			
Greece			
Luxembourg			
Netherlands			
United Kingdom			

6.3.2.3. Uncertainty and time series consistency

As for enteric fermentation, the activity data in the category 4B(a) are considered to be relatively certain with uncertainty estimates around 10% for most countries. Highest uncertainty for the activity data are estimated by Spain (35%) and Italy and Sweden (20%).

The uncertainty estimate for the emission factors is higher and ranges between 15% (Finland) and 200% (Spain).

Information on the consistency of the time series from the NIR of some countries is summarized below.

Table 6.41: Member State's background information on the time series in category 4.B(a)

Member State	Time series consistency
Austria	Emissions of Cattle dominate the trend. The reduction of Diary cows is partly counterbalanced by an increase in emissions per animal (because of the increasing gross energy intake, milk production and N excretion of Diary Cattle since 1990).
Belgium	In 2005, the number of agricultural and horticultural businesses amounted to 51.540. This number had dropped by 17 % in 5 years, the disappearing of small businesses being a general trend in the sector, also reinforced by the successive crises that have hit the agricultural sector (BSE [Bovine Spongiform Encephalitis], dioxin). Additionally in Flanders, this partly can be explained due to the subsidized cut down of the number of Cattle. This counted in 2001 and 2002 only for Swine, in 2003 also for bovine and Poultry.
Denmark	The emission from manure management has increased due to a change towards more slurry based stable systems, which has a higher emission factor than systems with solid manure.
Finland	Methane emissions from manure management have been fluctuating during 1990-2004. This is due to increase in the number of animals kept in a slurry-based system. The fluctuation in the emissions is related to both changes in animal numbers, which is largely dependent on agricultural policy, as well as changes in the distribution of manure management systems used. Slurry-based systems increase methane emissions per animal tenfold compared to the solid storage or pasture.
Germany	A reduction of the CH_4 emissions during the timeperiod observed can be explained by the reduction of animal numbers after the German reunification. There is some inconsistency in the time series of animal numbers due to the modification of the "Agrarstatistikgesetzes" with a rupture between 1998 and 1999. This applies particularly to sheep and horses, for both animal categories an approach for correction has been developed and applied.
Netherlands	The decrease of animal number does not reflect the small increase in the Dairy Cattle CH_4 emissions in the same period. This can be explained by the following: Starting from 2000, manure production per Dairy Cow in the Netherlands increased 9% compared to 1990; Starting from 2000, the CH_4 emission factor for the manure management system increased 6% compared to 1990 because the volatile solids content in the manure increased 6%. The increase in milk production in the period 1990-2000 of approximately 16% is concluded to be accompanied by an increase in manure amount and volatile solids content. This has led to a 20% increase in methane emission factor for manure management per Cow.
Portugal	The time series of livestock numbers were revised in a consistent way to what was done for Enteric Fermentation emissions.

6.3.3 Manure Management (N_2O) (CRF source category 4.B(b))

6.3.3.1. Source category description

Generally, GHG emissions (in CO_2-equivalents) from manure management are predominantly as CH_4 rather than as N_2O. At the EU-15 level, this ratio is at about a factor of 2, ranging from 0.45 (Finland) to 3.0 (Spain). Values close or smaller to unity are found for Sweden (0.8) and Austria (1.0).

Table 6.42 shows that the implied emission factors used for N_2O emission from manure management are IPCC default for all countries are close to the default value and that only small changes in the IEF occurred in the time between 1990 and 2004, namely a 2% decrease of the IEF for liquid system and a 1% increase of the IEF for solid systems.

The differences of the ratio across the countries can partly be explained by the implied emission factor used for CH_4 emissions in the manure management category (see discussion above), and partly by the nitrogen excretion factors. Total nitrogen excretion by Member State and manure management system are also given in Table 6.42.

Table 6.42: Total N_2O emissions in category 4B(b) and implied Emission Factor at EU-15 level for the years 1990 and 2004

1990	Anaerobic lagoon	Liquid systems	Solid storage and dry lots
Total Emissions of N_2O [Gg N_2O-N]	0.025	4.6	76.9
Total Nitrogen excreted [Gg N]	16	3022	2552
Implied Emission Factor [kg N_2O-N / kg N]	0.1%	0.10%	1.9%

2004	Anaerobic lagoon	Liquid systems	Solid storage and dry lots
	2004		
Total Emissions of N_2O [Gg N_2O-N]	0.025	4.2	67.3
Total Nitrogen excreted [Gg N]	16	2779	2224
Implied Emission Factor [kg N_2O-N / kg N]	0.1%	0.10%	1.9%

2004 value in percent of 1990	Anaerobic lagoon	Liquid systems	Solid storage and dry lots
	2004 value in percent of 1990		
Total Emissions of N2O [Gg N2O-N]	98%	90%	88%
Total Nitrogen excreted [Gg N]	98%	92%	87%
Implied Emission Factor [kg N2O-N / kg N]	100%	98%	101%

6.3.3.2. Methodological Issues

Methods

Emissions of nitrous oxide are much higher from solid storage systems than from liquid systems; the percentage of emissions from solid storage systems thus varies between 77% in Sweden and 97% in Portugal.

Table 6.43 shows the total emissions in category 4B(b), how this is composed and the methodology used for calculating the emissions for cattle and swine by Member States. Also, it is given whether the source category is key for the Member States, whereby one has to note that most countries do not disaggregate by manure management system. Activity Data are the excretion of nitrogen per animal and the distribution over the manure management systems. This is done by most Member States at a higher disaggregation level than categories that are reported in the CRF. The emission factor of N_2O per nitrogen managed in a certain manure management system is usually IPCC default. Therefore, on the basis of this information only, for only a low percentage of the N_2O emissions from manure management (14%) the estimate stems from a Tier 2 calculation. However, also the nitrogen excretion rates are, for some countries, based on country-specific methodologies or data. For the Member States where such an approach has been described, we have indicated the Tier 2 (= higher than Tier 1) approach in Table 6.43. The table shows, however, that still only about one third of the N_2O emissions from manure management are calculated with country-specific information. Information on the development of the nitrogen excretion factors is given in Table 6.44.

Some additional information on the methodological approaches for some Member States is given in Table 6.45.

Table 6.43: Total emissions and contribution of the main sub-categories to N_2O emissions in category 4B(b), methodology applied (EF) and key source assessment by Member States for the sub-categories solid storage and liquid systems

	Total	Solid Storage			Liquid Systems		
Member State	Gg CO_2-eq	a	b	c	a	b	c
Austria	886	96%	Tier 1	y[1]	2%	Tier 1	
Belgium	873	92%	Tier 2	y	6%	Tier 2	n
Denmark	561	86%	Tier 2	y[2]	14%	Tier 2	
Finland	554	97%	Tier 1	y[2]	3%	Tier 1	
France	6,117	96%	Tier 1	y	4%	Tier 1	n
Germany	2,840	87%	Tier 1	n	13%	Tier 1	n
Greece	281	93%	Tier 1	n	2%	Tier 1	n
Ireland	412	86%	Tier 2	y	14%	Tier 2	n
Italy	4,125	90%	Tier 1		3%	Tier 1	
Luxembourg 1)						Tier 1	
Netherlands 2)	707	82%	Tier 1	y[2]	18%	Tier 1	
Portugal	577	97%	Tier 1	y[2]	1%	Tier 1	
Spain	2,962	96%	Tier 1		4%	Tier 1	
Sw eden	544	77%	Tier 1	y[2]	4%	Tier 1	
United Kingdom	1,254	87%	Tier 2	y[2]	4%	Tier 2	
EU-15: Tier 1	**87%**	**87%**			**82%**		
EU-15: Tier 2	**13%**	**13%**			**18%**		

a Contribution to N_2O emissions from enteric fermentation
b Tier 1: default methodology; Tier 2: country-specific methodology
c Source category is key in the Member State's inventory (y/n)
1) Key source: 1B1
2) Key source assessment made for category 4B(b) as a whole only

Table 6.44: Member State's background information for the development of nitrogen excretion rates used in the calculation of N_2O emissions in category 4.B(b)

Member State	Nitrogen excretion rates
Belgium NIR 2006 p. 73-76	Nitrogen excreted by each animal category is estimated through local production factors. In Wallonia, the methane emissions from the manure applied during grazing are reported under agricultural soils (category 4.D). It will be checked if these emissions should not rather be included in the manure management category.
Denmark NIR 2006, p. 205-206	N-excretion (kg N/head/yr) is weighted values from the following categorisation: Non-dairy cattle: Calves, Bulls, Heifers and Suckling Cattle, Sheeps, Goats, Swine: Piglets, Slaugthering pigs, Fur animals, Poultry: Broilers, Hens, Ducks, etc. IEF for "Solid Storage and dry lot" is a weighted value: 0.005 for poultry manure without bedding and 0.02 for other manure is used as recommended in IPCC GPG table 4.13.
Finland NIR 2006, p. 125-132	Annual N excretion per animal was updated for this submission by experts of MTT Agrifood Research Finland (Nousiainen, 2005). Values for annual N excretion (Nex) are based on calculations on N intake-N retention for typical animal species in typical forage system. Annual nitrogen excretion/animal and in the case of animals kept less than 1 year in farms (Swine, Poultry), replacement of animals with new has been taken account in the calculations.
France, NIR 2006 p. 93	Heifers more than 2 years old are considered as Dairy cattle but this livestock is counted with Non-dairy cattle. As recommended by the IPCC GPG, a correction factor is applied to the calculation of the excretion rate of young animals.
Germany NIR 2006, p. 313-326	N-excretion factors are calculated on the basis of milk productivity for Dairy cattle and national data for other animals. Values for the content of total ammoniacal nitrogan (TAN) were estimated for Cattle, Swine, Sheep, Horses, and Poultry.
Greece, NIR 2006 p. 134-135	Especially for N excretion, the values referring to Mediterranean countries were chosen.
Ireland, NIR 2006 p. 56-57	For Cattle, the excretion rates are consistent with the nitrogen content of Cattle feeds and the quantities excreted by the animal, as analysed in conjunction with the determination of Tier 2 CH_4 emission factors for Cattle.
Netherlands NIR 2006, p. 6-9,10	Standard factors for manure production and manure N-excretion per animal per animal category and per manure management system are calculated by Netherlands Statistics and decided on by WUM (Working group for Uniform calculations on Manure- and minerals) annually, based on specific data such as milk yield. More specified data on manure management are based on statistical information on management systems and is documented (Van der Hoek, 2005).
Portugal	The new nitrogen excretion rates reflect the analysis results obtained in the Laboratory Rebelo da Silva, complement with international sources such as (Ryser, 1994) and data submitted by other countries. These rates are considered more representative of the national conditions than those that were formely submitted and which was set from information received from the Agriculture Ministry (Seixas, 2000). The nitrogen rates are presented in next table together with the default nitrogen excretion rates from IPCC for Western Europe. There is an acceptable agreement between country-specific values and IPCC defaults for all species other than Sheep, Goats and Equines.
Spain	IPCC methodology using Nex fraction of the "Near East & Mediterranean" climate region and applying age-related correction factors.

Table 6.45: Member State's background information for the calculation of N_2O emissions in category 4.B(b)

Member State	Methods
Belgium NIR 2006 p. 73-76	In Wallonia, the methane emissions from the manure applied during grazing are reported under agricultural soils (category 4.D). It will be checked if these emissions should not rather be included in the manure management category.
Denmark NIR 2006, p. 205-206	The emissions from the agricultural sector are calculated in a comprehensive agricultural model complex called DIEMA (Danish Integrated Emission Model for Agriculture). Thus, there is a direct coherence between the ammonia emission and the emission of N_2O. A more detailed description is published, but only in Danish (Mikkelsen, 2005). DIEMA is working with 30 different livestock categories depending on livestock category, weight class and age. These categories are subdivided in to different stable type and manure type, which result in about 100 different combinations of livestock subcategories and stable types. For each of these combinations information on e.g. feed intake, digestibility, excretion, methane conversion factor is attach. The N_2O emission from manure management is based on the amount of nitrogen in the manure in stables. The emission from manure deposits on grass is included in "Animal Production".

Member State	Methods
Finland, NIR 2006, p. 125-132	All manure assumed as deposited on pastures. For Bulls it is assumed that are not kept in pasture. N-excretion for Fur animals is average of two sub-categories: Minks and Fitches and Fox and Racoon. Emissions from pasture range and paddocks are included uncer 4.D agricultural soils.
Germany NIR 2006, p. 313-326	Emissions of nitrogen compounds from manure management is done with the mass-flow approach (EMEP, 2003; Daemmgen, 2006), using IPCC methodologies (Tier 1) for N_2O and NO emission estimates, which are no key sources. The distribution over manure management systems takes into consideration all relevant housing systems occurring in Germany and is based on the length of the grazing period, the average time per day spent grazing and in milking yards. All calculations are done on the district level using the agricultural model RAUMIS.
Portugal, NIR 2006 p. 365-373	Emissions of N_2O from manure for each Manure Management Systems were estimated with the proposed formula in GPG. This same methodology was used to assess Direct N_2O soil emissions from manure deposited in soil during grazing (Pasture Range and Paddock) and also Direct N_2O soil emissions from manure that is applied to soil as fertilizers.
Sweden NIR 2006, p. 176	The methodology for estimating N_2O from manure management is in accordance with the IPCC Guidelines Tier 2 methodology; it is based on emission factors from the IPCC Guidelines in combination with national activity data.
United Kingdom NIR 2006, p. 115-116	The IPCC (1997) method for calculating emissions of N_2O from animal waste management is followed. The UK application of the methodology assumes that 20% of the total N emitted by livestock volatilises as NOx and NH3 and therefore does not contribute to N_2O emissions from AWMS. This is because in the absence of a more detailed split of NH3 losses at the different stages of the manure handling process it has been assumed that NH3 loss occurs prior to major N_2O losses.

Activity Data

In EU-15, a total of 8.182 Gg N was managed in manure management systems or excreted on pasture range and paddock in 2004. The largest share of this manure-nitrogen was excreted by grazing animals, followed by manure managed in liquid and solid storage systems. Compared with 1990, this was a decrease of manure-nitrogen by 9%. The largest decrease of nitrogen managed occurred for the solid storage and dry lot systems, which in 2004 was 13% less than in 1990. The decrease of nitrogen was particularly pronounced in the Netherlands, where total nitrogen decreased by 31%. At the same time, the manure managed on solid storage systems increased by 10%.

The nitrogen managed in the various manure management systems in 2004 is given in Table 6.46. Additional background information for some Member States on the activity data used for estimating N_2O emissions from manure management are summarized in Table 6.47.

Table 6.46: Member State's nitrogen managed in the manure managed systems anaerobic lagoon, liquid systems, daily spread, and other systems, manure excreted on pasture range and paddock, and total nitrogen excreted in 2004

Member State	Anaerobic lagoon	Liquid systems	Daily Spread	Solid storage and dry lot	Other	Pasture range paddock	Total
Austria		42		87	7	23	159
Belgium		113	2	86	4	90	295
Denmark		191		51		32	273
Finland		33		55	0	22	110
France		468		604		780	1,853
Germany		843		322		143	1,308
Greece		14	1	27	6	366	413
Ireland		115		37		289	441
Italy		277		381	28	159	845
Luxembourg							
Netherlands 1)		305		68		88	461
Portugal	16	15		58		71	159
Spain		221	20	293		337	871
Sweden		45		43	11	44	143
United Kingdom		97	105	112	70	469	853
EU-15	16	2,779	128	2,224	125	2,912	8,182

NA: Not Applicable - NE: Not Estimated
Information source: CRF Table 4.B(b) for 2004, submitted in 2006
1) Values for pasture range paddock multiplied with 1000000 to make it consistent with Table4.D

Table 6.47: Member State's background information on the activity data used for the calculation of N_2O emissions in category 4.B(b)

Member State	Activity data
Austria NIR 2006, p. 210-214	Statistic Austria provides national data of annual livestock numbers on a very detailed level.These data are basis for the estimation. The animal numbers of Young Swine were not taken into account because the emission factors for Breeding Sows already includes nursery and growing Pigs (Schechtner, 1991). Data of Austria's manure management system distribution were taken from (Konrad, 1995). The animal waste management system distribution data used to estimate N_2O emissions from Manure Management are the same as those that were used to estimate CH_4 emissions.
Belgium NIR 2006, p. 73-76	In Flanders, the allocation of animals to AWMS as well as the detailed data for nitrogen excretion factors and processed animal manure originate from the Manure Bank of the Flemish Land Agency (www.vlm.be) and is based on the regional situation. In Wallonia, the allocation of animals to AWMS comes from the NIS agricultural census of 1992 and 1996, where those data were published by animal type. Those data are not collected yearly by the NIS given their slow pace of change. "Other" includes Horses, Mules and Asses, Goats and Rabbits.
Denmark NIR 2006, p. 205-206	The livestock production is primarily based on the agricultural census from the Statistics Denmark. The emission from slaughter pigs and poultry is based on slaughter data. At present, there exist no official statistics concerning the distribution of animal between stable types. This distribution is therefore based on an expert judgement from the Danish Agricultural Advisory Centre (DAAC). The Danish Institute of Agricultural Sciences (DIAS) deliver Danish standards related to feeding consumption, manure type in different stable types, nitrogen content in manure etc. N-excretion (kg N/head/yr) is weighted values from the following categorisation: Non-dairy Cattle (Calves, Bulls, Heifers and Suckling Cattle), Swine (Piglets, Slaugthering pigs, Sows), Poultry (Broilers, Hens, Ducks).
Finland NIR 2006, p. 125-132	The distribution of different manure management systems was received from published literature (Seppänen, 1998) and was updated for this submission with the help of experts from Rural Advisory Centres (ProAgria) (Kyntäjä, 2005) and MTT Agrifood Research Finland, Economics (Lehtonen, 2004). Manure management systems included in the inventory are pasture, solid storage and slurry.
Germany NIR 2006, p. 313-326	The estimation of N_2O emission requires the statistical assessment of boundary conditions such as the effective surface area, the ventilation conditions and the temperature during storage. In Germany, such data are not available.
Greece NIR 2006 p. 134-135	Data on animal population, agricultural production and cultivated areas used for the emissions calculation were provided by the NSSG.
Ireland NIR 2006 p. 56-57	Because of the importance of agriculture in the country, Ireland has very extensive and up-to-date statistical data on all aspects of the sector, compiled and published by the Central Statistics Office.
Netherlands NIR 2006, p. 6-9,10	Activity data on animal population are based on the annual agricultural survey, performed by Statistics Netherlands (CBS). Data can be found on www.cbs.nl; and in a background document (Van der Hoek, 2005). Activity data are collected on a tier 2 level.
Portugal, NIR 2006 p. 365-373	Livestock populations used to estimate total nitrogen excretion are the same that are also used to estimate emissions of CH_4 from Enteric Fermentation and CH_4 from Manure Management. The quantity of nitrogen excreted per head represents expert information provided by the Ministry of Agriculture.
Sweden NIR 2006, p. 176	The Farm Register provides the main basis for agricultural statistics in Sweden. The Register is administered by the Swedish Board of Agriculture and Statistics Sweden and provides annual information on the total number of animals of different categories on Swedish farms. Statistics on manure management and the use of manure and fertilisers are collected biannually by Statistics Sweden. Since Dairy Cows are often stabled at night, the data on stable periods for this animal category is combined with an assumption that 38% of its manure was produced in the stable during the grazing period.
United Kingdom, NIR 2006, p. 115-116	The animal population data are collected in an annual census, published by Defra.

Emission Factors and other parameters

As all countries are using IPCC default values for the IEF or values that are close to it (with the exception of the IEF for solid storage used by the Netherlands), these numbers apply also for the EC N_2O inventory for manure management. An overview of the implied emission factors is given in Table 6.48. The decreases in N_2O emissions of 9% (total; 8% in liquid systems and 13% for solid systems) are due to decreases in nitrogen excretion and changes of the IEF in some countries. For liquid systems, both nitrogen excretion and the implied emission factor decreases (decreases are estimated for Denmark and Germany); so that the decrease in N_2O emissions is even more pronounced. For solid systems, a dynamic IEF has been reported for Denmark, Netherlands and Sweden, which report an increase of the IEF by 1%, 2% and 11%, respectively. For Germany, the IEF has been calculated on the basis the emissions and nitrogen allocation to the AWMS and resulted in a sharp increase of the IEF by 21% explaining the increase of the IEF at European scale by 10% discussed above. In all other countries, the IEF is not time-dependent or stays within 2% of the 1990 level (Belgium, Netherlands) for both system types.

Table 6.48: Implied Emission factors for N_2O emissions from manure management used in Member State's inventory 2004

Member State	Implied EF (kg N_2O-N / kg N) 1)			
	Anaerobic lagoon	Liquid system	Solid storage and dry lot	Other
Austria	NO	0.10%	2.0%	0.5%
Belgium	NO	0.10%	1.9%	0.5%
Denmark	NO	0.08%	2.0%	NO
Finland	NE	0.10%	2.0%	NE
France		0.10%	2.0%	
Germany 1)	NO	IE	IE	NO
Greece	NA	0.10%	2.0%	0.5%
Ireland	NO	0.10%	2.0%	NO
Italy	NO	0.10%	2.0%	2.0%
Luxembourg				
Netherlands	NO	0.09%	1.7%	NO
Portugal	0.1%	0.10%	2.0%	
Spain	NO	0.10%	2.0%	NO
Sw eden	NO	0.10%	2.0%	2.0%
United Kingdom	NO	0.10%	2.0%	0.3%

NA: Not Applicable - NE: Not Estimated
Information source: CRF Table 4.B(b) for 2004, submitted in 2006
1) The IEF have for Germany have been calculated from the total nitrogen excretion and N_2O emissions per AWMS.

These numbers are based on the used nitrogen excretion rate per head and year, which are given in Table 6.49 for the main animal types. The table shows a range by a factor of ca. 2.0 between the highest and the lowest value used is found. For example, for dairy cattle, we have a range between 70 kg N head^{-1} y^{-1} for Spain and Greece and 131 kg N head^{-1} y^{-1} f for Denmark (factor 1.9). The largest range is found for sheep with values between 5.1 kg N head^{-1} y^{-1} (Spain) and 18.3 kg N head^{-1} y^{-1} (France). This range has somewhat narrowed with respect to the data submitted in 2005 for the inventory year 2003.

Additional information on the development of the emission factor is available for some Member States and is summarized in Table 6.50.

Table 6.49: Total Nitrogen excretion by AWMS [Gg N] for dairy and non-dairy cattle, sheep, swine, and poultry in 2004

Member State	Dairy	Non-Dairy	Sheep	Sw ine	Poultry
Austria	94.7	46.0	13.1	14.3	0.5
Belgium	111.1	55.5	7.1	11.9	0.6
Denmark	131.1	38.6	16.9	9.4	0.7
Finland	108.2	45.7	8.1	18.3	0.7
France	100.0	57.9	18.3	17.4	0.6
Germany	114.7	43.1	7.5	13.7	0.4
Greece	70.0	50.0	12.0	16.0	0.6
Ireland	85.0	65.0	5.9	8.3	0.4
Italy	116.0	50.0	16.2	11.5	0.5
Luxembourg					
Netherlands	IE	IE	NA	NA	NA
Portugal	87.6	47.1	6.0	8.0	0.7
Spain	67.5	52.2	5.1	9.1	0.7
Sw eden 1)	105.1	41.3	6.1	9.0	0.4
United Kingdom	105.8	48.5	6.8	10.0	0.7

NA: Not Applicable - NE: Not Estimated - IE: Implied Elsewhere
Information source: CRF Table 4.B(b) for 2004, submitted in 2006

1) Values divided by 1000 for dairy and non-dairy cattle

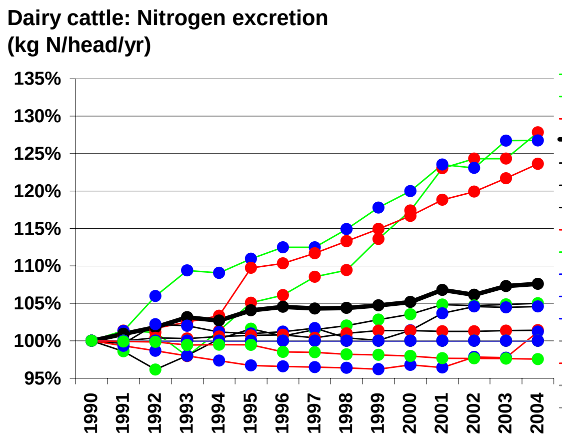
Table 6.50: Member State's background information for the development of the emission factor for calculation of N_2O emissions in category 4.B(b)

Member State	Emission Factors
Belgium NIR 2006 p. 73-76	Emission factors for each animal category have been developed by (Siterem, 2001). Those factors take into account the type and volume of manure produced during the time spent in stables, its density and carbon content, and its carbon volatilisation ratio. In Wallonia, such factors were first determined for the implementation of the CE Nitrates Directive 91/676 on http://www.nitrawal.be/pdf/arretenitrates_mb2.pdf, but were representing the nitrogen after deduction of the atmospheric losses, so new factors were calculated on this basis for the purposes of estimating atmospheric emissions.
Denmark, NIR 2006, p. 225-226	4.B Solid storage and dry lot:IEF for "Solid Storage and dry lot" is a weighted value. 0.005 for poultry manure without bedding and 0.02 for other manure i used as recommended in IPCC GPG table 4.13.
France, OMINEA 2006 B.2.3.2.2.3.	IPCC default emissions factors with the regards of some national conditions according to the GPG.
Germany, NIR 2006, p. 311-313	The default IPCC N_2O emission factor relates to the amount of nitrogen excreted or managed. As more accurate relationships are lacking, this approach is also followed in the German inventory. The EFs are taken/have been derived from the IPCC. The simultaneous formation of N2 has been estimated to allow a consistent assessment of indirect N_2O emissions.
Netherlands NIR 2006, p. 6-9,10	IPCC default values are used for N_2O emission factors for liquid and solid manure management systems.
Portugal, NIR 2006 p. 365-373	The emission factors are the default IPCC96 emission factors because there are no country-specific emission factors.
Sweden NIR 2006, p. 176	The emission factors are calculated as a function of national activity data for manure production, stable periods and animal manure management systems (AWMS), etc. Parameters that are used to estimate methane and N_2O emissions depend on the specific AWMS. The only national value chosen is the MCF for liquid manure, which is set to 10%, as was stated in the IPCC Guidelines. All other parameters, due to the lack of information needed to determine national values, are default values from the IPCC Guidelines.
United Kingdom NIR 2006, p. 115-116	For Dairy and Non-dairy Cattle, the emission factor for the housing phase is around 10% of the storage phase, so the non-stored FYM has been split between SSD and DS to account for this.

Trends

Figure 6.13 through Figure 6.18 show the trend of the nitrogen excretion rate per head and the nitrogen managed in solid storage and dry lot systems.

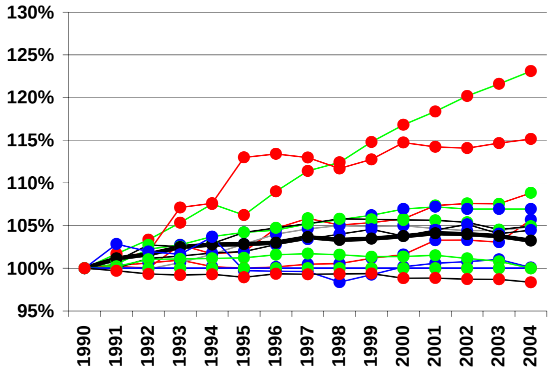
Figure 6.13. Trend of nitrogen excretion rates for dairy cattle



	1990	Trend (%) 1990-2004	2004
Finland	84.6	128%	108.2
Germany	90.5	127%	114.7
Austria	76.6	124%	94.7
EU-15	98.3	108%	105.8
Sweden	100.0	105%	105.1
United Kingdom	101.1	105%	105.8
Spain	66.6	101%	67.5
Denmark	129.5	101%	131.1
France	100.0	100%	100.0
Greece	70.0	100%	70.0
Ireland	85.0	100%	85.0
Italy	116.0	100%	116.0
Portugal	87.6	100%	87.6
Belgium	113.9	98%	111.1
Luxembourg			
Netherlands			

Figure 6.14. Trend of nitrogen excretion rates for non-dairy cattle:

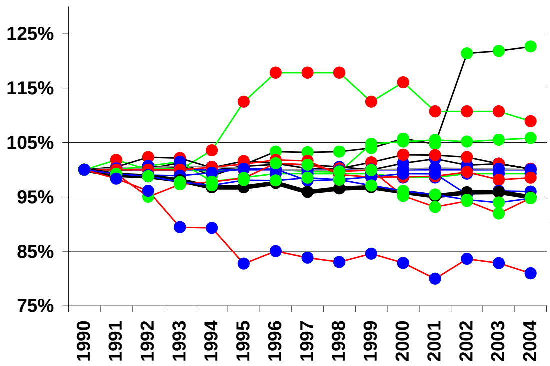
Non-dairy cattle: Nitrogen excretion (kg N/head/yr)



	1990	Trend (%) 1990-2004	2004
Finland	37.1	123%	45.7
Austria	40.0	115%	46.0
Belgium	51.0	109%	55.5
Germany	40.3	107%	43.1
Denmark	36.6	106%	38.6
Portugal	45.0	105%	47.1
Sweden	39.3	105%	41.3
United Kingdom	46.4	105%	48.5
EU-15	46.9	103%	48.5
Italy	50.0	100%	50.0
France	57.9	100%	57.9
Greece	50.0	100%	50.0
Ireland	65.0	100%	65.0
Spain	53.1	98%	52.2
Luxembourg			
Netherlands			

Figure 6.15. Trend of nitrogen excretion rates for swine

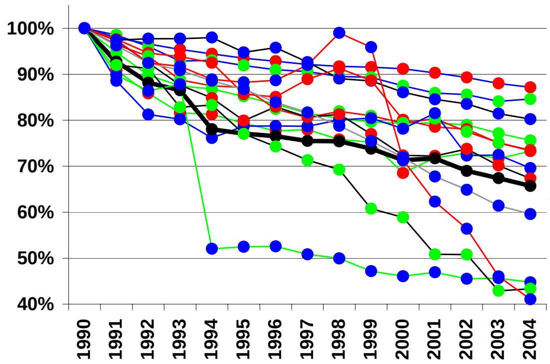
Swine: Nitrogen excretion (kg N/head/yr)



	1990	Trend (%) 1990-2004	2004
Sweden	7.4	123%	9.0
Finland	16.8	109%	18.3
France	16.4	106%	17.4
United Kingdom	10.0	100%	10.0
Spain	9.1	100%	9.1
Greece	16.0	100%	16.0
Portugal	8.0	100%	8.0
Germany	13.8	99%	13.7
Austria	14.6	99%	14.3
Italy	12.0	96%	11.5
EU-15	11.7	95%	11.1
Belgium	12.5	95%	11.9
Ireland	8.8	95%	8.3
Denmark	11.6	81%	9.4
Luxembourg			
Netherlands			

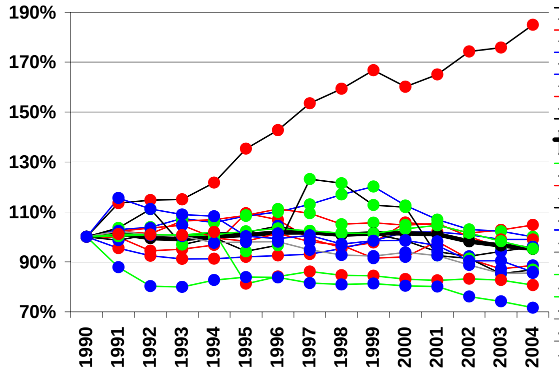
Figure 6.16. Trend of N managed in solid storage and dry lot, dairy cattle

Dairy cattle: N managed in solid storage and dry lot (kg N/yr)



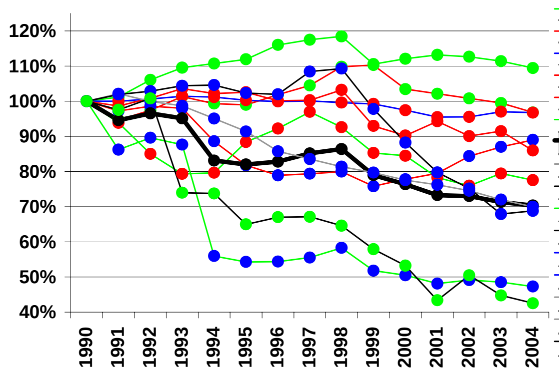
	1990	Trend (%) 1990-2004	2004
Greece	15529080	87%	13535073
Ireland	3318973	85%	2809599
United Kingdom	26855615	80%	21555355
France	227410795	76%	171974385
Austria	48794838	74%	35871498
Belgium	29354819	73%	21519955
Finland	20890400	73%	15311035
Italy	204184157	70%	142086553
Spain	64322659	67%	43303770
EU-15	868869108	66%	570913285
Portugal	12090260	60%	7203799
Germany	169075645	45%	75691538
Sweden	32428	43%	14050
Denmark	14613436	41%	6001174
Luxembourg			
Netherlands			

Figure 6.17. Trend of N managed in solid storage and dry lot, non-dairy cattle



	1990	Trend (%) 1990-2004	2004
Spain	57747360	185%	106791386
Austria	42961933	105%	45000179
Ireland	23820052	100%	23826889
Greece	11777158	99%	11652527
Belgium	46115617	96%	44324370
United Kingdom	66785929	96%	64094447
EU-15	904767614	95%	861296642
France	277135977	95%	263922923
Denmark	19525864	89%	17293650
Sweden	15373	87%	13357
Italy	136518950	86%	117320171
Portugal	12887420	86%	11027179
Finland	17087647	81%	13788551
Germany	171962342	72%	123129389
Luxembourg			
Netherlands			

Figure 6.18. Trend of N managed in solid storage and dry lot, swine



	1990	Trend (%) 1990-2004	2004
France	27393440	109%	29973401
Belgium	6405909	97%	6200307
Greece	1590645	97%	1539037
Denmark	11981934	89%	10665748
Austria	7125053	86%	6123642
Finland	12881484	78%	9988872
EU-15	171307095	70%	120416477
Portugal	607850	70%	425276
United Kingdom	32953088	69%	22660847
Germany	61761127	47%	29180094
Sweden	8606565	43%	3659253
Ireland			
Italy			
Luxembourg			
Netherlands			
Spain			

6.3.3.3. Uncertainty and time series consistency

Activity data used for the estimation of N_2O emissions from manure management are generally analogue to those used for the estimation of CH_4 emissions, and consequently also the uncertainty estimates are similar. Only United Kingdom estimates an uncertainty of up to 100% for the activity data for category 4B(b). The uncertainty of the emission factor is much higher, and only Finland (10%) have estimated an uncertainty lower than 50%. Generally an uncertainty of 100% is assumed, Spain and the United Kingdom assume high uncertainty with 200% and 414%, respectively.

Nevertheless, N_2O emissions from manure management are representing only a small fraction in most inventories, so that the contribution to the overall uncertainty remains in most cases small, i. e. 0.5% of total emissions or less. Only Denmark and Spain report a higher contribution of N_2O emissions from manure management to the overall uncertainty with 1.5% and 4.2% of total emissions, respectively.

Information on the consistency of the time series from the NIR of some countries is listed in Table 6.51.

Table 6.51: Member State's background information on the time series of N_2O emissions in category 4.B(b)

Member State	Time series consistency
Belgium	In 2005, the number of agricultural and horticultural businesses amounted to 51.540. This number had dropped by 17 % in 5 years, the disappearing of small businesses being a general trend in the sector, also reinforced by the successive crises that have hit the agricultural sector (BSE [Bovine Spongiform Encephalitis], dioxin). Additionally in Flanders, this partly can be explained due to the subsidized cut down of the number of cattle. This counted in 2001 and 2002 only for swine, in 2003 also for bovine and poultry.
Denmark	Biogas plants using animal slurry reduce the emissions of CH_4 and N_2O (Sommer, 2001). The Variations in N-excretion in the time-series reflect changes in feed intake, fodder efficiency and allocation of subcategories. The effects from the biogas treated slurry are from this year included in the N_2O emission.
Finland	CH_4 and N_2O emissions from manure management are affected by the fluctuation in animal numbers as well as the proportion of manure managed in different manure management systems which is dependent on animal species. N-excretion in slurry for sheeps estimated as NE in 1990-1994 because it is assumed that sheep manure has not been treated as slurry in that period. Assumption is that manure of Horses and Goats not treated as liquid 1990-1994. This is marked as "NE".
Netherlands	Between 1990 and 2004 the proportion of the total solid manure N-excretion increased from 13 to 18%. Compared to the liquid manure system, the N_2O emission factor for the solid system is about 20 times higher. This explains the increased overall IEF of 27%. Combined with the 20% decrease in total N-excretion, this explains the small N_2O emission increase. In 2003 N_2O emissions of solid manure decreased. This is explained by the decreased poultry animal manure. This is caused by decreased Poultry animal numbers due to the avian flu. In 2004, N_2O emissions increased again due to recovery of Poultry animal numbers.
Sweden	The N_2O emissions have decreased since 1990, mainly because of a change from solid manure management to slurry management in dairy and pork production. Due to more intense Swine production, the values for Sows and Pigs for meat production were updated in 2001.

6.3.4 Rice Cultivation (CH_4) (CRF source category 4.C)

6.3.4.1. Source category description

Rice cultivation is occurring in five EU-15 countries: France, Greece, Italy, Portugal, and Spain. All countries but Italy are reporting rice production under a continuously flooding regime, while in Italy the practice of multiple aeration is predominant. In Italy rice paddies are flooded with 15-25 cm of water usually from April-May to August. During this field submersion time two or three water drainage periods, 2 to 4 days each, can happen in 85% of rice paddies, a clearly uninterrupted submersion in 13-14% and about one month delayed submersion in 1-2% (National Inventory Report, Italy, 2003).

At EU-15 level, the implied emission factors amounts to 17.2 g m^{-2} in 2003 for continuous flooded rice fields, which represents a decrease in the implied emission factor by 9% since 1990 (see Table 6.52), which can be explained by the higher contribution of Spain. Note that the implied emission factors for intermittently flooded field are stemming from the Italian inventory only. Here it is smaller than the emissions from continuously flooded fields (see below). At the EU-15 level and with the given choices of emission factors by the different countries, however, the average emission from continuous flooded fields appears to be only half of those from single-aerated rice fields.

Table 6.52: Total CH_4 emissions, area harvested and implied Emission Factor for category 4C at EU-15 level for 2004 (data for Italy and Spain for 2003)

	Continuously Flooded	Intermittently flooded: single aeration	Intermittently flooded: multiple aeration
	1990		
Total Emissions of CH4 [Gg CH4]	31.1	0.6	73.8
Total Area harvested [10^9 m^2 y^{-1}]	1.6	0.0	2.1
Implied Emission Factor [g CH4 / m^2]	18.9	27.1	34.6

	Continuously Flooded	Intermittently flooded: single aeration	Intermittently flooded: multiple aeration
	2004		
Total Emissions of CH4 [Gg CH4]	32.6	8.8	63.9
Total Area harvested [10^9 m^2 y^{-1}]	1.9	0.4	1.9
Implied Emission Factor [g CH4 / m^2]	17.2	24.5	33.0

	Continuously Flooded	Intermittently flooded: single aeration	Intermittently flooded: multiple aeration
	2004 value in percent of 1990		
Total Emissions of CH4 [Gg CH4]	105%	1446%	87%
Total Area harvested [10^9 m^2 y^{-1}]	115%	1599%	91%
Implied Emission Factor [g CH4 / m^2]	91%	90%	95%

6.3.4.2. Methodological Issues

Methods

A summary of the methodologies used for the calculation of CH_4 emissions from rice cultivation is given in Table 6.53. More detailed data are given in the section on the emission factors.

Table 6.53: Additional information in the methodology used for the calculation of CH_4 emissions in category 4.C in 2004 (data for Italy and Spain for 2003)

France (NIR 2006 p. 95):	default EF, non key source, IPCC methodology. Statistic from the Ministry of Agriculture.
Greece (NIR 2006, p. 136):	In order to estimate methane emissions from rice cultivation, the default methodology suggested by the IPCC Good Practice Guidance was followed. The cultivated areas provided by the NSSG and the default emission factor (20 g CH_4 / m^2) were used for the emissions calculation. Rice cultivated in Greece is grown in continuously flooded fields without the use of organic amendments and one cropping period is considered annually.
Italy:	The EF is derived from a specific study on Italian paddies in the Po valley where 99% of rice production occur
Portugal (NIR 2005 p. 243):	Methane emissions from rice production were estimated following the GPG, but simplified because there are no appreciable differentiation in Portugal in what concerns water management regimes or any other conditions that are known to affect emissions from this source sector. Rice cultivated area is available from annual statistics from National Statistical Institute,
Spain (NIR 2005 p. 124):	The rice cultivation is not key source, EFs: IPCC default, methodology default.

Activity Data

Italy is by far the largest producer of rice in Europe, with 2297 km^2 of rice cultivation (2004 data), followed by Spain with an area of 1182 km^2 (2004 data). The other three countries have rice producing areas around 200 km^2, as shown in Table 6.54 for the rice cultivation practices continuously flooded, intermittently flooded with single aeration, and intermittently flooded with multiple aeration.

Table 6.54: Harvested Area Rice in the Member States in 2004 and 1990 (data for Italy and Spain for 2003)

Member State	Harvested area in 2004 [10^9 m^2]		
2004	Continuously Flooded	Intermittently flooded: single aeration	Intermittently flooded: multiple aeration
France	0.23	NA	NA
Greece	0.23	NO	NO
Italy	NO	0.36	1.94
Portugal	0.26	NO	NO
Spain	1.18	NO	NO
Member State	Harvested area in 1990 [10^9 m^2]		
1990	Continuously Flooded	Intermittently flooded: single aeration	Intermittently flooded: multiple aeration
France	0.24	NA	NA
Greece	0.16	NO	NO
Italy	NO	0.02	2.13
Portugal	0.34	NO	NO
Spain	0.90	NO	NO

NA: Not Applicable - NE: Not Estimated
1) Information source: CRF Table 4.C for 2004 and 1990, submitted in 2006

Emission Factors and other parameters

A summary of the implied emission factors used by these countries is given in Table 6.55. France and Greece are using IPCC default emission factors presented in the IPCC *Good Practice Guidance*. This value is the arithmetic mean of the seasonally integrated emission factors presented in Table 4-13 of the IPCC *Guidelines*. In this Table, a value from Schuetz et al (1989) is also presented (36 g m^{-2}, range 17-54 g m^{-2}, representing a seasonally averaged emission factor). In Italy (information from the submission of 2005 or the inventory 2003), as reference factor 33 g m^2 CH_4 per year has been selected (Schuetz et al., 1989), which are based on averaged CH_4 flux measurements over 3 years during the growing period only, carried out in continuously flooded rice paddies in the Po valley, without org. matter amendment or mineral fertilisation (Tani, 2000). The value has been adapted to 39.6 g m^2 CH_4 per year to take into account the post-harvest emissions (Tani, 2000). This value has been multiplied with the factor of 1.5 to account for the assumed emissions of rice fields that are amended with organic matter (factor of two) representing about 50% of the area cultivated. A scaling factor of 25% and 50% has then been applied to estimate the emissions from single and multiple aeration management regimes (National Inventory Report, Italy, 2003). No changes in implied emission factors occurred since 1990. Spain uses a seasonal emission factor of 12 g m^{-2}, which has been obtained from Table 4-9 of the IPCC *Guidelines* reporting a study carried out in Spain (Seiler et al., 1984); the value used by Portugal in 1990 and 2004 are the above-mentioned value of 36 g m^{-2} measured by Schuetz et al. (1989).

Table 6.55: Implied Emission factors for CH_4 emissions from rice cultivation used in Member State's inventory (data for Italy and Spain for 2003)

Member State	Implied EF (g CH_4 · m^{-2}) 1)		
	Continuously Flooded	Intermittently flooded: single aeration	Intermittently flooded: multiple aeration
France	20.0		
Greece	20.0	NO	NO
Italy	NO	24.5	33.0
Portugal	36.0		
Spain	12.0	NO	NO

NA: Not Applicable - NE: Not Estimated - NO: Not Occurring
1) Information source: CRF Table 4.C for 2004, submitted in 2006

Trend

The trend in rice growing areas in these countries is divers: while in Italy, the area cultivated with rice fluctuated since 1990, its level was in 2003 was 2% larger than in 1990. The harvested area in Spain increased from 1990 to 2003 by 31%, but around 1993-1995 rice production was only half of the area in 1990; also Greece increased its rice production since 1990 by 38%. The trend was opposite in France with peaks in rice production during 1993-1995 and about the same level in 1990 and 2003. Finally, Portugal saw a decline in rice production, amounting to 24% since 1990.

6.3.5 Agricultural soils – N_2O (CRF Source Category 4.D)

6.3.5.1. Source category description

For EU-15, emissions from all sub-categories in the category 4.D have decreased since 1990 (see Table 6.56). This was most significant for direct emissions from the application of synthetic fertiliser (-16%), followed by indirect emissions from leaching and run-off (-15%) and volatilisation of NH_3+NO_x (-13%). In the latter two cases, the reduction of emissions can be explained by a reduction of nitrogen input, as the implied emission factor was not or only slightly (leaching) changing during the reporting period.

At the aggregated EU-15 level, the implied emission factor for N_2O emissions from the application of manure increased by 5%, caused by a doubling of the implied emission factor for this source in the Netherlands during 1990 to 2004. The decrease in the input of nitrogen to agricultural soils was significant for all sub-categories and was 16% for synthetic fertilizer application, 9% for application of manure, 4% of the area of histosols cultivated and 8% of nitrogen excreted by grazing animals. This translated to a reduction of volatilized and re-deposited nitrogen by 15% and of the amount of nitrogen leached by 10%.

Table 6.56: Total N_2O emissions, Total Nitrogen input into agricultural soils and implied Emission Factor for category 4D at EU-15 level in 2004 and 1990 and relative changes

1990	Synthetic Fertilizer	Animal Wastes appl.	Cultiv. of Histosols 1)	Animal Production	Atmospheric Deposition	Nitrogen Leaching and run-off
	Direct				Indirect	
Total Emissions of N_2O [Gg N_2O]	198	90	28	92	48	211
Total Nitrogen input [Gg N]	10286	4937	23908	3127	3026	6818
Implied Emission Factor [kg N_2O-N / kg N]	1.22%	1.16%	7.5	1.88%	1.00%	1.97%

2004	Synthetic Fertilizer	Animal Wastes appl.	Cultiv. of Histosols 1)	Animal Production	Atmospheric Deposition	Nitrogen Leaching and run-off
	Direct				Indirect	
Total Emissions of N_2O [Gg N_2O]	166	86	27	84	41	183
Total Nitrogen input [Gg N]	8644	4473	23003	2878	2579	6144
Implied Emission Factor [kg N_2O-N / kg N]	1.22%	1.22%	7.5	1.86%	1.00%	1.90%

2004 value in percent of 1990	Synthetic Fertilizer	Animal Wastes appl.	Cultiv. of Histosols	Animal Production	Atmospheric Deposition	Nitrogen Leaching and run-off
	Direct				Indirect	
Total Emissions of N_2O	84%	95%	96%	91%	85%	87%
Total Nitrogen input	84%	91%	96%	92%	85%	90%
Implied Emission Factor	100%	105%	100%	99%	100%	96%

Source of information: Tables 4.D for 1990 and 2004, submitted in 2006

1) Unit AD: km^2; Unit IEF: kg N_2O-N/ha

6.3.5.2. Methodological Issues

Methods

Due to the large uncertainty associated with the emission factors in this category and the lack of well-established alternatives, most Member States rely on the IPCC default emission factors (see below). For other parameters used in the calculation of N_2O emissions from agricultural soils, however, many Member States use country-specific methodologies, linking the N_2O inventory with the CORINAIR NH_3 inventory or using simulation models. A more specific discussion of emission factors and parameters used is presented below.

Table 6.57 gives an overview of the total N_2O emissions in category 4D and the contribution of the main sub-categories. For direct N_2O emissions from the application of fertilizer and from emissions from animal production activity data are multiplied with the emission factor, which is for most countries the IPCC default factor. Thus, the vast majority of the emissions is calculated with the Tier 1 approach (83% for direct emissions and 90% for animal production). For the calculation of indirect N_2O emissions, as important as the emission factor, which in most countries is the IPCC default factor, are the fractions that are used to calculate the amount of nitrogen volatilized or leached. These are national for many Member States. In that case, a Tier 2 methodology (= higher than Tier 1) has been assigned to the emission estimate. At the European level, this means that two third (65%) of the indirect N_2O emissions are calculated using country-specific information.

A summary of the main methodological issues, as presented in the respective national greenhouse gas inventory reports, is given in Table 6.58.

Table 6.57: Total emissions and contribution of the main sub-categories to N_2O emissions in category 4D, methodology and key source assessment by Member States for the sub-categories direct emissions, animal production and indirect emissions for the year 2004.

	Total	Direct			Animal Production			Indirect		Volatilization		Leaching	
Member State	Gg CO_2-eq	a	b	c	a	b	c	a	c	a	b	a	b
Austria	2,812	53%	Tier 1	y	8%	Tier 1	n	39%	y	6%	Tier 2	32%	Tier 1
Belgium	3,929	55%	Tier 1	y	21%	Tier 1	y	24%	y	6%	Tier 2	18%	Tier 2
Denmark	5,699	52%	Tier 1	y	5%	Tier 1	n	42%	y	7%	Tier 2	35%	Tier 2
Finland	3,241	77%	Tier 1	y	4%	Tier 2	y	18%	y	6%	Tier 2	13%	Tier 2
France	49,373	47%	Tier 1	y	15%	Tier 1	n	37%	n	6%	Tier 1	31%	Tier 2
Germany	38,023	65%	Tier 1	y	4%	Tier 1	n	31%	y	7%	Tier 2	24%	Tier 2
Greece	8,146	21%	Tier 1	y	44%	Tier 1	y	35%	y	6%	Tier 1	29%	Tier 1
Ireland	7,171	42%	Tier 1	y	39%	Tier 1	y	19%	y	6%	Tier 2	13%	Tier 2
Italy	18,626	50%	Tier 2	y	8%	Tier 2	y	42%	y	9%	Tier 2	33%	Tier 2
Luxembourg	146	100%			0%			0%		0%		0%	
Netherlands	8,708	56%	Tier 2	y	7%	Tier 2	y	37%	y	6%		31%	
Portugal	3,472	42%	Tier 1	y	20%	Tier 1	y	38%	y	6%	Tier 2	32%	Tier 1
Spain	21,042	50%	Tier 1	y	8%	Tier 1	y	40%	y	5%	Tier 1	35%	Tier 1
Sweden	4,811	62%	Tier 2	y	7%	Tier 2	y	19%	y	4%	Tier 2	15%	Tier 2
United Kingdom	25,281	47%	Tier 1	y	18%	Tier 1	y	34%	y	6%	Tier 1	28%	Tier 2
EU-15: Tier 1	**67%**	**83%**			**90%**			**35%**		**56%**		**30%**	
EU-15: Tier 2	**33%**	**17%**			**10%**			**65%**		**44%**		**70%**	

a Contribution to CH_4 emissions from enteric fermentation

b Tier 1: default methodology; Tier 2: country-specific methodology

c Source category is key in the Member State's inventory (y/n)

Table 6.58: Member State's background information for the calculation of N_2O emissions in category 4.D

Member State	Methods
Austria NIR 2006, p. 215-230	The IPCC Tier 1a and – where applicable – Tier 1b but with Austria specific consideration of nitrogen losses (NH3-N, NOx-N, N_2O-N).
Denmark NIR 2006, p. 206-214	Emissions of N_2O are closely related to the nitrogen balance (DIEMA). The amount of nitrogen applied on soil is N-excretion in stables minus the emission of ammonia in stables, storage and in relation to application of manure (national, from ammonia emission inventory). N-Fixing crop: amount of fixed nitrogen in crops from the DIAS (Kristensen, 2003; Høgh-Jensen, 1998; Kyllingsbæk, 2000). Crop residue: N_2O emissions from crop residues are calculated as the total above-ground amount of crop residues returned to soil, emission is based on nitrogen content, the fraction of dry matter and the content of protein for each harvest crop type. Data for nitrogen content in stubble and husks are provided by the Danish Institute of Agricultural Sciences (Djurhuus, 2003).
Finland NIR 2006, p. 133-140	CO_2 emissions from agricultural soils are reported in the LULUCF sector. Indirect emissions fraction used as feed and fraction used as construction material is excluded. The calculation methodology has been developed towards a mass-flow approach in order to avoid double-counting. The N lost as NH3 and NOx ($Frac_{GASF}$, $Frac_{GASM)}$ as well as N leached (FracLEACH) are subtracted from the amount on N in synthetic fertilisers and manure applied to soils, as well from manure deposited on pastures and sewage sludge application. The distribution of different manure management systems has been received from published literature (Seppänen, 1998) and updated for this submission on the basis of expert judgement. Fraction volatilised as NH3 and NOx subtracted.
France NIR 2006 p. 95-97	A specific document describing the methodology used to estimate N_2O emissions from agriculture is available at CITEPA ("Méthodologie utilisée pour les inventaires de NH3 et de N_2O provenant des activités agricoles : évolution et perspectives"). Additional information: CS, Tier 1 methodology is applied.
Germany NIR 2006, p. 313-326	Nitrogen emissions are calculated with the mass-flow approach, taking generally the simple methodology of the CORINAIR guidebook (EMEP, 2003). Direct soil emissions: IPCC (2000) Tier-1a- and Tier-1b methodology, defalut EFs. Grazing animals: N input calculated with the mass-flow approach with default factors for N_2O, NH3, and NO emissions (IPCC, EMEP). The IPCC method is not applicable for the German Inventory of crop residues and N-fixing crops. Germany makes use of statistically available nitrogen contents in crop residues.
Ireland NIR 2006 p. 57-59	Direct Soil Emissions: calculated in a Tier 1 approach takes into account the nitrogen inputs from all these sources, except that due to the cultivation of organic soils. The Tier 1b method given by the IPCC good practice guidance is used to estimate the nitrogen contributions from nitrogen-fixing crops (FBN) and from crop residues (FCR) returned to the soil. Animal Production.
Netherlands NIR 2006, p. 6-10-13	Direct and indirect soil N_2O emissions, as well as N_2O emissions by animal production, are estimated using country-specific activity data on N input to soil and NH3 volatilisation during grazing, manure management (storage) and manure application. Most of these data are estimated on a tier 2 level (or higher). Direct N_2O emissions and animal production - the IPCC Tier 1b/2 methodology is used to estimate direct and animal production N_2O emissions. For animal production a distinction is made between nitrogen in urine and in faeces. Direct N_2O emissions from histosols, crop residues and nitrogen fixation are also estimated using country-specific tier 2 methods. The IPCC Tier 1 method is used to estimate indirect N_2O emissions. Indirect N_2O emissions resulting from atmospheric deposition are estimated using country-specific data on ammonia emissions (estimated at a tier 3 level; LEI-MAM). All relevant documents concerning methodology, emission factors and activity data are published on www.greenhousegases.nl.
Portugal NIR 2004, p. 249-266	Direct soil emissions from manure: only manure managed in solid systems, from all animal species, are assumed to be applied on soils. Therefore the equation introduces a 'fraction of manure-nitrogen used as fertilizer'. The approach used to estimate N_2O emissions from agricultural soils other than animal production (emissions of N_2O in Pasture Range and Paddock) may be better classified as Tier 1a, because the same emission factor was used to all nitrogen sources to soil. Emissions of N_2O from manure handled in Anaerobic Lagoons and Liquid Storage are already included in Liquid and Solid Waste emission source categories and are not double counted here. The quantity of nitrogen in manure that is applied to soil as fertilizer resulting in N_2O emissions is estimated from the same data that was used to estimate nitrogen excreted in N_2O from Manure Management and assuming that only the manure that is treated under Solid Storage or liquid systems is used as soil fertilizer.
United Kingdom NIR 2006, p. 117-118 CRF_2004_2006 Table 4.B(a)	Direct emissions of nitrous oxide from agricultural soils are estimated using the IPCC recommended methodology (IPCC, 1997) but incorporating some UK specific parameters. Emissions from the application of inorganic fertilizer are calculated using the IPCC (1997) methodology and IPCC default emission factors. Emissions of nitrous oxide from the biological fixation of nitrogen by crops are calculated using the Tier 1a methodology and IPCC default emission factors. Indirect emissions of N_2O from the atmospheric deposition of ammonia and NOx are estimated according to the IPCC (1997) methodology but with corrections to avoid double counting N. The sources of ammonia and NOx considered are synthetic fertiliser application and animal manures applied as fertiliser. The method used corrects for the N content of manures used as fuel but no longer for the N lost in the direct emission of N_2O from animal manures as previously. Nitrogen-fixing crops: includes contribution from improved grass (4 kg N/ha/year).

Activity Data

Consistent with the decrease of animal numbers in Europe and the decrease of nitrogen in manure (see above), also the input of nitrogen to agricultural soils decreased considerably in the time between 1990 and 2004, as shown in Table 6.59. The input of manure decreased by 29%, and the input of mineral fertilizer decreased even more, by 34%. Accordingly, also the amount of nitrogen volatilized or leached decreased by 33% and 47%, respectively.

For the estimation of N_2O emissions from N-fixing crops and crop residues, most Member States use the amount of N input (in Gg N) as activity data in the CRF table; but some countries give the emission factor in kilogram of nitrogen emitted per kg of dry crop production (N-fixing crop or other crops, respectively). Therefore, the data given in Table 6.59 in the respective columns are not comparable.

Additional background information on the source of the data used in the Member States's inventories are given in Table 6.60.

Table 6.59: Member State's activity data to calculate direct and indirect N_2O emissions in category 4D (Data for Italy and Spain for 2003)

Member States	Synthetic Fertilizer (Gg N)	Animal Wastes appl. (Gg N)	N-fixing crops (Gg N)	Crop residue (Gg N)	Cultiv. of Histosols (km²)	Animal Production (Gg N)	Atmosph. Deposition (Gg N)	Nitrogen Leaching and run-off (Gg N)
	DIRECT						Indirect	
Austria	94	105	21	26	NO	23	36	75
Belgium[2)]	143	156	21	3,749	25	84	49	58
Denmark	202	181	31	52	776	30	78	165
Finland	154	59	0.4	23	2,764	15	37	34
France[1), 2)]	2,098	1,055	6,342	49,030	NO	765	597	1,245
Germany	1,828	1,007	NA	NA	14,133	143	517	850
Greece	211	38	1.0	26	67	366	106	194
Ireland	357	109	0.5	24	NO	289	91	76
Italy	769	439	4,756.9	21,359	90	159	331	506
Luxembourg								
Netherlands	301	309	5	33	2,230	88	100	784
Portugal[2)]	155	56	49	4,373	NO	71	46	91
Spain	1,052	533	195	117	NO	337	220	2,004
Sweden[2)]	177	66	28	7,413	2,526	41	38	61
United Kingdom	1,105	359	37	432	392	469	334	0
EU-15	8,644	4,473	-	-	23,003	2,878	2,579	6,144

Information on source: CRF Table 4.D 2004 submitted in 2006

1) Unit for N-fixing crops: kg of dry biomass pulses and soybeans produced; 2) Unit for crop residue:

Table 6.60: Member State's background information on the activity data used for the calculation of N_2O emissions in category 4.D

Member State	Activity data
Austria NIR 2006, p. 215-230	*Mineral Fertilizer* -Application detailed data about the use of different kind of fertilizers are available until 1994, because until then, a fertilizer tax („Düngemittelabgabe") had been collected. Data about the total synthetic fertilizer consumption are available for amounts (but not for fertilizer types) from the statistical office (STATISTIK AUSTRIA) and from an agricultural marketing association (Agrarmarkt Austria, AMA). The yearly numbers of the *Legume cropping areas* were taken from official statistics (BMLFUW 2005). *Harvest data* were taken from (BMLFUW 2005) and the datapool of (BUNDESANSTALT FÜR AGRARWIRTSCHAFT 2005). Agriculturally applied *Sewage sludge* data were taken from Water Quality Report 20001), Report on sewage sludge2) and Gewässerschutzbericht 2002. Values for biological nitrogen fixation were taken from a publication made by the Umweltbundesamt (Goetz, 1998); these values are constant over the time series.
Denmark NIR 2006, p. 206-214	National data for the evaporation of ammonia from the ammonia inventory is applied from the ammonia emission inventory (Illerup et al., 2004). Synthetic fertiliser: The amount of nitrogen (N) applied on soil by use of synthetic fertil-iser is estimated from sale estimates by the Danish Plant Directorate, which is source to the FAO database. The amount of nitrogen deposit on grass is based on estimations from the ammonia inventory. It is assumed that 15% of the nitrogen from Dairy cattle in average is excreted on grass - expert judgement from the Danish Institute of Agricultural Science (Poulsen et al, 2001). Data for crop yield is based on Statistics Denmark. For nitrogen content in the plants the data is taken from Danish feed stuff tables (Danish Agricultural Advisory Centre). The estimates for the amount of fixed nitrogen in crops are estimated by Danish Institute of Agricultural Science (Swedish Board of Agriculture, 2004).
Finland NIR 2006, p. 133-140	Activity data is national and received mainly from annual agricultural statistics of the Ministry of Agriculture and Forestry. Other data sources are the Finnish Environment Institute (the amount of N in sewage sludge) and MTT Agrifood Research Finland (area of cultivated organic soils).
France NIR 2006 p. 95-97	National statistics of fertilizer consumption are from UNIFA. Crop production stastics are obtained from the ministry of agriculture (SCEES/ AGRESTE).
Greece NIR 2006, p. 137-140	The data regarding the annual quantities of synthetic fertilizers consumed in the country during the period 1990 – 2002 derive from FAO, while data for the last two years result from extrapolation based on the trend of the last five years. Data on agricultural crop production used for the calculation of emissions was obtained from the annual national statistics of the NSSG for the period 1990 – 2001 and from the provisional statistical data of the NSSG for the period 2002 – 2004. Data for the areas of organic soils derive from a relevant research conducted by the Soil Science Institute of Athens (SSIA, 2001).
Ireland NIR 2006 p. 57-59	The annual statistics on nitrogen fertilizer use (Nfert) are obtained from the Department of Agriculture and Food while the organic nitrogen inputs (Nex) are known from the analysis in the previous section in relation to manure management.
Netherlands NIR 2006, p. 6-10-13	More details and specific data (activity data and emission factors) including data sources (emission factors) are documented in background documents. Data can be found on www.cbs.nl. Specific information on the activity data and the time-series of relevant data is published (Van der Hoek et al., 2006).
Portugal, NIR 2006, p. 373-396	The time series of the quantity of nitrogen used as synthetic fertilizers, was obtained from FAO statistical database (http://www.apps.fao.org) which itself results from information gathered in Portugal. The values for 2002 and 2003 are still provisional and equals the 2001 value, in agreement with the observed trend in time series.
Sweden NIR 2006, p. 177-182	Sales of fertilisers, recalculated into nitrogen quantities, are published annually by Statistics Sweden and the national estimates are considered to be accurate, according to the quality declaration in the statistical report. The fraction of nitrogen supply emitted as ammonium-N is estimated by Statistics Sweden and the Swedish EPA. The Farm Register provides the main basis for agricultural statistics in Sweden. The Register is administered by the Swedish Board of Agriculture and Statistics Sweden and provides an-nual information on the total number of animals of different categories on Swedish farms (Swedish Board of Agriculture, 2004). Statistics on the use of sewage sludge have been published irregularly and in different reports, but a time series has been created through interpolation and the emissions are reported for the first time in the current submission of the GHG inventory.
United Kingdom NIR 2006, p. 117-118	Annual consumption of synthetic fertilizer is estimated based on crop areas (Defra, 2005a) and fertilizer application rates (BSFP, 2005).

Emission Factors and other parameters

Table 6.61 and Table 6.62 give an overview of the emission factors and other parameters used for the calculation of N_2O emissions from agricultural soil in 2004. As discussed already above, emission factors are largely IPCC default, while other parameters are more frequently country-specific. Also, while the emission factors are static in the time series, some parameters are dynamically calculated on the basis of national input data, for example the mix of mineral fertilizer types with different volatilization fractions associated.

In the following, country-specific elements in the calculation of N_2O emissions from agricultural soils as reported in the National Inventory Reports are given in Table 6.63 for direct N_2O emissions from fertilizer application, Table 6.67, Table 6.64 for N_2O emissions from N-fixing crops and crop residues, Table 6.65 for the N_2O emissions from animal production and Table 6.66 for N_2O emissions from cultivated histosols.

Furthermore, background information on the development of national parameters is given in Table 6.67 for $Frac_{GASF}$, Table 6.68 for $Frac_{GASM,}$ and Table 6.69 for $Frac_{LEACH}$.

Table 6.61: Implied Emission Factors for the category 4D - N_2O emissions from agricultural soils in 2004 (data for Italy and Spain for 2003)

Member States	Synthetic Fertilizer	Animal Wastes appl.	N-fixing crops	Crop residue	Cultiv. of Histosols	Animal Production	Atmosph. Deposition	Nitrogen Leaching and run-off
	Direct						Indirect	
Austria	1.25%	1.25%	1.25%	1.250%	NO	2.0%	1.00%	2.50%
Belgium	1.25%	1.25%	0.07%	0.018%	8.0	2.0%	0.99%	2.50%
Denmark	1.25%	1.25%	1.25%	1.250%	2.9	2.0%	1.00%	2.50%
Finland	1.25%	1.25%	1.25%	1.250%	7.8	2.0%	1.00%	2.50%
France	1.25%	1.00%	0.08%	0.013%		2.0%	1.00%	2.49%
Germany	1.25%	1.25%	NA	NA	8.0	2.0%	1.01%	2.24%
Greece	1.25%	1.25%	1.25%	1.250%	8.0	2.0%	1.00%	2.50%
Ireland	1.25%	1.25%	1.25%	1.250%	NO	2.0%	1.00%	2.50%
Italy	1.25%	1.25%	0.05%	0.008%	8.0	2.0%	1.00%	2.50%
Luxembourg								
Netherlands	0.99%	1.79%	1.06%	1.009%	4.7	1.5%	1.00%	0.71%
Portugal	1.25%	1.25%	0.11%	0.007%		2.0%	1.00%	2.50%
Spain	1.17%	1.02%	1.25%	1.250%	NO	1.0%	1.00%	0.75%
Sweden	0.79%	2.50%	1.25%	0.009%	8.0	1.6%	1.00%	2.50%
United Kingdom	1.25%	1.25%	1.25%	1.250%	8.0	2.0%	1.00%	2.50%
EU-15	1.22%	1.22%			27.1	8411.9%	1.00%	1.90%

Information on source: CRF Table 4.D 2004 submitted in 2006

Table 6.62: Relevant parameters for the calculation of N_2O emissions from agricultural soils in 2004 (data for Italy and Spain for 2003)

Member States	FracBURN	FracFUEL	FracGASF	FracGASM	0	FracLEACH	FracNCRBF	FracNCRO	FracR
Austria		NO	3.1%	20%	14%	30%	1.5%	0.5%	34%
Belgium									
Denmark		NO	2.2%	22%	12%	34%	NE	NE	26%
Finland	NA	NA	0.6%	33%	20%	15%	0.8%	4.2%	43%
France	NA	NA	10.0%	20%	28%	30%	CS	CS	CS
Germany			5.4%	30%	11%	30%	NA	NA	NA
Greece	10%		10.0%	20%	89%	30%	1.4%	0.5%	55%
Ireland		NO	1.6%	19%	66%	10%	NO	NO	NO
Italy	10%		9.0%	29%	19%	30%	3.0%	1.5%	45%
Luxembourg									
Netherlands		NO	NE	NE	NE	NE	NE	NE	NE
Portugal	5%		6.3%	22%	44%	30%	1.3%	2.3%	72%
Spain		NO	6.1%	34%	39%	30%	2.3%	0.6%	NA
Sweden	NO	NO	1.1%	33%	31%	22%	1.0%	2.0%	6%
United Kingdom			10.0%	20%	52%	30%	3.0%	2.0%	45%
EU-15[2)]	8.5%	NA	5.5%	25%	35%	27%	1.8%	1.7%	41%

[1)] Information on source: CRF Table 4.D 2004 submitted in 2006
[2)] Arithmetic average over the MS that reported.

Direct emissions from application of fertiliser.

Most Member States use the IPCC default emission factors for the calculation of N_2O emissions from the application of mineral and organic fertiliser. A differentiation between organic and inorganic fertiliser has been made by the Netherlands, Sweden. The Swedish EF of 0.8 % is based on a study on N_2O emissions in Sweden and other countries of northern Europe and in Canada (Kasimir-Klemedtsson, 2001), supported by a study in Norway suggesting a lower emission factor for emitted fertiliser N than the IPCC default value (Laegreid and Aastveit, 2002). The Netherlands distinguish also between mineral fertiliser application on mineral soils and on organic soils, with the EFs being twice as high for the application on organic soils; for the application of manure, differentiation is made between surface spreading and incorporation of the fertiliser. As more nitrogen is locally available if the fertiliser is incorporated into the soil, this application system is assumed to result in higher emissions of N_2O in mineral soils. For organic soils, the same, higher, EF is applied for both application systems.

Table 6.63: Member State's background information for the calculation of N_2O emissions from the application in category 4.D

Finland:	IPCC default emission factors have been used for calculating N_2O emissions from agricultural soils. However, emission factors for organic soils on grass and cereals are based on national data (Monni, in press). The amount of nitrogen applied to soils has been corrected with a fraction of nitrogen volatilised as NH3 and NOx from the synthetic fertilisers ($Frac_{GASF}$) and fraction of nitrogen volatilised as NH3 and NOx from manure and sewage sludge ($Frac_{GASM)}$ as well as with the fraction of nitrogen leached from applied synthetic fertilisers, manure and sewage sludge (FracLEACH). Separate EF´s for cultivated organic soils on cereals and grasses has been used. EF for cereals 11.08 kg N_2O-N/ha/yr, EF for grass 5.7 kg N_2O-N/ha/yr.
Netherlands:	For direct N_2O emission calculations country specific emission factors are used. The country specific emission factors for mineral soils are lower than IPCC defaults and for organic soils they are higher. For incorporation into soil also a higher emission factor than the IPCC default is used. A recent survey on N_2O emission factors (Kuikman., 2006) justifies the values of the emission factors.
Sweden:	National emission factor for direct emissions based on a study by (Klemedtsson, 2001). For nitrogen supply from fertilizers, a national emission factor, 0.8% N_2O-N of N-supply, is used. For nitrogen supply from manure, a national emission factor of 2.5% emissions of N-supply is used. The background emissions from the cultivation of mineral soils have also been included in the inventory with the national emission factor of 0.5 kg N_2O-N ha-1. For other direct soil emissions, default values from the IPCC Guidelines are used.

Direct emissions from crop residues and nitrogen-fixing crops.

As noted above, the values reported in the columns "N-fixing crops" and "Crop residue" are not directly comparable, since the emission factor can be applied either on the amount of dry biomass (pulses and soybeans or other crops, respectively) or on the amount of N input by N-fixing crops or by crop residues.

In the German inventory, N_2O emissions from nitrogen fixing crops are reported as an average emission per hectare (2.9) of cultivated crop based on mean nitrogen input factors of 200 kg N ha^{-1} (grass/clover, clover/alfalfa mixtures) and 250 kg N ha^{-1} (alfalfa, leguminous crops) and an emission factor of 1.25% (Daemmgen, 2004). No implied emission factor for N_2O emissions from crop residues are reported in the German inventory.

Table 6.64: Member State's background information for the calculation of N_2O emissions from crop residues and nitrogen fixation in category 4.D

Member State	Crop
Austria NIR 2006, p. 215-230	The method applied for calculation of the emissions is the IPCC Tier 1b method. During harvest crops and by-products (e.g. like cereal straw) are removed from fields, but stubble, roots or beet leaves are left on the field and release nitrogen during decay. The amount of crop residues is calculated on the basis of the harvest statistics. The residues that are removed from the fields during harvest (such as cereal straw or leaves of fodder beet) are subtracted. Also considered is the loss of nitrogen that is lost if residues are burned on the fields.
Belgium NIR 2006, p. 73-76	The N_2O emissions from crop residues can vary according to the preceding culture. The nitrogen residual from soil is estimated by multiplying, for each culture, the cultivated area by the nitrogen residual average quantity for the culture considered.

Member State	Crop
Denmark NIR 2006, p. 206-214	N_2O emissions from crop residues are calculated as the total above-ground amount of crop residues returned to soil. For cereals the aboveground residues are calculated as the amount of straw plus stubble and husks. The total amount of straw is given in the annual census and reduced with the amount used for feeding, bedding and biofuel in power plants. Straw for feeding and bedding is subtracted in the calculation because this amount of removed nitrogen returns to the soil via manure. Data for nitrogen content in stubble and husks are provided by the Danish Institute of Agricultural Sciences (Djurhuus and Hansen, 2003).
Finland NIR 2006, p. 133-140	Crop yields of cultivated plants have been received from agricultural statistics (Ministry of Agriculture and Forestry). Vegetables grown in the open have been included into the emission estimate of crop residues for the first time in 2005 submission. Vegetable yields have been received from literature (Puutarhayritysrekisteri, 1994; Yearbook of Farm Statistics, 2004).
Greece NIR 2006, p. 137-140	Tier 1b using default factors. T1b method is used for the estimation of N_2O emissions from N-fixing crops and crop residues.
Ireland NIR 2006 p. 57-59	The Tier 1b method with default values of nitrogen content and other input parameters.
Netherlands NIR 2006, p. 6-10-13	The percentage of crop residue removal is documented (Van der Hoek et al., 2006, in preparation) and the N-content of crop residue is established (Velthof en Kuikman, 2000)
Portugal, NIR 2006, p. 373-396	Estimates of nitrogen fixed by crops follows exactly the Tier1b approach of the GPG which means that crop-specific residue to product ratio and dry matter content are used. FCR, nitrogen input to soil in crop residues returned to soil, is estimated for all crops, whether they are nitrogen fixing crops or not, with the GPG tier 1b approach. N fixed by crops was estimated from the ratio of residue to crop product mass ($Res_{BF}/Crop_{BF}$), the fraction of dry matter in product (FracDM) and the fraction of dry biomass in the whole plant that is nitrogen ($Frac_{NCRBF}$).
Sweden NIR 2006, p. 177-182	Combining national activity data on removed residues and other parameters, such as nitrogen content, at crop level with the Good Practice Guidance's default emission factor for direct N_2O emissions. When calculating N-circulation in residues from cereal crops, national factors for recalculation from harvest to crop residue and the corresponding N-content based on national measurement data are used. For other crops, a combination of national factors and IPCC default values was used. National estimates of nitrogen fixation, which account for regional differences, in combination with the Good Practice Guidance's default emission factor for direct N_2O emissions.
United Kingdom NIR 2006, p. 117-118	Emissions of nitrous oxide from the ploughing in of crop residues are calculated using a combination of the IPCC (2000) Tier 1b and 1a methodology, for non-N fixing and N-fixing crops, respectively, and IPCC default emission factors. Production data of crops are taken from Defra (2005a, 2005b). Field burning has largely ceased in the UK since 1993. For years prior to 1993, field-burning data were taken from the annual MAFF Straw Disposal Survey (MAFF, 1995).

Direct emissions from animal production.

All countries are reporting N_2O emissions from manure excreted by animals during grazing and the implied EF is the default factor of 2% N_2O-N per kg N excreted and year, except of the emission inventories of the Spain, Netherlands and Sweden, which use an EF of 1%, 1.5% and 1.6%, respectively.

Table 6.65: Member State's background information for the calculation of N_2O emissions from animal production in category 4.D

Member State	Grazing animals
Austria NIR 2006, p. 215-230	Following the IPCC Guidelines, N_2O emissions resulting from nitrogen input through excretions of grazing animals (directly dropped onto the soil) were calculated under Manure Management but reported under Agricultural Soils.
Belgium NIR 2006, p. 73-76	The nitrogen from grazing is estimated, taking into account the number of days in pasture and the nitrogen excreted by each animal category. Available nitrogen is the difference between the manure nitrogen content and the manure nitrogen volatilisation in NH_3 and NO form. The IPCC default emission factor of 0.02 kg N-N_2O / kg N is then used to estimate the emissions.
Denmark NIR 2006, p. 206-214	$Frac_{GRAZ}$ is estimated as the volatile fraction by grassing animal compared to the total excreted nitrogen (N ab animal).
Germany NIR 2006, p. 313-326	Grazing animals: N input calculated with the mass-flow approach with default factors for N_2O, NH_3, and NO emissions (IPCC, EMEP).
Ireland NIR 2006 p. 57-59	The amount of organic nitrogen input concerned from the equations above, is large in Ireland due to the relatively short period that cattle remain in housing and the contribution from large sheep populations, the majority of which are not housed.
Netherlands NIR 2006, p. 6-10-13	National emission factor. A distinction is made between nitrogen in urine and in faeces.
Sweden NIR 2006, p. 177-182	Emissions from grazing animals (excretion during the grazing period) are calculated in a model-based and take into account many factors that influence gas emissions, but the emissions are attributed to agricultural soils; ammonia emission are considered as well, since national estimates of ammonia from grazing manure are available.
United Kingdom NIR 2006, p. 117-118	Emissions from manure deposited by grazing animals are reported under agricultural soils by IPCC. The method of calculation is the same as that for AWMS, using factors for pasture range and paddock. However the value for the fraction of livestock N excreted and deposited onto soil during grazing is a country specific value of 0.52, much larger than the IPCC recommended value (0.23).

Direct emissions from the cultivation of histosols.

N_2O emissions from the cultivation of histosols reported as not occurring in Austria, France, and Spain, and as not estimated in Portugal. Also, no emissions from the cultivation of histosols are reported by Ireland, because tillage farming in Ireland is concentrated in the south-east of the country while the bulk of organic soils occur in the middle and western part of the country. Consequently, nitrogen inputs due to the cultivation of organic soils have been taken as negligible.

The cultivation of histosols represents the biggest share of emissions from agricultural soils in Finland (42%), Sweden (33% and a substantial source for N_2O emissions in Germany (22% - almost as large as emission from application of manure) and the Netherlands (11%). The emission factor proposed in the IPCC GPG of 8 kg N_2O-N per hectare and year (IPCC, 2000) is used in most countries. Only the Netherlands uses 4.71 kg N_2O-N ha^{-1}, respectively; national emission factors are further used in Denmark (2.9 kg N_2O-N ha^{-1}) and Finland (7.85 kg N_2O-N ha^{-1}).

On absolute terms, the estimated emissions of N_2O from the cultivation of histosols are largest for Germany (17.8 Gg N_2O), followed by Finland (3.4 Gg N_2O) and Sweden (3.2 Gg N_2O).

Table 6.66: Member State's background information for the calculation of N_2O emissions from the cultivation of histosols in category 4.D

Member State	Histosols
Belgium NIR 2006, p. 73-76	In Flanders, during this submission the implied emission factor for histosols is updated from 5 to 8 kg N_2O-N / kg N. Also the area histosols has been corrected using region specific data based on an intersection between the CORINE Land Cover Geodataset from 1990 and the Belgian 'Soilassociationmap'.
Denmark NIR 2006, p. 206-214	N_2O emissions from histosols are based on the area with organic soils multiplied with a national emission factor for C, the C:N relationship for the organic matter in the histosols and an emission factor of 1.25 of the total amount of released N. See the LULUCF section for further description.
Finland NIR 2006, p. 133-140	The area of cultivated organic soils has been received from MTT Agrifood Research Finland and has been updated for the 2005 submission on the basis of Myllys & Sinkkonen (2004) and Kähäri et al. (1987). The area of cultivated organic soils is poorly known in Finland. Current area estimate is based on publications of Myllys & Sinkkonen (2004) and Kähäri et al. (1987) on a basis of the results of soil analysis.
Germany NIR 2006, p. 313-326	Estimation of the are of cultivated histosols on the basis of an overlay of a land-use map and a soil map.
Greece NIR 2006, p. 137-140	Estimation of N2O emissions from the organic soils (0.084 kt) was based on the cultivated area (6.7 kha, constant for the entire period examined) and the updated default emission factor suggested in the IPCC Good Practice Guidance for mid-latitude organic soils.
Ireland NIR 2006 p. 57-59	Not estimated. Tillage farming in Ireland is concentrated in the south-east of the country while the bulk of organic soils occur in the midlands and west. Consequently, nitrogen inputs due to the cultivation of organic soils can be taken as negligible.
Netherlands NIR 2006, p. 6-10-13	The area of histosoils and N mineralisation per unit of area was established recently (Kuikman et al., 2005).
Sweden NIR 2006, p. 177-182	Background emissions from agricultural soils are reported both for organic and mineral soils in the Swedish inventory. The estimated area of organic soils is multiplied by the default emission factor in the IPCC Guidelines and a national emission factor has been developed for mineral soils. The total area of arable land for each year is taken from the Farm Register and the area of organic soils is around 252 600 hectares according to a recent mapping of cultivated organic soils in Sweden.
United Kingdom NIR 2006, p. 117-118	Emissions from Histosols were estimated using the IPCC (2000) default factor of 8 kg N_2O-N/ha/yr. The area of cultivated Histosols is assumed to be equal to that of eutric organic soils in the UK and is based on a FAO soil map figure supplied by SSLRC (now NSRI).

Indirect emissions. All Member States but Luxembourg report indirect emissions of nitrous oxide induced by the atmospheric deposition of NH_3 and NO_x volatilised and nitrate leached to the groundwater using the default IPCC emission factors. Only the Netherlands and Spain use a smaller emission factor for N_2O from nitrogen leached or run-off (0.72% and 0.75%)**.**

Country-specific methodologies, however, are used by most Member States for the calculation of nitrogen volatilisation and nitrate leaching, with only 3 and 4 Member States using the IPCC default values for the volatilisation fractions of mineral and organic fertilizer ($Frac_{GASF}$ and $Frac_{GASM}$), respectively, and 8 countries are using the default IPCC values for the leaching fraction ($Frac_{LEACH}$). Belgium does not report the fractions used, and the Netherlands reports the fractions as NE. No N_2O emissions from agricultural soils are estimated by Luxembourg.

While volatilisation of NH_3 and NO_x from the application of mineral fertiliser is considered by all Member States to be lower as the IPCC default values (range of national factors 0.6% to 9.0%), most of the Member States with country-specific volatilisation rates for organic fertiliser are estimating larger losses of NH_3 + NO_x than proposed by the IPCC (range 22.0% to 33%). The country-specific methodology for the estimation of NH_3 volatilization is in some cases based on the NH_3 inventory using the CORINAIR methodology thus differentiating between different kinds of synthetic fertilisers. Also, model-based estimations for the fraction of nitrogen volatilised from applied animal wastes have been used. The fraction of nitrogen lost by leaching ranges from 10% to 34% with most national values being smaller than the IPCC default value. They are in some cases based on a nitrogen-leaching model (e.g., Denmark, Sweden) and in some cases based on national studies (e.g., Finland, Ireland).

Table 6.67: Member State's background information on the fraction of NH3 and NOx volatilized from applied mineral fertilizer, FracGASF for the calculation of N_2O emissions in category 4.D

Austria:	N_2O emissions through atmospheric nitrogen deposition. Emissions were calculated following IPCC Tier 1a. $Frac_{GASF}$ 23% for mineral fertilizers and 15.3% for urea fertilizers (CORINAIR). Calculated N losses are between 20% and 22% of total N excretion, which is consistent with the IPCC default value (20%).
Belgium:	$Frac_{GASF}$ 2.3% in Wallonia (recommended by IIASA for different fertiliser types); 4.3% in Flanders (weighted average for NH_3 and NO volatilisation).
Denmark:	The Danish value for the $Frac_{GASF}$ is estimated to 0.02 and is considerably lower than given in IPCC, i.e. 0.10. The ammonia emission depends on fertiliser type in accordance to emission factor recommended in Inventory guidebook for CLRTAP Emission Inventories. The major part of the Danish emission is related to the use of calcium ammonium nitrate and NPK fertiliser, where the emission factor is 0.02 kg NH_3-N/kg N. The low Danish $Frac_{GASF}$ is also probably due to a small consumption of urea (<1%), which has a high emission factor.
Finland:	The country-specific $Frac_{GASF}$ value is based on the NH_3 emission factor given in the report by ECETOC (1994) for NPK fertilisers, which is 1% of the nitrogen content in the fertilisers. The $Frac_{GASF}$ is calculated using the assumption that 80% of the nitrogen in synthetic fertilisers in Finland is applied using the placement method. The emission factor for placement fertilisation is assumed to be 50% of surface application (conservative assumption). A project to measure ammonia emissions from fertilisation will commence in Finland in 2005. The $Frac_{GASF}$ value used may be revised in future submissions based on the results of the project.
Germany:	$Frac_{GASF}$ dynamically calculated using default emission factors for the application of mineral fertilizers.
Portugal:	Losses of nitrogen from volatilisation of NH3 and NOx were estimated using a time variable and country-specific fraction $Frac_{GASF}$, which varies between 0.053 and 0.062 kg NH3-N/kg N, and which are almost half the default value.
Sweden:	The proportions of emitted N-content of fertilisers sold in different years varie because of changes in the sold quantities of different types of fertilisers. The sold quantities of ammonia-emitting products are varieted, which directly explains variations in the $Frac_{GASF}$.

Table 6.68: Member State's background information on the fraction of NH3 and NOx volatilized from applied manure, FracGASM for the calculation of N_2O emissions in category 4.D

Austria:	With regard to a comprehensive treatment of the nitrogen budged, Austria established a link between the ammonia and nitrous oxide emissions inventory. This procedure enables the use of country specific data, which is more accurate than the use of the default value for $Frac_{GASM.}$
Belgium:	In Wallonia the average volatilization rate is 2.3 % based on the default values recommended by IIASA for different types of fertilisers and in Flanders the weighted average for NH3 and NO volatilisation is 4.4%.
Denmark:	The $Frac_{GASM}$ is estimated as the total N-excretion (N ab animal) minus the ammonia emission in stables, storage and application. The $Frac_{GASM}$ has decreased from 0.26 in 1990 to 0.22 in 2004. This is a result of an active strategy to improve the utilization of the nitrogen in manure.
Finland:	Value for $Frac_{GASM}$ has been obtained from the ammonia model of VTT Technical Research Centre of Finland (Savolainen et al., 1996) which was updated for this submission. In the model, annual N excreted by each animal type has been distributed into different manure management systems typical for each animal group. Ammonia volatilisation during stable, storage and application were included with specific emission factor in each phase. $Frac_{GASM}$ is the proportion of total NH_3-N of the total N excreted.
Germany:	$Frac_{GASM}$ dynamically calculated using default emission factors for the application of organic fertilizers.
Ireland:	Significant proportions of the nitrogen applied to soils in synthetic fertilizers and animal manures are normally volatilized as NH_3 with some additional conversion to NO_X. These proportions, $Frac_{GASF}$ and $Frac_{GASM}$ respectively in the IPCC guidelines, must be taken into account in order to determine the amount of nitrogen available for direct N_2O production. The IPCC good practice guidance gives the default proportions of chemical fertilizer and animal manure nitrogen lost in this way as 10 percent and 20 percent, respectively. The volatilization rates for Ireland are however determined from an elaborate new NH_3 inventory for agriculture and it is assumed that nitrogen lost as NO_X is negligible in comparison to NH_3. In addition, $Frac_{GASM}$ is split into $Frac_{GASM1}$ and $Frac_{GASM2}$ with $Frac_{GASM1}$ referring to NH_3-N losses from animal manures in housing, storage and landspreading and $Frac_{GASM2}$ being the proportion of nitrogen excreted at pasture that is volatilised as NH_3. The 2004 values of $Frac_{GASM1}$ and $Frac_{GASM2}$ are 0.491 and 0.038, respectively indicating an overall volatilisation rate of 0.194 for animal manure nitrogen, which is close to the value used previously.
Portugal:	The use of emission factors of ammonia volatilisation from EMEP/UNECE results, therefore, in obtaining a value for $Frac_{GASM}$ that is different and lower than the default value for $Frac_{GASM.}$ The resultant implied $Frac_{GASM}$ is constant and equals 16%.

Spain:	National $Frac_{GASM}$
Sweden:	$Frac_{GASM}$ is the national value of the fraction of ammonia-N emissions from animal manure. The estimates of the fraction of nitrogen supply in emitted as ammonium-N are model-based and take into account many factors that influence gas emissions. The methodology, based on data collected on the use of manure from telephone interviews with farmers, was developed in the early 1990s. Later, the methodology was extended to take into account more detailed information on the use of manure and manure storage.

Table 6.69: Member State's background information on the fraction of nitrogen input leached or run-off, FracLEACH for the calculation of N_2O emissions in category 4.D

Austria:	The method applied for calculation of the emissions is IPCC Tier 1b. Following IPCC recommended values, leaching losses from nitrogen fertilizers are estimated to be about 30% of the nitrogen inputs from synthetic fertilizer use, livestock excretion, and sewage sludge application. N_2O emissions are then estimated as 2.5% of the leaching losses, as suggested by the IPCC.
Belgium:	The N_2O emissions from leaching and runoff are estimated by multiplying available nitrogen quantity in soil (animal excreta from grazing, mineral and organic fertilisers spreading, crop residues decomposition, sludge and atmospheric deposition) by two emission factors. The first estimates the fraction of nitrogen lost by leaching and runoff, with a value coming from local studies and which falls into the IPCC range (0.17 kg N / kg N available). The second estimates the volatilisation rate in N_2O form with the IPCC default value (0.025 kg N-N_2O / kg N, table 4.18 of the IPCC Good Practice Guidance). The nitrogen leaching (N_2O model) comes from the SENTWA model (System for the Evaluation of Nutrient Transport to Water) that is yearly updated.
Denmark:	The amount of nitrogen lost by leaching and run-off from 1986 to 2002 has been calculated by DIAS. The calculation is based on two different model predictions, SKEP/Daisy and N-Les21) and for both models measurements from study fields are taken into account. The result of these two calculations differs only marginally. The average of these two model predictions is used in the emission inventory. The fraction of N input to soils that are lost through leaching and runoff (FracLEACH) used in the Danish emission inventory is higher than the default value given in IPCC (30%). There is no simple expla-nation for this difference. In the Danish emission inventory the N-leaching is an important emission source and that explains why it has been chosen to use the national data. The data reflects the Danish conditions and are considered as best estimate.
Finland:	The amount of nitrogen volatilised has been used for calculating indirect N_2O emissions from atmospheric deposition. The amount of nitrogen leached has been used for calculating indirect N_2O emissions from leaching and run-off. It is estimated that nitrogen leaching is less than IPCC default value in Finnish conditions (according to Rekolainen et al. (1993) value is 15% and this has been used in the inventory).
Ireland:	The expressions for N_2O indirect-dep and N_2O indirect-leach are slightly modified to be consistent with those for estimating direct emissions above and to account for the two separate volatilisation fractions $Frac_{GASM1}$ and $Frac_{GASM2}$. The default value for FracLEACH, the fraction of nitrogen lost through leaching, in the IPCC Guidelines is 30 %. Estimates of the nitrogen loads in Irish rivers reported under the OSPAR Convention (NEUT, 1999) suggest that approximately 10 percent of all applied nitrogen in Irish agriculture is lost through leaching. This level of leaching is also indicated by farm budget studies where the nitrogen runoff equivalent to 60 kg N/ha has been measured in streams adjoining farmland receiving 200 kg N/ha from chemical fertilizer and 100 kg N/ha from animal manures per year. The value of 0.1 is considered to be a more realistic estimate of FracLEACH than the default value of 0.3 and it is used for 2004, as it was for previous years.
Netherlands:	Fraction of N leaching to ground water and surface water is based on calculation of total N to soils by manure application, animal production and chemical fertiliser. For estimation of the fraction of N leaching to ground water and surface water the default IPCC fracleach of 30% is used.
Sweden:	The national estimates of nitrogen leaching are calculated from the SOILNDB model , which is a part of the SOIL/SOILN model. The simulation model SOIL/SOILN was devel-oped during the 1980s in order to describe nitrogen processes in agricultural soils. By using national data on crops, yields, soil, use of fertilizer/manure and spreading time, the leaching is estimated for 22 regions. These regions are based on similarities in agricultural production. For calculating nitrogen leaching in the inventory, the average N leaching per hectare, calculated by the SOILNDB model, is multiplied by the total Swedish area of agricultural soil. To estimate the implied FracLEACH, which is required as additional information in CRF 4.D for each reporting year, the leached nitrogen, according to the national model, is divided by the sum of nitrogen in fertilisers and animal production. This quotient varies between 0.2 and 0.25, which is rather close to the IPCC Guidelines' default value of FracLEACH (0.3).
United Kingdom:	Indirect emissions of N_2O from leaching and runoff are estimated according the IPCC methodology but with corrections to avoid double counting N. The sources of nitrogen considered, are synthetic fertiliser application and animal manures applied as fertiliser.

N_2O emissions from other sources.

Six countries report emissions of N_2O from the application of sewage sludge, according to the IPCC GPG. The emission factors used are in four cases the IPCC default factor for direct N_2O emissions, two Member States used a different value. An overview of the emissions from sewage sludge and the specified other ‘other’ sources in category 4D is given in Table 6.70.

Table 6.70: Member State’s background information on the fraction of nitrogen input leached or run-off, FracLEACH for the calculation of N_2O emissions from agricultural soils (data for Italy and Spain for 2003)

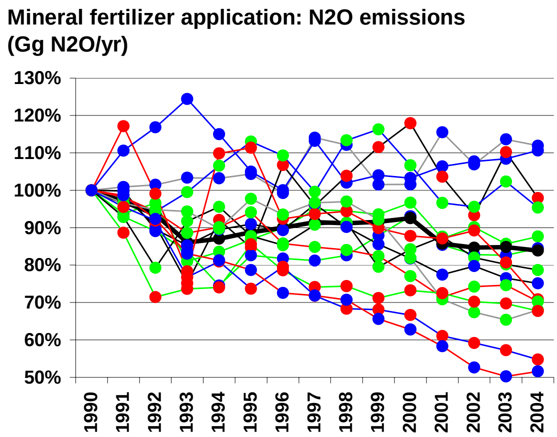
	AD (Gg N)	IEF (kg N2O-N/kg N)	Emissions (Gg N2O)
Sewage sludge			
Germany	29.0	0.0125	0.57
Denmark	3.0	0.0125	0.06
Spain	16.7	0.0125	0.33
Finland	0.5	0.0125	0.01
France	22.4	0.0198	0.70
Netherlands	1.6	0.0119	0.03
Municipal Solid Wastes Compost			
Spain	13.2	0.0125	0.26
Manure animal waste imported			
Germany	14.5	0.0125	0.28
Industrial waste used as fertilizer			
Denmark	10.0	0.0125	0.20
N fixed by improved grassland (kg N/yr)			
United Kingdom	27.5	0.0125	0.54

	AD (km2)	IEF (kg N2O-N/ha)	Emissions (Gg N2O)
Cultivation of mineral soils			
Sw eden	24,080	0.5	1.89
Overseas territories			
France			1.38

Trends

Figure 6.19 through Figure 6.22 show the trend of direct N_2O emissions from the source categories mineral and organic fertilizer application and indirect emissions from atmospheric deposition and nitrogen leaching and run-off.

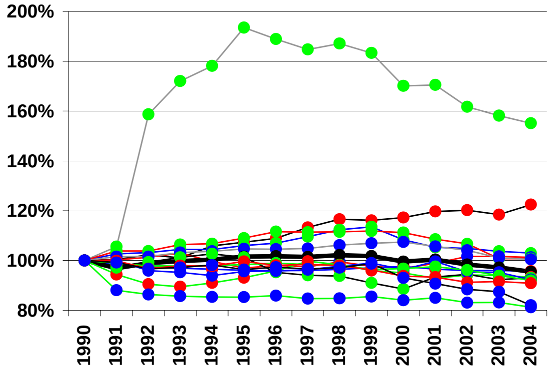
Figure 6.19. Trend of N_2O emissions for mineral fertilizer



	1990	Trend (%) 1990-2004	2004
Portugal	2.7	112%	3.0
Italy	13.6	111%	15.1
Spain	19.8	98%	19.4
Ireland	7.3	95%	7.0
France	47.0	88%	41.2
Germany	42.5	85%	35.9
EU-15	198.0	84%	166.0
Sweden	2.8	79%	2.2
United Kingdom	28.9	75%	21.7
Austria	2.6	71%	1.9
Belgium	4.0	70%	2.8
Netherlands	6.9	68%	4.7
Finland	4.5	68%	3.0
Greece	7.6	55%	4.1
Denmark	7.7	52%	4.0
Luxembourg			

Figure 6.20. Trend of N_2O emissions for organic fertilizer

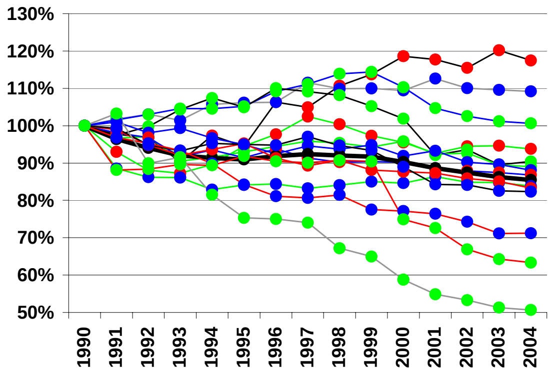
Organic fertilizer application: N2O emissions (Gg N2O/yr)



	1990	Trend (%) 1990-2004	2004
Netherlands	5.6	155%	8.7
Spain	7.0	122%	8.5
Ireland	2.1	103%	2.2
Denmark	3.5	101%	3.6
Belgium	3.0	101%	3.1
Portugal	1.1	100%	1.1
Greece	0.8	96%	0.7
EU-15	89.7	96%	85.7
Finland	1.2	93%	1.2
Sweden	2.8	93%	2.6
Italy	9.3	92%	8.6
France	18.0	92%	16.6
Austria	2.3	91%	2.1
United Kingdom	8.6	82%	7.1
Germany	24.4	81%	19.8
Luxembourg			

Figure 6.21. Trend of N_2O emissions for atmospheric deposition

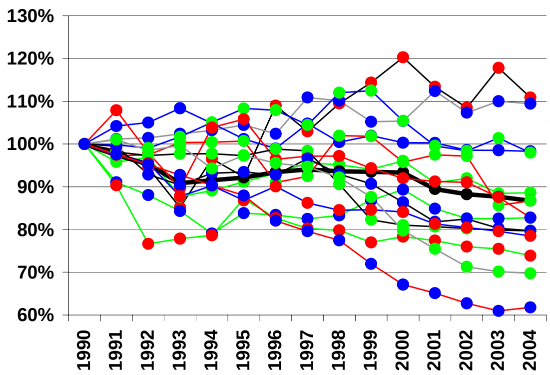
Atmospneric deposition: N2O emissions (Gg N2O/yr)



	1990	Trend (%) 1990-2004	2004
Spain	2.9	118%	3.5
Portugal	0.7	109%	0.7
Ireland	1.4	101%	1.4
Finland	0.6	94%	0.6
Sweden	0.7	90%	0.6
France	10.5	89%	9.4
Italy	5.9	88%	5.2
Greece	1.9	87%	1.7
EU-15	47.5	86%	40.6
Germany	9.8	84%	8.2
Austria	0.7	83%	0.6
United Kingdom	6.4	82%	5.2
Denmark	1.7	71%	1.2
Belgium	1.2	63%	0.8
Netherlands	3.1	51%	1.6
Luxembourg			

Figure 6.22. Trend of N_2O emissions for nitrogen leaching and run-off

Nitrogen leaching and run-off: N2O emissions (Gg N2O/yr)



	1990	Trend (%) 1990-2004	2004
Spain	21.3	111%	23.6
Portugal	3.3	109%	3.6
Italy	20.2	98%	19.9
Ireland	3.1	98%	3.0
France	55.0	89%	48.8
EU-15	211.1	87%	183.2
Belgium	2.6	87%	2.3
Austria	3.6	83%	2.9
Germany	36.1	83%	29.9
Sweden	3.0	80%	2.4
United Kingdom	28.3	80%	22.6
Greece	9.7	79%	7.6
Finland	1.8	74%	1.3
Netherlands	12.6	70%	8.8
Denmark	10.5	62%	6.5
Luxembourg			

6.3.5.3. Uncertainty and time series consistency

As described above, N_2O emissions from agricultural soils belong to the most uncertain source categories of national GHG inventories. For direct N_2O emissions, the highest uncertainty is attributed to the emission factor, which ranges between 48% Austria and 400% Greece relative uncertainty (expressed in 2•standard_deviation). For indirect emissions, both the activity data and the emission factors are considered equally uncertain, which stems from the fact that a most uncertain parameter, the fraction of nitrogen leached, must be applied to determine the activity data. Thus, uncertainties of indirect N_2O emissions are estimated as up to 100% and 900% (Spain) for the activity data and emission factor, respectively. Compared to these values, the sub-category of animal production is less uncertain, with a maximum uncertainty estimated by Greece and Spain (112%).

Table 6.71: Member State's background information on the time series of N_2O emissions in category 4.D

Austria:	The S&A report 2004 noticed high inter-annual variations in N_2O emissions - synthetic fertilizer use. These variations are caused by effects of storage as well as the difference between the calendar year and the agricultural economic year: the amounts of synthetic fertilizers over the years reflect the amounts sold in one calendar year. The economic year for the farmer does not correspond to the calendar year. The value for $Frac_{NCRBF}$ ist the lowest of the reporting parties. In fact, there happened a transcription error in additional table 4.D. For the fraction of nitrogen in N-fixing crops ($Frac_{NCRBF}$) an average value of 0.015 and not 0.005 was used.
Denmark:	The N_2O emissions from agricultural soils have been reduced by 32% from 1990 to 2004. This is mainly due to a decrease in the use of synthetic fertiliser and a decrease in N-leaching as a result of the national environmental policy, where action plans have focused on decreasing the nitrogen losses and on improving the nitrogen utilisation in manure.
Netherlands:	The 22% decrease in N-input to soil by manure and chemical fertiliser application and animal production is not fully reflected in the N_2O emission reduction (17%). The difference is explained by the increased IEF (16%) in this period, due to a shift from surface spreading of manure to incorporation of manure into soil.
Portugal:	Time series shows an abrupt decrease until 1992 and thereafter a lighter reduction: total synthetic nitrogen fertilizer use in 2003 is 22% less than in 1990. Nitrogen in fertilizers is the first source of nitrogen to soils in Portugal just above nitrogen in animal manure applied to soil. To avoid double counting of nitrogen added to soils the part of crop residues that is submitted to grazing should be assessed and corrected in FracFOD parameter.
Sweden:	Estimated standard yields for different crops are published annually by SJV/Statistics Sweden and are a function of crop yields estimated by surveys conducted over the last 15 years. By using standard yields instead of actual yields in the calculations, the time series becomes more regular.

6.3.6 Agricultural Soils – CH_4

Only a few countries report CH_4 fluxes from agricultural soils. Table 6.72 shows that the values spread over a large range and are reported under different sub-categories and thus not comparable.

Explanation on the methodology is given in Table 6.73. While Austria and Belgium relates CH_4 emissions to the sewage sludge and manure that is spread in soils, respectively, Germany calculates a sink strength for methane is calculated in soils as aerobic soils are consuming CH_4 from the atmosphere. Arable soils are known to have a smaller sink strength than forest or grassland soils.

Table 6.72: CH_4 Emission from agricultural soils in 2004

Member States	D. Agricultural Soils	1. Direct Soil Emissions	2. Animal Production	3. Indirect Emissions	4. Other
Austria	0.42	NA		NA	0.42
Belgium	0.17	NA	0.17	NE	
Denmark	NE,NO	NE		NE	NO
Finland	NE	NE		NE	NE
France		NO		NO	
Germany	-30.13	IE		NO	-30.13
Greece	NE,NO	NE		NE	NO
Ireland	NE,NO	NE		NO	NO
Italy		NA		NA	
Luxembourg					
Netherlands	NE,NO	NO		NO	NE,NO
Portugal		NE		NE	
Spain	NE	NE		NE	NE
Sweden	NA	NA		NA	NA
United Kingdom	NA,NE	NA		NE	NA,NE
EU-15	-29.54	0.00	0.17	0.00	-29.71

NA: Not Applicable - NE: Not Estimated - NO: Not Occurring - IE: Implied Elsewhere

[1)]Information on source: CRF Table 4.D 2004 submitted 2006

Table 6.73: Methodologies used to calculate CH_4 Emission from agricultural soils in 2004

Austria:	CH_4 emissions from Agricultural Soils originate from sewage sludge spreading on agricultural soils. They contribute only a negligible part of Austria's total methane emissions. For agricultural sewage sludge application on fields also CH_4 emissions were estimated (country specific method).
Belgium:	Following the centralised review report and in harmony with the IPCC 1996 guidelines the methane emissions from wetlands, unmanaged surface waters and removals in forest soils, grassland and agricultural soils are no longer reported in the national inventory. Wallonia calculates the CH_4 emissions on the basis of the manure applied during grazing. In both regions, this source is very small compared to enteric fermentation and manure management.
Germany:	The calculation of CH_4 emissions from agricultural soils is based on the approach of Boeckx and Van Cleemput (2001), compiling the available observations in Europe. Emissions are differentiated for grassland ($EFCH_4$ = -2,5 kg ha-1 a-1CH_4) and cropland ($EFCH_4$ = - 1,5 kg ha-1 a-1 CH_4).

6.4 Sector-specific uncertainty, quality assurance and quality control

6.4.1 Uncertainty

Table 4.74 shows the total EU-15 uncertainty estimates for the sector 'Agriculture' and the uncertainty estimates for the relevant gases of each source category. The highest level uncertainty was estimated for N_2O from 4.D and the lowest for CH_4 from 4.A. With regard to trend N_2O from 4F shows the highest uncertainty estimates, CH_4 from 4C the lowest. For a description of the Tier 1 uncertainty analysis carried out for the EU-15 see Chapter 1.7.

Table 4.74: EU-15 uncertainty estimates for the sector 'Agriculture'

Source category	Gas	Emissions 1990	Emissions 2004 [1)]	Emission trends 1990-2004	Emissions for which MS uncertainty estimates are available [2)]	Share of emissions for which MS uncertainty estimates are available	Level uncertainty estimates based on MS uncertainty estimates	Trend uncertainty estimates based on MS uncertainty estimates
4.A Enteric fermentation	CH_4	136,638	123,127	-10%	127,603	104%	11%	2
4.B Manure management	CH_4	44,461	44,295	0%	61,277	138%	33%	8
4.C Rice cultivation	CH_4	2,215	2,212	0%	1,657	75%	38%	1
4.D Agricultural soils	CH_4	-661	-620	-6%	-630	102%	107%	-6
4.F Field burning	CH_4	475	73	-85%	41	56%	35%	49
4.B Manure management	N_2O	25,547	22,695	-11%	20,683	91%	39%	6
4.D Agricultural soils	N_2O	226,311	200,480	-11%	191,283	95%	86% - 219%	13 - 30
4.F Field burning	N_2O	189	35	-82%	15	42%	34%	196
4.G Other	N_2O	237	224	-5%	225	100%	100%	5
Total Agriculture	**all**	**435,412**	**392,521**	**-9.9%**	**402,155**	**102%**	**41% - 104%**	**6 - 14**

Note: Emissions are in Gg CO_2 equivalents; trend uncertainty is presented as percentage points.

1) The sum of the source category emissions may not be the total sector emissions because uncertainty estimates are not available for all source categories.

2) Includes for some countries 2003 data and for Spain 2002 data

Quantitative estimates of the contribution of agriculture to the overall uncertainty of the national GHG inventories are reported in Table 6.75. For several countries, N_2O emissions from agricultural soils are by far dominating the uncertainty of the national inventory. The uncertainty estimates range from 1.5% (Austria) to 17.6% (France). Since the estimates from the inventory of 2005, the range has narrowed slightly (0.6% to 20.9%). The values are expressed in percentage relative to the total GHG emission estimates and have thus to be interpreted in relation to the overall estimated inventory uncertainty, which is 1.8% for Austria and 17.8% for France, thus very close to the contribution from agricultural soils.

Some countries allocate the biggest contribution to the direct emissions and others to the indirect emissions of N_2O. For example, the uncertainty of direct N_2O emissions is estimated in the Greece inventory of being 5.0% of the national total versus 1.1% uncertainty of the indirect emissions. On the other hands, the Netherlands estimate an uncertainty of 1.4% and 3.0% for direct and indirect N_2O emissions from agricultural soils, respectively. CH_4 emissions from enteric fermentation are less uncertain (0.3% to 2.0% of total national GHG emissions) and manure management contributes with usually less than 1.5% to uncertainty. This last sector represents only in Spain an important source of uncertainty (4.2% of total emissions with the uncertainty of category 4D being 8.0% and 11.8% for direct and indirect emissions, respectively, and a overall uncertainty of 15.8%).

An overview of the estimated total GHG inventory uncertainty (obtained from the respective national inventory reports) and the contribution of the agricultural sector to the overall uncertainty (calculated from reported relative uncertainties for activity data and emission factors, and the reported emissions) is given in Table 6.75. The corresponding uncertainties for activity data and emission factors are given in Table 6.75 and Table 6.77.

A table summarizing background information on the uncertainty estimates is given in Table 6.78.

Table 6.75: Member States's uncertainty estimates for agriculture

Member State	Year analysed	Total uncertainty of GHG	Enteric ferment. (4A)	Manure Managem. (4B)	Manure Managem. (4B)	Agricultural soils (4D)				Source
						total	direct	indirect	animal prod.	
			CH_4	CH_4	N_2O	N_2O	N_2O	N_2O	N_2O	
		% of total emissions	uncertainties expressed as % of total GHG emissions							Source
Austria	2004	1.8	0.29	0.47	0.73	1.48	0.8	0.6		NIR 2006 Tier 1 p. A-6
Belgium	2004	7.50	1.07	0.67	0.53	6.7				NIR 2006 Tier 1 p. 15
Denmark	2004	5.2	0.5	1.5	0.8	1.7				NIR 2006 Tier 1, p. 58
Finland	2004	-5 - +6	0.3	0.0	0.1	5.5	5.2	1.8		NIR 2006 Tier 2; p. 23, A - 1
France	2004	±17.8	2.0	1.2	0.5	17.6				NIR 2006 Tier 1; p. 34
Germany	2004	5.6	0.3	0.1	0.2	4.5	4.1	2.0	0.1	NIR 2006 Tier 1; p. 67
Greece	2004	10.8	0.6	0.2	0.2	5.8	5.0	1.1	2.9	NIR 2005 Tier 1, Annex IV, p. 214f
Ireland	2004	6.7	1.6	0.3	0.6	6.1	4.4	1.0	4.1	NIR 2006 Tier 1; p. 14 f
Italy	2001	2.5	0.5	0.6	0.7	2.1	1.6	1.4	0.3	NIR 2003 Tier 1; p. 15, A -1.3
Netherlands	2004	5.0	0.5	0.8	0.3	3.3	1.4	3.0	0.3	NIR 2006 Tier 1, p. A-1
Spain	2002	15.8	0.7	4.2	1.4	14.3	8.0	11.8	0.9	NIR 2005 Tier 1; p. 38
Sweden	2004	5.8	1.0	0.4	0.4	4.9				NIR 2006 Tier 1 p. 37, A-2
United Kingdom	2004	16.5	0.5	0.1	0.8	16.3				NIR 2006 Tier 1, Tier 2; p. 33, A-7

T1: Tier 1 methodology, T2: Tier 2 methodology

Uncertainty of total inventory given in NIR; sectoral uncertainties calculated from relative uncertainties and emission data."

Table 6.76: Member States's uncertainty estimates for Activity Data used in the agriculture sector

Member State	Year analysed	Enteric ferment. (4A)	Manure Managem. (4B)	Manure Managem. (4B)	Agricultural soils (4D)				
					total	direct	animal prod.	indirect	
		CH_4	CH_4	N_2O	N_2O	N_2O	N_2O	N_2O	
Austria	2004	0.0	10.0	10.0	0.0	0.0		0.0	NIR 2006 Tier 1 p. A-6
Belgium	2004	5.0	10.0	10.0	30.0				NIR 2006 Tier 1 p. 15
Denmark	2004	10.0	10.0	10.0	7.6				NIR 2006 Tier 1, p. 58
Finland	2004	0.0	0.0	0.0	0.0	0.0		0.0	NIR 2006 Tier 2; p. 23, A - 1
France	2004	5.0	5.0	5.0	10.0				NIR 2006 Tier 1; p. 34
Germany	2004	10.0	7.0	7.0		75.0	20.0	75.0	NIR 2006 Tier 1; p. 67
Greece	2004	5.0	5.0	50.0		20.0	50.0	20.0	NIR 2005 Tier 1, Annex IV, p. 214f
Ireland	2004	1.0	1.0	11.2	11.2	11.2	11.2	11.2	NIR 2006 Tier 1; p. 14 f
Italy	2001	20.0	20.0	20.0	20.0	20.0	20.0	20.0	NIR 2003 Tier 1; p. 15, A -1.3
Luxembourg									
Netherlands	2004	5.0	10.0	10.0		10.0	10.0	50.0	NIR 2006 Tier 1, p. A-1
Portugal									
Spain	2002	10.0	35.0	35.0		7.5	50.0	100.0	NIR 2005 Tier 1; p. 38
Sweden	2004	5.0	20.0	20.0	15.9				NIR 2006 Tier 1 p. 37, A-2
United Kingdom	2004	10.0	10.0	100.0	100.0				NIR 2006 Tier 1, Tier 2; p. 33, A-7

T1: Tier 1 methodology, T2: Tier 2 methodology

Table 6.77: Member States's uncertainty estimates for Emission Factors used in the agriculture sector

Member State	Year analysed	Enteric ferment. (4A)	Manure Managem. (4B)	Manure Managem. (4B)	Agricultural soils (4D)				
					total	direct	animal prod.	indirect	
		CH_4	CH_4	N_2O	N_2O	N_2O	N_2O	N_2O	
Austria	2004	8.0		75.0	48.0	48.0		48.0	NIR 2006 Tier 1 p. A-6
Belgium	2004	40.0	40.0	90.0	250.0				NIR 2006 Tier 1 p. 15
Denmark	2004	8.0	100.0	100.0	19.6				NIR 2006 Tier 1, p. 58
Finland	2004	14.2	15.3	10.3		168.9		238.7	NIR 2006 Tier 2; p. 23, A - 1
France	2004	40.0	50.0	50.0	200.0				NIR 2006 Tier 1; p. 34
Germany	2004	25.0	40.0	75.0		150.0	75.0	150.0	NIR 2006 Tier 1; p. 67
Greece	2004	30.0	50.0	100.0		400.0	100.0	50.0	NIR 2005 Tier 1, Annex IV, p. 214f
Ireland	2004			100.0		100.0	100.0	50.0	NIR 2006 Tier 1; p. 14 f
Italy	2001	20.0	100.0	100.0	100.0	100.0		100.0	NIR 2003 Tier 1; p. 15, A -1.3
Luxembourg									
Netherlands	2004		100.0	100.0		60.0	100.0	200.0	NIR 2006 Tier 1, p. A-1
Portugal									
Spain	2002	20.0	200.0	200.0		380.0	100.0	900.0	NIR 2005 Tier 1; p. 38
Sweden	2004	25.0	50.0	50.0	68.9				NIR 2006 Tier 1 p. 37, A-2
United Kingdom	2004	20.0	30.0	414.0	424.0				NIR 2006 Tier 1, Tier 2; p. 33, A-7

T1: Tier 1 methodology, T2: Tier 2 methodology

Table 6.78: Member State's background information on the uncertainty estimates in the sector of agriculture

Austria:	The uncertainty are mainly based on results from the first comprehensive uncertainty analysis that was performed in 2001 based on data from submission 1999 (WINIWARTER & RYPDAL 2001). According to the Tier 1 Uncertainty Analysis, the uncertainty introduced into the trend in total national emissions is 2.97%. Uncertainties of CH_4 emissions from Enteric Fermentation were estimated with a "Monte Carlo"simulation. Assuming a normal probability distribution, the calculated standard deviation is 4%. This indicates there is a 95% probability that CH_4 emissions are between +/- 2 standard deviations. The uncertainties for N_2O emissions were calculated by Monte Carlo analysis, using a model implemented with @risk software. The model uses a probability distribution as an input value instead of a single fixed value.
Belgium:	The IPCC Good Practice Guidance Tier 1 method has been applied to assess the uncertainty in the emission inventory of 2001 in the previous submission. In Flanders, a complete study of the uncertainty was conducted in 2004 by an independent consultant, Det Norske Veritas, both on Tier 1 and Tier 2 level.
Denmark:	The uncertainty estimates are based on the Tier 1 methodology in the IPCC Good Practice Guidance (GPG) (IPCC 2000). The total Danish GHG emission is estimated with an uncertainty of ±5.2% and the trend of GHG emission since 1990 has been estimated to be -1.5% ± 2.1%-age points. The highest uncertainty is connected with manure management. The emission factor for CH_4 from manure management is 10%. This figure may be underestimated and the uncertainty is therefore increased to 100% until further investigations reveal new data. Research on this topic will be made in Denmark in the next 2-3 years.

Finland:	Uncertainties of inventory estimates were quantified using KASPER model, developed by VTT Technical Research Centre of Finland. The model uses Monte Carlo simulation to estimate uncertainties, and is thus in accordance with the Tier 2 method presented by the IPCC Good Practice Guidance (IPCC, 2000). In agriculture, an uncertainty estimate was given for each calculation parameter of the calculation model at a detailed level.
France:	Uncertainty calculation according to Tier 1 methodology. Total uncertainty from 1990 to 2004 excluding LULUCF amount to ±17.8% (level uncertainty). Uncertainty of the total net emissions are 20.6% in 2004. Strongest impact on total uncertainty arises from the category of N_2O emissions from agriucltural soils.
Greece:	The uncertainty analysis for the Greek GHG inventory is based on Tier 1 methodology described in the IPCC Good Practice Guidance. Total uncertainty is 11.5% (without LULUCF), while the uncertainty that carried over into the GHG emissions trend is 9.6%. These results are slightly higher compared to results of the analysis performed in the previous submission.
Ireland:	The Tier 1 method provided by the IPCC good practice guidance has been used to make an assessment of uncertainty in the emissions inventory for 2004 in the same way as for previous years. In some of the most important emissions sources in Agriculture (such as enteric fermentation and agricultural soils) and Waste (solid waste disposal, for example) the activity data or emission factors ultimately used are determined by several specific component inputs, which are all subject to varying degrees of uncertainty. The uncertainty estimates used for both activity data and emission factor for these sources have been derived by assigning uncertainties to the key component parameters and combining them at the level of activity data or emission factors, as appropriate, for each activity for input to the Tier 1 uncertainty assessment.
Netherlands:	In Tables A1.2. and A1.3. the source ranking is done according to the contribution to the 2004 annual emissions total and to the base year to 2004 trend, respectively. This resulted in 31 level key sources and 30 trend key sources (indicated in the grey part at the top). The Tier 1 uncertainty analysis shown in Annex 7 provides estimates of uncertainty according to IPCC source categories. The uncertainty of CH_4 emissions from enteric fermentation from cattle sources is based on expert judgment and estimated to be about 20% in annual emissions, using 5% uncertainty for animal numbers and 20% for the emission factor. The uncertainty in the emission factor for swine and other animals is estimated at 50% and 30%, respectively.
Portugal:	The uncertainty of the emission factor was reduced by the improvement made from the passage from a tier 1 to a tier 2.
Sweden:	An uncertainty analysis has been done according to the Tier 1 method. Uncertainties are as far as possible presented on the same aggregation level as the Key Source analysis. The overall uncertainty is calculated to be 5.8%. Emissions from manure management have an estimated error of about 50 %. Methane from enteric fermentation may be a bit more certain with an error of about 30 %.
United Kingdom:	The UK GHG inventory estimates uncertainties using both the Tier 1 and Tier 2 methods described by the IPCC. The Tier 1 approach provides estimates of uncertainties by pollutant according to IPCC sector. The Tier 2 approach provides estimates according to GHG (1990, base year and latest reporting year) and has now been extended to provide emissions by IPCC sector. The uncertainty in the combined GWP weighted emission of all the greenhouse gases in 2004 was estimated as 14% and in 1990 as 14% also. The source making the major contribution to the overall uncertainty is 4D – Agricultural Soils.

6.4.2 Improvements since last submission

For the current inventory report, the present chapter on methodological issues and uncertainty in the sector agriculture has been completely re-designed and complemented with additional information. The chapter gives now a complete overview of all relevant parameters required for the estimation of GHG emissions in this sector.

The changes are partly due to a “natural evolution” of the inventory generation over the years and partly motivated by recommendations made by the UNFCCC review team on the occasion of the in-country review in 2005.

The main issues raised by the Expert Review Team and the major changes are:

1. Overview tables on methodological issues were difficult to read and were not sufficiently integrated to enable a view from European perspective

Two major changes in the present report respond to this issue

- For each category, an overview table for the main categories (which are key sources for EU-15) is given including quantitative importance and Tier used. This information is used to calculate a percentage of emissions at EU-15 level for each key source which was estimated by Tier 1 or by Tier 2 methodologies. This analysis was presented during the ICR and proposed for inclusion in the present inventory report.

- The textual overview tables on methodological issues have been split into several tables under the different sub-sections for each category to allow more concise comparison between the Member States.

2. Trend recalculations should be better explained

    - New sections on time series and recalculations summarize the relevant information.

    - Graphical representation of the trend for the most important activity data and other parameter enable to understand better the reason of trends in emissions.

3. The level of information presented in the NIR and the CRF tables was not always the same

    - The process of data compilation was streamlined so that is was possible for the first time to present a full set of background CRF tables, in which all relevant cells are filled.

    - Missing information by some MS have been obtained

4. Some relevant information required to assess the differences in the emission estimates across the Member States was not included in the inventory report

    - The inventory report is being continuously developed. This year it was for the first time possible to include overview tables for all relevant parameters in the report.

5. Major milestones in the collaboration with the Member States were mentioned in the inventory report with a link to the relevant websites. The ERT recommended to include also the recommendations of these workshops in the report itself

    - A summary of the workshops is given below.

6.4.3 Activities to improve the quality of the inventory in agriculture

As a first activity to assure the quality of the inventory by Member States, 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 (CH_4) and nitrous oxide (N_2O) induced by activities in the agricultural sector, not considering changes of carbon stocks in agricultural soils, but including emissions of ammonia (NH_3). The consideration of ammonia emissions allows the validation of the N_2O emission sources and it further strengthens the link between greenhouse gas and air pollutant emission inventories reported under the UNFCCC, the EC Climate Change Committee, 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.

Regarding the quality of national greenhouse gas inventories for the agricultural sector, the participants of the workshop expressed concern in the areas of the consistent assessment of the nitrogen balance in agricultural livestock production systems (source category. 4B), the quality of CH_4 emission estimates from enteric fermentation (source category 4A), and the comprehensive treatment of greenhouse gas emissions from agricultural soils (source category 4D). The workshop recommended, amongst other, to continue the exchange of experience between countries, to coordinate the input of MS into the revision of the IPCC *Guidelines*, and to involve European research projects. It was decided to focus on category 4D due to its dominant role in the total uncertainty of European GHG inventories.

Therefore, an expert meeting of the working group on "improving the quality for greenhouse gas emission inventories for category 4D" was held in October 2004 at the Joint Research Center in Ispra, Italy with the participation of experts from 14 countries and six international organizations / projects.

The objectives of the workshop were:

- To assess the current state of reporting of emissions from agricultural soils;
- To highlight gaps in the availability of data;
- To report on national activities for the generation of national emission factors and other parameters;
- To discuss the link between different source categories in agriculture and with the inventory for ammonia emissions;
- To discuss the use of Tier 3 approaches (process-based models);
- To make recommendations to improve comparability, transparency and completeness of reporting of N_2O emissions from agricultural soils.

The workshop's participants formulated general recommendations for the improvement of the quality of greenhouse gas emission inventories for category 4D as well as a series of specific recommendations, directed both at European Member States in order to improve GHG inventories under the current Guidelines and suggestions beyond the current guidelines addressing the IPCC process for revision of the Guidelines. These recommendations have been forwarded to the secretariat of the IPCC and most of the issues addressed are being updated in the 2006 guidelines.

These recommendations were discussed in a wider audience at scientific conferences, such as the Non-CO_2 greenhouse gas conference (NCGG-4) in Utrecht (see Leip, 2005a) and discussed for their scientific relevance in Leip et al. (2005). The proceedings of the workshop have been published as a EUReport (Leip, 2005b).

Recommendations

The participants of the workshop valued the concept and the quality standards as they are currently defined in the Guidelines for reporting to the respective conventions, and felt that some methodologies can indeed be improved.

The workshop's participants formulated general recommendations for improvement of the quality of greenhouse gas emissions for category 4D as well as a series of specific recommendations. Specific recommendations are directed both towards European Member States in order to improve GHG inventories under the current *Guidelines* and suggestions beyond the current guidelines addressing the IPCC process for revision of the *Guidelines*.

General recommendations

Coherent reporting

The participants recognized that, for reporting N-emissions, the existence of the two conventions is complementary rather than competitive and that mutual benefits can be achieved by combining the respective efforts and exchange of information.

Despite the differences in target and scale between the two conventions, the participants urge to a unified concept for reporting. Synergies and coherence with other directives (e.g., nitrate directive) should be considered. Inventory generation requires interdisciplinary expertise.

Comprehensive reporting

Emissions of air pollutants, greenhouse gases and inert gases from agricultural systems are closely interrelated. To avoid that a certain mitigation measure leads to a simple shift in emissions, it is important to have a comprehensive and integrated assessment of all emissions. This assessment could eventually be used for reporting requirements.

The guidance needs to be user-friendly and unequivocally, and stimuli for countries to actually improve reporting quality would help. The IPCC is offering methodologies and invites countries to use improved methodologies. One is the use of the CORINAIR guidebook for NH_3 calculations.

Stakeholders

The assessment of the environmental impact of agricultural activities in Europe is relevant at different levels, i.e., at the European level, at national and regional (e.g., drainage basins) level and at the farm level.

Each of them requires its own level of detail in the methodological approach (reporting, budgeting, process understanding) and is associated with a different degree and definition of uncertainty. Also, it is helpful to develop a communication tool between the levels.

Mitigation

Mitigation of emissions from agriculture is achieved at the farm and regional level. The processes involved in the formation of emission fluxes in agricultural systems are extremely difficult and complex. There is a need to allow in the reporting methodologies for mitigation measures other than changing N input. Methodologies should also encourage operating in a country-specific way. Process understanding should be incorporated in order to allow for (convincing) mitigation measures at the farm level.

Activity Data

There is (still) a lack (and uncertainty) in activity data. There is need of management data as input data for the guidelines in order to enable to make projection.

Emission Factors

Emission factors and other parameters used in the calculation of emission fluxes are associated with a large degree of uncertainty. The emissions of nitrous oxide from soils are affected by both variability in space and time and by inaccuracy. Deeper process knowledge is required to separate them. This can be achieved by a combination of well conceptualized experiments and (process) modeling.

There is a body of evidence that default Emission Factors can be revised on the basis of recent data. In some cases, there is less uncertainty associated with relative than with absolute emissions (e.g. nitrate ammonium > urea). Such knowledge could be better exploited.

Countries are encouraged to develop and use national data provided these are documented, validated and made available. Regionalization of emission factors is required. Additional information is needed in particular for Southern and Eastern European climate regions. Resources should be allocated with preference into the development of national estimates for indirect N_2O emissions (volatilization, leaching and run-off), which are most uncertain.

In some cases, there might be a need to find a compromise between comparability and accuracy. Existing national data are in some cases not yet used for reporting. Comparability can not be achieved by using the same factor.

Projections

An integrated research approach is required in order to enhance process understanding, to improve biogeochemical models and finally to narrow the uncertainty range in emission projections. Components of an integrated research approach must be field measurements accompanied by laboratory studies and model improvement and validation.

The workshop's participants see need for action at the EU level

There is value in exchanging ideas in the frame of a workshop especially as national data and methodologies are developed[21]. Particularly, the involvement of New Member States and Candidate Countries is needed.

Data requirements for the second commitment period (2006 guidelines) and negotiations/ preparations under COP/SBSTA

Process models are continuously evolving and improving. Their potential use for GHG inventories should be re-assessed in two years time.

There is the need to better assess the uncertainty associated with N_2O emissions from soils and to take action for reducing the uncertainty range.

Specific recommendations

General issues

Recommendations for current reporting

(1) Member States are encouraged to develop national emission factors or parameters required for the calculation of N_2O emissions, which are essential for reducing uncertainty of GHG inventories, provided these are documented, validated and made available. Priority areas are:

(a) Direct emission factors

[21] The participants of the workshop welcomed the project carried out in Italy for comparison of methodologies used in Mediterranean countries.

(b) Leaching fraction

(c) N_2O emissions from groundwater

(d) Nitrogen fraction in crop residues

(e) Volatilization fraction for synthetic fertilizer and applied animal wastes.

(2) Member States are required to appropriately disaggregate key source categories according to the *Guidelines*.

(3) Member States are encouraged to collect farm management information, which is still scarce and is required for N_2O emission estimates and projections.

Direct emissions of N_2O

Emission Factors

Recommendations for current reporting

(4) Member States are encouraged to develop regional emission factors/parameters. Eco-systemical stratification of emission factors by main ecological drivers is essential for reducing the uncertainty in national greenhouse gas inventories. Priority areas are:

- o Effect of soil type/climate (wetness/freeze-thaw events/rewetting of dry soils)
- o Effect of type of N applied (mineral / organic)
- o Effect of crop type (classes)

Recommendations for the revision of the Guidelines

(5) There is a basis for differentiating N_2O emission factors between the type of nitrogen input, in relationship to land use and soil conditions. In particular, specific EFs could be adopted, for

(a) the manure N deposited in situ, taking into account the state of the soil under the grazing regime; and

(b) the manure from animal housing etc. spread on the fields.

(6) Mitigation measures should be visible in the *Guidelines* for higher Tier methods as emissions of N_2O are a non-linear function of N input. Efficient use of nitrogen given to the crop is a function of both crop type and local conditions. Application rates in relation to crop needs and timing of management activities are key driver for avoiding excess input of nitrogen.

(7) Emissions of N_2O induced by different forms of nitrogen input are non-linearly interacting. The interdependency between forms of N-input should be reflected in the *Guidelines* for higher Tier methodologies, e.g. as an EF-matrix (total input vs. percent animal waste).

N_2O emissions from crop residues and from N-fixing crops

Recommendations for current reporting

(8) Member States should use Table4.F for reporting of parameters relevant for N_2O emissions from crop residues, even in case no burning of crop residues occurs in their country, to enhance transparency.

(9) Member States are required to estimate crop residues from all major crop types occurring in their country.

Recommendations for the revision of the Guidelines

(10) A separate calculation for forage legumes such as alfalfa and clover-grass mixtures should be included in the *Guidelines*. The role of rotational renewal of grass/clover leys by ploughing and reseeding every few years also needs attention.

(11) The methodology for reporting of emissions from crop residues needs revision. In particular:

(a) There are possible risks of double counting when background emissions from the cultivation of mineral soils are included in the inventory. Guidance on background emissions should be given.

(b) Default values for the nitrogen fraction need to be streamlined. Particular attention should be paid to the physiological part of the crop the parameters are referring to (crop product, crop residue, and total aboveground crop).

(c) The C/N ratio of crop residues appears to be a key variable in determining the amount of N_2O produced during winter and could be included in the methodology.

(12) An alternative and simpler method for estimating N_2O emissions could be based on area-based quantities of nitrogen in crop residues by crop type, which are more readily available in some countries.

Background emissions

(13) Reporting of background emissions from cultivation of mineral soils seems appropriate as long as nitrogen in roots is not accounted for and with regard of long-term effects of manure applications. However, reporting of background emissions bears the risk of double accounting. It would be helpful if the *Guidelines* address this issue.

Nitrogen balance in agricultural systems

Recommendations for current reporting

(14) Member States should link NH_3 and N_2O inventories as far as possible in order to enable the assessment of mitigation measures for its impact on both air pollution and climate change related policies.

(15) Member States should apply a mass-flow approach wherever possible, provided that appropriate factors are available (related to Total Ammoniacal Nitrogen for NH_3 and total nitrogen for N_2O). If possible, also emissions of N_2 should be reported wherever relevant.

(16) Member States are encouraged to differentiate between NH_3 volatilization from animal housing systems, manure storage systems and volatilization from soils. Information on NH_3 emission rates from housing and manure could be included in background Table4.B(b) as shown in the following example, indicating emissions of NH_3, NO_x, and N2 in columns $L to $N and differentiation between systems in rows #12ff.

(17) Member States should correct the amount of nitrogen deposited on pasture, range, and paddock (Equation 2 of p. 4.98 of the IPCC *Guidelines*) for the fraction of nitrogen volatilized in analogy to the calculation of direct emissions from applied manure (see equation 4.23 on page 4.56 if the IPCC *Good Practice Guidance*), as volatilization of NH_3 from pasture, range, and paddock occurs before N_2O production takes place. The Fraction of livestock N excreted and deposited onto soil during grazing that volatilizes as NH_3 and NO_x could be reported in cell J16 of the table "Additional information" of background Table4.D. A possible acronym is "$Frac_{GASP}$"

Recommendations for the revision of the Guidelines

(18) The *Guidelines* should apply a nitrogen-balance method allowing the comprehensive assessment of mitigation. This would – in some cases – require the estimation of other nitrogenous losses as NO_x and N_2.

(19) The CRF table should allow reporting separately volatilisation fractions for NH_3 and NO_x and optionally N_2, and differentiating for animal housing and manure storage systems. This could be achieved, for example, with additional columns/rows in the table "Implied Emission Factors" in background Table4.B(b).

(20) The default volatilization fractions for NH_3 and NO_x or fertilizer application should be replaced by a more detailed method, such as the methodology described in the CORINAIR guidebook.

(21) Volatilization fractions for NH_3 and NO_x from soils should be differentiated for manure applied on agricultural soils and manure dropped on Pasture, Range, and Paddock. This could be achieved, for example, by an additional row in the table "Additional information" in Table4.D

(22) The name of category 4D31 "Atmospheric Deposition" easily leads to confusion with atmospheric nitrogen deposited on the agricultural land. The workshop recommends another short name, such as Indirect N_2O emissions from "*Volatilization of NH_3 and NO_x*".

(23) The calculation of "Direct N_2O emissions from Animal Production" should be done under category 4D rather then under category 4B.

(24) The definition of manure as "animal wastes" does not seem appropriate.

Advanced methodologies

Recommendations for the revision of the Guidelines

(25) Biogeochemical models are potentially a powerful tool for deriving emission factors on a regional basis and for the policy-making process (projections, scenario analysis). They could play a useful role for inventory generation in some year's time, provided that they are thoroughly validated. Guidance should be given on the use of biogeochemical models, in particular

(26) how sub-sources, that are integrated in one calculated emission rate should be separated. In biogeochemical models, sub-sources are interacting, non-linear, and non-additive.

(27) if changes in weather conditions and other ephemeral changes should be fully reflected in the emission estimates or if – during a commitment period – climate data should be used rather than weather

(28) how transparency could be ensured (assumption behind models, parameterization, underlying data sets etc.)

Other issues

Recommendations for the revision of the Guidelines

Intercrops

(29) The occurrence of intercrops is common in certain European regions and has an impact on the use and efficiency of nitrogen fertilizer. The use of intercrops should be reflected in the *Guidelines*.

Reporting of emissions from land use and land-use change

(30) Permanent crops are important in Mediterranean countries. Allocation of permanent crops within the land use categories proposed in the *Good Practice Guidance* for LULUCF is not straightforward. Better guidance should be given in the *Guidelines*.

(31) The transformation of volatilized nitrogen from agriculture into N_2O can happen after one or more cycles of deposition/volatilization processes. Indirect N_2O emissions should be reported from all land uses where N_2O emissions are being estimated rather than from cropland only.

Indirect emissions from energy-related activities

(32) Energy-related emissions of NO_x are leading to N_2O emissions further down in the “nitrogen cascade” can significantly contribute to total anthropogenic N_2O emissions. Considering these emissions in the guidelines would ensure methodological consistency across the sectors.

6.5 Sector-specific recalculations

Table 6.79 shows that in the agriculture sector the largest recalculations were made for CH_4 in the years 1990 and 2003. Also N_2O emissions were recalculated in both years.

Table 6.79 Recalculations of total greenhouse gas emissions and recalculations of greenhouse gas emissions in CRF Sector 4: ‘Agriculture’, for 1990 and 2003 by gas (Gg and %)

1990	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
	Gg	percent	Gg	percent	Gg	percent	Gg	percent	Gg	percent	Gg	percent
Total emissions and removals	36,029	1.2%	-12,408	-2.8%	5,977	1.5%	839	3.1%	1,074	6.8%	569	5.5%
Agriculture	0	0.0%	-30,887	-14.4%	4,412	1.8%	NO	NO	NO	NO	NO	NO
2003												
Total emissions and removals	63,546	2.0%	-5,239	-1.6%	4,431	1.3%	614	1.2%	1,050	18.8%	-429	-4.6%
Agriculture	0	0.0%	-24,223	-12.5%	5,094	2.3%	NO	NO	NO	NO	NO	NO

NO: not occurring

Table 6.80 provides an overview of Member States’ contributions to EU-15 recalculations. Germany was mainly responsible for the CH_4 emission recalculations. For N_2O Spain had the largest recalculations for 1990 and 2003.

Table 6.80 Contribution of Member States to EU-15 recalculations in CRF Sector 4: ‘Agriculture’ for 1990 and 2003 by gas (difference between latest submission and previous submission Gg of CO_2 equivalents)

	1990						2003					
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6
Austria	0	228	438	NO	NO	NO	0	194	464	NO	NO	NO
Belgium	0	83	181	NO	NO	NO	0	-140	69	NO	NO	NO
Denmark	0	158	45	NO	NO	NO	0	116	18	NO	NO	NO
Finland	0	66	115	NO	NO	NO	0	106	216	NO	NO	NO
France	0	-13	32	NO	NO	NO	0	-31	-1,353	NO	NO	NO
Germany	0	-30,896	129	NO	NO	NO	0	-23,847	1,159	NO	NO	NO
Greece	0	5	0	NO	NO	NO	0	0	0	NO	NO	NO
Ireland	0	1,123	-245	NO	NO	NO	0	732	-342	NO	NO	NO
Italy	0	-704	1,263	NO	NO	NO	0	-480	370	NO	NO	NO
Luxembourg	-	0	0	NO	NO	NO	-	0	146	NO	NO	NO
Netherlands	0	203	-62	NO	NO	NO	0	287	68	NO	NO	NO
Portugal	0	-354	-688	NO	NO	NO	0	220	-151	NO	NO	NO
Spain	0	-773	3,407	NO	NO	NO	0	-1,225	4,731	NO	NO	NO
Sweden	0	-13	-199	NO	NO	NO	0	-26	-102	NO	NO	NO
UK	0	0	-3	NO	NO	NO	0	-127	-197	NO	NO	NO
EU15	**0**	**-30,887**	**4,412**	**NO**	**NO**	**NO**	**0**	**-24,223**	**5,094**	**NO**	**NO**	**NO**

NO: not occurring; IE: included elsewhere

6.5.1 *Enteric Fermentation (CRF source category 4.A)*

Information on recalculations of emission estimates in category 4A contained in the NIR of some countries are summarized below:

Table 6.81: Member State's background information for recalculations of CH_4 emissions in category 4.A

Austria:	GE-intake data of dairy and mother cows have been recalculated1) following2) , which resulted in higher CH_4 emissions from source category 4 A 1. The increasing recalculation difference of Non-dairy cattle 1990-2003 reflects the increasing number of Mother cows in Austria.
Belgium:	In Flanders the inconsistency in the livestock population data for Sheep and Swine reported in tables 4.A, 4.B(a) and 4.B(b) is solved during this submission for all years. In Wallonia, following the S&A report 2003, the IPCC default value is used since the submission of 2005 for the Swine category for the calculation of CH_4 emissions from enteric fermentation.
Denmark:	The emission related to the enteric fermentation from Dairy cattle and Heifer has been recalculated. A national Ym for all years is used. Research from DIAS has shown that the princi-pal used feeding stuff (sugar beets) in 1990 is giving a higher methane conversion rates than the default value recommended in IPCC reference manual. This has results in an in-crease of the emission with 4% in 1990 and 2% in 2003.
Finland:	Emission factors for Sheep and Reindeer have been revised with the assistance of animal nutrition experts of MTT Agrifood Research Finland3) using a national methodology for estimating the GE.
France:	Slight updates for some animal categories for the year 2003
Greece:	CH_4 emissions from enteric fermentation have been recalculated because of the use of the three-year average for Sheep population instead of the annual one and because of the availability of updated data on livestock population for 2001, which influence the following years until 2004 as well, since data for these years are extrapolated.
Ireland:	The major methodological change is the application of a robust Tier 2 approach for the estimation of CH_4 emissions from both enteric fermentation and manure management in Cattle. Other changes are largely due to the treatment of source categories 4.A Enteric Fermentation and 4.B Manure Management at a more disaggregated level and the application of official annual statistics (without three-year averaging) in a manner that best represents the activity data required for the individual sources in general.
Netherlands:	Due to the development of a country specific method methane emissions from enteric fermentation are estimated with improved accuracy. Besides it is possible to reflect changes in feed intake in the emission. Feed composition changes (affecting digestibility and the MCF) over time are now reflected in the MCF. Changes in emission factors for dairy cattle over time reflect changes in the milk production, energy uptake and feed composition of the cattle.
Portugal:	The enhancement of livestock characterization, using the most detailed disagregation available from the national statistics. The emission factor determination follow now a tier 2 methodology. the 3 year average is no longer centred, but represents the average of the 3 last years.
Sweden:	In the autumn of 2004, Statistics Sweden was commissioned by the Swedish Board of Agriculture to carry out a survey aimed at estimating the total number of horses and the number of establishments with horses. According to the survey, there were around 5 % less than the value used earlier. Since the Farm Register has used a new definition of piglets and pigs for meat production since 1994, the number of piglets has been recalculated for the years 1990 – 1993 in order to get a consistent time series.
United Kingdom:	For calculation of methane from enteric fermentation in the dairy breeding herd, the digestibility of the diet has been increased from 65% to 74%, based on expert opinion of Bruce Cottrill (ADAS).

6.5.2 *Manure Management CH_4 (CRF source category 4.B(a))*

Information on recalculations of emission estimates in category 4B(a) contained in the NIR of some countries are summarized below:

Table 6.82: Member State's background information for recalculations of CH_4 emissions in category 4.B(a)

Austria:	Within the revision of N excretion rates also the GE-intake and VS excretion data of dairy and mother cows have been recalculated. This resulted in higher CH_4 emissions from source category 4 A 1 and 4 B 1.
Belgium:	In Flanders the inconsistency in the livestock population data for Sheep and Swine reported in tables 4.A, 4.B(a) and 4.B(b) is solved during this submission for all years.

Denmark:	The changes over the years – both the total emission and the implied emission factor are not only a result of changes in number of animal, but also depends on changes in the allocation of subcategories, changes in feed consumption and changes in stable type.
Finland:	The most important improvements for this submission were updating of animal weights and nitrogen excretion rates and manure management systems of Cattle and Swine. New national emission factors were used for sheep and reindeer in this submission.
France:	Slight updates for some animal categories for the year 2003.
Germany:	Animal numbers for poultry were replaced by statistical data for the years 1990 to 1993. CH_4 emissions from manure management for non-dairy cattle and swine were calculated for the first time applying the Tier 2 methodology. Time series for animal numbers sheep and goats have been corrected.
Greece:	CH_4 emissions from manure management have been recalculated because of the availability of updated data on livestock population for 2001, which influence the following years until 2004, since data for these years are extrapolated, as well as year 2000 since the three-year average is used for the population.
Ireland:	Robust improvement for estimates of emissions from manure management based on the results of major research and extensive farm facility surveys conducted in recent years. This research, together with other relevant work related to the development of an elaborate new NH_3 inventory for agriculture and guidelines on implementation of the EU Nitrates Directive (CEC, 1991) has facilitated the application of a large amount of country-specific information underlying the various estimates of emissions. In preparing the inventory time-series for the years 1990-2004, particular attention was given to detailed application of new methods and data for 1990 and 2004. The emission factors for Cattle are higher than those previously used mainly because a much higher proportion of waste is allocated to liquid systems for which the applicable updated MCF value is 0.39. The emission factors for Swine are substantially higher than previously used, as all wastes are allocated to liquid systems, which have a relatively high MCF of 0.39. Previous NIRs have stated that Sheep remain outdoors all year round and that there is no management of sheep manures in Ireland. The farm facilities surveys show that lowland Sheep are housed for some time during the year thus allowing for the inclusion of Sheep manures in the estimation of emissions from manure management.
Portugal:	Emission factors were improved, reducing uncertainty, as result of the use of data from the enhanced livestock population characterization and of determination of country specific production, per animal, of manure (VS). New expert information concerning the share of each MMS and its evolution in time was used in the improvement of the emission factors;
United Kingdom:	There was a revision (in 2002) of the allocation of manure to the different management systems based on new data.

6.5.3 *Manure Management N_2O (CRF source category 4.B(b))*

Information on recalculations of emission estimates in category 4B(b) contained in the NIR of some countries are summarized below:

Table 6.83: Member State's background information for recalculations of CH_4 emissions in category 4.B(a)

Austria:	As recommended in the Centralized Review 2004, Austrian N excretion values were reviewed and recalculated by Poetsch (2005 following Gruber, Steinwidder, 1996) Especially N excretion rates of dairy and mother cows are higher now. The recalculation of VS excretion values of Dairy and Mother cows resulted in higher CH_4 emissions from these source categories. The improved methodology is based on the following literature (Gruber, Poetsch, 2005; Poetsch et all., 2005; Steinwidder, Guggenberger, 2003; Zaoer, 2004).
Belgium:	In Flanders the inconsistency in the livestock population data for Sheep and Swine reported in tables 4.A, 4.B(a) and 4.B(b) is solved during this submission for all years. In Wallonia, an allocation mistake in table 4.B(b) was corrected : in the inventory years 2002 and 2003, nitrogen excretion was wrongly reported under "daily spread" instead of "pasture range and paddocks".
Denmark:	Updating of slaughter weight 2000 – 2003 for pigs. This has re-sult in small changes in number of slaughter pigs. A recalculation has been performed for horses 1990 – 2003 due to a revision of the Danish normative feeding norms for horses lighter than 400 kg.
Finland:	Updating of animal weights and nitrogen excretion rates and manure management systems of Cattle and Swine. New national emission factors were used for Sheep and Reindeer in this submission. Distribution of manure management systems was updated for Cattle and Swine with the assistance of experts of ProAgria (Kyntäjä, J. & Nopanen, A., pers.comm) and MTT Agrifood Research (Lehtonen, H. pers.comm.).
France:	Only some animal types have been updated slightly for the year 2003
Germany:	The German inventory reports for the first time emissions from Goat and Buffalo and considers the emisisons from imported manure. N excretion rates were recalculatd for dairy cattle, bulls, and swine. Corrections of the entries in AWMS liquid, solid storage and dry lot, pasture range and paddock are necessary: In submission 2003 IPCC

	Default EF were submitted, in submission 2004 the AWMS figures were indicated in the unit kg/head. Both entries were wrong.
Ireland:	The nitrogen excretion rates for all animals in Ireland officially adopted by the Department of Agriculture for implementation of the Nitrates Directive are now consistently applied in the inventories. Reliable data on animal waste management systems and other farm-level practices underlying Ireland's elaborate NH3 inventory for Agriculture are fully utilised where appropriate in relation to 4.B Manure Management and 4.D Agricultural Soils and minor modifications to some of the IPCC emission equations have been introduced in the latter category to adequately account for countryspecific circumstances. The greater allocation of animal wastes to liquid systems reduces N_2O emissions for manure management as the emission factor for liquid systems is 0.001 kg N_2O-/kg N while that for solid systems is 0.02 kg N_2O-/kg N.
Sweden:	Emissions from sludge have been divided divided into direct and indirect emissions in the CRF formate. Indirect emissions from sludge are included in Atmospheric Deposition. This does not change the the estimated total emissions. The stable periods have been changed for the years 1990 – 1994 due to weak supporting data. The activity data for 1997 is now used for the period 1990 – 1997. The change yields a small reduction in emissions from farmyard manure and an increase in emissions from grazing manure.
United Kingdom:	The conversion of excreted N into N_2O emissions is determined by the type of manure management system used. The distributions used were revised for Cattle and poultry in the 2000 Inventory. The change related to the way that data on 'no significant storage capacity' of farmyard manure (FYM) were allocated. This could have a large effect on emissions because it amounted to around 50% of manure and the 'Daily spread (DS)' category has an emission factor of zero, compared to 0.02 for the 'Solid storage and dry lot (SSD)' category. Assigning this 'stored in house' manure to 'daily spread' is acceptable only if emissions from the housing phase are thought to be very small. Calculations were performed with the N_2O Inventory of Farmed Livestock to compare housing and storage phases (Sneath et al., 1997).

6.5.4 Agricultural Soils - N_2O (Source category 4.D)

Information on recalculations of emission estimates in category 4D contained in the NIR of some countries are summarized below:

Table 6.84: Member State's background information for recalculations of CH_4 emissions in category 4.D

Austria:	Revised N excretion data of Austrian livestock led to higher amounts of animal waste spread on agricultural soils. Amounts of agriculturally applied sewage sludge of the years 2002 to 2004 have been updated with data from the National Austrian Waste Water Database. Austrian N excretion values have been revised. Especially N excretion rates of dairy and mother cows are higher now, which led to higher emissions of N_2O from source category 4.D.
Belgium:	In Flanders, the nitrogen excretion factors were revised during this submission for the time series 1996-2004, taking into account the reduced nutrient content in the animal feed. In Flanders, the implied emission factor for histosols is updated from 5 to 8 kg N_2O-N / kg N. Also the area of cultivated histosols has been corrected using region specific data based on an intersection between the CORINE Land Cover Geodataset from 1990 and the Belgian 'Soilassociationmap'.
Denmark:	N_2O emission from histosols are recalculated and national emission factor is used based on the C:N relationship for the organic matter in the histosols. A more detailed description is given in the chapter for the LULUCF sector.
Finland:	Cultivated organic soils were not divided into peat soils and other organic soils anymore but into grasses and cereals instead and using national emission factor for both crop types.
France:	For fallow land (without fertilizer application), an EF of 1 kg N_2O/ ha was used so far. In the current inventory, these emissions are not included as they are considered to be natural and occur also on fertilized soils. For the calculation of the indirect emissions, volatilization from peat soils and water surfaces, which were included in former inventories, are not included any more to avoid double counting.
Germany:	In submission 2003 and 2004 in the field E10 the formular to calculate the IEF was wrong linked, it considered the emissions of animal production and not the emissions of animal waste applied to soils.
Greece:	N_2O emissions from agricultural soils have been recalculated because of the availability of updated data regarding livestock population and crop production.
Ireland:	The nitrogen excretion rates for all animals in Ireland officially adopted by the Department of Agriculture for implementation of the Nitrates Directive are now consistently applied in the inventories.
Netherlands:	Completeness was improved by incorporation of application of sewage sludge to agricultural soils.
Portugal:	Changes in activity data, such as the quantity of manure produced per head and the revision of some livestock populations, had indirectly influenced the emissions of this source. Emissions of N_2O from Animal Production are now estimated applying the emission factor before ammonia volatilization subtraction, in a consistent way to N_2O emissions estimate from Manure Management. Revision of crop production data, according to the revised production time series from INE and correction of errors for some intermediate years. The main modification in the

	methodology has resulted from the fact that now the quantity of nitrogen that is lixiviated is estimated prior to subtraction of ammonia from synthetic fertilizers and animal manure that are added to soil as nitrogen sources.
Sweden:	Nitrogen fixation: the method for estimating nitrogen fixation has been changed. A model according to Høgh-Jensen, has been used in the submission for 2006. The model covers nitrogen fixing from root and stubble as well as transmission to other plants. It has been adapted to Swedish conditions and has been used by e.g. the Swedish Board of Agriculture. A new method of estimating areas of organic soils has been developed. According to the new estimate, the area of organic soils totals 252,600 hectares. This estimation is believed to be a slight overestimation since some organic soils in natural pasture land is included. The results from this method are very close to those of the old method, which was based on expert judgement.

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7 LULUCF (CRF Sector 5)

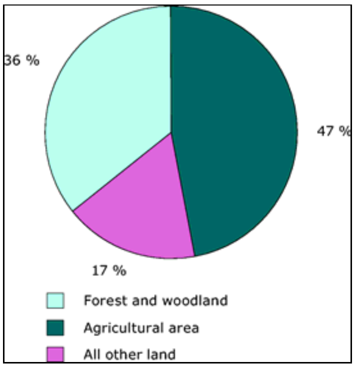
This chapter starts with an overview on emission removal trends in CRF Sector 5 ‘LUCF’. Sections on methodological issues and uncertainty, sector-specific QA/QC and on recalculations are also provided. The main improvement compared to the inventory report 2005 is the provision of the new LULUCF tables by the European Community including background information on stock changes, amount of fertiliser applied and total amount of lime applied.

7.1 Overview of sector

Complying with revelant provisions, this section of the NIR is structured to provide information on all land use, land use change and forestry sectors. As this is the first time of reporting emissions and removals this way, and also because of the fact that the report of the EC is a compilation of the reports of the Member States, we focus on some major issues, especially forestry issues.

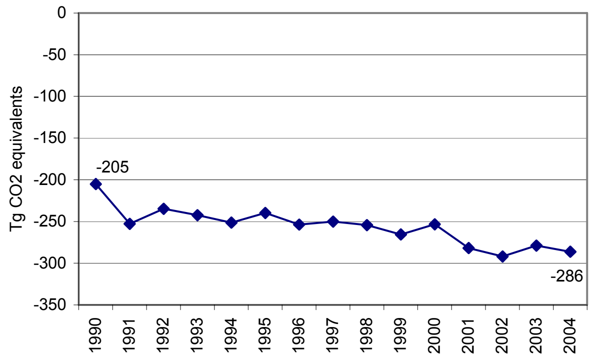
With almost all land under more or less intensive management, the LULUCF sector is an important economic sector within the EU. Almost half of the land is managed in the agriculture, and more than one-third is covered by forests (Figure 7.1).

Figure 7.1 The share of the main land use categories by area of the EU-25 (European Environmental Agency)



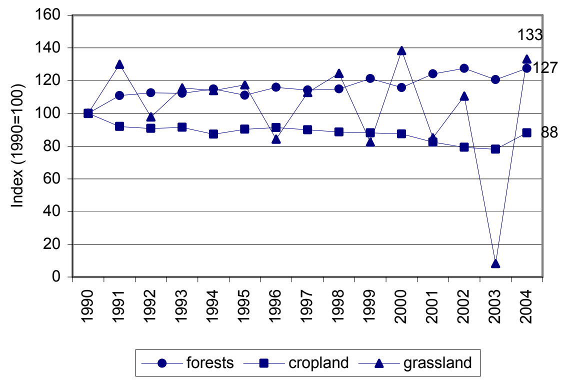
The CRF Sector 5 ‘LULUCF’ of the EC is a net carbon sink, resulting from emissions from sources and removals by sinks. In 2004, net CO_2 removals (removals minus emissions) from LULUCF were 291 Tg in the EC. The overall sink (including non-CO_2 greenhouse gases) increased by 40% from 1990, as the net removals in CO_2 equivalents were 205 Tg in 1990 and 286 Tg in 2004 (Figure 7.2)

Figure 7.2 **EU-15 net GHG emissions (emissions minus removals) for 1990–2004 from CRF Sector 5: 'LULCF' in CO_2 equivalents (Tg)**



Within the CRF Sector 5, forests of the EU-15 are a net carbon sink, whereas croplands and grasslands are net sources of greenhouse gases in the EU-15. Net CO_2 removals from forests increased by 27 % between 1990 and 2004; net CO_2 emissions from cropland decreased by 12 % in the same period. Emissions from grasslands fluctuated depending on the sum of emissions and removals reported by the Member States; seven Member States reported net CO_2 emissions from grasslands whereas in five Member States grasslands are a net CO_2 sink. In 2003, Italy reported exceedingly high net CO_2 removals from grasslands.

Figure 7.3 **EU-15 net GHG emissions (emissions minus removals) for 1990–2004 from forests, cropland and grassland**



Sector 5 is an overall sink of greenhouse gases for all Member States except the Netherlands (Table 7.1). Italy, France, Germany, and Spain account for the largest removals in absolute terMember States; large changes between 1990 and 2004 in relative terMember States occurred in Denmark. Denmark, Ireland, Portugal and the UK turned from net emissions in 1990 to net removals in 2004.

Table 7.1 Member States' contributions to net GHG emissions from CRF Sector 5: 'Land use change and forestry'

Member State	Net greenhouse gas emissions (Gg CO_2 equivalents)			Change 2003-2004		Change 1990-2004	
	1990	2003	2004	(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
Austria	-11.961	-16.597	-16.630	-33	0%	-4.669	39%
Belgium	-1.431	-1.717	-1.173	543	-32%	258	-18%
Denmark	552	-1.940	-2.280	-339	17%	-2.831	-513%
Finland	-21.381	-17.845	-18.485	-640	4%	2.896	-14%
France	-23.375	-50.400	-51.817	-1.417	3%	-28.442	122%
Germany	-28.241	-35.449	-35.831	-382	1%	-7.590	27%
Greece	-3.193	-5.529	-5.402	126	-2%	-2.209	69%
Ireland	108	-383	-72	311	-81%	-180	-166%
Italy	-79.722	-111.341	-105.107	6.233	-6%	-25.386	32%
Luxembourg	-273	-273	-273	0	0%	0	0%
Netherlands	2.392	2.374	2.356	-18	-1%	-36	-2%
Portugal	3.531	7.921	-2.742	-10.664	-135%	-6.273	-178%
Spain	-23.027	-30.234	-30.543	-308	1%	-7.515	33%
Sweden	-22.117	-16.339	-16.479	-140	1%	5.638	-25%
United Kingdom	2.931	-1.159	-1.923	-764	66%	-4.854	-166%
EU15	-205.208	-278.911	-286.401	-7.491	3%	-81.193	40%

Overall, for the EU-15, the Sector 5 offsets 6.6 % of the total emissions (without LULUCF). The equivalent shares of the Member States range from – 0.3 % (United Kingdom) to –23.6 % (Sweden) (Table 7.2, column a). In the Netherlands the sector gives a contribution to the total emissions respectively by 1.1 %.

Table 7.2 Contribution of Sector 5 (a) and Category 5.A (b) to total emissions (without LULUCF) and Member States contribution to EU-15 Sector 5.A(c)

Member State	**Sector 5 over total emission excluding LULUCF**	**Category 5.A over total emissions**	**Member States contribution to EU-15 total for Sector 5.A**
	(a) (%)	**(b) (%)**	**(c) (%)**
Austria	-18,2%	-18,7%	4,9%
Belgium ([1])	-0,8%	-2,0%	0,8%
Denmark	-3,3%	-5,1%	1,0%
Finland	-22,7%	-32,1%	7,6%
France	-9,2%	-12,1%	19,6%
Germany	-3,5%	-7,7%	22,7%
Greece	-3,9%	-3,1%	1,2%
Ireland	-0,1%	-1,0%	0,2%
Italy	-18,0%	-15,9%	26,7%
Luxembourg	-2,1%	-2,3%	0,1%
Netherlands	1,1%	-1,1%	0,7%
Portugal	-3,2%	-4,5%	1,1%
Spain	-7,1%	-7,1%	8,8%
Sweden	-23,6%	-26,7%	5,4%
United Kingdom	-0,3%	-2,5%	4,7%
EU15	-6,6%	-8,2%	100,0%

([1]) Data only from Wallonia which represents 80 % of the forest area of Belgium.

Source: 1: Member States' submissions 2006, CRF Table 5, 5.A and Summary 2.

If only Category 5.A: 'Forest land', the largest contributor to Sector 5 inventories and the only one reported by all Member States, is examined (Table 7.2, column b), it is possible to see that the category is a net remover of GHG for all Member States (also for the Netherlands) with a range of 1.1–32.1 %,) and for EU-15 as a total (– 8.2 %). When analysing Category 5.A, it should be considered that the proportion of total land area covered by forests is different in the various Member States, ranging from 8–9 % (Ireland and Netherlands) up to 67 % (Finland and Sweden). EU-15 as a whole has 42 % of its land covered by forests (FAO).

7.2 General methodological information

Pursuant to relevant regulations, emissions and removals from LULUCF of the EC are the sum of Member States' emissions and removals as reported in their CRF tables. Because of its predominance in both emission levels and reporting frequency, more methodological information is provided below for the forest land subcategory (5.A.1). However, some details – first of all information on improvements since previous submissions - are discussed also for the other categories.

Table 7.3 demonstrates current coverage of emission and removal estimation in the various subcategories. While forest land, cropland and grassland are generally well represented, little information is available for wetland, settlements and other land subcategories.

Table 7.3. Coverage of emission and removal estimation in the various subcategories in this submission

Member State	Reporting category											
	Forest land		Cropland		Grassland		Wetland		Settlements		Other land	
	5.A.1. FL-FL	5.A.2. L-FL	5.B.1. CL-CL	5.B.2. L-CL	5.C.1. GL-GL	5.C.2. L-GL	5.D.1. WL-WL	5.D.2. L-WL	5.E.1. SL-SL	5.E.2. L-SL	5.F.1. OL-OL	5.F.2. L-OL
Austria	R	R	R	R	E	E		E		E		E
Belgium	R		E		E							
Denmark	R		E		E		E					
Finland	R		E		R			E				
France	R	R		E	E	R		E		E		E
Germany	R	R	E	E	E	E						E
Greece	R		R									
Ireland	R	E	E	E	E	R	E			E		
Italy	R	R	R	E						E		
(Luxembourg)												
Netherlands	R	R		R	E	R				R		E
Portugal	E	R	R	E		R		E	E	E		E
Spain	R	R										
Sweden	R	R	E	R	R	R			R	R		
United Kingdom		R	E	E	E	R				E		

Note: „R" symbols indicate a (net) removal in the subcategory, whereas „E" symbols indicate (net) emissions in the subcategory. The table was made based on the inventory year 2004 data, but the coverage for the other inventory years is very similar.

Equally important is the distribution of carbon stock changes by pool (Table 7.4). Note that the table is filled in using the latest information in the CRF tables in the Member States. In addition to marking if a pool is reported (filled cells) or not (empty cells), it is also indicated whether an increase (I), decrease (D) or zero value (due to assumptions of no changes in the pool) is reported.

Table 7.4 The coverage of carbon stock changes by pool for the most important land use and land use change categories, as emerged from latest CRF tables submitted by Member States

Member State	Reporting category																	
	Forest land						Cropland						Grassland					
	5.A.1. FL-FL			5.A.2. L-FL			5.B.1. CL-CL			5.B.2. L-CL			5.C.1. GL-GL			5.C.2. L-GL		
	B	DOM	Soil	B	DOM	Soil	B	DOM	Soil	B	DOM	Soil	B	DOM	Soil	B	DOM	Soil
Austria	I	I		I		I	I		I	I		D			D	D		I
Belgium	I	0	I	0	0	0	0	0	D	0	0	0	0	0	D	0	0	0
Denmark	I						D		D						D			
Finland	I	I	D						D						I			
France	I	D		I	I	I				D	D	D		D		D	D	I
Germany	I	0	0	I	0	0	D	0	D	I	0	D	0	0	D	D	0	I
Greece	I	D					I		D									
Ireland	I	I		D	D	D			D	D		D			D	I		I
Italy	I	I	I	I	I	I	I	0	0	I	0	D	0	0	0	0	0	0
(Luxembourg)																		
Netherlands	I	I		I								I			D	D		I
Portugal	D	D	I	I	D	I	I	I	D	D	D	D	0	0	0	D	D	I
Spain	I			I														
Sweden	I	I	D	I	I	D	D	I	D	I	I	D	D	D	I	I	D	I
United Kingdom				I	I	I	I		D	D		D			D	I		I

Note: In addition to marking if a pool is reported (filled cells) or not (empty cells), it is also indicated whether an increase (I), decrease (D) or zero value (due to assumptions of no changes in the pool) is reported in the CRF.

It is also important to note that a lot of developments have taken place in the EC countries since the last inventory submission. The improvements include:

- extended use of the new Good Practice Guidance for LULUCF (IPCC 2003)
- key category analysis including LULUCF sector
- more complete category coverage (see Table 7.5 and Table 7.6)
- estimation of emissions from important pools like soils
- use of improved activity data
- use of improved emission factors
- developments in uncertainty estimation
- improved reporting on methodology.

Due to the improvements, data were recalculated and better estimated in several Member States (see Section 7.5.2).

Table 7.5. New sub-categories as estimated for the first time in the various countries

Member State	Reporting category											
	Forest land		Cropland		Grassland		Wetland		Settlements		Other land	
	5.A.1. FL-FL	5.A.2. L-FL	5.B.1. CL-CL	5.B.2. L-CL	5.C.1. GL-GL	5.C.2. L-GL	5.D.1. WL-WL	5.D.2. L-WL	5.E.1. SL-SL	5.E.2. L-SL	5.F.1. OL-OL	5.F.2. L-OL
Austria												
Belgium			**N**		**N**							
Denmark					**N**							
Finland								**N**				
France												
Germany												
Greece												
Ireland												
Italy		**N**		**N**	**N**	**N**						
(Luxembourg)												
Netherlands												
Portugal			**N**	**N**		**N**		**N**	**N**	**N**		**N**
Spain												
Sweden												
United Kingdom												

Note: The symbol „N" is used for a category which is new for the country. Note that the table provides information only for those countries that submitted their data in the new LULUCF table last year.

Table 7.6. New sub-categories by pool as estimated for the first time in the various countries

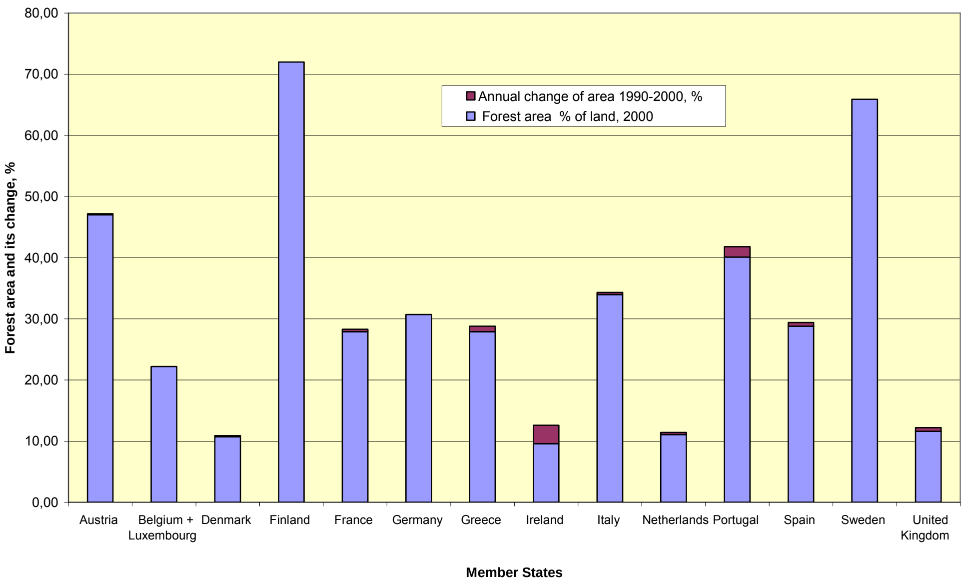
Member State	Reporting category																	
	Forest land						Cropland						Grassland					
	5.A.1.			5.A.2.			5.B.1.			5.B.2.			5.C.1.			5.C.2.		
	B	DOM	Soil	B	DOM	Soil	B	DOM	Soil	B	DOM	Soil	B	DOM	Soil	B	DOM	Soil
Austria		N				N						N						N
Belgium			N						N						N			
Denmark															N			
Finland		N	N															
France																		
Germany																		
Greece																		
Ireland																		
Italy				N	N	N			N	N		N			N	N		N
(Luxembourg)																		
Netherlands																		
Portugal		N	N		N	N	N	N	N	N	N	N				N	N	N
Spain																		
Sweden																		
United Kingdom																		

Note: The symbol „N" is used for a category which is new for the country. Note that the table provides information only for those countries that submitted their data in the new LULUCF table last year.

7.3 Forest land (5.A.1.)

In addition to agricultural lands, forests are dominant in the LULUCF sector, as they cover 36% of the land area of the EU-25, and 37% of EU-15 (FAO; Figure 7.1), with large differences among Member States (Fig. 7.4). While there have been considerable afforestations in many Member States since 1990, deforestations have been small, and "forests remaining forests" is by far the most important land use type in the forestry category either by area, or by emissions and removals.

Figure 7.4. The share of forests by area in 2000, and the mean annual change of forest area between 1990-2000 of the EU-25 countries (FAO)



7.3.1 Forest Land remaining Forest Land (5.A.1)

7.3.1.1. Category description

The area of "Forest land remaining forest land" in EU-15 has increased by about 5% from 1990 to 2004. These forests are rather diverse, from Mediterranean evergreen dry forests to boreal coniferous forests, with many intermediate temperate forest types. Diversity can be high even within a country, which may make it very difficult, among others, to develop forest inventories.

It is important to note that the definition of „forest" differs among Member States. A detailed description of forest definitions in the Member States was presented in the EC NIR of 2005. Because of the different conditions in the various countries, it is not possible to develop an harmonized definition from these different definitions. However, this does not really change the emission and removal estimates, as they are mostly based on estimation of timber volume in forests.

7.3.1.2. Methodological issues – CO_2 emissions and removals

As a basis for the greenhouse gas inventory, all countries use forest inventories or forestry census of some kind to obtain activity data. As with the forest definitions, the method of the collection of data itself differs among Member States in terMember States of their design, spatial intensity, frequency of field survey, and latest information available. However, as it is obvious from Table 7.7, and also from the sources of activity data as reported in the EU NIR in 2005, many countries have made considerable efforts to obtain as recent and accurate information as possible. Also, forest inventories have developed a lot, and further developments are under way.

Table 7.7. Some relevant information on the National Forest Inventories (NFI) in the various Member States.

Country	Type of forest inventory	Frequency of field surveys	Latest survey	Other information
Austria	Sample-based	5-10 years	2000-2002	
Belgium	Sample-based	~ 10 years	2000	
Denmark	Questionnaire-based Forestry Cencus since 1881	10 years	2000	The Forestry Census is being replaced by a sample-based National Forest Inventory
Finland	Sample-based	~ 8 years	2000	
France	Sample-based	~ 12 years	Continuous	
Germany	Sample-based	Two NFIs so far	2005	
Greece	Sample-based	Only one NFI so far	1994	
Ireland			1995	New inventory is ongoing?
Italy	Sample-based	First one in 1985, second one is on-going	Results are expected in the second half of 2007	
Luxembourg	Sample-based	Only one inventory so far	2000	
Netherlands	Sample-based	~ 10 years	2002	
Portugal	Sample-based ?	~ 15 years	1999	
Spain (based on the NIR of last year)	Second NFI: between 1986 and 1995; third NFI: 1997-2006			
Sweden	Sample-based since 1983-87	5-10 years	Ongoing	
United Kingdom	Forestry censuses and various land use surveys combined with yield tables	Various	2004	

It is also to be noted that considerable efforts have been made to improve and transform the information on forest inventory area and timber volume into carbon stock change. These efforts include e.g. developing new biomass functions (e.g. Austria, Finland, Ireland) that are used, or will be used, in near future instead of former biomass expansion factors to obtain more accurate biomass estimates. In addition to the advantages of using the functions instead of the factors, this development involves measuring new data which should make the new estimates more representative, thus eliminating or reducing some of the possible bias. (Because of the rather different approaches by country, we refer here to the individual NIRs of the Member States). See also section 7.5 where some elements of the methodology are mentioned).

7.3.2 Land converted to Forest Land (5.A.2)

According to the CRFs submitted by Member States, the area of "Land converted to forest land" in EU-15 has increased by about 25% in the last 15 years. However, as some Member State (e.g. Belgium and Finland) did not separate between "Forest land remaining forest land" and "Land converted to forest land", the above figure, and the estimated removals, are likely to be somehow underestimated. Furthermore, given the relatively small area of land converted to forest (not easily estimated with sample-based forest inventories) several Member States underlined the higher uncertainty associated with the emissions/removals of this subcategory as compared to the subcategory "Forest land remaining forest land".

7.4 Other land use categories, and non-CO_2 emissions

7.4.1 Cropland (5B) and Grassland (5C)

Most of the cropland and grassland area reported for the year 2004 falls into the category "Cropland remaining cropland" and "Grassland remaining grassland", respectively. For both land use categories, this is generally more than 90%. Conversion of land to cropland occurred predominantly from grassland, and also conversion to grassland occurred predominantly from cropland, with the exception of Sweden, where more land was converted from forests.

Consequently, fluxes are dominated by the land remaining in the land use. Exceptions are Ireland, the Netherlands, and the United Kingdom where most the emissions / removals (for the Netherlands) occurred on the land converted to cropland and for Austria in the case of grassland.

7.4.2 Non-CO_2 emissions

Most non-CO_2 emissions are CH_4 and NO_2 deriving from wildfires - especially in the Mediterranean countries – and N_2O from disturbance associated with land-use conversion to cropland. For some category and country (e.g. forest land remaining forest land in Austria) non-CO_2 emissions are estimated for the first time, while other Member States (e.g. Spain) did not provide any information on this issue. However, in most cases these emissions appeared negligible in comparison to emissions/removals of CO_2.

Significant N_2O emissions from disturbance associated with land-use conversion was reported by Germany (1.4 Gg N_2O) and Sweden (0.5 Gg N_2O), which represent 1 and 3% of the agricultural N_2O emissions, respectively. Small N_2O emissions are reported from Austria, about 0.5% of the agricultural emissions (0.04 Gg N_2O). With 0.7 kg N_2O-N per ha converted area, Austria uses the smallest IEF, the IEF used by Sweden is 2.5 kg N_2O-N per ha converted and that by Germany one order of magnitude higher (25 kg N_2O-N/ha).

Application of fertilizer to forest soils is for most countries not possible to be reported as a separate category. Only Finland and Sweden report small quantities of nitrogen applied and N_2O emissions (0.4 Gg N_2O each).

Only Denmark reports N_2O emissions from drained wetland, which are insignificant. Ireland reports considerable land that is drained (357 kha), but does not associate N_2O emissions to this activity.

Most countries report application of lime to agricultural soils with associated carbon emissions ranging from 22 Gg C (the Netherlands) to 450 Gg C (Germany).

7.5 Uncertainties and time-series consistency

The above sections show that, to estimate emissions and removals, EC Member States use different methodologies, but always in accordance with the IPCC guidelines and the new (2003) GPG for LULUCF. Due to lack of data for many elements of the entire estimation procedure, however, it is only possible to give an overview of the sources of uncertainty for the EC inventory based on information in the NIR of a few countries.

For Category 5.A in particular, Germany estimated a relative standard deviation of 8.2% and 12.8% for the old and new "Bundesländer", respectively, for 1993, and 7.7% and 10.1% for 2002. Some countries report quantitative estimates of uncertainty in terMember States of the percentage standard errors with regard to the data sources used in the 5.A inventories. A recent review (Laitat et al, 2000) provides more detailed data on the national forest inventories of 12 Member States. The following ranges were found:

- 0.2–1.2 % (3–15 % for UK) for forest area (9 Member States);
- 0.54–5.1 % (1–15 % for UK) for wood volume (10 Member States);
- 0.4–0.8 % for volume growth (3 Member States).

Austria also reports uncertainty values, but they are to be updated for the new land use and land use change categories. Several other countries also reported developments in uncertainty estimation. However, until further data is not available, it is important to identify factors that contribute to the overall uncertainty. Below is a detailed analysis that provides additional information on sources and ranges of uncertainty.

Uncertainties linked to forest area definitions

- Errors in forest area estimation are in the order of 1 to 10 %. This error considerably increases for the "Land converted to forest land", especially in those countries with a small area in this subcategory, or where conversion occurs in many small, fragmented areas. Austria, for example, indicates for this subcategory an uncertainty between 50 and 100%.
- The forest definition differs in Member States with regard to threshold of crown cover, area dimension and/or using a productivity index. However, many definitions are compatible with the one by FAO.
- In some countries, different land-cover data sources provide different estimates of total forest area.

Uncertainties linked to activity data

- More countries use updated forest inventory data than in the previous submissions. In several countries, forest inventories are based on representative sampling, where the uncertainty can be and, indeed, is estimated, and is generally low. In other countries (e.g. Denmark), a transition is under way to statistical forest inventories, which are expected to substantially decrease uncertainties.
- Harvest statistics are usually less certain, however, their quality is improving, too. Sweden uses periodic averages instead of annual data to decrease large interannual variation due to turbulent markets, which can also decrease the uncertainty for individual years. Other countries have

moved from the default method to the stock-change method, which makes it unnecessary to use uncertain harvest statistics.

Uncertainties linked to national forest inventories (NFI)

- Errors in volume and growth increment estimates in NFI are generally within 1–5 %.
- Volume calculations may start from different diameter thresholds in different countries, ranging from 0 to 7 cm. The overall impact of this on the volume estimation is expected to be minor.
- Volume and yield functions may sometimes be old. However, more and more countries try to base their estimates on field measurements. The use of old models may result in an underestimation of current volume/growth, as is the case in Germany where the latest forest inventory revealed that measured increment was more than twice the one that had been expected using yield tables. Austria, Sweden and Italy also updated their forest inventory estimates, including those of forest area.

Uncertainties linked to calculation of stocks increment

- There are different approaches to calculate the stocks increment, from the IPCC defaults (growth-harvest) to difference from consecutive surveys. As an example, Sweden has estimated the standard error of removals (10%) and of harvests (5-25%). Germany estimated the relative standard error or merchantable volume ("Derbholzvorrat", 1.4-40.0%), depending on species.
- The errors in the estimation of 'removals' values obtained with different approaches are: growth-harvest, error: 20 %; differences in state (e.g. two subsequent NFIs), error: 13 %; combined estimation, error: 11 %; Change estimation aided by remote sensing, error: 10 %.
- Reports to the UNFCCC have to be performed annually, even if most of the Category 5.A data are estimated periodically. Different uncertainty is related to the different approaches (e.g. annual values versus simple or moving averages, use of indicators, etc.). There are indications that the use of simple averages or interpolation between sampling years/periods of inventories may lead to significant errors, making it necessary to perform *ex-post* recalculation when new data became available.

Uncertainties linked to volume stocks statistics, or to harvest/drain statistics

- For countries using the stock change method, it is essential to have consistent uncertainty information on consecutive stock estimates. This may be difficult especially when two consecutive inventories are made using different methodologies (e.g. Germany).
- The uncertainty linked to different statistical sources is potentially higher than the one of forest inventories, but mostly unknown. Problematic areas are: reliability of market statistics, fuelwood, local use and export/import of wood. However, several countries directly measure the amount of wood that is removed from the forest, which produces more reliable estimates.
- Not all annual statistics include the effects of major disturbances on forest stocks. If disturbances are occurring between two NFIs, there could be inconsistencies in annual reporting when using interpolated/averaged data.

Uncertainties linked to expansion and conversion factors, or biomass functions

- Differences in conversion factor from dry weight to carbon may occur, but they are not really relevant (low variability/error).
- Wood density data are mostly based on literature, sometimes they are quite variable for the same species in different places and should be updated. Germany estimated the relative standard error of wood density (between 8.7 and 27.2, depending on species).
- The uncertainty related to biomass expansion factors (BEF), used to expand wood stem volume/biomass to total volume/biomass, is mostly unknown, but potentially relevant. Use of volume/biomass functions, dependent on diameter and age class may reduce somewhat this uncertainty. Germany reported relative standard error estimates for volume expansion factor by age and species (between 0.9% and 11.3%, depending on species and age), for root estimation factors (between 19.1 and 59.2%, depending on species groups).
- Most of the countries are using only two expansion factors, one for deciduous and one for conifers. Wood density is generally at species level.
- There are some gaps for BEF, at least in some regions. This may increase uncertainty.

- Not all countries include the same biomass components in their expansion factors.
- Finally, the use of biomass factors usually involves higher uncertainty than the use of biomass functions (Somogyi, Z., E. Cienciala, R. Mäkipää, P. Muukkonen, A. Lehtonen, P. Weiss. 2006. Indirect methods of large-scale forest biomass estimation. European Journal of Forest Research DOI: 10.1007/s10342-006-0125-7.). In this respect it must be mentioned that more and more countries use biomass functions (e.g. Austria, which has developed brand new biomass functions, and which reported an increase of 5-20% of the involved expansion factors of these functions compared with the expansion factors used in previous submissions).

Concerning the time-series of the emission and removal data reported, they can be regarded as consistent. The interannual variability has only been considered by a few countries, and is mainly attributed to disturbances like windthrow and forest fires.

7.6 Category-specific QA/QC, verification, and recent methodological improvements

Several Member States reported increased efforts of QA/QC. In addition to others, countries with extended forest cover (Finland, Germany, Sweden) reported extended procedures, which ensures the good quality of estimates. These procedures include checking both the forest inventory data, as well as the preparation of the GHG inventory. In addition, several steps were taken with respect to data quality at the EC level (see below).

Under the intergovernmental framework for European cooperation in the field of scientific and technical research (COST), the EC initiated, in 2000, the action ‘Contribution of forests and forestry to mitigate greenhouse effects’ (COST E21) with the objective to exchange experience and knowledge and to improve the quality of GHG inventory compilation for forests in Europe. This action completed its work in 2004. Another action (COST E43) was started in 2004 under the same framework: ‘Harmonisation of national forest inventories in Europe: Techniques for common reporting’ also aiming at improving and harmonising the existing national forest resource inventories in Europe and at promoting the use of scientifically sound and validated methods in forest inventory designs, data collection and data analysis. One specific area of work of COST E43, in which 25 European countries participate, is the harmonised estimation procedures for carbon pools and carbon pool changes.

Some methodological improvements at the Member States level was already mentioned above. At the EU level, an important workshop took place in 2005: “Improving the Quality of Community GHG Inventories and Projections for the LULUCF Sector” - Workshop under mandate of Working Groups I and II of the EU Climate Change Committee. The workshop was jointly organized by DG JRC, DG ENV, EEA, and ETC/ACC, and took place in Ispra (Italy), September 22-23, 2005. For further information, see the website of the workshop, http://afoludata.jrc.it/events/lucf/lucfmain.cfm.

7.7 Category-specific recalculations

Because of the many methodological improvements, revision of activity data, and the use of new or improved factors (e.g. biomass expansion factors), there have been a lot of recalculations (Table 7.8, 7.9, 7.10 and 7.11). Table 7.8 shows the extent of recalculations in the LULUCF sector by gas for the EU-15 for 1990 and 2003.

Table 7.8 Recalculations of total greenhouse gas emissions and recalculations of net greenhouse gas emissions in CRF Sector 5: ‘LULUCF’, for 1990 and 2003 by gas (Gg and percentage)

1990	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
	Gg	percent	Gg	percent	Gg	percent	Gg	percent	Gg	percent	Gg	percent
Total emissions and removals	36.029	1,2%	-12.408	-2,8%	5.977	1,5%	839	3,1%	1.074	6,8%	569	5,5%
LULUCF (net)	13.712	-6,1%	1.063	594,3%	3.421	2566,3%	NO	NO	NO	NO	NO	NO
2003												
Total emissions and removals	63.546	2,0%	-5.239	-1,6%	4.431	1,3%	614	1,2%	1.050	18,8%	-429	-4,6%
LULUCF (net)	26.047	-8,4%	-761	-35,3%	2.461	1122,0%	NO	NO	NO	NO	NO	NO

NO: not occurring

Table 7.9 provides an overview of Member States' contributions to EU-15 recalculations for the years 1990 and 2003.

Table 7.9 Contribution of Member States to EU-15 recalculations in CRF Sector 5: 'LULUCF' for 1990 and 2003 by gas (difference between latest submission and previous submission Gg of CO_2 equivalents)

	1990						2003					
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6
Austria	-2.959	0	11	NO	NO	NO	-3.834	0	9	NO	NO	NO
Belgium	1.672	0	0	NO	NO	NO	1.642	0	0	NO	NO	NO
Denmark	393	0	0	NO	NO	NO	-736	0	0	NO	NO	NO
Finland	1.354	6	7	NO	NO	NO	-77	6	11	NO	NO	NO
France	5.566	1.334	2.862	NO	NO	NO	-38	247	1.965	NO	NO	NO
Germany	44.634	0	375	NO	NO	NO	41.180	0	422	NO	NO	NO
Greece	0	0	0	NO	NO	NO	0	0	0	NO	NO	NO
Ireland	515	0	0	NO	NO	NO	598	0	0	NO	NO	NO
Italy	-19.030	0	35	NO	NO	NO	-29.513	0	0	NO	NO	NO
Luxembourg	0	0	0	NO	NO	NO	0	0	0	NO	NO	NO
Netherlands	-502	0	0	NO	NO	NO	-387	0	0	NO	NO	NO
Portugal	-2.211	-287	-29	NO	NO	NO	1.983	-1.033	-105	NO	NO	NO
Spain	-13.994	0	0	NO	NO	NO	9.884	0	0	NO	NO	NO
Sweden	-1.996	12	159	NO	NO	NO	4.988	14	158	NO	NO	NO
UK	270	-1	0	NO	NO	NO	356	6	1	NO	NO	NO
EU15	**13.712**	**1.063**	**3.421**	**NO**	**NO**	**NO**	**26.047**	**-761**	**2.461**	**NO**	**NO**	**NO**

NO: not occurring

Table 7.10. Sub-categories where individual Member States have recalculated the values submitted last year for the inventory year of 1990

Member State	Reporting category											
	Forest land		Cropland		Grassland		Wetland		Settlements		Other land	
	5.A.1. FL-FL	5.A.2. L-FL	5.B.1. CL-CL	5.B.2. L-CL	5.C.1. GL-GL	5.C.2. L-GL	5.D.1. WL-WL	5.D.2. L-WL	5.E.1. SL-SL	5.E.2. L-SL	5.F.1. OL-OL	5.F.2. L-OL
Austria	-	-	+	+	+	-	+	-	-		-	-
Belgium	-											
Denmark	-	+	+	+					-	+	-	
Finland	-		-	-		-	-					
France												
Germany			+	+		+	+	+				
Greece	+	-	+	+								
Ireland												
Italy												
(Luxembourg)												
Netherlands	+	+	-		-	+		+				-
Portugal	-	-										
Spain												
Sweden												
United Kingdom		-	-	+	-	-	+	-				-

Note: The "-" signs mean that the new (2006) values are smaller than the ones submitted last year, whereas the "+" signs mean the opposite.

Table 7.11. Sub-categories where individual Member States have recalculated the values submitted last year for the inventory year of 1990 by pool

Member State	Reporting category																	
	Forest land						Cropland						Grassland					
	5.A.1.			5.A.2.			5.B.1.			5.B.2.			5.C.1.			5.C.2.		
	B	DOM	Soil	B	DOM	Soil	B	DOM	Soil	B	DOM	Soil	B	DOM	Soil	B	DOM	Soil
Austria	-			-			+		+	+					+	-		
Belgium																		
Denmark							+		-									
Finland	-								-						+			
France																		
Germany									-						-	-		
Greece	+	-					-		+									
Ireland																		
Italy	+	-	+				-											
(Luxembourg)																		
Netherlands	-	+		+								-				+		-
Portugal	+			-														
Spain																		
Sweden																		
United Kingdom																		

Note: The "-" sings mean that the new (2006) values are smaller than the ones submitted last year, whereas the "+" signs mean the opposite.

8 Waste (CRF Sector 6)

This chapter starts with an overview on emission trends in CRF Sector 6: 'Waste'. For each EU-15 key source overview tables are presented including the Member States contributions to the key source in terms of level and trend, information on methodologies and emission factors. The quantitative uncertainty estimates for this sector and the sector specific QA/QC activities are summarised in separate sections. Finally, the chapter includes an overview of recalculations.

8.1 Overview of sector

CRF Sector 6 'Waste' is the fourth largest sector in the EU-15, contributing 2.6 % to total GHG emissions. Total emissions from 'Waste' have been decreasing by 33 % from 163 Tg in 1990 to 109 Tg in 2004 (Figure 8.1). In 2004, emissions decreased by 3.6% compared to 2003. The key sources in this sector are:

6 A 1 Managed Waste disposal on Land: (CH_4)
6 A 2 Unmanaged Waste Disposal Sites: (CH_4)
6 B 2 Domestic and Commercial Wastewater: (CH_4)
6 B 2 Domestic and Commercial Wastewater: (N_2O)

Figure 8.1 shows that CH_4 emissions from landfills account for about 66 % of waste-related GHG emissions in the EU-15.

Figure 8.1 EU-15 GHG emissions 1990–2004 from CRF Sector 6: 'Waste' in CO_2 equivalents (Tg) and share of largest key source categories in 2004

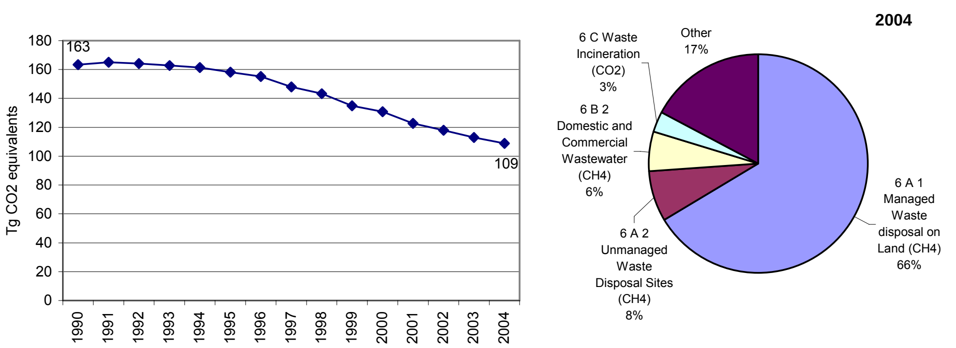
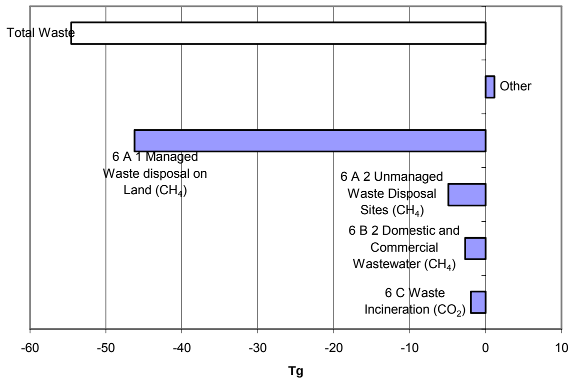


Figure 8.2 shows that CH_4 emissions from 'Managed waste disposal on land' had the greatest decrease of all waste-related emissions.

Figure 8.2 **Absolute change of GHG emissions by large key source categories 1990–2004 in CO_2 equivalents (Tg) in CRF Sector 6: 'Waste'**



8.2 Source categories

8.2.1 Solid waste disposal on land (CRF Source Category 6.A)

Table 8.1 summarises information by Member State on methodologies, emission factors, completeness and qualitative uncertainty estimates for CH_4 from 6.A: 'Solid waste disposal on land'. CH_4 emissions from 'Solid waste disposal on land' decreased by 38 % between 1990 and 2004 in the EU-15. Nearly all EU-15 Member States reduced their emissions from this source.

This source category includes two key sources: CH_4 from 6.A.1: 'Managed waste disposal on land' and CH_4 from 6.A.2: 'Unmanaged waste disposal on land'.

Table 8.1 **Member States' contributions to CH_4 emissions from 6.A: 'Solid waste disposal on land' and information on methods applied and emission factors**

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1]	EF [1]
Austria	3.375	2.219	T2	CS,D
Belgium	2.630	815	M	CS
Denmark	1.334	1.074	T2	CS
Finland	3.653	2.296	T2	CS,D
France	11.209	9.996	CS/ T2	CS
Germany	35.965	12.039	T2	D,CS
Greece	1.801	2.376	NA,T2	CS,D,NA
Ireland	1.332	1.678	T2	CS
Italy	13.127	16.020	T2	D, CS
Luxembourg	64	49	C/D	C/D
Netherlands	12.011	6.521	T2	CS
Portugal	3.892	4.756	T2	D+CS
Spain	3.783	7.953	CS,T2	CS,CR,CS,D
Sweden	2.874	2.067	NA,T3	CS,D,NA
United Kingdom	38.091	13.987	T2	CS
EU15	135.140	83.845	C, CS, D, M, T1, T2,T3,NA	C,CS,CR, D,NA

([1]) Information source: CRF Summary Table 3 for 2004.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 8.2 provides information on emission trends of the key source CH_4 from 6.A.1 'Managed waste disposal on land' by Member State. CH_4 emissions from managed waste disposal on land account for 1.7 % of total EU-15 GHG emissions. Between 1990 and 2004, CH_4 emissions from managed landfills declined by 39 % in the EU-15. In 2004, CH_4 emissions from landfills decreased by 4 %. A main driving force of CH_4 emissions from managed waste disposal on land is the amount of biodegradable waste going to landfills. Total municipal waste disposal on land declined by about 23 % between 1990 and 2004. In addition, CH_4 emissions from landfills are influenced by the amount of CH_4 recovered and utilised or flared. The share of CH_4 recovery increased in several EU-15 Member States.

The Member States with most emissions from this source were Germany, France, Italy and the UK. Several Member States reduced their emissions between 1990 and 2004. The largest reductions in absolute terms were reported by Germany and the UK. The emission reductions are partly due to the (early) implementation of the landfill waste directive or similar legislation of the Member States. The landfill waste directive was adopted in 1999 and requires the Member States to reduce the amount of biodegradable waste disposed untreated to landfills and to install landfill gas recovery at all new sites.

Table 8.2 Member States' contributions to CH_4 emissions from 6.A.1:'Managed waste disposal on land'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	3.375	2.194	2.219	3,1%	24	1%	-1.156	-34%	T2	NS	CS
Belgium	2.630	904	815	1,1%	-89	-10%	-1.815	-69%	M	RS	CS
Denmark	1.334	1.163	1.074	1,5%	-90	-8%	-260	-20%	T2	NS/PS	CS
Finland	2.235	1.515	1.444	2,0%	-72	-5%	-791	-35%	T2	PS/NS	D/CS
France	6.332	7.963	7.801	10,8%	-162	-2%	1.469	23%	CS/T2	NS	CS
Germany	35.915	12.995	11.383	15,8%	-1.612	-12%	-24.532	-68%	T2	NS	CS/D
Greece	542	819	822	1,1%	3	0%	280	52%	T1	NS/Q	D
Ireland	980	1.118	1.179	1,6%	61	5%	199	20%	T2	NS	CS
Italy	8.526	14.538	14.129	19,6%	-409	-3%	5.603	66%	T2	NS	D, CS
Luxembourg	64	49	49	0,1%	0	0%	-16	-25%	C/D		C/D
Netherlands	12.011	6.775	6.521	9,0%	-253	-4%	-5.489	-46%	T2	AS	CS
Portugal	549	1.620	1.780	2,5%	160	10%	1.231	224%	T2	NS	D
Spain	3.034	6.803	6.985	9,7%	182	3%	3.951	130%	T2	NS, Q	D, C, CS
Sweden	2.874	2.088	2.067	2,9%	-21	-1%	-807	-28%	T3	NS	D/SC
United Kingdom	38.091	15.043	13.987	19,4%	-1.056	-7%	-24.104	-63%	M	AS	CS
EU15	118.494	75.587	72.254	100,0%	-3.332	-4%	-46.239	-39%			

CH_4 emissions from 6.A.2: 'Unmanaged waste disposal on land' account for 0.2 % of total EU-15 GHG emissions in 2004. Between 1990 and 2004, CH_4 emissions from this source decreased by 37 % due to a decreasing amount of municipal waste going to unmanaged waste disposal sites (Table 8.3). Not all Member States reported emissions from this source. France and Greece are responsible for 45 % of the total EU-15 emissions. France and Italy had large absolute reductions between 1990 and 2004.

Table 8.3 Member States' contributions to CH_4 emissions from 6.A.2: 'Unmanaged waste disposal on land'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	NO	NO	NO	-	-	-	-	-	NO	NO	NO
Belgium	0	0	0	0,0%	0	-	0	-	NO	NO	NO
Denmark	NO	NO	NO	-	-	-	-	-	-	NO	-
Finland	NO	NO	NO	-	-	-	-	-	NA	NA	NA
France	4.876	2.347	2.195	26,7%	-152	-6%	-2.681	-55%	CS/T2	NS	CS
Germany	NO	NO	NO	-	-	-	-	-	-	-	-
Greece	1.255	1.502	1.507	18,3%	5	0%	252	20%	T1	NS/Q	D
Ireland	352	479	499	6,1%	20	4%	147	42%	T2	NS	CS
Italy	4.601	2.007	1.891	23,0%	-116	-6%	-2.709	-59%	T2	NS	D, CS
Luxembourg	0	0	0	0,0%	0	-	0	-	C/D		C/D
Netherlands	NO	NO	NO	-	-	-	-	-	NA	AS	NA
Portugal	1.291	1.260	1.161	14,1%	-98	-8%	-129	-10%	T2	NS	D
Spain	734	994	967	11,8%	-27	-3%	233	32%	T2	NS	D
Sweden	NO	NO	NO	-	-	-	-	-	NO	NO	NO
United Kingdom	NA	NA	NA	-	-	-	-	-	NO	NO	NO
EU15	13.108	8.589	8.221	100,0%	-368	-4%	-4.888	-37%			

Table 8.4 provides information on the contribution of Member States to EC recalculations in CH_4 from 6.A 'Solid waste disposal on land' for 1990 and 2003 and main explanations for the largest recalculaltions in absolute terms.

Table 8.4 Contribution of MS to EC recalculations in CH_4 from 6.A Solid waste disposal on land for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

	1990		2003		Main explanations
	Gg	Percent	Gg	Percent	
Austria	-769	-18,6	-634	-22,4	
Belgium	0	0,0	-13	-1,5	
Denmark	0	0,0	10	0,9	
Finland	-27	-0,7	-59	-2,4	
France	0	0,0	0	0,0	
Germany	4.486	14,3	1.949	16,7	Revised Tier 2 methodology
Greece	-851	-32,1	-1.548	-39,5	
Ireland	98	7,9	-333	-17,3	
Italy	2.779	26,9	6.855	70,7	Revised methane generation potential (L0) estimate Revised CH4 recovered data Separate emission estimates for different waste types Updated emission factors
Luxembourg	0	0,0	0	0,0	
Netherlands	0	0,0	0	0,0	
Portugal	0	0,0	-122	-2,5	
Spain	327	9,5	405	5,5	
Sweden	320	12,5	348	20,0	
UK	14.331	60,3	6.979	86,5	Revised oxidation factors and waste composition data
EU15	**20.695**	**18,1**	**13.834**	**18,8**	

8.2.2 Wastewater handling (CRF Source Category 6.B)

Table 8.5 summarises information by Member State on methodologies, emission factors, completeness and qualitative uncertainty estimates for CH_4 from 6.B: 'Wastewater handling'. Between 1990 and 2004, CH_4 emissions from wastewater handling decreased by 21 %. This source category includes one key source: CH_4 from 6.B.2: 'Domestic and commercial wastewater'.

Table 8.5 Member States' contributions to CH_4 emissions from 6.B: 'Wastewater handling' and information on methods applied and emission factors

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1)]	EF [1)]
Austria	102	41	D	CS,D
Belgium	85	66	D	D,CS
Denmark	126	265	D/CS	D/CS
Finland	154	125	D	CS,D
France	713	1.131	CS/T2	CS
Germany	2.226	91	D	D,CS
Greece	2.319	518	D,NA	D,NA
Ireland	15	24	T1	D
Italy	1.969	2.312	D	D
Luxembourg	4	5	C/D	C/D
Netherlands	290	225	T2	CS
Portugal	2.689	2.249	D	D+CS
Spain	1.240	2.075	D,NA	CS,D,NA
Sweden	0	0	NA	NA
United Kingdom	701	790	CS	CS
EU15	12.631	9.917	C,CS,D,T1,T2,NA	C,CS,D,NA

([1]) Information source: CRF Summary Table 3 for 2004.
Abbreviations explained in the Chapter 'Units and abbreviations'.

CH_4 from 6.B.2: 'Domestic and commercial wastewater' accounts for 0.2 % of total EU-15 GHG emissions. Between 1990 and 2004 emissions decreased by 30 %. Large decreases in absolute terms are reported from Germany and Greece, whereas Spain had large emission increases (Table 8.6).

Table 8.6 Member States' contributions to CH_4 emissions from 6.B.2: 'Domestic and commercial wastewater'

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	102	41	41	0,6%	0	0%	-61	-60%	D	NS	D, CS
Belgium	85	67	66	1,0%	0	-1%	-18	-22%	D	RS	D,CS
Denmark	126	299	265	4,2%	-35	-12%	139	111%	D/CS	NS	D/CS
Finland	131	108	106	1,7%	-2	-2%	-25	-19%	D	NS/PS	CS
France	713	1.110	1.131	17,8%	21	2%	418	59%	CS/T2	NS	CS
Germany	2.226	112	91	1,4%	-21	-19%	-2.135	-96%	D	NS	D/ CS
Greece	2.211	529	404	6,4%	-124	-24%	-1.807	-82%	D	NS/Q[7]	D
Ireland	13	19	20	0,3%	0	2%	7	53%	T1	NS	D
Italy	711	1.079	1.089	17,2%	10	1%	378	53%	D	NS	D
Luxembourg	2	2	2	0,0%	0	0%	0	10%	C/D		C/D
Netherlands	190	168	183	2,9%	15	9%	-8	-4%	NA/T2	NS	NA/CS
Portugal	1.056	745	693	10,9%	-53	-7%	-364	-34%	D	NS	D+CS
Spain	756	1.404	1.461	23,0%	56	4%	705	93%	D	NS	D, CS
Sweden	IE	IE	IE	-	-	-	-	-	NA	NA	NA
United Kingdom	701	793	790	12,5%	-3	0%	89	13%	M	NS	CS
EU15	9.024	6.476	6.341	100,0%	-135	-2%	-2.682	-30%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 8.7 provides information on the contribution of Member States to EC recalculations in CH_4 from 6.B 'Wastewater handling' for 1990 and 2003 and main explanations for the largest recalculations in absolute terms.

Table 8.7 Contribution of MS to EC recalculations in CH_4 from 6.B Wastewater handling for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

	1990		2003		Main explanations
	Gg	Percent	Gg	Percent	
Austria	-185	-64,4	-262	-86,6	
Belgium	4	4,7	-11	-13,8	
Denmark	-74	-37,2	55	22,7	
Finland	0	0,3	-1	-0,6	
France	-1	-0,1	-59	-5,0	
Germany	0	0,0	0	0,0	
Greece	-39	-1,6	-23	-3,4	
Ireland	15	-	24	-	
Italy	628	46,9	869	60,7	Revised activity data related to pulp and paper Revised wastewater production from leather industry
Luxembourg	0	5,3	0	0,0	
Netherlands	0	0,0	0	0,0	
Portugal	1.819	209,2	1.562	187,1	Additional estimate of CH4 emissions from anaerobic treatment of sludges Revised methodology in accordance with the IPCC Good Pratice Guidelines
Spain	-10	-0,8	-10	-0,5	
Sweden	-	-	0	0,0	
UK	0	0,0	4	0,5	
EU15	**2.158**	**20,6**	**2.150**	**26,9**	

Table 8.8 summarises information by Member State on methodologies, emission factors, completeness and qualitative uncertainty estimates for N_2O from 6.B: 'Wastewater handling'. Between 1990 and 2004, N_2O emissions from wastewater handling increased by 5 %. This source category includes one key source: N_2O from 6.B.2: 'Domestic and commercial wastewater'.

Table 8.8 Member States' contributions to N_2O emissions from 6.B: 'Wastewater handling' and information on methods applied and quality of these emission estimates

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1)]	EF [1)]
Austria	17	201	CS,D	CS,D
Belgium	270	267	D	D
Denmark	88	53	D/CS	D/CS
Finland	144	105	CS,D	D
France	1.274	1.257	CS/T2	CS
Germany	2.224	2.277	D	D,CS
Greece	325	367	D,NA	D,NA
Ireland	114	131	T1	D
Italy	1.045	1.065	D	D, C
Luxembourg	6	6	C/D	C/D
Netherlands	513	399	T2	D
Portugal	469	580	D	D
Spain	1.072	1.194	D,NA	D,NA
Sweden	195	139	CS,NA	D,NA
United Kingdom	1.027	1.203	T1	D
EU15	8.784	9.245	C,CS,D,T1,T2,NA	C,CS,D,NA

([1]) Information source: CRF Summary Table 3 for 2004.
Abbreviations explained in the Chapter 'Units and abbreviations'.

N_2O from 6.B.2: 'Domestic and commercial wastewater' accounts for 0.2 % of total EU-15 GHG emissions. Between 1990 and 2004 emissions increased by 5 %. Large increases in absolute terms are reported from Austria and the UK (Table 8.9).

Table 8.9 Member States' contributions to N_2O emissions from 6.B.2: 'Domestic and commercial wastewater'

Member State	Greenhouse gas emissions (Gg CO_2			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	13	153	155	1,8%	2	1%	142	1080%	CS,D	NS	CS, D
Belgium	270	266	267	3,1%	1	0%	-3	-1%	-	-	-
Denmark	88	50	53	0,6%	3	-	-34	-	D/CS	NS	D/CS
Finland	105	85	83	1,0%	-2	-3%	-23	-21%	D/CS	NS/PS	D
France	1.011	975	976	11,4%	1	0%	-35	-3%	CS/T2	NS	CS
Germany	2.224	2.278	2.277	26,5%	-1	0%	53	2%	D	NS	D
Greece	325	366	367	4,3%	1	0%	42	-	NE	NE	NE
Ireland	114	129	131	1,5%	2	2%	17	15%	T1	NS	D
Italy	975	997	1.000	11,7%	3	0%	25	3%	D	NS	D
Luxembourg	3	3	3	0,0%	0	0%	0	0%	C/D		C/D
Netherlands	513	397	399	4,6%	2	-	-114	-	NA/T2	NS	NA/D
Portugal	286	352	352	4,1%	1	0%	67	23%	D	IS	D
Spain	1.072	1.153	1.194	13,9%	40	4%	121	11%	D	NS	D
Sweden	166	122	122	1,4%	0	0%	-44	-26%	CS/NA	NS	D/NA
United Kingdom	1.027	1.214	1.203	14,0%	-11	-1%	175	17%	M	NS	D
EU15	8.192	8.540	8.583	100,0%	43	0%	390	5%			

Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 8.10 provides information on the contribution of Member States to EC recalculations in N_2O from 6.B 'Wastewater handling' for 1990 and 2003.

Table 8.10 Contribution of MS to EC recalculations in N_2O from 6.B Wastewater handling for 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and percent)

	1990		2003	
	Gg	Percent	Gg	Percent
Austria	0	0,0	6	3,4
Belgium	-8	-2,9	-40	-13,0
Denmark	0	0,0	-11	-18,0
Finland	3	1,9	2	2,0
France	0	0,0	-24	-1,9
Germany	10	0,5	2	0,1
Greece	-2	-0,7	-9	-2,4
Ireland	-1	-0,5	0	0,0
Italy	1	0,1	0	0,0
Luxembourg	0	0,0	0	0,0
Netherlands	0	0,0	0	0,0
Portugal	22	5,0	18	3,2
Spain	70	7,0	26	2,3
Sweden	0	0,0	0	0,0
UK	-6	-0,6	6	0,5
EU15	**89**	**1,0**	**-25**	**-0,3**

8.2.3 Waste incineration (CRF Source Category 6.C)

Table 8.11 and Table 8.12 summarise information by Member State on emission trends, methodologies, emission factors, completeness and qualitative uncertainty estimates for CO_2 from 6.C: 'Waste incineration'. This key source accounts for 0.1 % of total EU-15 GHG emissions. Between 1990 and 2004, CO_2 emissions from waste incineration decreased by 37 %; France and the UK had the largest decreases in absolute terms.

Table 8.11 Member States' contributions to CO_2 emissions from 6.C: 'Waste incineration' and information on methods applied and quality of these emission estimates

Member State	GHG emissions in 1990 (Gg CO_2 equivalents)	GHG emissions in 2004 (Gg CO_2 equivalents)	Methods applied [1)]	EF [1)]
Austria	27	12	D	CS,D
Belgium	337	440	D	PS
Denmark	IE	IE	NA	-
Finland	NE	IE	NA	NA
France	2.300	1.566	C	CS/ PS
Germany	NO	NO	NO	NO
Greece	0	1	NO	-
Ireland	NE	NE	NA	NA
Italy	496	211	D	CS
Luxembourg	10	10	C/D	C/D
Netherlands	IE	IE	NA	NA
Portugal	10	330	D	D+C
Spain	750	76	CR,NA	CS,CR,NA
Sweden	44	140	M	PS
United Kingdom	1.201	452	T2	CS
EU15	5.175	3.238	C,D,T2,M,CR,NA,NO	C,CS,D,PS,CR,NA

([1]) Information source: CRF Summary Table 3 for 2004.
Emissions of Denmark are included of 1.A.1.a.
Emissions Ireland are not reported because data for whole time serie are not available.
Emissions of the Netherlands are included of 1.A.1.a.
Abbreviations explained in the Chapter 'Units and abbreviations'.

Table 8.12 Member States' contributions to CO_2 emissions from 6.C: 'Waste incineration' and information on methods applied and quality of these emission estimates

Member State	Greenhouse gas emissions (Gg CO_2 equivalents)			Share in EU15 emissions in 2004	Change 2003-2004		Change 1990-2004		Method applied	Activity data	Emission factor
	1990	2003	2004		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)			
Austria	27	12	12	0.4%	0	0%	-15	-54%	C	AS	CS
Belgium	337	442	440	13.6%	-2	0%	103	31%	D	PS	PS
Denmark	IE	IE	IE	-	-	-	-	-	IE		
Finland	NE	NE	IE	-	-	-	-	-	IE		
France	2,300	1,702	1,566	48.4%	-136	-8%	-734	-32%	C	NS, PS	CS, PS
Germany	NO	NO	NO	-	-	-	-	-	NO		
Greece	0	1	1	0.0%	0	25%	1	550%	NO		
Ireland	NE	NE	NE	-	-	-	-	-			
Italy	496	216	211	6.5%	-5	-2%	-286	-58%	D	NS	CS
Luxembourg	10	10	10	0.3%	0	-	0	0%			
Netherlands	IE	IE	IE	-	-	-	-	-	IE		
Portugal	10	350	330	10.2%	-20	-6%	320	3175%	D	PS, NS	PS, C, CS
Spain	750	178	76	2.3%	-102	-58%	-675	-90%	C	NS, Q	CS, C
Sweden	44	121	140	4.3%	19	16%	96	220%	PS	PS	PS
United Kingdom	1,201	460	452	14.0%	-8	-2%	-749	-62%	T2	NS, AS	CS
EU15	5,175	3,492	3,238	100.0%	-254	-7%	-1,937	-37%			

Emissions of Denmark are included of 1.A.1.a.
Emissions Ireland are not reported because data for whole time serie are not available.
Emissions of the Netherlands are included of 1.A.1.a.
Abbreviations explained in the Chapter 'Units and abbreviations'.

8.3 Methodological issues and uncertainties

The following considerations address national methods and circumstances which are available in the Member States' national inventory reports. The focus is laid on the reporting categories 6.A.1 'CH_4 emissions from managed solid waste disposal sites' and 6.A.2 'CH_4 emissions from unmanaged solid waste disposal sites' since they are EU-15 key sources and contribute 1.6 % and 0.2 % of the GHG emissions from the sector 'Waste', respectively. The reporting category 6.B.2 'CH_4 emissions from domestic and commerical wastewater', key source in the EU-15 as well, is also comprehensively analysed. Source categories 6.B.1, 6.C and 6.D are only briefly discussed.

8.3.1 Managed Solid Waste Disposal (CRF Source Category 6.A.1)

CH_4 emissions from managed solid waste disposal are key sources in all Member States. For key sources in the source category, 6.A it is good practice to use the First Order Decay (FOD) method (Tier 2) to calculate the emissions and to display emissions trends over time. All EU-15 Member States applied – in line with the IPCC Good Practice Guidance – tier 2 methodologies in order to estimate CH_4 emissions from managed solid waste disposal sites (see Table 8.2). The method used in Luxembourg is not indicated. Three Member States used a country-specific emission model in accordance with the Tier 2 methodology (Denmark, United Kingdom and Belgium) and five Member States (Sweden, Austria, France, Ireland and Finland) applied country-specific methods in accordance with the Tier 2 methodology. The remaining Member States applied the tier Tier 2 methodology proposed by the IPCC Good Practice Guidance and the IPCC Guidelines. Table 8.13 summarizes the characteristics of the national methodologies for estimating CH_4 emissions from managed solid waste disposal sites.

Table 8.13 Description of national methods used for estimating CH_4 emissions from managed solid waste disposal

Member States	Description of methods
Austria	IPCC Tier 2: In the framework of a national study (SCHACHERMAYER, 2005) the IPCC method was compared to the country specific method that was used until now. As a result the method was changed: For calculation of emissions of solid waste disposal on land IPCC Tier 2 method is applied. Until now for calculation of emissions of solid waste disposal on land the directly deposited waste is separated into two categories: "residual waste" and "non residual waste". The emissions of residual waste were calculated according

	to TABASARAN and RETTENBERGER and for the calculation of the emissions of non residual waste the methodology of MARTICORENA was used. Both methodologies are described in (BAUMELER ET AL 1998). Comparisons between the IPCC methodology and Austrian estimates showed that on the one hand the emissions calculated according to the Tabasaran & Rettenberger model are nearly identical to the emissions calculated according to the IPCC model but on the other hand the Marticorena model seems to overestimate the emissions. Thus considering the larger methodological uncertainties - the Marticorena model was developed to calculate CH_4 emissions of one single landfill and not national totals - it was decided to change the methodology and use the IPCC Tier 2 model.
Belgium	The methodology used to calculate the emissions from solid waste disposal on land differs between the 2 regions in Belgium where these sites are located (Flanders and Wallonia). In the Flemish region a combination of 2 models is used: a multiphase model for the estimation of emissions of the sites which are permitted and a first order decay model for all other, old waste disposal sites which are no longer permitted to dispose but where still emissions occur after the ban of disposal on these sites (these are the solid waste disposal sites in after-care). Walloon region: The CO_2 and CH_4 emissions from solid waste disposal on land are calculated with a model that considers separately the emissions of industrial and municipal waste. The model, developed by the Vito, acknowledges the fact that methane is emitted over a long period of time. A first order decay model is used to take into account the various factors that influence the rate and extent of methane generation and release from landfill. The overall methodology follows the Tier 2 IPCC methodology. No waste disposal sites are located in the Brussels region.
Denmark	Emissions based on a model suited to Danish conditions. The model is based on the IPCC tier 2 approach (NIR 2006).
Finland	Finland used IPCC Tier 2 method as basis. However Equation 5.1 from the GPG (2000) has been slightly modified, so that term MCF (t) has substituted for the term MCF (x) in the calculation of methane generation potential $L_0(x)$. Calculation is not made separately for each landfill but the total waste amount and the average common MCF value for each year have been used. It has been thought that the situation in year t defines the MCF to be used for the emissions caused by waste amounts landfilled in the previous year also (NIR 2006).
France	IPCC Tier 2 Method
Germany	The amount of landfilled municipal waste is taken from the Federal Statistics Office (1975 – 2002). The surveys of waste quantities commenced in 1975 on the basis of the Environmental Statistics Act in 1974. Waste quantities for the period from 1950 to 1975 were extrapolated on the basis of population data. The most recent year for which suitable differentiated data is available is 2002. For 2003 and 2004, quantities were extrapolated based on a linear regression analysis over the time period 1996 – 2002.. Data for landfilled waste in the former GDR in the 1980ies were provided by a national study. According to that study the amount of landfilled waste per capita was significantly lower than in the old German Länder (190 kg/capita versus 330 kg/capita). For the years 1990 and 1993 for the new German Länder detailed data about landfilled municipal solid waste is available. Since 1996, differentiated data is available on landfilled quantities of individual fractions of industrial waste. The amount of landfilled industrial waste between 1975 and 1996 was derived on the basis of the overall amount of landfilled waste. The amount of landfilled industrial waste is kept constant between 1950 and 1975. Data on landfilled sludges from municipal and industrial wastewater treatment is available since 1975 for the Old German Länder and was extrapolated for the time period before 1975 based on population data as well as on the assumption that the amount of sludges from industrial wastewater remained constant.
Greece	IPCC Tier 2 Method
Ireland	A modified form of the IPCC Tier 2 method was adopted as the most appropriate basis on which to assess annual CH_4 emissions where reasonable predictions could be made for decreasing waste quantities into the future. The results obtained from this revised methodology were included as an important component of the recalculations reported in the 2002 submission. The approach underlying the quantification of CH_4 from solid waste disposal uses a function to describe the CH_4 production from all contributing solid waste deposited in landfills in a particular year. This relationship is based on a two-stage first-order model (Cossu et al, 1996) for landfill gas production, incorporating a lag period of one year before CH_4 generation commences, followed by active CH_4 production over 20 years. The estimates take account of a variable allocation of wastes between well-managed landfills, where the full CH_4 potential is realised, and shallow unmanaged landfills for which 40 percent of the potential CH_4 is assumed to be emitted. To estimate annual emissions for the years 1990 to 2004, the CH_4 potential of wastes landfilled in each year from 1969 (21 years prior to 1990) is first determined. These annual CH_4 potentials are then assigned as emissions over 20 subsequent years (with an initial lag of 1 year) according to the function described and their cumulative contributions for the 20 year period give the total emissions for the end year in that period.
Italy	IPCC Tier 2 method
Luxembourg	Method is described neither in NIR nor in CRF.
Netherlands	IPCC Tier 2 Method
Portugal	IPCC Tier 2 method
Spain	IPCC Tier 2 method
Sweden	IPCC Tier 2 methodology with a slightly different time factor and with some estimates on the national gas potentials (NIR 2006). Comparison between the suggested IPCC gas potentials and Swedish estimates show that the IPCC values tend to be higher, but considering the large methodological uncertainties, which is the same in both cases, the difference might be within a reasonable interval.
United Kingdom	Tier 2 method with country specific model. The UK method is based on equation 4 and 5 in the Revised 1996 IPCC guidelines which are compatible with equations 5.1 and 5.2 in the Good Practice Guidance. A slightly different version of equation 5.1 is used, which takes into account the fact that the model uses a finite time interval (one year).

Source: NIR 2006 if available, else NIR 2005

The Tier 2 FOD method requires data on current as well as historic waste quantities, composition and disposal practices for several decades. In the following section a detailed overview of the most important parameters and methodological aspects of the FOD method applied by the Member States are presented. The main factors influencing the quantity of CH_4 produced are the *amount* of waste disposed of on land and the *concentration* of biodegradable C in that waste.

Amount of waste disposed on SWDS: The FOD method requires historic data on waste generation over decades but it is difficult to achieve consistent time series for the activity data over such long periods. The data sources used for generating time series of activity data by the Member States are summarized in Table 8.14.

Table 8.14: Data sources used for generating time series of activity data for managed solid waste disposal

Member States	Data sources used for generating time series (6.A.1)
Austria	The quantities of "residual waste" from 1950 to 1988 were taken from a study [Hackl, Mauschitz; 1999] and from 1989 to 1997 from the current Bundesabfallwirtschaftsplan (Federal Waste Management Plan). However, in both references the amount of waste from administrative facilities of industry is not considered whereas it is included in the Deponiedatenbank, which is used for the activity data from 1998 onwards. Thus to achieve a consistent time series, the share of waste from administrative facilities of industry was estimated and the data from the federal waste management plan and the national study [Hackl, Mauschitz; 1999] adjusted. In fact it was assumed that the share of waste from administrative facilities of industry remained constant over the time series. The quantities of "non residual waste" from 1998 to 2004 were taken from the database for solid waste disposals "Deponiedatenbank" ("Austrian landfill database"), whereas only the amount of waste with biodegradable lots was considered. There are no data available for the years before 1998. Thus extrapolation was done using the Austrian GDP (gross domestic product) as indicator.
Belgium	In Wallonia, the quantity of waste disposed comes from the statistics of OWD (Walloon Waste Office). It publishes each year the industrial and municipal waste disposed, based on the taxes declaration forms covering 50 solid waste disposal sites of various sizes. Those statistics are available on a yearly basis since 1994. For the years before, the amounts have been estimated using available data and OWD expert judgement assumptions (NIR 2006). In the Flemish region the quantity of waste disposed originates from the institute responsible for waste management in Flanders (OVAM). There are no solid waste disposal sites in the Brussels Region.
Denmark	The amount of municipal solid waste deposited at solid waste disposal sites is according to official registration performed by the Danish Environmental Protection Agency in the so called ISAG database.
Finland	Activity data for the time series is taken from different sources: VAHTI database contains data on the total amounts of waste taken to landfills from 1997 onwards. Corresponding data for the years 1992-1996 were collected to the Landfill Registry of the Finish Environment Institute. The activity data for municipal waste for the year 1990 is based on the estimates of the Advisory Board for Waste Management (1992) for municipal solid waste generation and treatment in Finland in 1989. The disposal data (amount and composition) at the beginning of 1990s for industrial, construction and demolition waste are based on surveys and research by Statistics Finland, VTT Technical Research Centre of Finland and National Board of Waters and the Environment. Estimated data on waste amounts before the year 1990 is based on the report of VTT (Tukhanen 2002) (NIR 2006).
France	The amount of waste on SWDS derives from the surveys called "ITOMA" made by ADEME (NIR 2006). These surveys have been developed since 1985. For years 1960 to 1984, assumptions made by ADEME are used. ADEME is the French agency for environment and energy management.
Germany	The surveys of waste quantities commenced in 1975 on the basis of the Environmental Statistics Act in 1974. Waste quantities for the period from 1970 to 1975 were extrapolated on the basis of population data. The most recent year for which suitable differentiated data is available is 2000. For 2001 and 2002, quantities were assumed to remain constant in comparison to 2000. This data will be recalculated as soon as the relevant specialized series of the Federal Statistical Office become available. For the period 1970 to 1990, there was no standardized basis for waste-production and waste disposal data throughout all of Germany, as this creates a problem with regard to data on waste quantities and landfilled proportions of waste during that period. Data for the former GDR cannot simply be derived from average data of the old German Länder, since marked differences applied: the average per-capita waste production (municipal waste), at about 175 kg/a was considerably lower than that of the Federal Republic of Germany, where the corresponding figure was about 365 kg/a of household waste. From the former GDR's Ministry for nature Conservation, Environmental Protection and Water Resources Management, statistical data on settlement-waste production for the territory of the former GDR is available for four different years in the period leading up to reunification (1983, 1985, 1988, 1989); from this data, in connection with population data, the applicable settlement-waste quantities for the former GDR were derived for the period 1970-1990. For the years 1990 and 1993 and for the period since 1996, differentiated data is available on landfilled quantities of individual fractions of municipal waste. For the years prior to 1990, the landfilled proportions from 1990 were used, with no changes. For the years after 1990 for which data was lacking, data from framing years was interpolated.
Greece	Estimates on solid waste quantities generated are contained in various reports, research programs and studies, but refer to specific points in time rather than to complete time series, while different assumptions are applied in each source for the estimation of generated quantities. Therefore, on the one hand there is a lack of data for some years, while on the other hand the evolution of quantities between years for which official data are available cannot always be considered as reliable. For this reason, a re-estimation of generated quantities of municipal solid wastes for the whole period 1960-2004 was carried out, on the basis of population figures and coherent assumptions regarding generation rates per capita and day, in order to derive complete time series for waste quantities generated (NIR 2006).
Ireland	The waste material contributing to DOC includes MSW and street cleansings, are given in the National Waste Database reports

Member States	Data sources used for generating time series (6.A.1)
	together with sludge from municipal wastewater treatment that are deposited in landfills. The EPA commenced the development of the National Waste Database in the early 1990s. National statistics generated from this database and published on a three-year cycle by EPA are the primary basis for establishing the historical time-series of MSW placed in landfills in Ireland. These publications provide detailed descriptions of the methods employed to compile the waste database. The results of other less comprehensive surveys undertaken in previous years (1987, 1993, and 1994) have also been used to some extent in compiling the MSW time-series.
Italy	The complete database from 1975 of waste production, waste disposal in managed and unmanaged landfills and sludge disposal in landfills has been reconstructed on the basis of available data reported in different sources: studies, national legislation and regression models based on population (NIR 2004).
Luxembourg	No information available.
Netherlands	The amount of waste disposed on landfill sites are mainly based on the annual survey performed by the Working Group on Waste Registration at all the landfill sites in the Netherlands. Data can be found on www.uitvoeringafvalbeheer.nl, and are documented in SenterNovem, 2005. This document contains also yearly the amount of methane recovered from landfill sites (NIR 2006).
Portugal	Since 1999 data on MSW is available, including production amounts, final disposal and, to a less extent, waste composition. For previous years information was available from the Strategic Plan on Municipal Solid Waste which was approved by the Government in 1997. This plan includes data from annual municipal registries. Another source of information is a research study performed by Quercus (1995). The data was based on a survey performed in 1994, which enabled the calculation of per capita generation rates for 1994, based on the amounts of waste collected and the population served by waste collection. Before 1994, data on landfill wastes had to be estimated based on expert judgment for waste generation growth rates. For the period 1960-1980 it was considered a per capita waste generation growth rate of 2.5% per year; for the following years (1980-1994) 3% per year (NIR 2006).
Spain	The data source for characterization and quantification of the waste has been the annual publication entitled “Environment in Spain” from the Ministry of the Environment (NIR 2005).
Sweden	Household waste: First national survey by EPA in 1980, similar data in 1985 and 1990 by Statistics Sweden, since 1994 annual survey on landfilled waste by RVF. For the years in between the surveys, where data are missing, data are interpolated. Figures on sludge from wastewater treatment and garden waste are available since 1990. Industrial waste: Studies on quantities and treatment of organic waste from industry in 1993, 1996 and 2004 by EPA. Landfilled wastewater sludge from the pulp industry (important waste fraction): yearly documented from 1994 with high quality from the Swedish EPA. Previously landfilled wastewater sludge from the pulp industry has been documented intermittently.
United Kingdom	The estimates of historical waste disposal and composition data are based on various data sources. Estimates for municipal waste are based on population where data are absent. Until 1994 the waste arising data are based on waste surveys in the UK using actual data. After 1994, data are based on a new study carried out by a UK consultancy. Years between 1995 and 1998 inclusive are extrapolated backwards form the 1999 data and years ahead of 1999 are extrapolated based on a projected scenario of waste disposal.

Source: NIR 2006 if available, else NIR 2005

Some Member States explicitly describe the consistency of their time series (compare Table 8.15).

Table 8.15: Consistency of time series of activity data

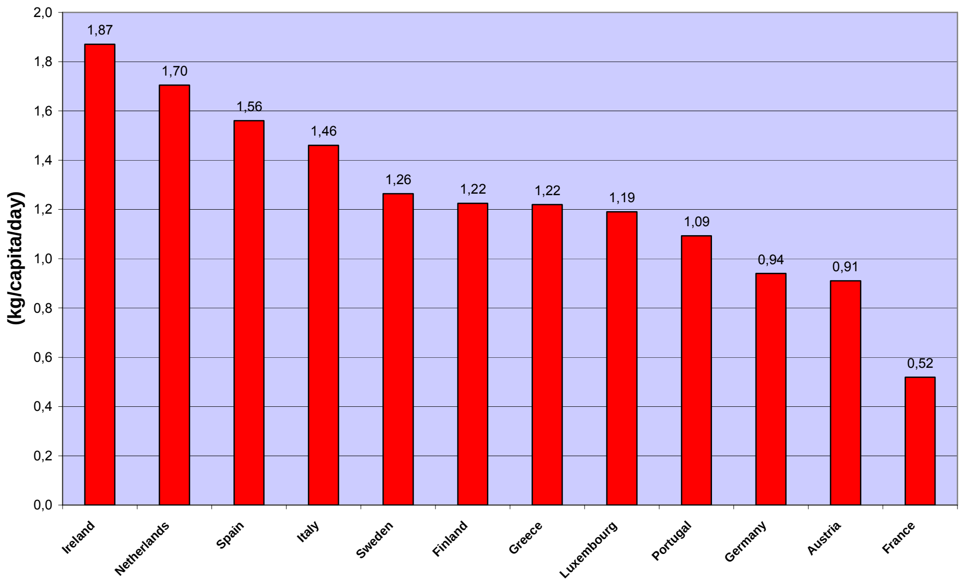
Member States	Consistency of time series
Austria	Concerning residual waste, to achieve a consistent time series, the share of waste from administrative facilities of industry was estimated and the data from the federal waste management plan and the national study [Hackl, Mauschitz; 1999] adjusted. In fact it was assumed that the share of waste from administrative facilities of industry remained constant over the time series. There is no explicit description of time series consistency for non-residual waste.
Belgium	No detailed description of time series consistency.
Denmark	The time series of activity data is consistent in the sense that the source for the data for the whole time-series is the registered amount of waste. A registration has been done since the start of the 1990s in order to measure the effects of action plans. The consistency of the emission factor comes as a result of the same model used for the whole time-series. The time lag factor has been filled in the CRF-format as zero, since the model used accounts for emissions from waste the same year as the waste is deposited. (NIR 2006).
Finland	No detailed description of time series consistency.
France	Since 1985, ADEME ensures completeness of the surveys by providing adjustments if necessary. Surveys are not available for each year, so interpolations are made, for years 1986-1988, 1990 – 1992, 1994 and 2001. For years 1960 – 1984, consistency between 1984 and 1985 was checked to approve the times series (email communication with national waste expert April 2005).
Germany	Over the long activity-data period involved, thirty years, time series inconsistencies are inevitable. In Germany, such inconsistencies are primarily a result of German reunification and the fusion of two different economic and statistical systems. Further aspects are changes of legislation and statistics in the waste sector.
Greece	No detailed description of time series consistency.
Ireland	The time-series estimates given in the present submission are updated to account for the inclusion of sewage sludge and are fully consistent over the period 1990-2004 (NIR 2006).
Italy	No detailed description of time series consistency. Time series refer to different official reports; from 1996 it could be considered fully consistent.

Luxembourg	No information available.
Netherlands	The time-series consistency of the activity data is very good due to the continuity in data provided (NIR 2006). The amounts of waste deposited are registered by a yearly survey since 1990 with a response of 100% (email communication with national waste expert April 2005).
Portugal	No detailed description of time series consistency.
Spain	No detailed description of time series consistency
Sweden	The times series in the waste sector are calculated consistently, and when statistics are not produced annually, interpolation and extrapolation have been necessary tools for imputation.
United Kingdom	The estimates for all years have been calculated from the LQM model and thus the methodology is consistent throughout the time series. Estimates of waste composition and quantities have been taken from different sources prior to 1995 and after 1995. This has led to some discontinuity between the two sets of estimates (discontinuity in estimated MSW, industrial and commercial waste arising) (NIR 2006).

Source: NIR 2006 if available, else NIR 2005.

The amount of waste disposed on SWDS depends on the one hand on the total amount of waste generated respectively on the per capita waste generation rate, Figure 8.3 provides an overview.

Figure 8.3: Waste Generation Rate



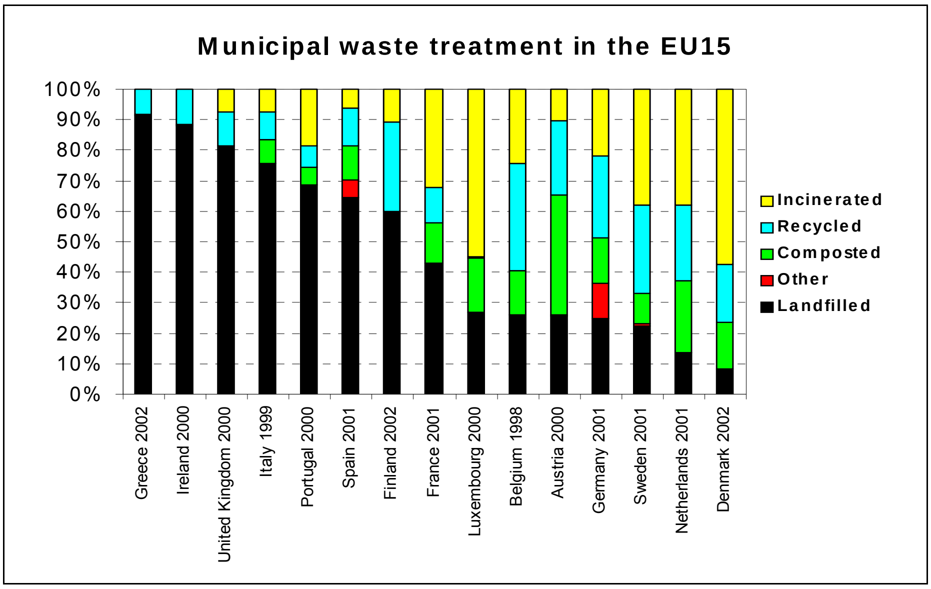
Source: CRF 2006, table 6 A, C Additional information; Additional information by Luxembourg (2005)

The waste generation rate per capita varies significantly among the Member States. France shows the lowest rate of 0.52 kg/capita/day, while Ireland reports the highest waste generation rate of 1.87 kg/capita/day. Denmark reports a waste generation rate of 6.78 kg/capita/day. However, this is due to the fact that the total waste generation (i.e. including industrial waste as well as building and construction waste) was considered. The value is therefore not comparable to other Member States.

In the additional information box of the CRF tables, the waste generation rate is not very well defined. No clear definition is available on which waste fractions should be included for comparability. In the case of Austria considerable amounts of composting is reported under 6.D (other), which means that the composted waste amounts are excluded from 6.A. For the Netherlands the MSW generation includes industrial inorganic waste (construction and demolition waste). A recalculated value corresponds to 0.8 kg/capita/day. For Spain and Greece large number of tourists increase the waste amounts, but are not reflected in the population numbers. It is difficult, though, to explain the differences for all EU Member States from the information available in the NIR. Because of the different coverage of ‘wastes’ included, the waste generation rate reported does not reflect policies and measures to reduce waste generation.

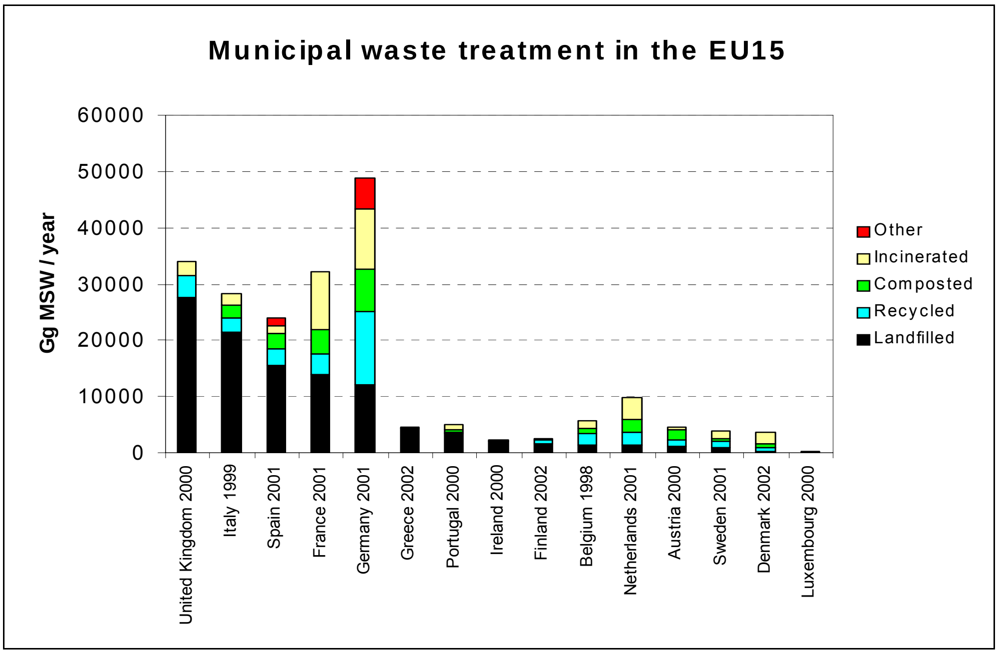
On the other hand the amount of waste generated on SWDS is strongly influenced by the waste management practices of the individual Member States: by the share of waste incinerated, recycled and composted, compare Figure 8.4 and 8.5.

Figure 8.4: Waste management practices in the EU-15 (shares)



Source: Waste Framework Directive; EUROSTAT

Figure 8.5. Waste management practices in the EU-15 (absolute values)



Source: Waste Framework Directive; EUROSTAT

The United Kingdom, Italy, Germany, France and Spain are currently representing 80% of the generation of MSW and 85% of landfilling within EU-15. Many Member States experienced a reduction of waste landfilled and an increase of amounts of waste recycled, composted and increased recovery of landfill gas. Both trends have already taken place before the Landfill Directive and the Directive on packaging waste, but are further supported by these directives.

The waste management practices and policies which determine the fraction of MSW disposed to SWDS, the fraction of waste incinerated and the fraction of waste recycled differ significantly among the Member States. For example, disposing waste on SWDS is the predominant waste disposal route in Greece and Ireland with correspondingly few quantities of waste incinerated and recycled in these countries (the latter due to considerable public concern over the use of large-scale waste incineration). In Germany, Denmark and the Netherlands it is vice versa. Since 2005, landfills in Germany remaining in operation may store only waste that conforms to strict categorisation criteria. They also must reduce landfill-gas formation from such waste by more than 90% with respect to gas from untreated waste. In the Netherlands, waste policy also has the aim of reducing landfilling by introducing bans for the landfilling of certain categories of waste, e.g. the organic fraction of household waste (in the early 1990s) and by raising the landfill tariff to comply with the incineration of waste.

The amount of methane generated on SWDS depends on the Methane Correction Factor, the fraction of dissolved organic carbon (DOC) dissimilated, the fraction by volume of CH_4 in landfill gas and the waste composition, more precisely the fraction of DOC in waste. While the first three parameters do not vary strongly among the Member States, more information is provided on the DOC (Figure 8.6 and Table 8.17) as well on waste composition of land filled waste (Table 8.16). The latter parameters are again strongly influenced by waste management practices and policies.

Table 8.16: Waste composition of landfilled waste

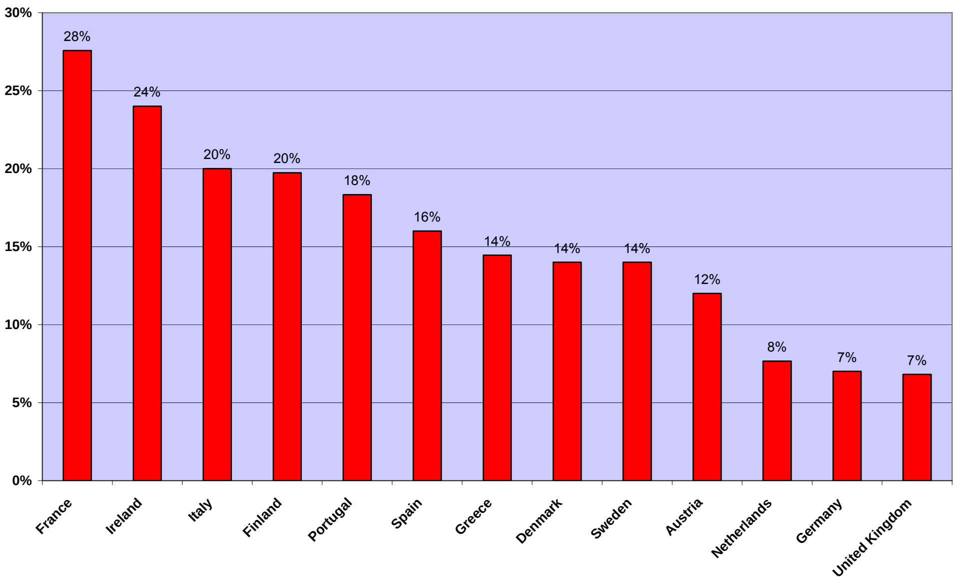
Member States	Composition of landfilled waste
Austria	Landfilled waste is differentiated in "residual waste" and ""non residual waste" (bulk, construction, mixed industrial waste, road sweeping, sewage sludge, rakings, residual matter from waste treatment). Detailed values such as for the half life period, DOC, and DOC_F are available for different waste types. The composition of residual waste is specified according to different waste fractions (NIR 2006).
Belgium	Waste types are differentiated into municipal and industrial categories as well as into several sub categories. Several values for DOC, DOC_F and k are given.
Denmark	The composition of waste has considerable variation. As waste types are taken into consideration: Domestic waste, bulky waste, garden waste, commercial & office waste, industrial waste, building and construction waste, sludge and ash and slag. As material fraction the following types are differentiated: Waste food, cardboard, paper, wet card board and paper, plastics, other combustibles, glass and other non-combustibles (NIR 2006).
Finland	Solid municipal, industrial, construction and demolition wastes and municipal and industrial sludges are considered as emissions sources. Different DOC are applied (NIR 2005).
France	Composition of landfilled waste is not mentioned explicitly in the NIR 2006. According to the surveys of ADEME for year 2000, landfilled waste is composed of: "green waste" 0.4%, household waste 42.2% (paper 25%, food and garden waste 29%, plastics,11%, glass 13%, other inert 22%), standard industrial waste 29.1%, waste similar to household waste 4.7%, secondary waste and other (inert) 23% (email communication with national waste expert April 2005).
Germany	Several studies on the waste composition were evaluated. The analysis for the Old German Länder was performed for different waste types: household waste (organic material, paper, composites, textiles, diapers, and wood), commercial waste, and bulky waste (organic material, paper, textiles, and wood). For the former GDR waste fractions were taken from a study (Lale (2000)). According to that study, household waste in the GDR was composed of vegetable waste, paper, wood, rubber, composites as well as textiles.
Greece	The estimated composition of generated MSW is: Putrescible matter, paper, plastics, metals, glass, rest. However, accurate data on the composition of generated municipal solid waste at national level are not available, as a comprehensive analysis at national scale covering a complete time period has not been accomplished yet.
Ireland	Waste constituents of MSW that contribute to DOC are organics, paper, textiles and in the category other (fine elements, unclassified materials and wood wastes). Furthermore street cleansings and sludge from municipal wastewater treatment are considered (NIR 2006).
Italy	The landfilled waste in Italy has the following composition (2004): paper and paperboard: 26.05%, food and garden waste: 26.62%, plastics: 12.94%, glass: 5.47%, textiles: 4.44%, other (inert): 10.94%, other (organic): 13.54% (CRF 2006).
Luxembourg	The waste amounts indicated by Luxembourg which are incinerated and disposed of on SWDS comprise all types of waste which have been accepted by the installation, comprising municipal, industrial and bulky waste (information from 2005).
Netherlands	Composition of landfilled waste comprises IPCC categories for municipal waste (paper and paperboard, food and garden waste, plastics, glass, textiles and other: Metals, building wastes and ashes, wood and other) (NIR 2005).
Portugal	SWDS include solid municipal or urban waste (household, garden, commercial-services wastes) and industrial wastes.

	For the fermentable fractions of urban waste the following categories apply: paper and textiles, non-food fermentable materials, food waste, and wood or straw. For the fermentable fraction of industrial waste several groups exist: paper and textiles, garden waste, park waste or other non-food organic putrescibles, food waste, wood or straw, fuels, plastics, sludge from natural origin, sludge from non-natural origin or hydrocarbons, synthetic fibres, and non-natural organic substances (NIR 2006).
Spain	No information available.
Sweden	Landfilled waste includes household and similar waste, sludge from wastewater handling, garden waste, sludge from the pulp industry and other organic industrial wastes.
United Kingdom	The UK method divides the waste stream into four categories of waste: rapidly degrading, moderately degrading, slowly degrading and inert waste. As recommended in the Good Practice Guidance, the estimates of waste disposal quantities include commercial and industrial waste, demolition and construction waste and sewage sludge, as well as municipal waste (NIR 2006). The composition is based on an assumption used in the model, not measured data (CRF 2006).

Source: NIR 2006 if available, else NIR 2005; CRF 2004

Fraction of Dissolved Organic Carbon (DOC) in MSW: The DOC content of landfill waste is based on the composition of waste and can be calculated from a weighted average of the carbon content of various components of the waste stream. Different countries are known to have MSW with widely differing waste compositions. While the average DOC value in MSW are illustrated in Figure 8.6, Table 8.17 provides corresponding detailed information on the DOC values extracted from the NIR.

Figure 8.6: Fraction of DOC in MSW



Source: CRF 2006 Table 6A,C Additional information. Personal communications (Denmark, Germany). The value for the Netherlands differs slightly between the CRF tables and the NIR.

Table 8.17: Further information on DOC values

Member States	Further information on DOC values
Austria	Detailed values for DOC_F and DOC differentiated with respect to the waste type are available in the NIR 2006. A time series of bio-degradable organic carbon content of directly deposited residual waste is indicated for the years 1950 to 2003.
Belgium	For the Walloon region the data are classified according to 12 main categories (119 subcategories), thus allowing an accurate calculation of the amounts of waste and its degradable organic carbon content (IPCC Good Practice Guidance, equation 5.4, page 5.9), which are used as an input in the model. Those statistics are available on a yearly basis since 1994. For the years before, the amounts have been estimated using available data and OWD expert judgment assumptions. The DOC value for municipal waste lies in the default value range from IPCC revised 1996 Guidelines and was chosen according to national expert judgment (NIR 2006). The value for industrial waste was estimated calculated using the detailed waste types from OWD and the IPCC Good Practice Guidance methodology (equation 5.4, page 5.9).

Denmark	The value is a calculation of a weighted mean DOC value from individual DOC values for waste fractions used in the FOD model. The calculation is based on 2004 data and uses values to be found in the NIR 2006.
Finland	DOC fractions of different types of waste are based on the IPCC default values and national research data. DOC values of groups (solid municipal waste, municipal and industrial sludge (from dry matter), solid industrial waste, construction and demolition waste and industrial inert waste) and of subgroups are indicated (NIR 2006).
France	Country specific data according to the composition of landfilled waste and the DOC for 3 kinds of waste (high DOC 150 kg/ t, medium DOC 75 kg/t, inert DOC 0 kg/t). The result is a DOC of 100 kg/ t. With regard to the IPCC default 210 kg/ t, a middle value of 140 – 150 kg/t was chosen (email communication with national waste expert 2005). The OMINEA report (February 2006) fixes a DOC of 150 kg/t.
Germany	Both national and IPCC default factors were used for DOC. The following values were chosen: Organic material: 18%, garden and park waste: 20%, paper and cardboard: 40%, wood and straw: 43%, textiles: 24%, diapers: 24%, composites: 10%, sludges from wastewater treatment: 50%
Greece	Time series of total amounts of DOC for waste on managed and unmanaged waste disposal sites as well as of sludge are provided (NIR 2006). Degradable organic carbon (DOC): 0.4 for paper (default value), 0.15 for food waste (default value) and 0.4 for sewage sludge.
Ireland	IPCC DOC default values are used for organics, paper and textiles. Country specific values for street cleansings and the category other are indicated. The DOC contribution of sludge is determined from information on the BOD content, the BOD removal rate and the proportion of sludge disposed to landfill. Available DOC of MSW is estimated from the given composition and appropriate DOC contents (40 % for paper and textiles, 15 % for organics, 25 % for street cleansings and 15 % for other) (NIR 2006)
Italy	DOC contents for each land filled waste typology was identified based on Andreottola and Cossu (1996). In the NIR one DOC value is indicated for the Italian waste composition. There is a difference to the average DOC in the waste according to IPCC, depends on the Italian waste composition (NIR 2004). In particular paper and paperboard DOC value differs from the IPCC default figure (CRF 2005)
Luxembourg	No information available.
Netherlands	Time series of DOC values for solid waste are presented for 1990-2004 (NIR 2006). The DOC values are based on the composition of the different waste streams landfilled. The DOC value of 0.09 is the average of all the waste land filled (not only MSW) (email communication with national waste expert April 2005).
Portugal	The estimation of DOC for urban waste is based on information on the waste composition from several sources. Figures are presented for IPCC categories A,B, C and D. Furthermore, DOC values are available for the different groups of industrial waste (NIR 2006)
Spain	The variables A, B, C and D that appear in the calculation of the DOC have been derived from specific country data on waste streams disposed of in landfills (NIR 2005). No further specification is provided.
Sweden	IPCC default values for gas potentials are used for the different fractions of household waste and a weighted average is calculated as suggested in the GPG (email communication with national waste expert April 2005). Values for the gas potential are available for different types of organic industrial waste.
United Kingdom	DOC was estimated assuming that the DOC arises solely from the cellulose and hemi-cellulose content of waste. The proportion of cellulose and hemi-cellulose in each waste component and the degradability of these fractions were based on a study by Barlaz et al. 1997. Each waste component (paper, food, etc.) was assigned a DOC value based on the cellulose and hemi-cellulose content. The component was then split into four fractions: rapidly degrading, moderately degrading, slowly degrading and inert, each of which was assigned the appropriate degradation rate. For example, paper was assumed to be 25% moderately degrading and 75% slowly degrading. The DOC value for both components was assumed to be equal to the percentage by weight of cellulose and hemi-cellulose multiplied by a factor of 72/162 (to account for the carbon content). This was around 22% for household waste (NIR 2006). The DOC degraded is taken to be the DOC content of the waste disposed of in the given year, including construction and demolition waste. It should be noted that this figure is derived from assumptions used in the model, not from measurement (CRF 2006)

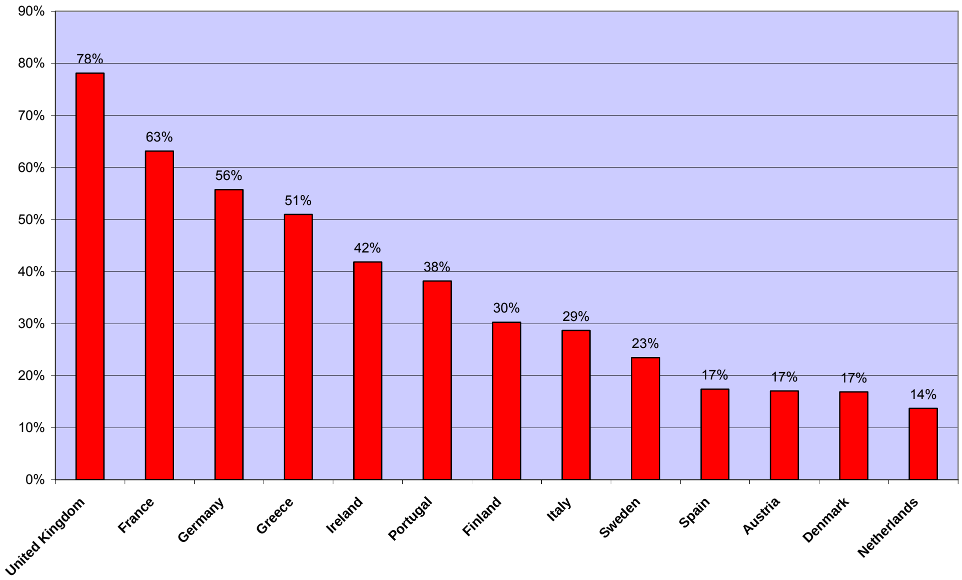
Source: CRF 2006 Table 6A,C Additional information; NIR 2006 if available, else NIR 2005

Figure 8.6 presents an average DOC, however usually different DOC values for individual waste fractions are used. In the case of the United Kingdom, a national model is based on a country-specific method, in which the DOC value is based on cellulose and hemi-cellulose content for each waste component and degradability. These values may lack comparability with other countries. For Austria composting of biodegradable waste is reported separately. Consequently considerable amounts of waste with high DOC are excluded from category 6.A which results in a lower DOC for the remaining MSW. In Italy different national DOC values for paper and paperboard are based on national studies. In the Netherlands the average DOC reported is the average of all waste landfilled, not only MSW. The average DOC of MSW in Germany includes industrial waste and construction waste under MSW with low DOC contents. In addition the DOC reflects the considerable reductions achieved in diverting biodegradable waste to other waste management methods such as composting or mechanical-biological treatment.

Besides lower quantities of organic carbon deposited into landfills, the major determining factor for the decrease in net CH_4 emissions are increasing methane recovery rates from landfills.

Methane recovery: The recovered CH_4 is the amount of CH_4 that is captured for flaring or energy use and is a country-specific value which has significant influence on the emission level. The percentage of CH_4 recovered, compare Figure 8.7, varies among the Member States between 14% in the Netherlands and 78 % in the United Kingdom and depends on the share of solid waste disposal sites that are able to recover CH_4 (see Table 8.18)

Figure 8.7: Methane recovery



*CH_4 recovery in % = CH_4 recovery in Gg/ (CH_4 recovery in Gg + CH_4 emissions in Gg)*100*
Source: CRF 2006 Table 6.A,C

Table 8.18: Further information on methane recovery

Member States	No of SWDS recovering CH_4 1) 2)	Total No of SWDS 2)	Data source for methane recovery 2)
Austria	54	Excavated-soil landfills: 211 Construction-waste landfills: 63 Residual waste landfills: 23 Mass waste landfills: 62	In 2004 the Umweltbundesamt made an investigation (ROLLAND & OLIVA 2004) and asked the operators of landfill sites to report their annual collected landfill gas. As this study considers only the amount of collected landfill gas from 1990 to 2002, the data were extrapolated constantly for the years 2003 and 2004 as well.
Belgium	12 (Wallonia) 20 (Flanders)		For Wallonia, each year all the landfills with CH_4 recovery (12 in 2002) are contacted to collect data on the amount and CH_4 content of the biogas recovered (flaring or energy purposes). The CH_4 content is measured by landfill owners as it determines the possible use of the biogas (only "rich" biogas" is used in engines, the rest is flared). Following a 1997 legal decree, a contract with the ISSEP (Scientific Institute for Public Service in Wallonia) also organises a close following of the environmental impacts of the Solid Waste Disposal Sites on Air, Water and Health. Seven main Sites are followed for the time being and the report includes biogas analysis. Details can be found on the DGRNE web site (NIR 2006).
Denmark	26	134	Data for landfill gas plants are according to Energy Statistics from the Danish Energy Agency (NIR 2005).
Finland	28		Finnish Biogas Plant Register (Kuittinen et al. 2005)
France	86%		86% of the solid waste disposal are landfilled on SWDS with biogas capturing (NIR 2006).
Germany	95% (NIR)	400	For 2004 it was assumed that methane is captured on 95% of all landfills and that the corresponding capturing efficiency is 60%.
Greece	4		According to data from the Ministry for Environment, recovery and flaring of biogas constitute management practices in the 4 major managed SWDS of Greece (in the cities of Athens, Patra, Thessalonica and Larissa). For 3 of these sites (in Patra, Thessalonica

			and Larissa) the collection of data on the amount of biogas flared has not been possible yet. The estimation of biogas recovered in these sites was based on the assumption that for technical reasons, 60% of biogas released is finally recovered and flared. Detailed measurements data have been collected only for the SWDS of Athens, in which almost 50% of total waste going to managed sites is disposed. The quantities of waste disposed in the 3 sites for which the CH_4 recovery is based on assumptions, the volume of biogas flared in the SWDS of Athens and methane that is totally recovered, are presented. For the estimation of methane recovered in the SWDS of Athens, the fraction of methane in landfill gas (F) was calculated at 0.5 and methane density at 0.7 kg CH_4/m^3, based on the data collected (NIR 2006).
Ireland	5 (NIR 2005)		Annual reports on renewable energy use; top down: the amount of CH_4 captured for energy use is estimated from the reported electricity production in the national energy balance, assuming 35 % conversion efficiency; Bottom-up: Estimates on CH_4 utilized and flared from 65 individual landfills that were producing CH_4 in any appreciable quantities in that year (NIR 2006).
Italy	420		Amount of methane recovered is estimated on the basis of a survey (De Poli F., Pasqualini S., 1997. Landfill gas: the Italian situation. ENEA, atti del convegno Sardinia 97), and of the amount of energy recovered in landfills (GRTN, 2004. Dati statistici sugli impianti e la produzione di energia elettrica in Italia nel 2002. Gestore Rete Trasmissione Nazionale (also available at web-site www.grtn.it).
Luxembourg	2 (2005)		No information available.
Netherlands	51	27 operating, few thousand old sites which still are reactive	The amount of waste disposed on landfill sites are mainly based on the annual survey performed by the Working Group on Waste Registration at all the landfill sites in The Netherlands. Data can be found on www.uitvoeringafvalbeheer.nl, and are documented in SenterNovem, 2005. This document contains also yearly the amount of methane recovered from landfill sites.
Portugal	21		In the absence of metering landfill gas recovered data, estimates on recovered CH_4 for urban waste were done based on: the information of INR for each waste management system - existence of burners, and the starting year of landfill operation and on an average efficiency for the gas capture (75%) and the gas burners (97%). Industrial waste: Data on quantities of CH_4 recovered and combusted are estimates based on the assumptions presented for urban waste, considering that they share the same disposal places. (NIR 2006).
Spain	9 CRF (2005), 174 NIR (2005)	183	The information on methane recovered is based on specific country data (NIR 2005).
Sweden	70	175	Information on recovered gas (in energy units) is provided by RVF and converted to use quantities by Statistic Sweden (NIR 2006).
United Kingdom			The fraction of methane recovered was derived from a survey of statistics on gas use for power generation, and a survey of installed flare capacity, assuming that flares operate at full capacity except for 25 % downtime. In 2004 the estimates were that 32% of generated methane was utilized and 44% was flared. The estimates on generated methane and flaring are not derived from metering data, as recommended by the Guidance as such data were not readily available at the time of the study (NIR 2006).

Source: 1) CRF 2006 Table 6 A,C 2) NIR 2006 if available, else NIR 2005

CH_4 recovery in EU-15 amounts to about 30% of the generated CH_4. Methane recovery will be enhanced by the Landfill Directive, and monitoring programmes will need to be established. The recovery potential depends on the waste management strategies, e.g. diverting organic fractions to composting leaves more inert materials on landfills and reduces the potentials to recover and use CH_4 (as in the case of the Netherlands, Austria or Denmark).

Moreover, Member States use different methods to determine CH_4 recovery. Belgium, Finland, Denmark, Ireland and the Netherlands use measured plant-specific data. In Italy surveys are carried out. Ireland and Sweden take the corresponding data from their energy statistics. France, Germany, Portugal, United Kingdom and Spain use general assumptions concerning the methane recovery.

Industrial waste: Data on industrial waste may be difficult to obtain in many countries. DOC default values for industrial waste are not provided by the IPCC. Table 8.19 illustrates how industrial waste is considered in the individual Member States. Six Member States neither mention nor consider industrial waste in the NIR.

Table 8.19: Methodological issues regarding industrial waste

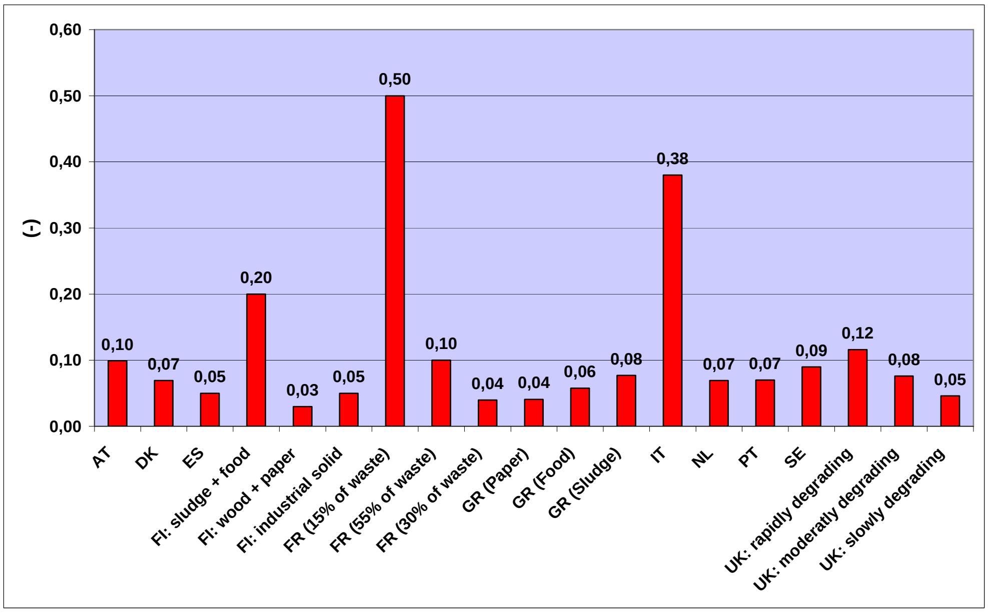
Member	Industrial waste

States	
Austria	"Mixed industrial waste" is considered under "non residual waste". Several waste types with their respective waste identification numbers are described. These are not clearly referenced as industrial wastes, though (NIR 2006).
Belgium	A country specific model for industrial waste is applied. The DOC value for industrial waste was estimated calculated using the detailed waste types from OWD and the IPCC Good Practice Guidance methodology (equation 5.4, page 5.9). This detailed estimation led to a complete recalculation, as the new estimated DOC were much lower than the default value previously used (NIR 2006).
Denmark	Industrial waste is considered and data on its composition and amount deposited are used in the emission model (NIR 2006).
Finland	Industrial wastes and sludges are considered besides the solid municipal, construction and demolition wastes and municipal sludges as emission source on solid waste disposal sites. Activity data and DOC of industrial sludge and solid industrial waste are indicated.
France	Industrial waste is neither mentioned nor considered explicitly (NIR 2006)
Germany	The Federal Statistical Office provides detailed data about landfilling of industrial waste since 1996. In the inventory the following waste types are considered: wastes from agriculture, horticulture, forestry, fishery and food processing, wastes from wood processing, wastes from the production of cellulose, paper and cardboard, wastes from the textiles industry, packaging wastes as well as the wood fraction from construction and demolition wastes (NIR 2006).
Greece	Industrial waste is neither mentioned nor considered explicitly (NIR 2006)
Ireland	Industrial waste is neither mentioned nor considered explicitly (NIR 2006)
Italy	Industrial waste which is landfilled in SWDS and sludge from wastewater handling plants has also been considered (NIR 2004).
Luxembourg	Industrial waste is neither mentioned nor considered explicitly (NIR 2006)
Netherlands	Industrial waste is neither mentioned nor considered explicitly (NIR 2006)
Portugal	The fermentable part of industrial waste is considered. Historical time series are based on 1999 data which refer to annual registries relating to industrial unit declarations sent to the regional environment directorates which have been estimated on expert judgment. For the period 1960-1990 it was considered a growth rate of 1,5% per year; for the following years (1990-1998) 2% per year. Data for the years 2000 and 2002 refer to annual registries. The years 2001, 2003 and 2004 are also estimates based on interpolation (2001) and last available data (2003-04 refer to 2002 data). All industrial waste generated was considered to be disposed in SWDS together with urban waste. However, as there is no available information concerning final industrial waste disposal, it was assumed that all estimated waste produced have followed the urban disposal pattern between uncontrolled and controlled SWDS. Except for DOC, the same parameters are used for industrial waste as for municipal waste (NIR 2006).
Spain	Industrial waste is neither mentioned nor considered explicitly (NIR 2005).
Sweden	Detailed description of how activity data and emissions of relevant industrial wastes and sludges are generated.
United Kingdom	The estimates of waste disposal quantities include commercial and industrial waste. For industrial and commercial waste, the data are based on national estimates from a recent study. The data were extrapolated to cover past years based on employment rates in the industries concerned (NIR 2006). In the revised LQM model, all industrial waste except for construction and demolition, blast furnace and steel slag and power station ash is assumed to have some organic content and are therefore included in the figure for MSW. (CRF 2006)

Source: NIR 2006 if available else NIR 2005; CRF 2006 Table 6,C documentation box

Methane generation rate constant: CH_4 is emitted on SWDS over a long period of time rather than instantaneously. The tier 2 FOD model can be used to model landfill gas generation rate curves for individual landfill over time. One important parameter is the methane generation rate constant. It is determined by a large number of factors associated with the composition of waste and the conditions at the site. Rapid rates which are associated with a high moisture content and rapidly degradable material can be found for example in part of the waste in Finland, France and Italy. Figure 8.8 gives an overview of the CH_4 generation rate constants reported by the Member States, while Table 8.20 summarizes information on the applied country specific approach.

Figure 8.8: Methane generation rate constant



Source: CRF 2006 Table 6 A,C Additional information, OMINEA 2006 (France).

Table 8.20: Further information on the methane generation rate constant

Member States	Information on the half-time respectively the methane generation rate constant
Austria	Several values for the half life period of different waste types (residual waste, wood, paper, sludges, bulky waste and other waste, bio waste, textiles, construction waste and fats) are presented in the NIR 2006.
Belgium	Several values for the biodegradation constant are given in the NIR 2006.
Denmark	Assumption is that the half-life of the carbon in the waste is 10 years (NIR 2006).
Finland	Methane generation rate constants are divided into three categories: k1= 0.2 for wastewater sludges and food waste in MSW, k2=0.03 for wood waste in MSW and in construction and demolition waste, de-inking sludge, paper waste containing lignin in MSW, k3=0.05 for industrial solid waste and other fractions of MSW as well as fibre and coating sludges. Country specific k1 and k2 are according to rapid and slow rate constants in Good Practice Guidance (NIR 2006).
France	In the OMINEA report (February 2006) three values are given without further specification: k1=0.5 for 15 % of the waste, k2=0.1 for 55 % of the waste and k3=0.04 for 30 % of the waste.
Germany	Several values for the half life are provided (years): food waste: 4, garden and park waste: 7, paper and cardboard: 12, wood: 23, textiles/diapers: 12, composites: 12, sludges from wastewater treatment: 4 (NIR 2006).
Greece	The estimation of k is determined by the conditions in the disposal sites (e.g. moisture content, temperature, soil type) and by the composition of waste land filled. Considering the fact that climate in Greece is dry temperate (the ratio of mean annual precipitation to potential evapotranspiration (MAP/PET) is around 0.5), "half life" was estimated at 17 years for paper, 12 years for food waste and 9 years for sewage sludge disposed on land. This corresponds to the following values: k1=0.0408 (paper), k2=0.0578 (food) and k3=0.077 (sludge).
Ireland	Not applicable.
Italy	The CH_4 generation rate constant is a weighted average of the three different values corresponding to each fraction of waste (rapidly degradable waste, moderately degradable waste and slowly degradable waste).
Luxembourg	No information available.
Netherlands	Methane generation rate constant: 0.094 up to and including 1989, decreasing to 0.0693 in 1995 and constant thereafter, this corresponds to half-life times of 7.4 and 10 years, respectively. The change in k-values is caused by a sharp increase in the recycling of vegetable, fruit and garden waste in the early 1990s (NIR 2006).
Portugal	The value of CH_4 generation rate constant (k) depends on several factors as the composition of the waste and the conditions of the SWDS. In the absence of national studies to determine this parameter, and following the recommendations of the in-depth review, the values used in the previous submissions were revised in order to apply the guidance from IPCC 2000. The k value considered was 0.07 (half life of about 10 years), which represents a higher decay rate compared to the k default value proposed by the IPCC 2000 (0.05 - half life of about 14 years).
Spain	Methane generation rate constant (k=0.05) has been taken from the IPCC Good Practice Guidance (NIR 2005).
Sweden	National value for half-life time of 7.5 years (NIR 2006).
United Kingdom	The UK method divides the waste stream into four categories of waste: rapidly degrading, moderately degrading, slowly degrading and inert waste. These categories each have a separate decay rate. They now range from 0.046

	(slowly degrading waste) to 0.076 (moderately degrading waste) to 0.116 (rapidly degrading waste), within the range of 0.030 to 0.200 quoted in the Good Practice Guidance (NIR 2006).

Source: NIR 2006 if available else NIR 2005, CRF 2006 Table 6 A,C Additional information, OMINEA 2006 (France)

Concerning the magnitude of the methane generation factor, Italy explains its high degradation rate with high moisture contents. The weighted averages of k should reflect the waste composition as well as the moisture content or average temperatures. In general, a comparison is difficult since many parameters have influence on the average value.

8.3.2 Unmanaged Solid Waste Disposal (CRF Source Category 6.A.2)

CH_4 emissions from unmanaged solid waste disposal were reported in only six Member States in 2006 (France, Greece, Ireland, Italy, Portugal and Spain). All of these Member States apply Tier 2 methods according to the IPCC (compare Table 8.3). Five of these six Member States (France, Portugal, Spain, Greece and Ireland) still dispose MSW to unmanaged SWDS, compare column 'Annual MSW to unmanaged SWDS' in Table 8.21, while in Italy waste disposals from the past still emits (see Table 8.3). The Methane Correction Factor (MCF) reflects the way in which MSW is managed and the effect of management practices on CH_4 generation. According to the Revised 1996 IPCC Guidelines, the MCF for unmanaged disposal of solid waste depends of the type of site – shallow, deep or uncategorized. Table 8.21 gives an overview of the MCF applied the relevant Member States.

Table 8.21: Selected parameters for calculating emissions from source category 6.A.2

Member States	Emissions reported from unmanaged SWDS	Annual MSW to unmanaged SWDS (Gg)	MCF CH_4		
			Unmanaged SWDS	Deep	Shallow
France	X	152.37	0.5	NA	0.50
Greece	X	1,672.19	0.60	0.60	IE
Ireland	X	561.09	NE	NA	0.40
Italy	X	0	0.60	NO	0.60
Portugal	X	22.32	-	IE	0.60
Spain	X	634.30	0.60	0.80	0.40

Source: CRF 2006 table 6 and 6.A, else CRF 2005 table 6 and 6.A

Table 8.22: Further information on unmanaged solid waste disposal

Member States	Unmanaged waste disposal on SWDS
France	The difference between managed and unmanaged MSWD is only if MSWD use compacting or not (email communication with national waste expert April 2005). No further information given in the NIR 2006.
Greece	Out of the existing disposal sites, it is estimated that 37 of them fulfill the criteria set by the IPCC guidelines so as to be considered as 'managed'. The remaining waste is disposed at unmanaged disposal sites. Time series of DOC and MSW quantities disposed on unmanaged SWDS are given for 1960-2004 (NIR 2006).
Ireland	In 1995, 40% of DOC is assigned a MCF of 0.4, on the assumption that 40 percent of MSW is places in unmanaged SWDS of less than 5 m depth: The MSW split between managed and unmanaged sites in 1969 is taken to be the reverse of that adopted for the years 1990-1995 and appropriate adjustment is made for the intervening years and for the years after 1995 to reflect a gradual increase for managed landfills (NIR 2006).
Italy	The share of waste disposed of into uncontrolled landfills, which was 52.7% in 1975, gradually decreases thanks to the enforcement of new regulations, and it has been assumed equal to 0 in the year 2000, although emissions are released due to the waste disposed in the past years (NIR 2004).
Portugal	The share of final disposal destiny (inter alia open dump sites) for the beginning years of the 1960-2002 time series was calculated having as a basis the Quercus survey. Data for recent years refer to data collected from management systems. There have been significant efforts at national level to deactivate and close all uncontrolled dumping sites. This effort was concluded in 2002 when all uncontrolled dumping sites had been closed. Concerning uncontrolled dumping sites, it was considered that there is gas burning when a dumping site has been closed and is associated with a managed landfill having recovery of CH_4. It was assumed that gas burning starts typically 2-3 years after the beginning of the landfill operation. It was assumed that all estimated industrial waste produced have followed the urban disposal pattern between uncontrolled and controlled SWDS (NIR 2006).
Spain	In the case of uncontrolled sites, part of the mass is burnt, in order to reduce the volume, and in this case, apart from the biogas emissions from the unburnt MSW fraction, there are also emissions corresponding to the combustion of the fraction

	burnt. Different MCF values have been applied to uncontrolled landfill sites (0.8 and 0.4) depending on whether they are deep (more than 5 meters) or shallow (less than 5 meters) assuming 50 % of landfills in each category. In case of uncontrolled dumping, the estimation of the emissions from the burnt fraction has been effected by multiplying the activity variable by the corresponding emission factors. Of the total waste burnt in uncontrolled dumpsites, it has been assumed that 85 % is of renewable organic origin and 15 % of fossil origin, a ration considered country specific information. Further details are given on how the emission factors for the combustion are determined (NIR 2004).

Source: NIR 2006 if available, else NIR 2005; CRF 2004.

8.3.3 Waste water handling (CRF Source Category 6.B)

CH_4 Emissions from domestic and commercial waste water handling (6.B.2) are the most significant emission source in category 6.B and key source in the EU. CH_4 emissions from waste water handling are calculated with the help of diverse methods (C, CS, D, M, T1 and T2). Table 8.23 provides an overview of the CH_4 emission sources in wastewater handling which have been identified by the Member States. Furthermore methods applied to determine CH_4 emission from municipal wastewater and sludge handling are described in detail.

Table 8.23: CH_4 emission sources in wastewater handling and methods for determining CH_4 emissions from municipal wastewater and sludge handling

Member States	CH_4 emission sources and description of methods (municipal wastewater and sludge)
Austria	Municipal wastewater treatment in Austria uses mainly aerobic procedures. As a result no or negligible methane emissions are produced since such emissions only occur under anaerobic conditions. Mainly due to the structure of area of settlement in Austria there is still a small amount of inhabitants not connected to sewage systems and wastewater treatment plants. This wastewater is discharged in septic tanks and cesspools. As in there occur anaerobic processes methane emissions are produced. CH_4 emissions from cesspools and septic tanks are calculated pursuant to the IPCC method. Whereas the following parameters were used: Average organic load: 60 g BOD5 per inhabitant and day [IPCC default], Methane producing capacity Bo: 0,6 kg CH_4/ kg BoB5 [IPCC default], Methane conversion factor MCF: 0,27 (STEINLECHNER ET AL. 1994). The amount of inhabitants not connected to sewage systems and wastewater treatment plants was taken from the recent Austrian reports on water pollution control. Data for the years 1971, 1981, 1991, 1995 and 1998 were available. The missing data were interpolated. As a consequence the amount of inhabitants connected to septic tanks in the years form 2001 to 2004 has to be extrapolated taking into account the trend of earlier years. In Austria sewage sludge treatment is carried out on the one hand by aerobic stabilisation and on the other hand by anaerobic digestion. As sludge stabilisation is carried out aerobicly the amount of methane emissions produced is negligible. Methane gas produced in the digestion processes is usually used for energy recovery or is flared. Thus a negligible amount of CH_4 emissions is emitted as well.
Belgium	In this category, two sources of methane emissions are taken into account: the CH_4 emissions from municipal wastewater treatment plants and from sceptic tanks. The methodology for the individual wastewater treatment plant (septic tank) is based on an article (Vasel, 1992), which describes the characteristics and parameters of individual septic tanks. In the Walloon region, after discussion with the regional responsible for municipal wastewater treatment plants, it appears that most of the plants are conducted aerobically. Those who use anaerobical digestion of the sludge recover the CH_4 for energy purpose. Consequently, no CH_4 emissions are accounted in this subcategory. In the Brussels region, the municipal wastewater treatment plant is conducted aerobically; no CH_4 emissions are then estimated for this subcategory. In the Flemish region the emissions of CH_4 of the municipal waste water treatment plants are estimated by using the methodology as described in the EMEP/CORINAIR guidebook.
Denmark	The methodology developed for the NIR 2006 for estimating emission of methane from wastewater handling is following the IPCC Guidelines (1996) and IPCC Good Practice Guidance (2000). According to IPCC GL the emission should be calculated for domestic and industrial wastewater and the resulting two types of sludge, i.e. domestic and industrial sludge. The information available for the Danish wastewater treatment systems does not fit into the above categorisation as a significant fraction of the industrial wastewater is treated at centralised municipal wastewater treatment plants (WWTPs) and the data available for the total organic waste (TOW) does not differentiate between industrial and municipal sewage sludge. The IPPC default methodology for household wastewater has been applied by accounting and correcting for the industrial influent load. Of the total influent load of organic wastewater, the separated sludge has different final disposal categories. The fractions that are used for biogas, combustion or reuse including combustion include methane potentials that are either recovered or emitted as CO_2. These fractions have been subtracted from the calculated (theoretical) gross emission of CH_4.An EF value given in IPCC (2003) for the sludge disposal category biogas has been used for calculating the recovered and not emitted methane potential.
Finland	A national methodology that corresponds to the methodology given in the Revised (1996) Guidelines is used in the estimation of the CH_4 emissions. Emission sources cover municipal and industrial wastewater handling plants and uncollected domestic waste water for CH_4 emissions (NIR 2006). For uncollected domestic wastewaters the Check-method with default parameters (IPCC Good Practice Guidance) has been used.
France	On the basis of the statistics of the wastewater treatment plants in France, the emissions are calculated according to the IPCC tier 2 method, distinguishing natural lagoons and cesspools (NIR 2006).

Germany	Municipal wastewater treatment in Deutschland uses aerobic procedures (municipal wastewater-treatment facilities, small wastewater-treatment facilities), i.e. it produces no methane emissions, since such emissions occur only under anaerobic conditions. Treatment of human sewage from persons not connected to sewage networks or small wastewater treatment facilities represents an exception: in cesspools, uncontrolled processes (partly aerobic, partly anaerobic) may occur that lead to methane formation. Organic loads from cesspools are calculated pursuant to the IPCC method, in which the relevant population is multiplied by the average organic load per person.
Greece	CH_4 from waste water handling was estimated according to the default methodologies suggested by IPCC (NIR 2006).
Ireland	It is assumed that no CH_4 emission from wastewater handling occur due to aerobic conditions. National studies (O'Leary and Carty, 1998) indicate that 3 percent of sludge produced in both industrial wastewater and domestic and commercial wastewater handling, including septic tanks, is treated anaerobically. The estimates of CH_4 emissions from sludge are derived using the national statistics, country specific values and default values from the IPCC Guidelines.
Italy	In Italy wastewater handling is managed mainly using aerobic treatment plants, where the complete-mix activated sludge process is more frequently designed. It is assumed that domestic and commercial wastewaters are treated 100% aerobically, whereas industrial wastewaters are treated 85% aerobically and 15% anaerobically. Consequently, there are no CH_4 emissions from the treatment of domestic and commercial wastewaters. The stabilization of sludge, both in domestic and industrial wastewater treatment plants, occurs in aerobic or anaerobic reactors; whereas anaerobic digestion is used, the reactors are of course covered and provided of gas recovery; therefore, emissions from sludge disposal do not occur (NIR 2004). CH_4 emissions have been estimated from sludge stabilisation occurring in Imhoff tanks (3-5% of total sludge anaerobically treated).
Luxembourg	CH_4 and N_2O emissions from industrial as well as domestic and commercial wastewater treatment are determined. No detailed information is available.
Netherlands	Country-specific methodology is used for CH_4 from wastewater handling, which is equivalent to the IPCC Tier 2 method. A full description of the methodology is provided in the monitoring protocol 6B_CH_4_N_2O_waste_water (see www.greenhousegases.nl) and in the background document (Oonk et al., 2004).
Portugal	CH_4 emissions from domestic wastewater handling were estimated using a methodology adapted from IPCC 1996 Revised Guidelines (IPCC,1997) and GPG (IPCC,2000), which follows three basic steps: 1. Determination of the total amount of organic material originated in each wastewater handling system 2. Estimation of emission factors and 3. Calculation of emissions (NIR 2006).
Spain	For the treatment of waste water in the residential and commercial sectors, the methodology used has been derived from the IPCC Reference Manual and the EMEP/CORINAIR Guidelines. The activity variable taken has been the organic load in terms of tonnes of BOD5. To calculate this variable, the datum used has been the population effectively served by the residential waste water treatment plants. For the degradable organic load, a burden of 21.9 kg BOD5/inhabitant equivalent per year and 0.75 as the fraction for the degradable organic load was taken into account. The emissions on the water and sludge lines are obtained as the product of the activity variable by the methane emission factors, discounting from this result the amount of methane recovered (NIR 2005).
Sweden	CH_4 emissions from wastewater handling are reported under 6.A.1.
United Kingdom	The methodology of the UK model differs in some respects from the IPCC default methodology. The main differences are that it considers wastewater and sewage together rather than separately. It also considers domestic, commercial and industrial wastewater together rather than separately. Emissions are based on empirical emission factors derived from the literature expressed in kg CH_4/tonne dry solids rather than the BOD default factors used by IPCC. The model however complies with the IPCC Good Practice Guidance as a national model (IPCC, 2000). Emissions from sewage are calculated by disaggregating the throughput of sewage into 14 different routes. The routes consist of different treatment processes each with an own emission factor. The allocation of sludge to the treatment routes is reported for each year. Emissions of methane from sewage sludge applications to agricultural land are also included in the sector 6B2 (NIR 2006).

Source: NIR 2006 if available else NIR 2005; CRF 2004 Tables 6 and 6 B

CH_4 emissions from industrial wastewater and sludge handling are not key sources but the reporting of these emissions by Member States is very inhomogeneous and seems to be difficult.

Emissions from sludge handling are reported only by two Member States (Ireland, Spain), other Member States either did not estimate the emissions (eight Member States: Belgium, Denmark, France, Germany, Greece, Netherlands, Portugal, United Kingdom) or reported the emissions elsewhere (four Member States: Austria, Finland, Italy and Sweden).

Emissions from industrial wastewater handling are reported by six Member States (Finland, Greece, Italy, Netherlands, Portugal, Spain), but six Member States indicate either that emissions are not estimated or not applicable (Austria, Belgium, Germany, United Kingdom), or that emissions are reported elsewhere (Denmark, Sweden). An overview of methodological issues regarding CH_4 emissions from industrial wastewater and sludge handling is provided in Table 8.24.

Table 8.24: CH_4 emissions from industrial wastewater and sludge handling and methods applied

Member States	CH_4 from industrial wastewater	Methods for determining CH_4 emissions from industrial wastewater and sludge handling

	Waste water	Sludge	
Austria	**NA**	**IE**	Industrial Wastewater treatment and sewage sludge treatment is carried out under aerobic as well as anaerobic conditions. Due to lack of data the overall amount of industrial wastewater can not be estimated. But according to national experts the amount of CH_4 emissions from industrial wastewater treatment and sewage sludge treatment is negligible because CH_4 gas is usually used for energy recovery or is flared.
Belgium	**NE**	**NE**	
Denmark	**IE**	**NE**	The methodology developed for the NIR 2006 for estimating emission of methane from wastewater handling is following the IPCC Guidelines (1996) and IPCC Good Practice Guidance (2000). According to IPCC GL the emission should be calculated for domestic and industrial wastewater and the resulting two types of sludge, i.e. domestic and industrial sludge. The information available for the Danish wastewater treatment systems does not fit into the above categorisation as a significant fraction of the industrial wastewater is treated at centralised municipal wastewater treatment plants (WWTPs) and the data available for the total organic waste (TOW) does not differentiate between industrial and municipal sewage sludge. The IPPC default methodology for household wastewater has been applied by accounting and correcting for the industrial influent load. Of the total influent load of organic wastewater, the separated sludge has different final disposal categories. The fractions that are used for biogas, combustion or reuse including combustion include methane potentials that are either recovered or emitted as CO_2. These fractions have been subtracted from the calculated (theoretical) gross emission of CH_4.An EF value given in IPCC (2003) for the sludge disposal category biogas has been used for calculating the recovered and not emitted methane potential.
Finland	**X**	**IE**	A national methodology that corresponds to the methodology given in the Revised (1996) Guidelines is used in estimation of the CH_4 emissions. The emissions from industrial wastewater treatment are based on the COD load. A formula is provided in the NIR 2006.
France	**0**	**NE**	For industrial wastewater, emissions from treatments on site are not estimated (CRF 2006). Due to the major use of aerobic treatment system in industrial wastewater treatment plants CH_4 emissions are very small. Due to the lack of data CH_4 emissions from industrial sludge are not estimated (email communication with national waste expert April 2005).
Germany	**NE**	**NE**	The composition of industrial wastewater, in contrast to that of household wastewater, varies greatly, by industrial sector. In Germany, the biological stage of industrial wastewater treatment is partly aerobic and partly anaerobic. Anaerobic wastewater treatment is especially useful for industries whose wastewater has high levels of organic loads. This treatment method has the advantages that it does not require large amounts of oxygen, produces considerably smaller amounts of sludge requiring disposal and generates methane that can be used for energy recovery. As in treatment of municipal wastewater, treatment of industrial wastewater releases no methane emissions into the environment. The processes include aerobic treatment and anaerobic digestion; gas formed in the latter is either used for energy recovery or is flared (NIR 2006).
Greece	**X**	**NE**	The methodology for calculating methane emissions from industrial wastewater is similar to the one used for domestic wastewater. In order to estimate the total organic waste produced through anaerobic treatment, the following basic steps were accomplished: Collection of data regarding industrial production of approximately 25 industrial sectors / sub-sectors for the period 1990 – 2003. Data on industrial production for 2004 were not available and for this reason production was estimated through linear extrapolation. Calculation of generated wastewater, by using the default factors per industrial sector (m^3 of wastewater/t product) as suggested by the IPCC Good Practice Guidance. Calculation of degradable organic fraction of waste, by using the default factors (kg COD/m^3 wastewater) suggested by the IPCC Good Practice Guidance for each sector / sub-sector. The distribution between aerobic and anaerobic treatment of industrial wastewater for each industrial sector was estimated on the basis of data derived from a relevant project. The maximum methane production potential factors and the methane conversion factors for aerobic and anaerobic treatment, which were used for the final estimation of methane emissions, are similar to those used for domestic wastewater handling (NIR 2006).
Ireland	**NO**	**X**	It is assumed that no CH_4 emission from wastewater handling occur due to aerobic conditions. National studies (O'Leary and Carty, 1998) indicate that 3 percent of sludge produced in both industrial wastewater and domestic and commercial wastewater handling, including septic tanks, is treated anaerobically. The estimates of CH_4 emissions from sludge are derived using the national statistics, country specific values and default values from the IPCC Guidelines.
Italy	**x**	**IE**	The methane estimation concerning industrial wastewaters makes use of the IPCC method based on wastewater output and the respective DOC for each major industrial wastewater source. No country specific emission factors of methane per COD are available, so the default value of 0.25 kg CH_4/kg DC, suggested in the IPCC GPG had been used for the whole time series. As recommended by the GPG for key source categories, data have been collected for several industrial sectors (food and beverage, paper and pulp, organic chemicals, iron and steel, textile, leather industry). National data have been used in the calculation of the total amount of both COD produced and wastewater output for: pulp & paper sector, beer, wine, milk and sugar sectors. The introduction of leather sector has improved the emission estimation (NIR 2004).
Luxembourg			CH_4 and N_2O emissions from industrial wastewater treatment are determined. No detailed information is available.
Netherlands	**X**	**NE**	CH_4 emissions from industrial wastewater refer to anaerobic industrial waste water treatment plants. The major part of the Dutch industry emit in the sewer system which is connected to municipal waste water treatment plants. These emissions are included in the category: Domestic and commercial waste

Member States	CH_4 from industrial wastewater		Methods for determining CH_4 emissions from industrial wastewater and sludge handling
	Waste water	Sludge	
			water (CRF 2006).
Portugal	**X**	**NE**	No methodology description available.
Spain	**X**	**X**	For the treatment of industrial waste water, the methodology followed has been derived from the IPCC Reference Manual for the area sources (general statistic information) and the EMEP/CORINAIR Guidebook for the point sources (sectorial questionnaires). The activity variable taken for point sources has been the volume of waste water purified in the oil refineries and paper pulp works, where the information has been obtained through questionnaires, and for area sources it has been the organic load in terms of chemical oxygen demand in water and sludge, with the basic variables coming from the discharge regulation studies carried out by the Directorate General for Hydraulic Works and Water Quality at the Ministry of the Environment for the food sectors in 1994 and chemistry sector in 1996. In order to extend the time series homogeneously for the food and chemistry sectors, the corresponding values from the industrial production index produced by the Spanish National Statistics Institute were used (NIR 2005).
Sweden	**IE**	**IE**	CH_4 emissions from wastewater handling are reported under 6.A.1.
United Kingdom	**NE**	**NE**	Industrial waste water is considered together with commercial and domestic wastewater. There is no estimate made of emissions from private wastewater treatment plants operated by companies prior to discharge to the public sewage system or rivers (NIR 2006). They are not estimated but believed to be small (CRF 2006).

Source: NIR 2006 if available else NIR 2005; CRF 2006 Tables 6 and 6.B

According to the IPCC Good Practice Guidance, the emission factor for determining CH_4 emissions from wastewater and sludge handling is composed of the maximum methane producing potential (B_0) and the methane conversion factor (MCF). There is an IPCC default value available for the maximum methane producing potential which is applied in most of the Member States. In contrast, the MCF has to be determined country specifically and varies strongly among the Member States depending on wastewater and sludge treatment systems used; Table 8.25 provides an overview of the MCF applied by the Member States.

Table 8.25: Methane Conversion Factors

Member States	MCF	Specification of MCF	Further information on MCF
Austria	**0.27**	Cesspools and septic tanks	Value is taken from a study (STEINLECHNER ET AL. 1994).
Belgium	-	-	No information provided.
Denmark	**0.20**	Anaerobic treatment of sludge	Value for the year 2002.
Finland	**0.01** **0.005**	Collected domestic wastewater Industrial wastewater	The estimated methane conversion factors for collected wastewater handling systems (industrial and domestic) are low in Finland because the handling systems included in the inventory are either aerobic or anaerobic with complete methane recovery. The emission factors mainly illustrate exceptional operation conditions. The MCF is based on country specific knowledge.
France	**0.23** **0.35**	"natural" lagoons septic system	Country specific data from experts.
Germany	**0** **0.5**	Municipal wastewater treatment Cesspools	Aerobic conditions. The MCF for cesspools has been estimated on the basis of experience gained in other countries (septic tanks in the U.S., anaerobically treated municipal wastewater in the Czech Republic).
Greece	-	-	The default values for these factors are 0 for aerobic conditions and 1 for anaerobic conditions (and these values were applied in the calculations).
Ireland	**0**	Wastewater	All aerobic treatment.
Italy			Default IPCC emission factors have been used: g CH_4/g BOD= 0.6 for domestic wastewater and sludge treatment and g CH_4/g COD=0,25 for industrial wastewater.
Luxembourg			No information available.
Netherlands	**0.5**	Septic tank	
Portugal	**0.8** **0.2** **0.17**	Imhoff tank Lagoon with anaerobic pond Percolation beds with anaerobic	Average MCF factors for wastewater treatment systems were weighted by the percentage of each type of treatment for each region, and using the MCF values established by expert

	0	sludge digestion Oxidation pond	judgement for each treatment type. More detailed MCF values are available in the NIR 2006.
Spain	**0.15** **0.3** **0.005** **0.3**	industrial wastewater industrial sludge domestic wastewater domestic wastewater sludge	
Sweden	**-**	-	Not applicable (emissions are reported under 6.A.1).
United Kingdom	**-**	-	No information available.

Source: NIR 2006 if available else NIR 2005

Most Member States report N_2O Emission from waste water handling. Different methods are applied (C, CS, D, T1 and T2). In Table 8.26 the methods for determining N_2O emissions from wastewater handling applied by the Member States are described in detail.

Table 8.26: Methods for determining N_2O emissions from wastewater handling

Member States	N_2O Emissions from wastewater 1) Industrial	Domestic	Description of methods used (N_2O)
Austria	**X**	**X**	N_2O emissions from domestic and industrial waste water were calculated in accordance with the IPCC methodology with the assumption that industrial wastewater handling additionally contributes 30% of N_2O emissions from urban wastewater handling [ORTHOFER et al., 1995]. According to this study the amount of wastewater that is treated in sewage plants and the amount of nitrogen that is denitrificated is considered additionally. Only 1% of the total nitrogen in the denitrification process is emitted as N_2O. The amount of wastewater that is treated in sewage plants as well as the denitrification rate increased over the time series. Data were taken from the Austrian reports on water pollution control (GEWÄSSERSCHUTZBERICHTE 1993 – 2002); data in between were interpolated. The number of inhabitants was provided by STATISTIK AUSTRIA. The daily protein intake was updated according to FAO statistics (NIR 2006).
Belgium	**NE**	**X**	The N_2O emissions are estimated by using the methodology described in the IPCC Guidelines. The figures of protein consumption originate from the FAO statistics. The population figures come from the National Institute of Statistics.
Denmark	**IE**	**X**	Emissions of N_2O was divided into direct and indirect emission contributions, i.e. from wastewater handling and effluents, respectively. Indirect emissions was divided into contributions from industrial discharges, rainwater conditioned effluents, effluents from scattered houses, from mariculture and fish farming and from WWTPs. The methods are described in the Danish NIR 2006.
Finland	**NE**	**X**	In Finland, the N input from fish farming and from municipal and industrial wastewaters into the waterways is collected into the VAHTI database. For municipal wastewaters the measured values have been considered more reliable than the N input according to population data. In addition to the IPCC approach, also nitrogen load from industry and fish farming were taken into account. For uncollected wastewaters the nitrogen load is based on population data. The assessed N_2O emissions cover only the emissions caused by the nitrogen load to waterways. In addition to the emissions caused by nitrogen load of domestic and industrial wastewaters also the emissions caused by the nitrogen load of fish farming have been estimated. N_2O emission calculations are consistent with the IPCC method for discharge of sewage nitrogen to waterways (NIR 2006).
France	**X**	**NO**	N_2O from industrial sites is estimated according to the total N rejected into water (not collected and treated by domestic systems). N_2O from human sewage: Approximately 40% of total N entering into domestic wastewater handling systems are eliminated (CRF 2006).
Germany	**NE**	**NE**	IPCC Default Method
Greece	**NE**	**X**	N_2O from waste water handling were estimated according to the default methodologies suggested by IPCC (NIR 2006).
Ireland	**NO**	**X**	Emissions of N_2O from human sewage discharges reported under source category 6.B wastewater handling have been made following the IPCC methodology (NIR 2006).
Italy	**X**	**IE**	N_2O emissions from domestic and commercial wastewater are included in human sewage (CRF 2006).
Luxembourg	**X**	**X**	N_2O emissions from industrial as well as domestic and commercial wastewater treatment are determined. No detailed information is available.
Netherlands	**NE**	**X**	Country-specific methodology is used for N_2O emissions from wastewater handling, which is equivalent to the IPCC Tier 2 method. A full description of the methodology is provided in the monitoring protocol 6B_CH_4_N_2O_waste_water (see www.greenhousegases.nl) and in the background document (Oonk et al., 2004). The present Tier 2 methodology complies with the IPCC Good Practice Guidance (IPCC,

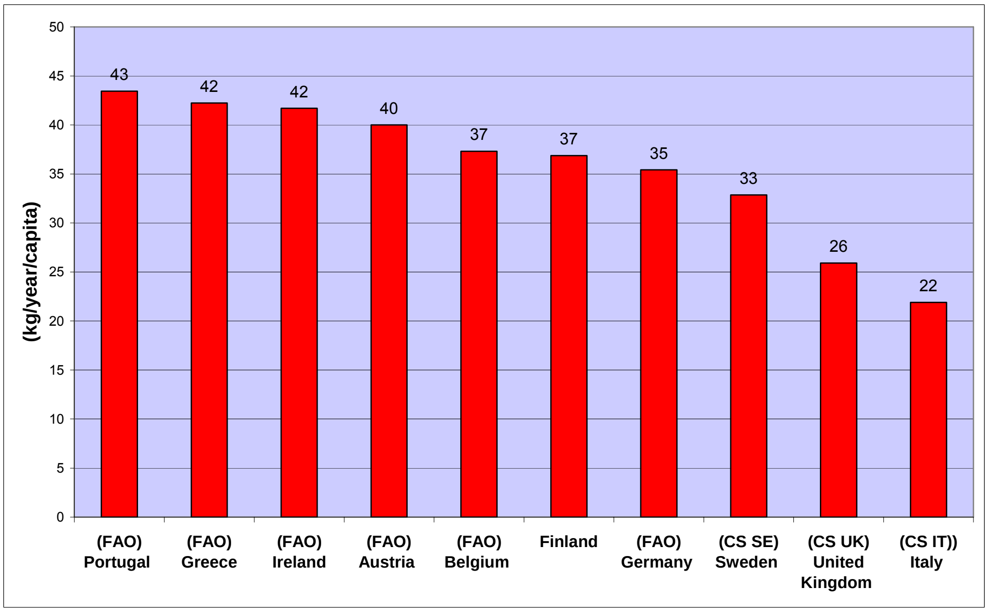
Member States	N_2O Emissions from wastewater [1)]		Description of methods used (N_2O)
	Industrial	Domestic	
			2000) (NIR, 2006). N_2O from industrial wastewater is considered as minor source and no data available (CRF 2006).
Portugal	**X**	**X**	Emissions of N_2O from domestic wastewater were estimated following the proposal of IPCC 1996 Revised Guidelines (IPCC,1997) (NIR 2006). No methodology description for industrial wastewater.
Spain	**NE**	**NE**	
Sweden	**X**	**X**	National activity data on nitrogen in discharged wastewater (industry and domestic waste water) is used, in combination with a model estimating nitrogen in human sewage from people not connected to municipal wastewater treatment plants.
United Kingdom	**NE**	**X**	Nitrous oxide emissions from the treatment of human sewage are based on the IPCC (1997c) default methodology.

1) according to table 6.B in CRF 2006; X= emissions are reported; NE= not estimated; IE= included elsewhere; NO=not occuring

Source: NIR 2006 if available else NIR 2005; CRF 2006 Tables 6 and 6.B

One important parameter for the determination of N_2O emissions from wastewater handling, the daily per capita protein consumption is country-specific and applied by almost all Member States, an overview of the values in given in Figure 8.9.

Figure 8.9: Protein consumption



Source: CRF 2006 Table 6 B; NIR 2006 if available else NIR 2005
CS= Country specific value; FAO= FAO data basis
CS UK) DEFRA, 2004: The National Food Survey, CS SE: National value, National Food Administration. 2002. www.slv.se; CS IT: INRAN - Istituto Nazonale di Ricerca per gli Alimenti e la Nutrizione, 1997.

8.3.4 Waste Incineration (CRF Source Category 6.C)

Emissions from waste incineration are reported by ten Member States in 2004 (Austria, Belgium, France, Greece, Sweden, United Kingdom, Italy, Luxembourg, Spain and Portugal). In Table 8.27 an overview of category descriptions and methodological issues is provided.

Table 8.27: Emissions reported and methodological issues of CRF category 6.C

Member States	Emissions reported in CRF	Type of waste incinerated and methods applied
Austria	X	In this category CO_2 emissions from incineration of corpses and waste oil are included as well as CO_2, CH_4 and N_2O Emissions from municipal waste incineration without energy recovery. There is only one waste incineration plant without energy recovery which has been operated until 1991 with a capacity of 22 000 tons of municipal waste per year (NIR 2006).
Belgium	X	N_2O Emissions from domestic waste incineration are calculated using activity data known from the individual companies involved combined with the emission factor of CITEPA. For CO_2 emissions, each region applies its own methodology according to the available activity data. In *Flanders*, only the fraction of organic-synthetic waste is taken into consideration (assuming that organic waste does not give any net CO_2 emissions). For the municipal waste, the institute responsible for waste management in Flanders (OVAM) is given the analysis of the different fractions in the waste. Based on this information, the amount of non-biogenic waste (excluding the inert fraction) is determined. The carbon emission factor is based on data from literature for the different fractions involved. For industrial waste, the amount of biogenic waste is considered to be the same as in municipal waste. The remaining amount is considered to be the non-biogenic part in which no inert fraction is present. For industrial waste, it is more difficult to determine the content of C and therefore the results of a study carried out by the Vito 'Debruyn en Van Rensbergen 'Greenhouse gas emissions from municipal and industrial wastes of October 1994' are used. This study gives a content of C of the industrial waste of 65,5 %. In *Wallonia*, following a legal decree in 2000, the air emissions from waste incineration are measured by ISSEP and the results are validated by a Steering Committee . These results allow a crosscheck with the results of measurements directly transmitted by the incinerators to the environmental administration. There is a distinction between the emission from municipal waste incineration and hospital waste incineration. The CO_2 emissions of municipal waste incineration are reported assuming that 68 % of the waste is composed of organic material. This is based on the average garbage composition in Wallonia and the use of IPCC equation on organic content of the various materials. The CO_2 emissions from hospital waste incineration are measured by the Walloon incinerators and are fully reported. Emissions from the incineration of corpses are calculated using the EMEP/CORINAIR emission factors and statistical data on the number of corpses. In *Brussels*, The emission factors for the incineration of hospital and municipal waste and corpses are estimated by measurements in situ in connection with EMEP/CORINAIR emission factors. The emissions of CO_2 form the flaring in the chemical industry are reported in Category 6.C according to IPCC Guidelines.
Denmark	IE	For the CRF source category 6.C. Waste Incineration the emissions are included in the energy sector since all wastes incinerated in Denmark are used in the energy production.
Finland	IE	Emissions of greenhouse gases CO_2, N_2O and CH_4 from Waste Incineration (CRF 6.C) are reported in the energy sector (CRF 1.A) in the Finnish inventory.
France	X	Carbon dioxide of biogenic origin was excluded from the emission estimates. Only waste incinerators without energy recovery are considered in this category. The incineration of special industrial waste is partially included according to the information available. Furthermore the incineration of utilised greenhouse films is included (NIR 2006)
Germany	IE	Reported in the energy sector (CRF 1).
Greece	X	Carbon dioxide emissions from the incineration of clinical waste produced in the Attica region have been estimated. For the estimation of CO_2 emissions, the default method suggested by the IPCC Good Practice Guidance was used. CH_4 and N_2O emissions have not been estimated because there are not any available relevant emission factors. However, according to the IPCC Good Practice Guidance, these emissions are not likely to be significant. Data related to the amount of clinical waste incinerated derive from the ACMAR, which is operating the incinerator. The relevant parameters and emission factor used are the ones suggested in the IPCC Good Practice Guidance.
Ireland	-	-
Italy	X	Existing incinerators in Italy are used for the disposal of municipal waste, together with industrial waste, hospital waste, sewage sludge and waste oil. Emissions from removable residues from agricultural production are included in this IPCC category. They refer mainly to olives and wine residues: the total residues amount and carbon content have been estimated by both IPCC and national factors. In order to improve emission estimations from incinerators, a complete data base of these plants has been built; for each plant a lot of information has been included, among which the year of the construction and possible upgrade, the typology of combustion chamber and gas treatment section, if it is provided of energy recovery (thermal or electric), the type and amount of waste incinerated (municipal, industrial, etc.). Different procedures were used to estimate emission factors, according to the data available for each type of waste. With regard to municipal waste, on the basis of the IPCC Guidelines (IPCC, 1997) and referring to the average content analysis on a national scale a distinction was made between CO_2 from fossil fuels (generally plastics) and CO_2 from renewable organic sources (paper, wood, other organic materials). Only emissions from fossil fuels, which are equivalent to 35% of the total, were included in the inventory. On the other hand, CO_2 emissions from the incineration of sewage sludge were not included at all, while all emissions relating to the incineration of hospital and industrial waste were included. Removable residues from agriculture production are estimated for each crop type (cereal, green crop, permanent cultivation) taking in account the amount of crop produced, the ratio of removable residue in the crop, dry matter content of removable residue, the ratio of removable residue burned, the fraction of residues oxidised in burning, the carbon and nitrogen content of the residues. On the basis of these parameters CH_4 and N_2O emissions have been calculated. CO_2 emissions have been calculated but not included in the inventory as biomass. All these parameters refer both to the IPCC Guidelines (IPCC, 1997) and country-specific values, when available (CESTAAT, 1992; Borgioli, 1981). Emissions from olives and wine residues are more than 65% of the total emissions from removable residues

Member States	Emissions reported in CRF	Type of waste incinerated and methods applied
		(NIR 2004).
Luxembourg	X	The single existing incinerator of municipal waste is a major CO_2 emission source in that sector. CO_2 emissions were estimated at 125 kt in 1990, however a big part of those emissions result from biomass combustion. It is estimated that 10 kt of CO_2 (non biomass combustion) should be included into the national total.
Netherlands	IE	The source category waste incineration is included in source category 1A1 '*Energy industries'* since all waste incineration facilities also produce electricity or heat used for energetic purposes and according to the *IPCC Guidelines* (IPCC, 1997), these should be reported under category 1A1a. Total CO_2 emissions – i.e. the sum of organic and fossil carbon – from waste incineration are reported per facility in the annual environmental reports. The fossil-based and organic CO_2 emissions from *waste incineration* (e.g. plastics) are calculated from the total amount of waste incinerated. Per waste stream (residential and several others) the composition of the waste is determined. For each of these types a specific carbon content and fractions of fossil C in total C is assumed, which will yield the CO_2 emissions. The method is described in detail in *Joosen and De Jager (2003)* and in the monitoring protocol (Ruyssenaars, 2005).
Portugal	X	CO_2 emissions from incineration are calculated according to IPCC Guidelines (IPCC,1997), for each waste type (e.g. municipal solid waste (MSW), hazardous waste, clinical waste, and sewage sludge). Until 1999, incineration of solid wastes refers exclusively to incineration of hospital hazardous wastes. The figure for 1995 was used as an estimated for the former years. In 1999, two new incineration units, Valorsul and Lipor started to operate in an experimental regime, respectively in April and August 1999. Their industrial exploration started at the end of the same year or early January 2000. These units are exclusively dedicated to the combustion of MSW which is composed of domestic/commercial waste. Most of the organic materials in MSW are of biogenic origin (e.g. food waste, paper), and so they are not accounted for in net emissions calculations, according to the IPCC Guidelines (IPCC,1997). However, the components of fossil origin – plastics, synthetic fibbers, and synthetic rubber – are to be accounted in the estimates. Data on clinical waste incinerated refers only to Mainland Portugal and correspond to data declared in registry maps of public hospital units (there is no incineration in private units). The quantities of clinical waste incinerated decreased strongly in recent years. 25 incinerators were closed in recent years in Mainland Portugal, remaining at present 2 hospital incinerators. Nowadays the other clinical wastes receive alternative treatment or are treated abroad. The non-biogenic components fractions are considered to be different for MSW, and clinical waste. CH_4 and N_2O and other emissions were estimated as the product of the mass of total waste combusted, and an emission factor for the pollutant emitted per unit mass of waste incinerated. Emission factors applied are either country-specific, being obtained from monitoring data in incineration units, or obtained from references US/AP42 or EMEP/CORINAIR (EEA,2002).
Spain	X	The amount of municipal solid waste entering the incineration process in all the incinerators in operation without energy recovery was obtained from the publication "The Environment in Spain". The information of the emission factors has been taken assuming that the control technique used is the one for "control of particles". For SO_2, NO_x, VOC, CO, N_2O and NH_3 the emission factors are taken from EMEP/CORINAIR Guide Book. For CO_2 a factor of 324 kg/ton has been assumed, calculated assuming 36% of fossil origin and 64% of biogenic origin in the waste and considering that the overall factor forCO_2 per ton of waste is 900 kg(fossil + biogenic)/ton. The incinerators burn the following waste types: corpses, hospital wastes, industrial wastewater sludge and domestic/commercial wastewater sludge. Moreover, open burning of agricultural wastes is reported here (CRF 2006).
Sweden	X	Emissions from incineration of hazardous waste, and in later years also MSW and industrial waste, from one large plant are reported in CRF 6.C. Emissions from non-hazardous waste are included in CRF 1. Reported emissions are for the whole time series obtained from the facility's Environmental report or directly from the facility on request. CO_2, SO_2 and NO_x are measured continuously in the fumes at the plant. In 2003 capacity was increased substantially at the plant by taking one new incinerator into operation. The new incinerator incinerates a mixture of MSW, industrial waste and hazardous waste. As a consequence of increased capacity, the emissions in 2003 increased compared to earlier years. Emissions reported are CO_2, NO_x, SO_2 and NMVOC. According to information from the facility, occasional measurements concerning CH_4 and N_2O have been performed. The CH_4 measurement showed very low or non-detectable amounts. CH_4 is therefore reported as NE in the CRF tables. For N_2O the occasional measurements showed levels giving emissions in the approximate order of 0.2 Mg N_2O/year. N_2O is reported as NE in the CRF tables.

Member States	Emissions reported in CRF	Type of waste incinerated and methods applied
United Kingdom	X	Incineration of chemical wastes, clinical wastes, sewage sludge and animal carcasses is included here. There are approximately 70 plants incinerating chemical or clinical waste or sewage sludge and approximately 2600 animal carcass incinerators. Animal carcass incinerators are, typically, much smaller than the incinerators used to burn other forms of waste. This source category also includes emissions from crematoria. Emissions are taken from research studies or are estimated on literature based emission factors, IPCC default values, or data reported by the Environment Agency's Pollution Inventory.

X = Emissions are reported in source category 6.C, IE = included elsewhere

Source: NIR 2006 if available, else NIR 2005, CRF 2006.

8.3.5 Waste – Other (CRF Source Category 6.D)

Under CRF source category 6.D eleven Member States report emissions. Emissions from composting have been reported by eight Member States (Austria, Belgium, Finland, France, Germany, Italy, Luxembourg and the Netherlands), Denmark and France determine emissions from biogas production, Portugal indicates emissions from open burning of industrial waste and Spain from domestic and commercial wastewater sludge spreading, compare Table 8.28.

Table 8.28: Reported emissions under CRF source category 6.D

Member States	Specification of "other waste"	6 D CO_2	6 D CH_4	6 D N_2O	6 D NO_x
Austria	Compost production	NA	1.19	0.18	NA
Belgium	Compost production	NA	2.25	NA	NA
Denmark	Combustion of biogas in biogas production plants	2.04	0.00	0.00	0.00
Finland	Composting production	NO	2.69	0.18	NO
France	Biogas and compost production	0.00	4.00	0.67	NO
Germany	Compost production	NO	NO	0.79	NO
Italy	Compost production	NA	0.18	NA	NA
Luxembourg	Compost production	0.00	0.15	0.00	-
Netherlands	Compost production	NA	3.42	0.14	1.23
Portugal	Open burning of industrial waste	0.00	0.002	0.00	0.11
Spain	Domestic/Commercial Wastewater sludge spreading	NE	29.75	NE	NE

Source: CRF 2006 Table 6

In Table 8.29 the source category is described further in detail

Table 8.29: Description and methodological issues of source category CRF 6.D

Member States	Waste – Other
Austria	Emissions were estimated using a country specific methodology. To estimate the amount of composted waste it was split up into three fractions of composted waste: 1) mechanical biological treated residual waste, 2) bio waste, loppings, bio composting, 3) sewage sludge. CH_4 emissions were calculated by multiplying with an emission factor (CH_4 and N_2O) based on national references by the quantity waste (NIR 2006).
Belgium	CH_4 emissions from compost production are estimated using regional activity data combined with a default emission factor of 2,4 kg CH_4/ton compost.
Denmark	Emission from combustion of biogas in biogas production plants is included in CRF sector 6D. The fuel consumption rate of the biogas production plants refers to the Danish energy statistics. The applied emission factors are the same as for biogas boilers (see NIR chapter 3, Energy).
Finland	Emissions from composting have been calculated using an analogous method with Draft 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Activity data are based on VAHTI database and the Water and Sewage Works Register. The activity data for composted municipal biowaste for the year 1990 are based on the estimates of the Advisory Board for Waste Management (1992) for municipal solid waste generation and treatment in Finland in 1989. Data on years 1997 and 2004 are from VAHTI database and the intermediate years have been interpolated. In addition, composted solid biowaste in the years 1991-1996 has been interpolated using auxiliary information from the National Waste Plan until 2005 (Ministry of the Environment 1998).
France	CH_4 and N_2O emissions from composting as well as CH_4 emissions from biogas production.
Germany	In Germany, yearly increasing amounts of organic waste are composted. For this purpose N_2O emissions from composting of municipal solid waste are determined using a national method. Composting of garden and organic waste in individual households is not considered in this category.
Italy	Under this source category, CH_4 emissions from compost production have been reported. The amount of waste treated in

	composting plants has shown a nearly 15-fold increase in Italy from 363,319 in 1990 to 5,361,471 in 2002. Since no methodology is provided by the IPCC for these emissions, literature data (Hogg, 2001) has been used for the emission factor, 0.029 kg CH_4/kg treated waste (NIR 2004).
Luxembourg	No information available.
Netherlands	This source category consists of the CH_4 and N_2O emissions from composting separately collected organic waste from households. A country-specific methodology for this source category is used with activity data based on the annual survey performed by the Working Group on Waste Registration at all the industrial composting sites in the Netherlands (data can be found on www.uitvoeringafvalbeheer.nl and in a background document (SenterNovem, 2005a)) and emission factors based on the average emissions (per ton composted organic waste) of some facilities in the late 90's (during a large scale monitoring programme in the Netherlands). Emissions from small-scale composting of garden waste and food waste by households are not estimated as this is assumed to be negligible. Since this source is not considered as a key source, the present methodology level complies with the *IPCC Good Practice Guidance* (IPCC, 2000) (NIR, 2006).
Portugal	This category includes emissions from the open burning of industrial solid waste on land which was previously reported in the category 6C. This change relates to the in-depth review recommendation to report these emissions under category 6.A. These emissions have however been reported under 6.D in order to report more pollutants (SO_2) in CRF tables than was possible in category 6.A. The same methodology as for category 6.C Waste incineration was used, which refers to IPCC Guidelines (IPCC,1997). Ultimate CO_2 emissions from open combustion of industrial waste on land were calculated based on data which refer to uncontrolled combustion of industrial solid waste on land and which were collected from INR. Data for the years 2000 and 2002 refer to industrial units declarations. The years 2001 and 2003 are estimates based on interpolation (2001) and on the last available data (2003-04 refer to 2002 data). Data for the period 1990-98 are based on the same assumptions used for Industrial Solid Waste Disposed on Land: a per year growth rate of 2%. Emissions were estimated as the product of the mass of total waste combusted, and an emission factor for the pollutant emitted per unit mass of waste incinerated. Emission factors applied are either country-specific, being obtained from monitoring data in incineration units, or obtained from references US/AP42 or EMEP/CORINAIR (EEA,2002).
Spain	No further specifications in the NIR 2005.

Source: NIR 2006 if available, else NIR 2005.

8.4 EU-15 uncertainty estimates

Table 8.30 shows the total EU-15 uncertainty estimates for the sector 'Waste' and the uncertainty estimates for the relevant gases of each source category. The highest level uncertainty was estimated for N_2O from 6.B and the lowest for CH_4 from 6.A. With regard to trend CH_4 from 6D shows the highest uncertainty estimates, CO_2 from 6C the lowest. For a description of the Tier 1 uncertainty analysis carried out for the EU-15 see Chapter 1.7.

Table 8.30: EU-15 uncertainty estimates for the sector 'waste'

Source category	Gas	Emissions 1990	Emissions 2004 1)	Emission trends 1990-2004	Emissions for which MS uncertainty estimates are available 2)	Share of emissions for which MS uncertainty estimates are available	Level uncertainty estimates based on MS uncertainty estimates	Trend uncertainty estimates based on MS uncertainty estimates
6.C Waste incineration	CO_2	5,175	3,238	-37%	2,769	86%	18%	7
6.A Solid waste disposal on land	CH_4	135,140	83,845	-38%	71,896	86%	17%	12
6.B Waste water handling	CH_4	12,631	9,917	-21%	6,631	67%	51%	28
6.C Waste incineration	CH_4	569	659	16%	264	40%	20%	23
6.D Other	CH_4	337	916	171%	122	13%	79%	990
6.B Waste water handling	N_2O	8,784	9,245	5%	8,217	89%	111%	9
6.C Waste incineration	N_2O	394	418	6%	172	41%	97%	18
Total Waste	**all**	**163,446**	**108,866**	**-33.4%**	**90,072**	**83%**	**18%**	**11**

Note: Emissions are in Gg CO_2 equivalents; trend uncertainty is presented as percentage points.

1) The sum of the source category emissions may not be the total sector emissions because uncertainty estimates are not available for all source categories.

2) Includes for some countries 2003 data and for Spain 2002 data

8.5 Sector-specific quality assurance and quality control

Under the Climate Change Committee a workshop was conducted in Spring 2005 on inventories and projections of greenhouse gas emissions from waste. The main objectives of the workshop were: (1) to provide an opportunity to learn about the methods used for inventories and projections in the different Member States, to share information, experience and best practice; (2) to compare the parameters chosen in the estimation methodologies across EU-15 Member States; (3) to compare emissions and methods used for GHG inventories with data and methods for EPER; and (4) to strengthen links between assessment of air pollution under the IPPC and emissions under the UNFCCC. In addition, the workshop provided an opportunity to discuss potential methodological changes or improvements of the draft 2006 IPCC inventory guidelines. The recommendations and presentations of this workshop can be downloaded from the Internet under the following link: http://air-climate.eionet.eu.int/docs/meetings/050502_GHGEm_Waste_WS/meeting050502.html. Clarifications from discussions of individual parameters used in the estimation of emissions from waste were incorporated in this report.

A second expert meeting under the Climate Change Committee on the estimation of CH_4 emissions from solid waste disposed to landfills was conducted in March 2006. This meeting was targeting in particular those EU Member States that do not yet use the IPCC FOD methods for their inventories (mostly new EU Member States). The objective of the expert meeting was to use the new default model provided by draft 2006 IPCC Guidelines for national GHG inventories in order to calculate CH_4 emissions for the participants' countries. 11 Member States, 2 EEA Member countries, and one accession country participated. 9 of the 14 countries had previously not estimated CH_4 emissions with a FOD method. The meeting enabled those Member States that still used Tier 1 method to use the FOD model with national/default data as available. Other Member States used the IPCC FOD model as quality check and for comparison with the results of the country-specific model with usually minor differences compared to the national model. The meeting also contributed to the exchange of experiences of specific circumstances regarding waste generation, composition and solid waste disposal in new Member States and on the estimation of CH_4 recovery in the absence of monitored data. In addition, the meeting provided recommendations to IPCC for further improvement and corrections of the draft default model.

8.6 Sector-specific recalculations

Table 8.31 shows that in the waste sector large recalculations were made for CH_4 in 1990 and 2003.

Table 8.31 Recalculations of total greenhouse gas emissions and recalculations of greenhouse gas emissions in CRF Sector 6: 'Waste', for 1990 and 2003 by gas (Gg and percentage)

1990	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
	Gg	percent	Gg	percent	Gg	percent	Gg	percent	Gg	percent	Gg	percent
Total emissions and removals	36.029	1,2%	-12.408	-2,8%	5.977	1,5%	839	3,1%	1.074	6,8%	569	5,5%
Waste	-1.041	-16,1%	22.966	18,3%	245	2,7%	NO	NO	NO	NO	NO	NO
2003												
Total emissions and removals	63.546	2,0%	-5.239	-1,6%	4.431	1,3%	614	1,2%	1.050	18,8%	-429	-4,6%
Waste	-293	-7,7%	15.910	19,1%	537	5,6%	NO	NO	NO	NO	NO	NO

NO: not occurring

Table 8.32 provides an overview of Member States' contributions to EU-15 recalculations. The United Kingdom had by far the largest reclaculation but also Portugal, Austria and Greece show large recalculations.

Table 8.32 Contribution of Member States to EU-15 recalculations in CRF Sector 6: 'Waste' for 1990 and 2003 by gas (difference between latest submission and previous submission Gg of CO_2 equivalents)

	1990						2003					
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6
Austria	6	-954	0	NO	NO	NO	1	-897	7	NO	NO	NO
Belgium	-2	-47	-8	NO	NO	NO	99	-314	-54	NO	NO	NO
Denmark	IE,NA,NE,NO	-74	0	NO	NO	NO	3	66	-11	NO	NO	NO
Finland	IE,NO	-5	23	NO	NO	NO	IE,NO	-6	55	NO	NO	NO
France	0	10	95	NO	NO	NO	317	23	220	NO	NO	NO
Germany	NE	4.486	24	NO	NO	NO	NE	1.949	232	NO	NO	NO
Greece	-21	-889	-2	NO	NO	NO	-232	-1.571	-9	NO	NO	NO
Ireland	NA,NE,NO	113	-1	NO	NO	NO	NA,NE,NO	-310	0	NO	NO	NO
Italy	3	3.407	0	NO	NO	NO	48	7.732	4	NO	NO	NO
Luxembourg	-9	0	3	NO	NO	NO	10	0	0	NO	NO	NO
Netherlands	IE,NA,NO	0	0	NO	NO	NO	IE,NA,NO	68	40	NO	NO	NO
Portugal	0	1.819	22	NO	NO	NO	0	1.440	18	NO	NO	NO
Spain	0	317	89	NO	NO	NO	15	399	31	NO	NO	NO
Sweden	0	320	0	NO	NO	NO	0	348	0	NO	NO	NO
UK	-1.019	14.463	0	NO	NO	NO	-554	6.983	6	NO	NO	NO
EU15	**-1.041**	**22.966**	**245**	**NO**	**NO**	**NO**	**-293**	**15.910**	**537**	**NO**	**NO**	**NO**

NO: not occurring; NE: not estimated

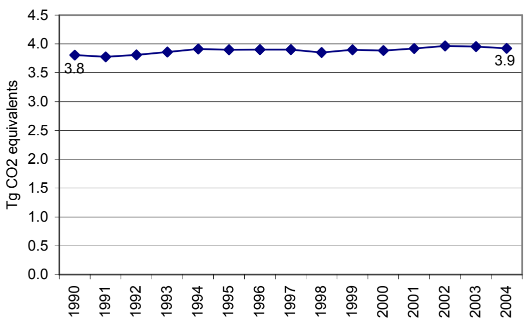
9 Other (CRF Sector 7)

This chapter provides information on emission trends, source allocations of Member States and recalculations in CRF Sector 7: 'Other'. No information on methods, emission factors and uncertainty estimates is included in this chapter because the sector does not contain an EU-15 key source ([22]). Neither is included a section on sector-specific QA/QC as no such activities are performed in this sector.

9.1 Overview of sector

CRF Sector 7 'Other' is the smallest sector contributing 0.09 % to overall EU-15 GHG emissions. CO_2 is the only gas under 'Other'; emissions from 'Other' have increased since 1990 (+ 3 %). In 2004, the emissions decreased by 1 % compared to 2003.

Figure 9.1 EU-15 GHG emissions 1990–2004 from CRF Sector 7: 'Other' in CO_2 equivalents (Tg)



Only Finland und UK report emissions under 'Other'. Finland reports indirect N_2O emissions caused from N deposition by total NOx emissions in Finland. The UK reports direct greenhouse gas emissions for the following overseas territories: Guernsey, Jersey, The Isle of Man, The Falkland Islands, The Cayman Islands, Bermuda, Montserrat, Cyprus.

9.2 Methodological issues and uncertainties

This report does not include more information on methodological issues because the emissions in this sector are caused by two Member States only.

9.3 Sector-specific quality assurance and quality control

There are no sector-specific QA/QC procedures for this sector.

9.4 Sector-specific recalculations

Table 9.1 shows that in CRF Sector 7: 'Other', recalculations were mainly due to the inclusion of the UK overseas territorries for the first time.

([22]) In this report, overview tables on methodologies and on uncertainties are only presented for the EC key sources as identified in Section 1.5 due to time restrictions (see Section 1.8.5). For information on sector-specific methods used by the Member States see Member States' submissions.

Table 9.1 Recalculations of total greenhouse gas emissions and recalculations of greenhouse gas emissions in CRF Sector 7: 'Other', for 1990 and 2003 by gas (Gg and percentage)

1990	**CO_2**		**CH_4**		**N_2O**		**HFCs**		**PFCs**		**SF_6**	
	Gg	percent	Gg	percent	Gg	percent	Gg	percent	Gg	percent	Gg	percent
Total emissions and removals	36,029	1.2%	-12,408	-2.8%	5,977	1.5%	839	3.1%	1,074	6.8%	569	5.5%
Other	2,222	347.0%	417	-	526	-	NO	NO	NO	NO	NO	NO
2003												
Total emissions and removals	63,546	2.0%	-5,239	-1.6%	4,431	1.3%	614	1.2%	1,050	18.8%	-429	-4.6%
Other	2,447	294.8%	251	-	428	-	NO	NO	NO	NO	NO	NO

NO: not occurring

10 Recalculations and improvements

10.1 Explanations and justifications for recalculations

Tables 10.1 and 10.2 provide an overview of the main reasons for recalculating emissions in the year 1990 and 2003 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 that 1 000 Gg are presented. For more details see the information provided by the Member States' submissions in Annex 12.

Table 10.1 Main recalculations in the Member States for 1990 and Member States' explanations for recalculations given in the CRF or in the NIR

	Absolute difference between latest and previous submission used for the EU-15 inventory (Gg CO_2 equivalents)	Member States' explanation for recalculation	Information source of reasons for recalculations
Austria			
Total emissions excluding LUCF	371		
CH_4 from 6.A	-769	Update of activity data *6 A 1 Managed waste disposal on land:* The activity data (1998 to 2004) have been updated. According to the Austrian Landfill Ordinance, the operators of landfill sites have to report their activity data annually. Based on reports received after the due date, there are minor changes of the activity data in this submission compared to the previous submission. For those years where no data were available on non-residual wastes (before 1998) extrapolation according to the GDP was used as recommended by ERT, instead of assuming the amount of non-residual wastes to be constant. Double Counting of the amount of construction waste has been corrected. Improvements of methodology: *6 A 1 Managed Waste Disposal on Land:* The IPCC Tier 2 Methodology is now used instead of a country-specific one. *6 B Waste Water Handling:* For calculating CH_4 emissions, the IPCC Methodology is now used instead of a country-specific one. *6 C Waste Incineration:* For incineration of municipal solid waste without energy recovery, the IPCC default CO_2 emission factor is now used because the emission factor used in the previous submission was based on a non-verified expert guess. CO_2, CH_4 and N_2O emissions from the incineration of clinical waste without energy recovery are additionally estimated by means of activity data based on expert guesses and IPCC default emission factors. CO_2 emissions from cremation are now reported as "NA" due to elimination of double counting with category *1 A 4 a Commercial/Institutional-Gaseous fuels.*	NIR 2006, p. 297
CO_2 from 1.A.2	482	*1 A 2 a Iron and Steel:* Coke oven gas consumption (included in solid fuels) of integrated steel plants has been recalculated. Coke oven coke consumption for blast furnaces has been updated for 2003. *1 A 2 b,c,d,e:* The minor changes of each sub-category are due to changes of the energy balance, mainly due to shifts between categories. Final consumption of gasworks gas 1990 to 1995 which is not considered in the energy balance reported to EUROSTAT/IEA is additionally considered in the specific subcategories as specified in the "Austrian energy balance". *1 A 2 f Manufacturing Industries and Construction-Other*: Consumption of hard coal 1990 to 1993 has been moved from *1 A 4 Other Sectors* to "Non metallic Mineral Products Industry" according to cement industry emissions declarations.	NIR 2006, p. 294
N_2O from 4.B	219	Improvements of methodologies and emission factors: *4 A, 4 B, 4 D Enteric Fermentation, Manure Management, Agricultural Soils:* As recommended in the Centralized Review 2004, Austrian N excretion values have been revised. Especially N excretion rates of dairy and mother cows are higher now, which has resulted in higher emissions of N_2O from source category 4 B and 4 D. With the revision of N excretion rates, the GE intake and VS excretion data were also recalculated. This has resulted in higher CH_4 emissions from source categories 4 A and 4 B.	NIR 2006, p. 296
Belgium			
Total emissions excluding LUCF	106		

	Absolute difference between latest and previous submission used for the EU-15 inventory (Gg CO_2 equivalents)	Member States' explanation for recalculation	Information source of reasons for recalculations
N_2O from 1.A.2	-274	For the Flemish region, the EF used for LPG was corrected because a wrong one was used before and the emissions in the iron and steel sector are corrected after contacts with the involved industry. The N_2O emissions from the glass sector in Wallonia are newly calculated using the default emission factors of IPCC. In the iron and steel sector in Wallonia, the energy consumption was previously based partly on a bottom-up approach. A complete recalculation was made on a top-down approach by using the walloon energy balance for all years.	NIR 2006, p. 55-57
CO_2 from 1.A.3	196	The model that is used to calculate the emissions of the domestic aviation in the Flemish region (category 1.A.3.a) has undergone minor changes during this submission for all years. All emissions from road transport (category 1.A.3.b) are recalculated in the Flemish region for all years during this submission because of the use of a new model, the so-called MIMOSA-model. The emissions of navigation (category 1.A.3.d) are optimized in the Flemish region for all years during this submission. A new developed model, the so-called susatrans-model, is used.	NIR 2006, p. 55-57
CO_2 from 1.B.2	-195	To obtain a harmonisation with the Walloon region, the emissions of CO_2 in the Flemish region are newly calculated in the category 1.B.2.b, fugitive emissions of the distribution of gas. This calculation is based on the composition of the natural gas used and carried out for all years. The non-energetic emissions of CH_4 originating from the storage and transport of natural gas (category 1.B.2.b) are obtained during this submission for the complete time series (see section 3.2.6 for more detail) so no longer estimations were needed for the years 1991 to 2002.	NIR 2006, p. 55-57
N_2O from 4.D	192	In Flanders, the default emission factor for histosols is updated from 5 to 8 kg N_2O-N/kg N. Also the area has been revised for the entire time series according to region specific information (category 4.D.1). A correction of the total emissions of N_2O in the sector of agriculture is made in the CRF tables for 1990 (table 4s1 - cel C7). The formula to calculate this total was removed by mistake for this year.	NIR 2006, p. 76-77
Czech Republic			
Total emissions excluding LUCF	4 202		
CO_2 from 2.C	12 533		
CO_2 from 1.A.2	-12 522		
CH_4 from 4.A	1 598		
Denmark			
Total emissions excluding LUCF	-286		
CO_2 from 3	-180	Methods/EF/AD: A survey based on new methodologies results in new NMVOC emission estimates. The changes are mainly caused by new information on the used amounts of propane and butane as propellants.	CRF 1990, Table 8(b)
N_2O from 1.A.1	-157	Stationary: Emission factor has been updated for coal powered plants according to a study carried out for major Danish power plants. AD: Energy Statistics have been updated for the years 1990-2003.	CRF 1990, Table 8(b)
CH_4 from 4.A	149	EF: A recalculation has been performed for all years due to revised emissions factors for dairy cattle and other cattle (only heifers) because recent research has shown that the principal used feeding stuff (sugar beets) are giving higher methane conversion rates than the default value. EF: A recalculation has been performed for all years for horses due a revision of the Danish Normative feeding norm for horses lighter	CRF 1990, Table 8(b)

	Absolute difference between latest and previous submission used for the EU-15 inventory (Gg CO_2 equivalents)	Member States' explanation for recalculation	Information source of reasons for recalculations
		than 400 kg.	
Estonia			
Total emissions excluding LUCF	-851		
CH_4 from 6.A	-900	EF: DOC, wastewater production AD: Number of residents, total industrial output Replacement of the fraction of anaerobically treated wastewater. In addition the N_2O calculations.	CRF 2004, Table 8(b)
N_2O from 6.B	45	No information provided	
CH_4 from 6.B	4	EF: DOC, DOC which actually decreades AD: Disposal amounts, recovered methane amounts	CRF 2004, Table 8(b)
Finland			
Total emissions excluding LUCF	740		
CO_2 from 1.A.2	-1 888	Reallocation: process-related CO_2 emissions from iron and steel production have been reallocated from the energy sector to 2.C.1 Method: Revised and harmonised fuel classification, checking of plant level fuel codes and quantities. Method/EF: CO_2 emission factors of certain fuels have been updated (from IPCC default to country specific) Method: Oxidation factors of solid fuel and liquid fuels (from IPCC default to regional EU ETS default). Method: Correction of old wood in peat (from biomass to peat). AD: Corrections in total consumption of peat. Method/AD: Previously missing fuels (e.g. petroleum coke)	NIR 2006, p. 202
CO_2 from 2.C	1 858	2.C.1: Reallocation: process-related CO_2 emissions from iron and steel production have been reallocated from the energy sector to 2.C.1 Method: Indirect CO_2 emissions are calculated from NMVOC emissions from chemical industry and storage of chemicals, iron and steel production, secondary aluminium production, forest and food industries.	NIR 2006, p. 202
CO_2 from 1.A.1	731	Method: Revised and harmonised fuel classification, checking of plant level fuel codes and quantities. Method/EF: CO_2 emission factors of certain fuels have been updated (from IPCC default to country specific) Method: Oxidation factors of solid fuel and liquid fuels (from IPCC default to regional EU ETS default). Method: Correction of old wood in peat (from biomass to peat). AD: Corrections in total consumption of peat. Method/AD: Previously missing fuels (e.g. petroleum coke)	NIR 2006, p. 202
CO_2 from 1.A.5	238	Revised methodology for feedstocks used as fuel (removal of double counting)	NIR 2006, p. 202
France			
Total emissions excluding LUCF	-881		
CO_2 from 1.A.1	-1 673	Replacement of emissions from 3 power plants in oversea territories from 1A2 (previously misallocated) into 1A1a Updated EF from coke oven furnaces according to actual fuel consumption structure of each year	CRF 1990, Table 8(b)
PFC from 2.C.3	742	Method: New method from IAI for PFC from aluminium production (electrolysis); AD: Updated data from magnesium production industry	CRF 1990, Table 8(b)

	Absolute difference between latest and previous submission used for the EU-15 inventory (Gg CO_2 equivalents)	Member States' explanation for recalculation	Information source of reasons for recalculations
CO_2 from 1.A.4	-578	No information available	
Germany			
Total emissions excluding LUCF	-17 326		CRF 1990, Table 8(b)
CO_2 from 2.C	48 700	2.C.1: Method/EF/AD: New method for whole time series 1990 -2004, now according to IPCC Guidelines and Good Practice Guidance (process related CO_2 emissions formerly reported under 1.A.2 are now included included in 2.C.1.) 2.C.1: Method: Output of the 2.A.3 project Limestone-Balance; EF: stoichiometric EF; AD: only the limestone-input. 2.C.2: Addition in 2006, time series from 1990 to 2004.	CRF 1990, Table 8(b) NIR 2006
CO_2 from 1.A.2	-43 211	1.A.2.a: AD: Some fuels have been reassigned 1.A.2.a: reallocation: process related CO_2 emissions formerly reported under 1.A.2 are now included included in 2.C.1. 1.A.2. a-f: Method/EF/AD: 1990-2003: new because of disaggregation 1.A.2 b,e,f: AD: Fuel consumptions of the Neue Bundesländer 1990 have been calculated with the specific fuel consumption of the year 1989 and the production of 1990. 1.A.2.f: Method: separation of activity data for non-biomass and biomass fraction of waste; new CO_2 EF; AD: Recalculation from 1990 until 2004 because of corrections of input data.	CRF 1990, Table 8(b) NIR 2006
CH_4 from 4.B	-21 027	4.B.1.a: EF: recalculated using Tier 2, AD: provisional data for 2003 replaced 4.B.1.b: EF: recalculated using Tier 2AD: provisional data for 2003 replaced, animal subcategories redistributed, mature males included. 4.B.4: Method: Tier 1; EF: default 4.B.6: Method: Tier 1; EF: default; AD: animal number after 1998 recalculated; German census system changed in 1999. Horse numbers were affected after 1998. Differentiation between heavy and light horses necessary. See Dämmgen (2005). 4.B.9: Method: Tier 1; AD: provisional data for 2003 replaced.	
CH_4 from 4.A	-9 869	4.A.1a,b: EF: recalculated using Tier 2 4.A.1.b: AD: provisional data for 2003 replaced, animal subcategories redistributed, mature males included; Application of Tier 2 for dairy cattle presupposed reorganization of activity data. German census data were reformed to fir the Tier 2 methodology. Details in Dämmgen et al. (2005), chapter 4.4.2. 4.A.3: AD: animal numbers before 1999 recalculated, provisional data for 2003 replaced; German census system changed in 1999. Sheep numbers were affected before 1999. See Dämmgen (2005). 4.A.6: AD: animal number after 1998 recalculated; German census system changed in 1999. Horse numbers were affected after 1998. Differentiation between heavy and light horses necessary. See Dämmgen (2005). 4.A.8: Method: Tier 2; AD: provisional data for 2003 replaced; Application of Tier 2 for pigs presupposed reorganization of activity data. German census data were reformend to fir the Tier 2 methodology. Details in Dämmgen et al. (2005), chapter 4.4.3.	CRF 1990, Table 8(b)
CO_2 from 2.B	9.632	2.B.1: Method: EM=EFxAR; EF: Default value of 1.5 t(CO_2)/t/NH3) is applied as former EF was not documented. There is also an stoichiometric factor of 1.21 applied, resulting in an EF of 1.815 t(CO_2) / t(N); AD: AR is provided in t(N). 2.B.5: Addition of new subsources in 2006, time series from 1990 to 2004.	CRF 1990, Table 8(b)
CH_4 from 1.B.1	-5 532	EF: completeness, transparency AD: additional and new data. Consolidation and improvements for data sources, statistical and mine specific data, partially new primary data and additional data referred information.	CRF 1990, Table 8(b)
CH_4 from 6.A	4 486	No information provided.	

	Absolute difference between latest and previous submission used for the EU-15 inventory (Gg CO_2 equivalents)	Member States' explanation for recalculation	Information source of reasons for recalculations
N_2O from 1.A.3	-2 407	1990-2003: because of new consumption data of fuels, there are new Tremod values	CRF 1990, Table 8(b)
Greece			
Total emissions excluding LUCF	-677		
CH_4 from 6.A	-851	6.A.1: Method: Tier 2 for solid waste disposal on land; AD: Update of data on total population, recycle, biogas recovery and quantities of waste landfilled for some years.	CRF 1990, Table 8(b)
CO_2 from 2.A	125	2.A.2, 2.A.3: AD: Update of activity data.	CRF 1990, Table 8(b)
CO_2 from 1.A.4	100	No information provided	
Hungary			
Total emissions excluding LUCF	0		
Ireland			
Total emissions excluding LUCF	1 705		
CH_4 from 4.B	965	Method: Move to Tier 2-Cattle, more categories EF: New Emission Factors for Tier 2 and all categories AD: New Populations	CRF 1990, Table 8(b)
CO_2 from 1.A.2	279	AD: Revision of 1990 Energy data	CRF 1990, Table 8(b)
CO_2 from 1.A.4	272	AD: Revision of energy data	CRF 1990, Table 8(b)
Italy			
Total emissions excluding LUCF	8 387		
CO_2 from 1.A.2	3 968	Method: Emissions from the iron and steel sector have been revised in response to the review process. The full carbon cycle has been accounted for and emissions have been balanced between the energy and the industrial processes sectors. A complete balance of energy and carbon has been carried out.	CRF 2004, Table 8(b)
CH_4 from 6.A	2 779	Method: In response to the review process, the methane generation potential (L0) estimate has been revised. Moreover, CH_4 emissions have been estimated separately for different waste types and added up. EF: Emission factors have been revised on the basis of national information on waste composition and half time of DOC for different waste fraction. Moreover, in response to the review process the normalization factor has been applied. AD: In response to the review process, the amount of waste landfilled has been collected from 1950. Moreover, CH_4 recovered data have been revised.	CRF 2004, Table 8(b)
CO_2 from 2.C	1 778	Method: Emissions from the iron and steel sector have been revised in response to the review process. The full carbon cycle has been accounted for and emissions have been balanced between the energy and the industrial processes sectors. A complete balance of energy and carbon has been carried out.	CRF 2004, Table 8(b)
Latvia			
Total emissions excluding LUCF	542		

	Absolute difference between latest and previous submission used for the EU-15 inventory (Gg CO_2 equivalents)	Member States' explanation for recalculation	Information source of reasons for recalculations
CO_2 from 1.A.1	-1 272	AD: Main changes in estimated emissions occured due to changes in activity data, concretized statistical information was used.	CRF 1990, Table 8(b)
CO_2 from 1.A.2	1 173	AD: Main changes in estimated emissions occured due to changes in activity data, concretized statistical information was used.	CRF 1990, Table 8(b)
N_2O from 4.D	527	Method: N_2O emissions from N-fixing Crops and Crop Residue were calculated using Tier 1a method and default emission factors from IPCC GPG Table 1.16, Equation 4.28. EF: new EF for nitrogen excretion per animal AD: An error regarding use of synthetic fertilizer (kg N/yr) was identified in 1990 and was corrected in this submission AD: More activity data for crop residue calculation for the period 1990-2003 was used than previously. AD: Area of cultivated organic soils for 1990-2003 was reassessed according to national research project AD: Nitrogen excretion per head of animal and AWMS were reassessed	NIR 2006, p. 89
Lithuania			
Total emissions excluding LUCF	0		
Luxembourg			
Total emissions excluding LUCF	-49		
CO_2 from 2.C	111	No information provided	
CO_2 from 1.A.2	-109	No information provided	
HCF from 2.F	-29	No information provided	
Netherlands			
Total emissions excluding LUCF	1 259		
CO_2 from 1.A.1	758	Reallocation: Emissions from gas compressors formerly reported under 1.B.2 are now reallocated and included in 1.A.1c.	NIR 2006, p. 10-1
CH_4 from 1.B.2	-406	Method: Recalculation of emissions from oil and natural gas production based on detailed data from the industry . Reallocation: Emissions from gas compressors formerly reported under 1.B.2 are now reallocated and included in 1.A. 1c. Method: Recalculation of CH_4 emissions from gas distribution based on detailed data and EF determined by the gas distribution sector.	NIR 2006, p. 10-1
CH_4 from 4.A	203	Method: recalculation based on country-specific Tier 2 EF.	NIR 2006, p. 10-1
Poland			
Total emissions excluding LUCF	0		
Portugal			
Total emissions excluding LUCF	579		
CH_4 from 6.B	1 819	No information provided	
CH_4 from 4.B	-382	This source sector suffered substantial changes since last submission: - The time series of livestock numbers were revised in a consistent way to what was done for Enteric Fermentation emissions, and was	NIR 2006, p. 363

Comment [k1]: Erklärungen nicht im NIR gefunden

	Absolute difference between latest and previous submission used for the EU-15 inventory (Gg CO_2 equivalents)	Member States' explanation for recalculation	Information source of reasons for recalculations
		already discussed in the previous chapter. - Emission factors were improved, reducing uncertainty, as result of the use of data from the enhanced livestock population characterization and of determination of country specific production, per animal, of manure (VS); - New expert information concerning the share of each MMS and its evolution in time was used in the improvement of the emission factors; - The share of the livestock population per climate region was revised, and the trend of population in administrative regions is considered.	
N_2O from 4.B	-380	Substantial improvements were made in this source category: - Use of an enhanced livestock population, detailed by sex and age; - revision of the share of each Manure Management System (MMS) in a coherent mode to what was done for the N_2O emissions from Manure Management; - The use of an enhanced population characterization was accompanied by development of new nitrogen excretion rates, based in expert guess from technical experts in the field, and considered more representative of the national conditions.	NIR 2006, p. 373
Slovakia			
Total emissions excluding LUCF	1 249		
CO_2 from 1.A.1	-35 211	No information provided	
CH_4 from 1.A.1	-339	No information provided	
CH_4 from 1.A.4	389	No information provided	
Slovenia			
Total emissions excluding LUCF	-117		
CH_4 from 4.B	241	No information provided	
N_2O from 4.D	-156	No information provided	
CH_4 from 6.A	-155	Method: Transition from the default methodology to FOD methodology	NIR 2006, p. 159
Spain			
Total emissions excluding LUCF	3 296		
N_2O from 4.D	2 800	No information provided	
CH_4 from 4.A	-872	No information provided	
N_2O from 4.B	833	No information provided	
CO_2 from 1.A.2	504	No information provided	
Sweden			
Total emissions excluding LUCF	151		
CO_2 from 2.C	325	2.C.11: Addition: For steel production data has been added from one more plant that was earlier lacking, causing slightly higher emissions of CO_2. 2.C.11: AD: Emissions have been revised for five plants due to new information on use of dolo-mite and added carbon from scrap and	NIR 2006, p. 148

	Absolute difference between latest and previous submission used for the EU-15 inventory (Gg CO_2 equivalents)	Member States' explanation for recalculation	Information source of reasons for recalculations
		bound carbon in steel and slag products 2.C.11, 2.C.12:: EF: In order to make the Swedish emissions comparable with those from other parties, the production of steel has been reported as activity data for CO_2 in submission 2006, instead of amount of different reducing agents, causing totally changed implied emission factors. 2.C.12: reallocation: • As regards CO_2 from the iron powder producer emissions from the use of limestone has been included in CRF 2C12 instead of in CRF 2A3 as in earlier submission, in order to be consistent with emissions reported from pig iron production 2.C.12: AD: Emissions of CO_2 from one of the pig iron producers have been recalculated in sub-mission 2006 due to new activity data for 2003. 2.C.5: The whole time series has been revised for CO_2 emissions, due to more complete information and data on carbon containing raw materials and outgoing carbon in slag products from the earlier reported plant. 2.C.5: Addition: Data on combustion of batteries and coke, resulting in emissions of CO_2 from two plants, earlier not included in the inventory, has been collected and emissions has been estimated.	
CO_2 from 1.A.2	321	1.A.2a: Method: Data on coke consumption has been excluded when calculation emission of CO_2, N_2O and CH_4, since the coke is used as redusing agents and is already included in CRF 2C5. 1.A.2c: Emission factors for CO_2 for carbide furnace gas have been revised 1.A.2d: AD: New activity data, collected from a number of plants, have been added or exchanged with old data for the years 1990-2003. The revision was made due to new informa-tion directly from the plants 1.A.2e: AD: Activity data on residual fuel oil was exchanged from one plant all years except 1994, 2000 and 2002-2003, due to new information from the plant. 1.A.2f: AD: Activity data for several fuels, especially for solid and liquid fuels, and several plants has been revised. Activity data has been added or exchanged in 1990-2003, due to new information from the plant.	NIR 2006, p. 115
CH_4 from 6.A	320	Method: Two new waste categories have been included in the calculations: Construction and demolition waste (including estimated organic fraction) and Industrial (not industry specific) waste (including estimated organic fraction). Method: DOCF for deposited waste has been changed from 0.7 to 0.5 according to IPCC methodology.	NIR 2006, p. 254
United Kingdom			
Total emissions excluding LUCF	16 511		
CH_4 from 6.A	14 331	6.A.1: By far the most significant revision to the UK methane emissions inventory is the increases in estimates that result from revisions to the oxidation factors and waste composition data used within the UK model for calculating methane emissions from landfills. Across the time-series, large increases in methane emission estimates are evident from this source, compared to the previous inventory submission.	NIR 2006, Chap. 10
CO_2 from 7	2 862	No information provided	
CO_2 from 1.A.2	1 731	1.A.2f: Research as part of the Base Year review lead has lead to changes to both the total amount of lubricant assumed oxidised & the allocation of emissions to sectors, taking from road transport and adding to industrial and other transport sectors. 1.A.2f: New estimates of gas oil usage by off-road vehicles and machinery and the rail sector have been introduced and the cement industry have provided data on their own use of gas oil. In order to maintain consistency with national statistics, gas oil activity data for stationary industrial, commercial and institutional combustion plant have been reduced. 1.A.2a,f: In the latest publication of the Digest of UK Energy Statistics, both the format and the values of the available data have changed somewhat for recent years (1999-2003 data revised from previous publications).	NIR 2006, Chap. 10

	Absolute difference between latest and previous submission used for the EU-15 inventory (Gg CO_2 equivalents)	Member States' explanation for recalculation	Information source of reasons for recalculations
		1.A.2f: Driven by the development of the EU Emission Trading Scheme, improved cement industry-sourced estimates of fuel use have been used in the latest inventory cycle, which has been used to amend the DTI UK energy statistics which underestimate the use of coal in cement kilns. Re-allocations of coal use between 1A1a and 1A2f have been made for later years in the time-series, to reflect sales of coal between power generators and cement manufacturers, whilst for earlier years, coal is re-allocated between industrial sectors reporting to 1A2f. In previous versions of the GHGI, gas was assumed to be a significant fuel, but this gas use has now largely been re-allocated to other industrial sectors. The cement industry data also includes waste-derived fuels and petroleum coke. Although the revisions have no net impact on total coal or gas use, emission estimates have changed because of differences in carbon factors for different sectors and because of changes in the activity data and emissions for waste-derived fuels and petroleum coke. 1.A.2a,f: Following consultation with the operator of all UK integrated steelwork's (Corus UK Ltd), several alterations were made to the carbon balance approach to fuel transformation processes associated with steelworks.	
CO_2 from 1.A.4	-1 099	1.A.4cii: Research as part of the Base Year review lead has lead to changes to both the total amount of lubricant assumed oxidised & the allocation of emissions to sectors, taking from road transport and adding to industrial and other transport sectors. 1.A.4a,c: New estimates of gas oil usage by off-road vehicles and machinery and the rail sector have been introduced and the cement industry have provided data on their own use of gas oil. In order to maintain consistency with national statistics, gas oil activity data for stationary industrial, commercial and institutional combustion plant have been reduced. 1.A.4a,b,ci: In the latest publication of the Digest of UK Energy Statistics, both the format and the values of the available data have changed somewhat for recent years (1999-2003 data revised from previous publications). 1.A.4b,ci: Following consultation with the operator of all UK integrated steelwork's (Corus UK Ltd), several alterations were made to the carbon balance approach to fuel transformation processes associated with steelworks.	NIR 2006, Chap. 10
CO_2 from 1.B.2	-1 004	1.B.2ai,aii,ciii: EF: Changes to carbon emission factors for some combustion sources, to ensure that emissions reported via the UK GHG inventory are consistent with those reported via the EU Emissions Trading Scheme. The sector-specific splits for the 1990-1994 datasets have been re-allocated by benchmarking against the 1997 UKOOA dataset. Previously the 1990-1994 emission totals were split out based on 1995 data, but irreconcilable gaps in the 1995 and 1996 datasets have been identified that indicate that use of the 1997 dataset will provide a more accurate estimate for 1990-1994. The missing sources in 1995 and 1996 will lead to a slight under-report for GHG emissions in those years. Changes to some historic emission estimates of methane and nitrous oxide where the application of emission factors has been identified as inconsistent across the time-series.	NIR 2006, Chap. 10

Table 10.2 Main recalculations in the Member States for 2003 and Member States' explanations for recalculations given in the CRF or in the NIR

	Absolute difference between latest and previous submission used for the EU-15 inventory (Gg CO_2 equivalents)	Member States' explanation for recalculation	Information source of reasons for recalculations
Austria			
Total emissions excluding LUCF	944		
CH_4 from 6.A	-634	Update of activity data *6 A 1 Managed waste disposal on land:* The activity data (1998 to 2004) have been updated. According to the Austrian Landfill	NIR 2006, p. 297

	Absolute difference between latest and previous submission used for the EU-15 inventory (Gg CO_2 equivalents)	Member States' explanation for recalculation	Information source of reasons for recalculations
		Ordinance, the operators of landfill sites have to report their activity data annually. Based on reports received after the due date, there are minor changes of the activity data in this submission compared to the previous submission. For those years where no data were available on non-residual wastes (before 1998) extrapolation according to the GDP was used as recommended by ERT, instead of assuming the amount of non-residual wastes to be constant. Double Counting of the amount of construction waste has been corrected. Improvements of methodology: 6 A 1 Managed Waste Disposal on Land: The IPCC Tier 2 Methodology is now used instead of a country-specific one. .	
CO_2 from 1.A.4	557	Changes of 2003 activity data are based on energy balance recalculation as described in Annex 2. New pellets, wood chips and wood gasifiers stoves and boilers are considered from 2001 on. This new biomass heatings have lower VOC emissions and thus lower CH_4 emissions than conventional boiler types. AD: Coke oven coke net calorific values have been revised from 1990 to 2003. AD: Consumption of gasworks gas 1990 to 1995 is additionally considered in subcategory 1 A 4. Stationary: AD: Natural gas consumption has been shifted from or to other subcategories of *1 A Fuel Consumption* according to the updated energy balance. Consumption of gas works gas has been additionally considered. Solid biomass consumption has been revised from the year 2000 to 2003 according to changes of the national energy balance. EF: The Natural gas CO_2 emission factor has been changed from 55 t/TJ to 55.4 t/TJ for the whole period by means of calculations based on the chemical specification. Industrial waste CO_2 emission factors are now based on IPCC-default values (104.17 kg/TJ) whereas in the previous submission the values where based on country specific expert guess (10 to 50 kg/TJ). Other Sectors: Consideration of "new" pellets, wood chips, fuel wood heating technologies from 2001 on. This leads to lower CH_4 emissions from combustion of biomass.	NIR 2006, p.97
HFC from 2.F	-443	*2 F Consumption of Halocarbons and SF_6:* HFC emissions from the sub-category 2 Foam Blowing have been recalculated incorporating the results from a new study on HFC used in foam blowing. The following study was used: Obernosterer R., Smutny R., Jäger E., Merl A. (2004): HFKW Gase in Dämmschäumen des Bauwesens. Umweltbundesamt, Internal Report HFC emissions from disposal have been estimated for the sub-category 1 Refrigeration and Air conditioning equipment. Method: HFC emissions from the sub-categories 4 Aerosols/Metered dose inhalers and 5 Solvents have been added to the inventory.	NIR 2006, p. 295
Belgium			
Total emissions excluding LUCF	-189		
CO_2 from 1.A.4	524	1.A.4.b: In Wallonia, the walloon energy balance in 2003 was recalculated in the residential sector. The emission factors of CO_2 used to calculate the energy related emissions for the Brussels region have been harmonized with the emission factors used in Flanders and Wallonia. 1.A.4.c: Some small corrections are made in the Flemish region for all years on the model used to calculate the emissions of the fisheries.	NIR 2006, p. 55-57
CO_2 from 2.B	426	In the Walloon region the process emissions of CO_2 from the ceramic production are newly added in this submission for the complete time series with an emission factor based on the emission trading data in 2004. In the iron and steel sector, the CO_2 emission factor in the basic oxygen furnace was recalculated with the emission trading data in 2004, and the complete time series was recalculated in the Walloon region. The CO_2 emissions coming from the use of lubricants and solvents in Wallonia are newly included for all the time series. Contrary to the previous submission the emissions of CO_2 from the flaring activities in the chemical industry are allocated to the	NIR 2006, p. 64-65

	Absolute difference between latest and previous submission used for the EU-15 inventory (Gg CO_2 equivalents)	Member States' explanation for recalculation	Information source of reasons for recalculations
		category 2.B.5. instead of category 6.C (as described in the IPCC Good Practice Guidance) because these emissions are also included in the surveys which are carried out on a yearly basis by the chemical federation in cooperation with the Vito and because it's difficult to take out these emissions (Flemish region).	
CH_4 from 6.D	-290	In the category 6.D the emissions of the composting are recalculated for the complete time series by using a much lower emission factor 2,4 instead of 20 kg CH_4/ton compost. This lower emission factor is based on monitoring results carried out in the Netherlands.	NIR 2006, p. 96
Czech Republic			
Total emissions excluding LUCF	2 151		
CO_2 from 2.A	1 438	No information provided.	
CH_4 from 4.A	873	No information provided	
HFC from 2.F	590	No information provided	
Denmark			
Total emissions excluding LUCF	56		
CO_2 from 1.A.2	294	Stationary: AD:Energy Statistics have been updated for the years 1990-2003. 1.A.2f: AD: A complete revision of the 1985-2003 time series of fuel use and emissions has been made using results from a specific Danish non road research project. The latter project directly produces new results for agriculture, forestry, industry, residential and small boats.	CRF 1990, Table 8(b)
CO_2 from 1.A.3	-181	1.A.3a: AD: Small changes of 2001-2002 fuel use and emissions have been made for large aircraft, based on changes in representative aircraft groupings. For 2003 and error in jet fuel use has been corrected, thus influencing the total emission figures. For 2002 and 2003 errors in aviation gasoline fuel use have been corrected, thus influencing the total emission figures. 1.A.3b: AD: A revision of the 1985-2003 time series of emissions has been made based on revised fleet and mileage data from the Danish Road Directorate, and corrections of road transport gasoline fuel use according to a new gasoline fuel use estimate for non road machinery. 1.A.3d: A complete revision of the 1985-2003 time series of fuel use and emissions has been made for small boats, using results from a specific Danish non road research project. The latter project directly produces new results for agriculture, forestry, industry, residential and small boats.	CRF 1990, Table 8(b)
N_2O from 1.A.1	-157	EF: Emission factor has been updated for coal powered plants according to a study carried out for major Danish power plants. Stationary: AD:Energy Statistics have been updated for the years 1990-2003.	CRF 1990, Table 8(b)
Estonia			
Total emissions excluding LUCF	-200		
CH_4 from 6.B	-251	EF: DOC, DOC which actually decreades AD: Disposal amounts, recovered methane amounts	CRF 2004, Table 8(b)
N_2O from 6.B	36	No information provided	
CH_4 from 6.A	11	EF: DOC, wastewater production	CRF 2004, Table 8(b)

	Absolute difference between latest and previous submission used for the EU-15 inventory (Gg CO_2 equivalents)	Member States' explanation for recalculation	Information source of reasons for recalculations
		AD: Number of residents, total industrial output Replacement of the fraction of anaerobically treated wastewater. In addition the N_2O calculations.	
Finland			
Total emissions excluding LUCF	150		
CO_2 from 2.C	2 459	2.C.1: Reallocation: process-related CO_2 emissions from iron and steel production have been reallocated from the energy sector to 2.C.1 Method: Indirect CO_2 emissions are calculated from NMVOC emissions from chemical industry and storage of chemicals, iron and steel production, secondary aluminium production, forest and food industries.	NIR 2006, p. 202
CO_2 from 1.A.1	418	Revision of classifications (NACE, fuels); correction in plant level technical data and classifications	
CO_2 from 1.A.2	-2 169	Reallocation: process-related CO_2 emissions from iron and steel production have been reallocated from the energy sector to 2.C.1 Method: Revised and harmonised fuel classification, checking of plant level fuel codes and quantities. Method/EF: CO_2 emission factors of certain fuels have been updated (from IPCC default to country specific) Method: Oxidation factors of solid fuel and liquid fuels (from IPCC default to regional EU ETS default). AD: Corrections in total consumption of peat.	NIR 2006, p. 202
CO_2 from 1.A.5	438	Reallocation: process-related CO_2 emissions from iron and steel production have been reallocated from the energy sector to 2.C.1 Method: Revised and harmonised fuel classification, checking of plant level fuel codes and quantities. Method/EF: CO_2 emission factors of certain fuels have been updated (from IPCC default to country specific) Method: Oxidation factors of solid fuel and liquid fuels (from IPCC default to regional EU ETS default). AD: Corrections in total consumption of peat.	NIR 2006, p. 202
CO_2 from 1.B	-488		
France			
Total emissions excluding LUCF	3 925		
CO_2 from 1.A.4	3 020	Updated energy consumptions (2003)	CRF 2003, Table8(b)
PFC from 2.C.3	1 417	New method from IAI for PFC from aluminium production (electrolysis). Updated data from magnesium production industry	CRF 2003, Table8(b)
N_2O from 4.D	-1 328	Updated animal population and sludge spreading (2003). Removal of natural N_2O emissions from soil	CRF 2003, Table8(b)
Germany			
Total emissions excluding LUCF	6 871		
CO_2 from 2.C	43 229	2.C.1: Method/EF/AD: New method for whole time series 1990 -2004, now according to IPCC Guidelines and Good Practice Guidance (process related CO_2 emissions formerly reported under 1.A.2 are now included included in 2.C.1.) 2.C.1: Method: Output of the 2.A.3 project Limestone-Balance; EF: stoichiometric EF; AD: only the limestone-input. 2.C.2: Addition in 2006, time series from 1990 to 2004.	CRF 2003, Table8(b) NIR 2006
CO_2 from 1.A.2	-32 940	1.A.2.a: AD: Some fuels have been reassigned 1.A.2.a: reallocation: process related CO_2 emissions formerly reported under 1.A.2 are now included included in 2.C.1.	CRF 2003, Table8(b) NIR 2006

	Absolute difference between latest and previous submission used for the EU-15 inventory (Gg CO_2 equivalents)	Member States' explanation for recalculation	Information source of reasons for recalculations
		1.A.2. a-f: Method/EF/AD: 1990-2003: new because of disaggregation 1.A.2 b,e,f: AD: Fuel consumptions of the Neue Bundesländer 1990 have been calculated with the specific fuel consumption of the year 1989 and the production of 1990. 1.A.2.f: Method: separation of activity data for non-biomass and biomass fraction of waste; new CO_2 EF; AD: Recalculation from 1990 until 2004 because of corrections of input data.	
CH_4 from 4.B	-17 751	4.B.1.a: EF: recalculated using Tier 2, AD: provisional data for 2003 replaced 4.B.1.b: EF: recalculated using Tier 2; AD: provisional data for 2003 replaced, animal subcategories redistributed, mature males included. 4.B.4: Method: Tier 1; EF: default 4.B.6: Method: Tier 1; EF: default; AD: animal number after 1998 recalculated; German census system changed in 1999. Horse numbers were affected after 1998. Differentiation between heavy and light horses necessary. See Dämmgen (2005). 4.B.9: Method: Tier 1; AD: provisional data for 2003 replaced.	CRF 2003, Table8(b)
CO_2 from 2.B	12 725	2.B.1: Method: EM=EFxAR; EF: Default value of 1.5 t(CO_2)/t/NH3) is applied as former EF was not documented. There is also an stoichiometric factor of 1.21 applied, resulting in an EF of 1.815 t(CO_2) / t(N); AD: AR is provided in t(N). 2.B.5: Addition of new subsources in 2006, time series from 1990 to 2004.	CRF 2003, Table8(b)
CH_4 from 4.A	-6 096	4.A.1a,b: EF: recalculated using Tier 2 4.A.1.b: AD: provisional data for 2003 replaced, animal subcategories redistributed, mature males included; Application of Tier 2 for dairy cattle presupposed reorganization of activity data. German census data were reformed to fir the Tier 2 methodology. Details in Dämmgen et al. (2005), chapter 4.4.2. 4.A.3: AD: animal numbers before 1999 recalculated, provisional data for 2003 replaced; German census system changed in 1999. Sheep numbers were affected before 1999. See Dämmgen (2005). 4.A.6: AD: animal number after 1998 recalculated; German census system changed in 1999. Horse numbers were affected after 1998. Differentiation between heavy and light horses necessary. See Dämmgen (2005). 4.A.8: Method: Tier 2; AD: provisional data for 2003 replaced; Application of Tier 2 for pigs presupposed reorganization of activity data. German census data were reformend to fir the Tier 2 methodology. Details in Dämmgen et al. (2005), chapter 4.4.3.	CRF 2003, Table8(b)
CO_2 from 1.A.1	-4 541	1.A.1.a: Method: new since 1990: The category Solid Fuels includes the CO_2-Emissions of SO2-Scrubbing by using of limestone; EF: The IEF in this category is influenced of this new method. 1.A.1.a-c: Method: separation of activity data for non-biomass and biomass fraction of waste; EF: new; AD: Recalculation from 1990 until 2004 because of corrections of input data	CRF 2003, Table8(b)
CH_4 from 1.B.1	3 257	EF: completeness, transparency AD: additional and new data. consolidation and improvements for data sources, statistical and mine specific data, partially new primary data and additional data referred information.	CRF 2003, Table8(b)
N_2O from 1.A.3	-2 846	EF: 1990-2003: because of new consumption data of fuels, there are new Tremod values	CRF 2003, Table8(b)
CH_4 from 6.A	1 949	Revised Tier 2 methodology including industrial waste.	NIR 2006, p. 357
N_2O from 4.D	1 183	4.D.1 (mineral fertilizer): AD: provisional data for 2003 replaced 4.D.1 (animal waste): AD: N returned to soil recalculated for all mammals, imported manure considered; Poultry manure imported from the Netherlands is considered. See Dämmgen et al. (2005), chapter 4.12. 4.D.1 (sewage sludge): AD: For most Federal states, no data are available before 2001. 4.D.3 (deposition): AD: NH3 and NO emissions recalculated for all mammals, additional sources considered	CRF 2003, Table8(b)

	Absolute difference between latest and previous submission used for the EU-15 inventory (Gg CO_2 equivalents)	Member States' explanation for recalculation	Information source of reasons for recalculations
		4.D.3 (leaching): AD: NH3, N_2O, NO and N2 emissions recalculated for all mammals, additional sources considered	
Greece			
Total emissions excluding LUCF	-358		
HFC from 2.F	1 953	Emissions from the consumption of halocarbons and SF_6 have been recalculated because of the availability of updated information regarding the penetration rate of HFC in the Greek market and the estimation of emissions from "new' sources (commercial refrigeration and SF_6 from electrical equipment).	NIR 2006, p. 120
CH_4 from 6.A	-1548	Tier 2 for solid waste disposal on land Update of activity data CH_4 emissions from sludge disposal	NIR 2006, p. 190
HFC from 2.E	-534	Emissions from the consumption of halocarbons and SF_6 have been recalculated because of the availability of updated information regarding the penetration rate of HFC in the Greek market and the estimation of emissions from "new' sources (commercial refrigeration and SF_6 from electrical equipment).	NIR 2006, p. 120
Hungary			
Total emissions excluding LUCF	1		
HFC from 2.F	1		
Ireland			
Total emissions excluding LUCF	806		
CH_4 from 4.B	822	Method: Move to Tier 2-Cattle, more categories EF: New Emission Factors for Tier 2 and all categories AD: New Populations	CRF 2003, Table 8(b)
CH_4 from 1.B.2	559	No information provided	
CH_4 from 6.A	-333	AD: New populations statistics	CRF 2003, Table 8(b)
Italy			
Total emissions excluding LUCF	7 655		
CH_4 from 6.A	6 855	Method: In response to the review process, the methane generation potential (L0) estimate has been revised. Moreover, CH_4 emissions have been estimated separately for different waste types and added up. EF: Emission factors have been revised on the basis of national information on waste composition and half time of DOC for different waste fraction. Moreover, in response to the review process the normalization factor has been applied. AD: In response to the review process, the amount of waste landfilled has been collected from 1950. Moreover, CH_4 recovered data have been revised.	CRF 2004, Table 8(b)
CO_2 from 1.A.1	-2 291	Method: Emissions from the iron and steel sector have been revised in response to the review process. The full carbon cycle has been accounted for and emissions have been balanced between the energy and the industrial processes sectors. A complete balance of energy and carbon has been carried out.	CRF 2004, Table 8(b)

	Absolute difference between latest and previous submission used for the EU-15 inventory (Gg CO_2 equivalents)	Member States' explanation for recalculation	Information source of reasons for recalculations
CH_4 from 6.B	869	6.B.1: AD: Activity data related to pulp and paper industry have been revised. Moreover, for the year 2003, wastewater production from leather industry has been updated. 6.B.2: In response to the review process, it has been assumed that 95% of wastewater is treated aerobically and 5% anaerobically.	CRF 2004, Table 8(b)
CO_2 from 1.A.4	856	Method: Emissions from the iron and steel sector have been revised in response to the review process. The full carbon cycle has been accounted for and emissions have been balanced between the energy and the industrial processes sectors. A complete balance of energy and carbon has been carried out.	CRF 2004, Table 8(b)
Latvia			
Total emissions excluding LUCF	176		
N_2O from 4.D	254	AD: An error regarding use of synthetic fertilizer (kg N/yr) was identified in 1990 and was corrected in this submission AD: More activity data for crop residue calculation for the period 1990-2003 was used than previously. AD: Area of cultivated organic soils for 1990-2003 was reassessed according to national research project AD: Nitrogen excretion per head of animal and AWMS were reassessed Method: N_2O emissions from N-fixing crops and crop residue were calculated using Tier 1a method and default emission factors from IPCC GPG Table 1.16	NIR 2006, p. 89
CO_2 from 1.A.2	162	AD: Main changes in estimated emissions occured due to changes in activity data, concretized statistical information was used.	CRF 2003, Table 8(b)
CO_2 from 1.A.1	-149	AD: Main changes in estimated emissions occured due to changes in activity data, concretized statistical information was used.	CRF 2003, Table 8(b)
CH_4 from 6.A	-169	In waste disposal sector landfill classification till year 1990 are changed from unmanaged sites to uncategorised and managed. Previous expert estimation was not correct, because biggest landfills were managed in that time. Other landfills are estimated like uncategorised, because inventory agency do not have feasible information about old small landfills profiles. Some corrections are done in disposed amounts for all inventory years (1990- 2004). Now data about disposed amounts must be similar to data, which are reported to EUROSTAT and European Environment agency. First time First Order Decay (Tier2) method is used for methane calculation and emissions decrease in all years considerably.	NIR 2006, p. 106
Lithuania			
Total emissions excluding LUCF	0		
Luxembourg			
Total emissions excluding LUCF	156		
N_2O from 4.D	146	No information provided	
CO_2 from 6.C	10	No information provided	
Netherlands			
Total emissions excluding LUCF	518		
PFC from 2.C.3	-764	AD: recalculations based on new data from the industry	NIR 2006, p. 10-1
CO_2 from 1.A.1	768	Reallocation: Emissions from gas compressors formerly reported under 1.B.2 are now reallocated and included in 1.A.1c.	NIR 2006, p. 10-1
PFC from 2.C.3	-764		

	Absolute difference between latest and previous submission used for the EU-15 inventory (Gg CO_2 equivalents)	Member States' explanation for recalculation	Information source of reasons for recalculations
CO_2 from 1.A.4	468	Method: Recalculation of CH_4 emissions from gas distribution based on detailed data and EF determined by the gas distribution sector. (1.B.2?)	NIR 2006, p. 10-1
Poland			
Total emissions excluding LUCF	-1 443		
CO_2 from 1.A.3	-3 255	Addition: New source categories included.	NIR 2006, p. 32
CH_4 from 6.A	-2 926	Addition: New source categories included.	NIR 2006, p. 32
CO_2 from 1.A.2	-2 246	Addition: New source categories included.	NIR 2006, p. 32
CO_2 from 1.A.5	2 112	Addition: New source categories included.	NIR 2006, p. 32
CO_2 from 2.B	1 563	Addition: New source categories included.	NIR 2006, p. 32
CH_4 from 1.B.1	1 326	Addition: New source categories included.	NIR 2006, p. 32
Portugal			
Total emissions excluding LUCF	2 525	No information provided	
CH_4 from 6.B	1 562	6.B.1: Method: Use of a methodology in accordance with the IPCC Good Pratice Guidelines; AD: Estimate of the full time series of quantities of wastewater generated and characteization of the treatment systems in use 6.B.2: Method: First time estimate of CH_4 emissions from anaerobic treatment of sludges; EF: Revision of MCF values for each treatment system; AD: Revision of the share of treatment systems and better knowledge of trends	CRF 2004, Table 8(b)
N_2O from 4.B	-449	EF: Revision of the share of MMS for all animal types and consideration of a time trend. Revision of the quantity of manure that is added to soil as fertilizer; Following updated expert guess from the Ministry of Agriculture AD: Revision of Livestock numbers for some animal types: horses, assinines, poultry and other animals	CRF 2004, Table 8(b)
CH_4 from 4.A	419	EF: Use of tier 2 EF determination for all animal classes except horses, mules and donkeys, and considering country-specific data AD: Revision of Livestock numbers for some animal types: horses, assinines, poultry and other animals	CRF 2004, Table 8(b)
Slovakia			
Total emissions excluding LUCF	-617		
CO_2 from 1.A.4	-291	No information provided	
CO_2 from 1.A.2	-202	No information provided	
CO_2 from 1.A.1	-193	No information provided	
Slovenia			
Total emissions excluding LUCF	-137		
CH_4 from 4.B	304	No information provided.	
CH_4 from 6.A	-183	Method: Transition from the default methodology to FOD methodology	NIR 2006, p. 159
N_2O from 4.D	-101	No information provided.	
Spain			
Total emissions	5882		

	Absolute difference between latest and previous submission used for the EU-15 inventory (Gg CO_2 equivalents)	Member States' explanation for recalculation	Information source of reasons for recalculations
excluding LUCF			
CO_2 from 1.A.4	422	No information provided	
CO_2 from 1.A.4	1 271	No information provided	
CH_4 from 4.A	-924	No information provided	
N_2O from 4.B	1 312	No information provided	
N_2O from 4.D	3 726	No information provided	
CH_4 from 6.B	405	No information provided	
Sweden			
Total emissions excluding LUCF	352		
N_2O from 1.A.3	-501	1.A.3a: Activity data on number LTOs has been revised for N_2O 1990-2003. 1.A.3b: Method/EF: implementation of the new emission model ARTEMIS 1.A.3c: New activity data and emission data from the Swedish Railroad Administration 1990-2003 have been added. 1.A.3d: A new model for estimating activity data for leisure boats 1990-2003, has been used. resulting in about 60 % lower gasoline consumption for all years. 1.A.3b,d,e: The diesel consumption in the allocation model 1990-2003 has been adjusted due to new activity data from the road transportation sector and the introduction of the sub-sector fishery.	NIR 2006, p. 112
CO_2 from 1.A.3	-386	1.A.3c: New activity data and emission data from the Swedish Railroad Administration 1990-2003 have been added. 1.A.3d: A new model for estimating activity data for leisure boats 1990-2003, has been used. resulting in about 60 % lower gasoline consumption for all years. 1.A.3b,d,e: The diesel consumption in the allocation model 1990-2003 has been adjusted due to new activity data from the road transportation sector and the introduction of the sub-sector fishery.	NIR 2006, p. 112
CH_4 from 6.A	348	AD: A new report on content of Swedish household waste has been published, which has resulted in updated values for DOC for household waste 1996-2004. AD: Data on deposited sludge from wastewater handling 2003 has been adjusted. AD: New data on deposited sludge from the pulp industry (reference year 2004) has been available and used. Method: Two new waste categories have been included in the calculations: Construction and demolition waste (including estimated organic fraction) and Industrial (not industry specific) waste (including estimated organic fraction). Method: DOCF for deposited waste has been changed from 0.7 to 0.5 according to IPCC methodology.	NIR 2006, p. 249
United Kingdom			
Total emissions excluding LUCF	6 933		
CH_4 from 6.A	6 979	6.A.1: By far the most significant revision to the UK methane emissions inventory is the increases in estimates that result from revisions to the oxidation factors and waste composition data used within the UK model for calculating methane emissions from landfills.	NIR 2006, Chap. 10
CO_2 from 1.A.1	-5 208	1.A.1a: Research as part of the Base Year review has lead to changes to both the total amount of lubricant assumed oxidised & the allocation of emissions to sectors, taking from road transport and adding to industrial and other transport sectors.	NIR 2006, Chap. 10

	Absolute difference between latest and previous submission used for the EU-15 inventory (Gg CO_2 equivalents)	Member States' explanation for recalculation	Information source of reasons for recalculations
		1.A.1a,b,cii: In the latest publication of the Digest of UK Energy Statistics, both the format and the values of the available data have changed somewhat for recent years (1999-2003 data revised from previous publications). 1.A.1a: Driven by the development of the EU Emission Trading Scheme, improved cement industry-sourced estimates of fuel use have been used in the latest inventory cycle, which has been used to amend the DTI UK energy statistics which underestimate the use of coal in cement kilns. Re-allocations of coal use between 1A1a and 1A2f have been made for later years in the time-series, to reflect sales of coal between power generators and cement manufacturers, whilst for earlier years, coal is re-allocated between industrial sectors reporting to 1A2f. In previous versions of the GHGI, gas was assumed to be a significant fuel, but this gas use has now largely been re-allocated to other industrial sectors. The cement industry data also includes waste-derived fuels and petroleum coke. Although the revisions have no net impact on total coal or gas use, emission estimates have changed because of differences in carbon factors for different sectors and because of changes in the activity data and emissions for waste-derived fuels and petroleum coke. 1.A.1a: Updated information from process operators regarding scrap tyre use in power generation in recent years has lead to an increase in the estimated emissions for IPCC Sector 1A1a of 14 ktC in 2003. 1.A.1ci: Following consultation with the operator of all UK integrated steelwork's (Corus UK Ltd), several alterations were made to the carbon balance approach to fuel transformation processes associated with steelworks. Several re-allocations have been made between IPCC sectors 1.A.1cii: EF: Changes to carbon emission factors for some combustion sources, to ensure that emissions reported via the UK GHG inventory are consistent with those reported via the EU Emissions Trading Scheme. The sector-specific splits for the 1990-1994 datasets have been re-allocated by benchmarking against the 1997 UKOOA dataset. Previously the 1990-1994 emission totals were split out based on 1995 data, but irreconcilable gaps in the 1995 and 1996 datasets have been identified that indicate that use of the 1997 dataset will provide a more accurate estimate for 1990-1994. The missing sources in 1995 and 1996 will lead to a slight under-report for GHG emissions in those years. Changes to some historic emission estimates of methane and nitrous oxide where the application of emission factors has been identified as inconsistent across the time-series.	
CO_2 from 1.A.4	4 303	1.A.4cii: Research as part of the Base Year review lead has lead to changes to both the total amount of lubricant assumed oxidised & the allocation of emissions to sectors, taking from road transport and adding to industrial and other transport sectors. 1.A.4a,c: New estimates of gas oil usage by off-road vehicles and machinery and the rail sector have been introduced and the cement industry have provided data on their own use of gas oil. In order to maintain consistency with national statistics, gas oil activity data for stationary industrial, commercial and institutional combustion plant have been reduced. 1.A.4a,b,ci: In the latest publication of the Digest of UK Energy Statistics, both the format and the values of the available data have changed somewhat for recent years (1999-2003 data revised from previous publications). 1.A.4b,ci: Following consultation with the operator of all UK integrated steelwork's (Corus UK Ltd), several alterations were made to the carbon balance approach to fuel transformation processes associated with steelworks.	NIR 2006, Chap. 10
CO_2 from 7	3 277	No information provided	
CO_2 from 1.A.2	-1 569	1.A.2f: Research as part of the Base Year review lead has lead to changes to both the total amount of lubricant assumed oxidised & the allocation of emissions to sectors, taking from road transport and adding to industrial and other transport sectors. 1.A.2f: New estimates of gas oil usage by off-road vehicles and machinery and the rail sector have been introduced and the cement industry have provided data on their own use of gas oil. In order to maintain consistency with national statistics, gas oil activity data for stationary industrial, commercial and institutional combustion plant have been reduced. 1.A.2a,f: In the latest publication of the Digest of UK Energy Statistics, both the format and the values of the available data have changed somewhat for recent years (1999-2003 data revised from previous publications). 1.A.2f: Driven by the development of the EU Emission Trading Scheme, improved cement industry-sourced estimates of fuel use have	NIR 2006, Chap. 10

	Absolute difference between latest and previous submission used for the EU-15 inventory (Gg CO_2 equivalents)	Member States' explanation for recalculation	Information source of reasons for recalculations
		been used in the latest inventory cycle, which has been used to amend the DTI UK energy statistics which underestimate the use of coal in cement kilns. Re-allocations of coal use between 1A1a and 1A2f have been made for later years in the time-series, to reflect sales of coal between power generators and cement manufacturers, whilst for earlier years, coal is re-allocated between industrial sectors reporting to 1A2f. In previous versions of the GHGI, gas was assumed to be a significant fuel, but this gas use has now largely been re-allocated to other industrial sectors. The cement industry data also includes waste-derived fuels and petroleum coke. Although the revisions have no net impact on total coal or gas use, emission estimates have changed because of differences in carbon factors for different sectors and because of changes in the activity data and emissions for waste-derived fuels and petroleum coke. 1.A.2a,f: Following consultation with the operator of all UK integrated steelwork's (Corus UK Ltd), several alterations were made to the carbon balance approach to fuel transformation processes associated with steelworks.	
N_2O from 1.A.1	-1 497	1A1a: The emission factors for N_2O emissions from coal and natural gas combustion in this sector have been changed due to revisions in the time-series of the fuel calorific values. This has lead to a significant reduction in N_2O emission estimates from this source across the time-series. 1A1cii: Emissions from offshore own gas use in the oil & gas sector have been revised across the time-series due to changes to the default emission factors applied to operator activity data. This has reduced emission estimates from this sector across the time-series.	NIR 2006, Chap. 10
CO_2 from 1.A.3	1.047	1.A.3.b,d: Activity data/Reallocation: review of lubricant use: changes to both the total amount of lubricant assumed oxidised and the allocation of emissions to industrial sectors 1.A.3.c,d,e: New estimates of gas oil usage by off-road vehicles and machinery and the rail sector 1.A.3.a,b: Inclusion of emissions from UK Overseas Territories	NIR 2006, Chap. 10

10.2 Implications for emission levels

Table 10.3 provides the differences in total EU-15 GHG emissions between the latest submission and the previous submission in absolute and relative terms. The table shows that due to recalculations, total EU-15 1990 GHG emissions excluding LUCF have increased in the latest submission compared to the previous submission by 13.885 Gg (+ 0.3 %). EU-15 GHG emissions for 2003 increased 36.226 Gg (+ 0.9 %) due to recalculations.

Table 10.3 Overview of recalculations of EU-15 total GHG emissions (difference between latest submission and previous submission in Gg CO_2 equivalents)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total CO_2 equivalent emissions including LULUCF (absolute)	32.080	35.734	44.749	40.091	31.787	36.541	44.402	49.651	45.397	55.693	58.504	52.390	65.396	63.973
Total CO_2 equivalent emissions including LULUCF (percent)	0,8%	0,9%	1,1%	1,0%	0,8%	0,9%	1,1%	1,3%	1,2%	1,5%	1,5%	1,4%	1,7%	1,7%
Total CO_2 equivalent emissions excluding LULUCF (absolute)	13.885	18.120	17.729	20.612	18.501	14.873	19.881	21.560	23.707	27.724	28.838	27.014	28.376	36.226
Total CO_2 equivalent emissions excluding LULUCF (percent)	0,3%	0,4%	0,4%	0,5%	0,5%	0,4%	0,5%	0,5%	0,6%	0,7%	0,7%	0,7%	0,7%	0,9%

Table 10.4 provides an overview of recalculations for the EU-15 key source categories for 1990 and 2003 (see Section 1.5 for information on identification of EU-15 key sources). The table shows that the largest recalculations in absolute terms were made in the Key Source 1.A.2: 'Manufacturing Industries' (- 37.423 Gg in 1990 and - 34.235 Gg in 2003). This was mainly due to the reallocation of German process related CO_2 emissions from iron and steel production from source category 1A2 to 2C1.

Table 10.5 and Table 10.6 give an overview of absolute and percentage changes of Member States' emissions due to recalculations for 1990 and 2003. Large recalculations in absolute terms were made in Germany and the UK. In relative terms, the highest recalculations were made by Portugal.

Table 10.4 Recalculations for the EU-15 key source categories 1990 and 2003 (difference between latest submission and previous submission in Gg of CO_2 equivalents and in percentage)

Greenhouse Gas Source Categories	Gas	Recalculations 1990		Recalculations 2003	
		(Gg CO_2 equivalents)	(%)	(Gg CO_2 equivalents)	(%)
1.A.1. Energy Industries	CO_2	-1208	-0.1%	-634	-0.1%
1.A.1. Energy Industries	N_2O	-770	-5.8%	-1943	-12.8%
1.A.2. Manufacturing Industries	CO_2	-37423	-5.8%	-34235	-5.9%
1.A.3. Transport	CO_2	-378	-0.1%	795	0.1%
1.A.3. Transport	CH_4	-181	-3.9%	-45	-1.8%
1.A.3. Transport	N_2O	-2441	-23.4%	-3028	-12.4%
1.A.4. Other Sectors	CO_2	-870	-0.1%	11582	1.8%
1.A.4. Other Sectors	CH_4	32	0.3%	7	0.1%
1.A.5. Other	CO_2	238	1.1%	392	5.0%
1.B.1. Solid Fuels	CH_4	-5584	-10.8%	3848	24.9%
1.B.2. Oil and Natural Gas	CH_4	189	0.6%	1203	5.1%
2.A. Mineral Products	CO_2	-507	-0.5%	-1126	-1.0%
2.B. Chemical Industry	CO_2	10267	62.0%	13767	94.8%
2.B. Chemical Industry	N_2O	283	0.3%	903	2.0%
2.C. Metal Production	CO_2	52928	212.2%	45733	200.6%
2.C. Metal Production	PFC	900	7.2%	610	17.9%
2.C. Metal Production	SF_6	-358	-16.6%	-279	-9.2%
2.E. Production of Halocarbons and SF_6	HFC	849	3.2%	-1504	-16.3%
2.F. Consumption of Halocarbons and SF_6	HFC	-10	-1.8%	2118	5.2%
2.E. Production of Halocarbons and SF_6	PFC	440	6.7%	-334	-5.6%
2.F. Consumption of Halocarbons and SF_6	SF_6	440	6.7%	-334	-5.6%
4.A. Enteric Fermentation	CH_4	-10085	-6.9%	-6196	-4.7%
4.B. Manure Management	CH_4	-20814	-31.9%	-17823	-28.8%
4.B. Manure Management	N_2O	790	3.2%	1113	5.1%
4.D. Agricultural Soils	N_2O	3866	1.7%	4317	2.2%
6.A. Solid Waste Disposal on Land	CH_4	20695	18.1%	13834	18.8%
6.B. Waste-water Handling	CH_4	2158	20.6%	2150	26.9%
6.B. Waste incineration	CO_2	-1	0.0%	475	15.8%

Note: Many of these source categories are more aggregated than the EU-15 key source categories identified in Section 1.5 because the more detailed data was not estimated in the 2003 inventory.

Table 10.4 Contribution of Member States to EU-25 and EU-15 recalculations of total GHG emissions without LULUCF for 1990–2003 (difference between latest submission and previous submission Gg of CO_2 equivalents)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Austria	371	335	222	77	51	59	313	84	75	381	180	258	409	944
Belgium	106	114	389	36	-308	34	-122	-191	138	584	-284	273	-258	-189
Denmark	-286	-374	-356	-562	-711	-386	-393	-316	-144	-144	-137	-31	-86	56
Finland	740	-204	55	1.608	541	-30	389	-37	-633	-722	-187	-364	324	150
France	-881	-3.289	-2.120	-1.139	-1.966	-1.127	-138	-1.159	316	2.381	1.018	-2.069	2.561	3.925
Germany	-17.326	-9.311	-10.225	-7.865	-7.925	-8.023	-5.706	-3.557	-3.104	2.332	6.162	7.083	3.430	6.871
Greece	-677	-867	-537	-1.101	-1.281	-1.296	-1.208	-1.157	-1.259	-695	-571	-299	-541	-358
Ireland	1.705	664	450	585	682	742	929	886	1.050	474	-240	-191	-400	806
Italy	8.387	8.278	9.262	8.470	9.074	5.078	6.369	6.524	7.872	5.539	3.268	5.194	6.852	7.655
Luxembourg	-49	273	258	270	-177	-56	-43	-11	107	107	168	171	153	156
Netherlands	1.259	1.676	1.488	1.629	1.411	1.106	707	1.495	887	744	559	652	1.411	518
Portugal	579	873	941	933	1.330	1.653	1.442	1.885	2.018	1.850	2.031	2.475	2.491	2.525
Spain	3.296	3.026	2.176	2.443	3.009	3.261	3.996	3.786	4.327	4.739	3.770	5.241	3.472	5.882
Sweden	151	316	343	181	228	469	376	175	28	10	1.106	783	589	352
UK	16.511	16.611	15.386	15.049	14.544	13.388	12.970	13.155	12.029	10.143	11.994	7.839	7.969	6.933
Cyprus														
Czech Republic	4.202	5.364	2.176	2.362	1.583	1.321	866	1.034	1.527	1.643	1.534	1.497	1.250	2.151
Estonia	-851	-271	-85	-333	-314	-302	-576	-778	-680	-553	-466	-141	-165	-200
Hungary	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Latvia	542	-216	331	271	-1.048	-151	-38	-156	17	113	-11	-72	-39	176
Lithuania	0	2.077	1.952	1.826	1.701	1.575	1.449	1.324	0	0	0	0	0	0
Malta														
Poland	0	0	0	0	0	0	0	0	0	0	-450	-15	-7	-1.443
Slovakia	1.249	51	43	34	-2	0	-8	-24	4	5	769	1.217	-390	-617
Slovenia	-117	-14	-105	-48	19	-55	-90	-209	-972	-209	-161	-152	-114	-137
EU-25	**18.910**	**25.112**	**22.042**	**24.724**	**20.438**	**17.262**	**21.486**	**22.750**	**23.604**	**28.723**	**30.053**	**29.347**	**28.910**	**36.157**
EU-15	**13.885**	**18.120**	**17.729**	**20.612**	**18.501**	**14.873**	**19.881**	**21.560**	**23.707**	**27.724**	**28.838**	**27.014**	**28.376**	**36.226**

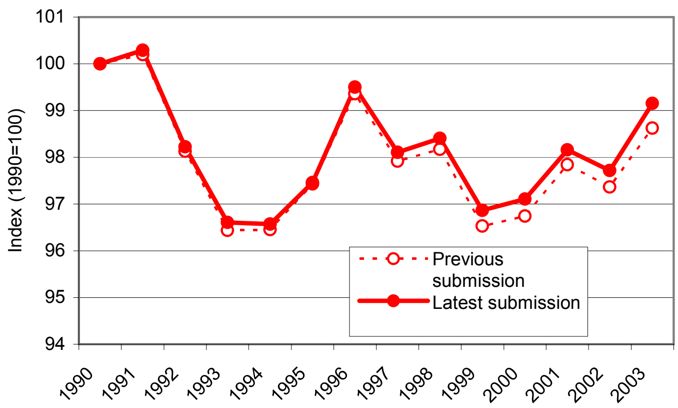
Table 10.5 Contribution of Member States to EU-25 and EU-15 recalculations of total GHG emissions without LULUCF for 1990–2003 (difference between latest submission and previous submission in percentage)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Austria	0.5	0.4	0.3	0.1	0.1	0.1	0.4	0.1	0.1	0.5	0.2	0.3	0.5	1.0
Belgium	0.1	0.1	0.3	0.0	-0.2	0.0	-0.1	-0.1	0.1	0.4	-0.2	0.2	-0.2	-0.1
Denmark	-0.4	-0.5	-0.5	-0.7	-0.9	-0.5	-0.4	-0.4	-0.2	-0.2	-0.2	0.0	-0.1	0.1
Finland	1.1	-0.3	0.1	2.4	0.7	0.0	0.5	0.0	-0.9	-1.0	-0.3	-0.5	0.4	0.2
France	-0.2	-0.6	-0.4	-0.2	-0.4	-0.2	0.0	-0.2	0.1	0.4	0.2	-0.4	0.5	0.7
Germany	-1.4	-0.8	-0.9	-0.7	-0.7	-0.7	-0.5	-0.3	-0.3	0.2	0.6	0.7	0.3	0.7
Greece	-0.6	-0.8	-0.5	-1.0	-1.1	-1.1	-1.0	-0.9	-1.0	-0.5	-0.4	-0.2	-0.4	-0.3
Ireland	3.2	1.2	0.8	1.1	1.2	1.3	1.6	1.4	1.6	0.7	-0.3	-0.3	-0.6	1.2
Italy	1.6	1.6	1.8	1.7	1.8	1.0	1.2	1.2	1.5	1.0	0.6	0.9	1.2	1.3
Luxembourg	-0.4	2.1	2.0	2.1	-1.4	-0.6	-0.4	-0.1	1.3	1.2	1.8	1.7	1.4	1.4
Netherlands	0.6	0.8	0.7	0.7	0.6	0.5	0.3	0.7	0.4	0.3	0.3	0.3	0.7	0.2
Portugal	1.0	1.4	1.4	1.5	2.0	2.4	2.1	2.7	2.7	2.2	2.5	3.0	2.9	3.1
Spain	1.2	1.0	0.7	0.9	1.0	1.0	1.3	1.2	1.3	1.3	1.0	1.4	0.9	1.5
Sweden	0.2	0.4	0.5	0.3	0.3	0.6	0.5	0.2	0.0	0.0	1.6	1.1	0.8	0.5
UK	2.2	2.2	2.1	2.1	2.1	1.9	1.8	1.9	1.8	1.6	1.8	1.2	1.2	1.1
Cyprus														
Czech Republic	2.1	3.0	1.3	1.4	1.0	0.9	0.6	0.7	1.0	1.2	1.0	1.0	0.9	1.5
Estonia	-2.0	-0.7	-0.3	-1.4	-1.3	-1.4	-2.5	-3.3	-3.2	-2.8	-2.4	-0.7	-0.8	-0.9
Hungary	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Latvia	2.1	-0.9	1.8	1.7	-7.1	-1.2	-0.3	-1.3	0.1	1.1	-0.1	-0.7	-0.4	1.7
Lithuania	0.0	4.6	4.7	4.8	4.9	5.1	5.2	5.5	0.0	0.0	0.0	0.0	0.0	0.0
Malta														
Poland	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	-0.4
Slovakia	1.7	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	1.6	2.4	-0.8	-1.2
Slovenia	-0.6	-0.1	-0.6	-0.3	0.1	-0.3	-0.5	-1.1	-4.8	-1.1	-0.8	-0.8	-0.6	-0.7
EU-25	**0.4**	**0.5**	**0.4**	**0.5**	**0.4**	**0.4**	**0.4**	**0.5**	**0.5**	**0.6**	**0.6**	**0.6**	**0.6**	**0.7**
EU-15	**0.3**	**0.4**	**0.4**	**0.5**	**0.5**	**0.4**	**0.5**	**0.5**	**0.6**	**0.7**	**0.7**	**0.7**	**0.7**	**0.9**

10.3 Implications for emission trends, including time series consistency

Figure 10.1 shows that due to the fact that both the 1990 and 2003 emissions have increased, the emission trend in the EU-15 has changed slightly. In the previous submission the trend of GHG excluding LUCF between 1990 and 2003 was – 1.4 %. In the latest submission this trend has changed to – 0.8 %.

Figure 10.1 Comparison of EU-15 GHG emission trends 1990–2003 (excl. LULUCF) of the latest and the previous submission



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

10.4.1 EC response to UNFCCC review

In 2006 the following improvements were made, most of them in response to UNFCCC reviews:

- **Energy:** detailed information on activity data and emission factors for the EC key sources and the description of sub-sectors of source category 1A2 Manufacturing industries.
- **Industrial processes:** more detailed information on methods used for the EC key sources and overviews of Member States' responses to UNFCCC review findings are included; for HFC emissions from 2F1 'Refrigeration and air conditioning' information on activity data and implied emission factors as included in CRF Table 2(II).F is provided for 2004.
- **Solvent use:** detailed descriptions of methods used by Member States are included.
- **Agriculture:** more detailed description of methods used, activity data, emissions factors and other relevant parameters; inclusion of background data and additional parameters in the EC CRF tables.
- **LULUCF:** the new LULUCF tables are provided for the EU-15 including background information on stock changes, amount of fertiliser applied and total amount of lime applied.
- **Inventory system:** overview of Member States inventory systems in place.
- **Key source analysis:** the key source analysis was made at fuel level.
- **QA/QC:** activities have been further extended on the basis of the EC QA/QC manual:
  - Implied emission factors have been checked for almost all EC key sources.
  - More active follow-up checks have been made on Member States' inventories: consistency reports have been prepared for 19 EC Member States; for 18 Member States follow-checks were made. Several Member States provided updated information/inventories in response of these checks.

- **Uncertainties:** A quantitative Tier 1 trend uncertainty analysis has been performed on the basis of Member States' Tier 1 uncertainty analysis.
- **Completeness:** overviews are provided of data availability of background data tables (see Chapter 1.8.5).
- **Consistency:** the EC CRF tables are internally consistent due to follow-up checks with Member States and reallocation of some source categories (see Chapter 1.4).
- **Recalculations:** more detailed information is provided for the EC key sources in the sector chapters
- **EU-25:** for the new Member States more inforamtion is included such as: (1) on inventory systems; (2) QA/QC procedures in place; (3) information on methods, emission factors and activity data; (4) reasons for recalculations.

10.4.2 Member States' responses to UNFCCC review

Since the improvement of the EC inventory depends on Member States' efforts regarding completeness of estimation and improvement of methods and parameters used, Table 10.7 provides an overview of Member States' responses to the UNFCCC review ([23]). The table shows that a considerable amount of improvements were made compared with the 2005 submissions of Member States. In addition to the response to the UNFCCC review, a large number of additional improvements were implemented by Member States. However, an aggregation of all improvements conducted in all Member States would be too much information and too detailed to be included in this report.

Table 10.7 Improvements made by Member States in response to the UNFCCC review

Member State	Improvements as recommended by the review team	Improvements in response to UNFCCC review as indicated in the NIR
Austria	The ERT identifies the following cross-cutting issues for improvement. The Party should: (a) Provide tier 1 quantified uncertainty estimates following the IPCC good practice guidance and use the results of this analysis to plan improvements to the inventory; (b) Improve time-series consistencies: (i) For those source categories where AD are derived from different data sources for different years; (ii) By extrapolation or interpolation of EFs and AD wherever such data for specific years are not available rather than keeping such values constant to avoid discontinuities in trends; (c) Provide more detailed descriptions of the methodologies used in cases where the country specific EFs deviate significantly from the IPCC default values or fall outside the ranges provided by the Revised 1996 IPCC Guidelines. (para 16) FCCC/ARR/2005/AUT	Tier 1 uncertainty analysis was made for several sources and provided in Annex 6. Time series consistencies have been checked for all sources and inconsistencies are planned to be improved. Emissions from source categories 1.A.2.a (iron and steel), 2.B.1 (Ammonia), 4.A (enteric fermentation), 4.B (manure management), 4.D (agricultural soils) and 6.A.1 (managed waste disposal on land) have been recalculated in response to the 2005 inventory review. The emission factors for natural gas and industrial waste were adjusted in response to the 2005 inventory review.
Belgium	The NIR identifies possible improvements in carbon EFs as a result of data becoming available in connection with the European Union Emissions Trading Scheme (ETS); better estimation of emissions of non-methane volatile organic compounds (NMVOCs); work on emissions from agricultural soils and manure management; the establishment of the geographical location of LULUCF activities and an evaluation of forest soil carbon; the inclusion of recovery of CH_4 from waste-water handling; and regional improvements in the estimation of emissions from waste, as identified below. Independent reviews by region and an external review involving experts from the Netherlands are planned. The overriding priority for Belgium is to continue working to present activity data (AD), EFs and methodologies in a transparent and consistent manner for the country as a whole. This is linked to the priority of developing current QA/QC practices into a coherent quality management system. Progress in recalculations requires adequate transparency, and Belgium should provide the CRF table 8(b) (Recalculations). The ERT understands that Belgium will submit this CRF table in its next submission. (para 13,14) FCCC/ARR/2005/BEL	The results of the draft centralized review report of the 2005 greenhouse gas inventory submission of Belgium are taken into account as much as possible during this submission. Following the centralised review report, the methane emissions from wetlands, unmanaged surface waters (rivers and lakes) and removals from forest, grassland and agricultural soils in Flanders are no longer reported in the national inventory.

([23]) Issues related to the NIR are not included in this table as already addressed in Table 1.11.

Member State	Improvements as recommended by the review team	Improvements in response to UNFCCC review as indicated in the NIR
Denmark, centralized review 2005	The inclusion of all LULUCF categories to the inventory is planned by the party. It is also planned to include estimates for CO_2 from soda ash use and limestone and dolomite use in its next inventory submission. The ERT mentions that the rationale for the detail (e.g. the need to relate to CORINAIR classification) could usefully be clarified. Similarly, more transparent information could be provided on the models used in the Agriculture sector, either by providing succinct summaries of technical material in annexes to the NIR or by giving references to background reports (in translation).(para 13,14) FCCC/ARR/2005/DNK	Considerable improvements of the inventories and the reporting have been made in response to the latest UNFCCC review process and as a result of an on-going working process. Stationary Combustion: The N_2O emission factor for coal combusted in large power plants has been changed for 1990-2003. Mobile sources (Inland waterways/ agriculture/ forestry/ household-gardening): A complete revision of the 1985-2003 time series of fuel use and emissions has been made using results from a specific Danish non road research project. Industry: Emissions of CO_2 from production of mineral wool and expanded clay products, refining of sugar, flue gas cleaning (wet process) in relation to waste incineration, combined heat and power plants and power plants have been included. Indirect emission of CO_2 and emission of NMVOC from asphalt roofing and road paving with asphalt has also been included. Cropland, grassland and wetlands: Mineral soils are for the first time incorporated in the inventory. Detailed methodological descriptions for individual source or sink categories are provided in Annex 3. Issues raised by the review team which could not be solved immediately are planned to be addressed in the next inventory.
Finland, centralized review 2005	The party identifies the following improvements: updating the time series of point source data, the reallocation of process emissions from Iron and Steel from the Energy to the Industrial Processes sector, further improvement of AD and EF for peat production, improved factors for carbon storage for the estimation of feedstocks and non-energy fuel use, improved non-CO_2 EFs for fuel combustion, the development of ways to verify the estimates of emissions of fluorinated gases (F-gases), the improvement of estimation parameters for enteric fermentation, additional data collection of manure management systems, and increased completeness in the LULUCF sector, including area estimates of grasslands before 1995, N_2O emissions from disturbance and soil drainage, and carbon (C) stock change in soil and dead organic matter pools on forest lands. The ERT recommends the precise descriptions of methodologies and parameters.(para 16,17) FCCC/ARR/2005/FIN	Most of the identified improvements have been implemented in the 2006 submission. The point source data has been checked and updated, CO_2 emissions from iron and steel industry have been reallocated, and emissions from peat production have been recalculated with amended AD. Due to updated activity data and emission factors recalculations have been done in the agricultural sector. Also the reporting in the LULUCF sector has been improved. In addition emissions from composting (CRF 6. D) have been included for the first time as response to the review process of 2005.Updated activity data and new emission factors have been used in this submission.
France	The NIR identifies several areas for improvement: (a) Finalization of the report on methodologies (the OMINEA report); (b) Studies and further investigations to improve the accuracy of the estimates for key categories; (c) The provision of better uncertainty estimates for key categories; (d) Improvements to data collection and to the emissions estimates for sources with high uncertainties, such as the non-energy use of fossil fuels; (e) The development of a new method to estimate and report LULUCF emissions following the IPCC Good Practice Guidance for Land LULUCF. The ERT identifies the following cross-cutting issues for improvement. The Party should: (a) Provide more detailed descriptions on methodologies in the NIR, using the structure given in the revised UNFCCC reporting guidelines. Descriptions of methodologies in the NIR can be complemented with relevant references to detailed information reported in the OMINEA report. The OMINEA report then needs to be completed and finalized; (b) Use the notation keys in a way that is consistent with the revised UNFCCC reporting guidelines; (c) Provide more detailed information in the NIR regarding recalculations; (d) Consider the possibility of implementing a tier 2 key category analysis (linked with the improvement of uncertainty estimation). (para 20,21) FCCC/ARR/2005/FRA	The OMINEA report on methodologies has been updated. The LULUCF tables are provided as required by decision 13/CP.9. Information on recalculations is provided. A tier 2 uncertainty estimation is under evaluation.
Germany	The ERT recommends that the Party consider the following	Several emission factors and activity data has been updated

Member State	Improvements as recommended by the review team	Improvements in response to UNFCCC review as indicated in the NIR
	cross-cutting issues for improvement. The Party should: (a) Provide the reference approach in full detail for the years 2000 and later as these are essential as an independent cross-check on the quality of the reporting in Energy sector; (b) Report emissions from coke use in Iron and Steel Production in the Industrial Processes sector, rather than as part of fuel combustion activities in the Manufacturing Industries and Construction category; (c) Estimate and report (as memo items) emissions of CO_2 from biomass combustion, and to distinguish clearly and report separately the biomass fractions in solid fuels; (d) Improve the completeness of the CRF, especially the LULUCF tables; (e) Use the QA/QC and the uncertainty assessment to plan improvements to the inventory; (f) Quantify uncertainties for the LULUCF sector. (para 15,16) FCCC/ARR/2005/DEU	and recalculations have been made. Emissions from source categories 1.A.2 (manufacturing industries and construction), 1.B.1.a (coal mining), 1.B.1.b (solid fuel transformation) and 2.C (metal production) were recalculated in response to inventory reviews. Emissions from biomass combustion are reported. Reference approach for recent years is provided.
Greece	The NIR identifies several areas for improvement. Many of the improvements are related to the collection of AD which are at present not available. The ERT identifies the following cross-cutting issues for improvement. Greece should: (a) Provide more comprehensive information on the methodologies, AD and EFs used in calculating the emissions estimates to further improve the transparency of inventory; and (b) Present more explanatory information related to source-specific uncertainties, QA/QC and verification in the NIR. (para 14,15) FCCC/ARR/2005/GRC	Methodologies were upgraded for several source categories, new sources added and errors corrected. Recalculations were made according to the recommendations of the review process.
Ireland, centralized review 2005	The most important improvement identified by the party is the development of a QA/QC system for the national inventory. Also an inventory improvement and the use of higher tier methodologies is planned. Ireland also plans to implement the IPCC good practice guidance for LULUCF and submit LULUCF reporting tables in accordance with decision 13/CP.9. The ERT identifies the following cross-cutting issues for improvement: (a) Use of tier 2 methods for key category analysis; (b) More extensive use of higher-tier methods for key categories, depending on available resources and AD; (c) Full use of the NIR structure set out in the revised UNFCCC reporting guidelines. (para 23,24) FCCC/ARR/2005/IRL	Substantial improvements have been made in the inventory. A QA/QC plan was developed and most emission estimates were done by applying the tier 2 methods. Many recalculations were undertaken. The inventory of the LULUCF sector was completed in accordance with the requirements of Decision 13/CP.9. The majority of the recommendations in the 2003 review report have now been implemented, following the extensive improvements and recalculations conducted for the 2006 submission. As these improvements cover issues such as the development of an expanded national inventory report in line with the structure specified in the UNFCCC reporting guidelines, the complete coverage of the LULUCF sector according to the requirements of Decision 13/CP.9 and detailed work to ensure full consistency between the NIR information and the CRF tables, they also address the main findings of the more recent centralised reviews in 2004 and 2005. The uncertainty estimation has been changed to reflect comments from the 2003 review. The FAO estimate of protein intake in the estimates for 2003 and the corresponding emissions in other years were recalculated as suggested by the 2003 in-country review. Enteric fermentation is calculated using Tier 2 as recommended by several reviews of the Irish inventory.
Italy, In country review 2005	Identified by the party: Establishment of a National Inventory System, including single national entity for inventory. Development of QA/QC system, including general and sectoral plans. (para 33) Identified by ERT: Complete and correct some key category analysis. Improve transparency of inventory by filling blank cells etc. Improve reporting on recalculations and document uncertainty estimates of tier 1 analysis. (para 35-36) **Energy:** Identified by the party: Provide information of carbon content of fuel in NIR. Improve documentation of national energy balance, Strenghten cooperation with other ministries to further analyse coal data.(para 63) Identified by ERT: Clear reference between cross categories in the NIR is needed. Provide in the NIR information on recalculations performed, a clearer explanation of the carbon flow within the iron and steel industry, the balance of data between the model used and the national statistics in road transport, and the methodology for calculating fugitive emissions from oil and gas.(para64) **Industrial processes and solvent use:** Identified by party:	[Updated NIR not yet provided]

Member State	Improvements as recommended by the review team	Improvements in response to UNFCCC review as indicated in the NIR
	Improvements focus on better EFs and AD, consistency of the estimates of PFC emissions, updating AD and time series EFs etc. .(para 79, 80) Identified by ERT: More detailed information on methodologies used and further work with industries to improve AD and EFs. (para 81, 82) **Agriculture:** The ERT recommends to further improve transparency. (para 111) **LULUCF:** Identified by the party: Refinement of the forest land C estimates. Improvement of the land cover and land use change data. Collection of additional statistics on land management. Acquisition of data on hydroelectric reservois, flooded lands and urban forestry.(para 138-141) Identified by ERT: Improvements on the reporting on land classification and land representation over time. Increased characterization of land management practices and LUC patterns on cropland and grasland. (para 142, 143) **Waste:** The party planns to improve emission estimates from solid waste disposal on land. The ERT redommends some improvements related to transparency and improvement of estimated CH_4 emissions from solid waste disposal. (para 175, 176) FCCC/ARR/2005/ITA	
Luxembourg	No review of the 2005 inventory because Luxembourg did not submit a NIR	As the 2006 submission is the first NIR submitted to the UNFCCC there are no improvements in response to reviews.
Netherlands, centralized review 2005	The party explained that an improvement program started in 2000 and is almost finished. The ERT recommends the following improvements: a)Estimate emissions for sources that are still missing in the inventory (b) Incorporate the LULUCF categories into the key category analysis; (c) Provide auxiliary information to facilitate an assessment of the estimates for emission sources that are affected by confidentiality of data.(para 18,19) FCCC/ARR/2005/NLD	Some missing emission sources have been already estimated, some are considered to be negligible. The LULUCF sector has been included in the key source assessment.
Portugal, centralized review 2005	The key improvements identified by Portugal are greater completeness and a tier 2 key category analysis including LULUCF. The ERT identified the following cross-cutting issues for improvement: (a) Improvement in the completeness of the inventory, such as CH_4 from natural gas transportation and potential emissions of HFCs, PFCs and SF_6; (b) More extensive use of higher-tier methods for key categories, depending on available resources and AD; (c) A more comprehensive description of the QA/QC procedures, including subsections on QA/QC and verification, in the sectoral chapters; (d) Correct use of the notation keys in the CRF. (para 18,19) FCCC/ARR/2005/PRT	The party improved the use of Tier 2 analysis methods as far as sufficient data was available (e.g. 4.A enteric fermentation). Completeness has also been improved to some extend. CH_4 emissions from natural gas are reported. IPCC default values are used for the CH_4 generation rate constant and the domestic CH_4 estimated emissions were compared with the “check method” proposed in the IPCC GPG as recommended by the in-depth review.
Spain	The ERT identifies the following cross-cutting issues for improvement. The Party should: (a) Improve the transparency of its reporting, including by providing bibliographic references, listing EFs, and providing national energy balances and worksheets; (b) Link its key category analysis to the choice of methodology; (c) Complete the development of a QA/QC management system, including better arrangements for internal data exchange; (d) Fill remaining gaps, especially in the LUCF sector, and report on LULUCF using the revised CRF tables. (para 14) FCCC/ARR/2005/ESP	Updated NIR not yet provided.
Sweden	The NIR identifies several areas for improvement. Many improvements relate to a review of existing methods for allocating emissions, the addition of some small sources not currently included and the collection of AD which at present are unavailable. The ERT identified the following cross-cutting issues for improvement. The Party should: (a) Provide additional detailed documentation on methods, data and assumptions; (b) Continue the development and implementation of the QA/QC system;	General • Information on the rationale behind recalculations is better described in the NIR. • Transparent explanation in Annex 2 on how uncertainties are estimated for activity data, emission factors and emissions. • More information about the quality assurance and verifications in the NIR. Energy • Factors influencing trends in activity data and emission factors have been better described.

Member State	Improvements as recommended by the review team	Improvements in response to UNFCCC review as indicated in the NIR
	(c) Improve the quantified uncertainty estimates; (d) Provide a national inventory report that is structured better to be in line with the UNFCCC reporting requirements on presenting source-specific information on AD, EFs, methodology, uncertainty estimates, time series consistency, QA/QC, verification, recalculations and planned improvements. (para 14,15) FCCC/ARR/2005/SWE	• Emissions from road transport calculated bottom-up by models have been compared with fuel delivery statistics (top-down approach). Industrial processes • Factors influencing trends in activity data and emission factors have been better described for CO_2. • Production data has been reported as activity data in CRF 2C1 instead of reducing agents and fuel consumption. • Emissions of CO_2 from cement production have been separated into emissions from clinker and dust in the NIR. • The reason for the low implied emission factor for CO_2 in lime production has been described in more detail. • A comparison between emissions of PFC from aluminum production calculated with the method used by the company and the IPCC default method is included in the NIR. • Consumption of halocarbons and SF_6 Potential emissions has been estimated for the whole time series, 1990-2004. Previously potential emissions were only estimated from 1995-2003. Agriculture • Beef cows are included in the same group as dairy cattle in the GHG inventory as of the 2006 submission and beyond. • Sludge had been divided into direct and indirect emissions. The indirect emissions are reported in the CRF together with Atmospheric Deposition. • Activity data for the stable period has been changed for the years 1990 – 1994 due to the weak documentation of the supporting data. LULUCF • Sweden has reported all requested pools and more properly use the notation keys. Waste • The half-life of waste differed from the IPCC default values. It is assumed to be 7.5 years instead of 14.5 (the IPCC default). The rationale for this assumption is provided in NIR in submission 2006. • The per capita waste generation rate has been reported in kg/year in Table 6.A. This re-porting mistake is corrected to kg/day in submission 2006. • The percentage figures on the composition of deposited waste are adjusted to add up to 100 per cent. The information is provided in the NIR as the ERT encouraged Sweden to do.
United Kingdom	The United Kingdom identified the following areas for improvement: (a) A review of the methods for estimating feedstocks and non-energy fuel use and the provision of further information about this category; (b) A review of the completeness of the GHG inventory of the United Kingdom; (c) A review of the allocation of emissions to IPCC sectors. The ERT identifies the following cross-cutting issues for improvement: (a) The key category analysis with and without LULUCF should be conducted and presented separately to be consistent with the IPCC good practice guidance for LULUCF, and the aggregation level chosen should be reconsidered; (b) The uncertainty estimation should be updated, and more analysis and discussion of uncertainties in the sectoral chapters of the NIR should be provided; (c) Consistency between the NIR and the CRF and within the NIR should be improved; (d) The transparency of the reporting of some key categories as indicated in the sectoral sections of this review report should be improved.	The UK addressed many issues raised by the review team as well as several unresolved recommendation from the two reviews before. A detailed list is provided in table 10.2 of chapter 10.4 of the UK NIR.

10.4.3 Improvements planned at EC level

The following activities are planned in 2006 at EC level with a view to improving the EC GHG inventory:

- Start sector-specific QA/QC activities for the industrial processes sector within the EC internal review;
- Test the newly developed CRF Aggregator database in order to ensure full functionality for the 2007 submission.
- Prepare for providing background data in the CRF table for Industrial processes (in particular Table 2(II).F) and for Waste.
- Compare emission estimates for avaition with Eurocontrol flight data.
- Further develop the EC QA/QC activities on the basis of the experience in 2006.

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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

AWMS	animal waste management systems
BEF	biomass expansion factor
BKB	lignite briquettes
C	confidential
CCC	Climate Change Committee (established under Council Decision No 280/2004/EC)
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
EF	emission factor
Eionet	European environmental information and observation network
ETC/ACC	European Topic Centre on Air and Climate Change
EU	European Union
FAO	Food and Agriculture Organisation of the United Nations
GHG	greenhouse gas
GPG	good practice guidance and uncertainty management in national greenhouse gas inventories (IPCC, 2000)
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	nitrogen
NH_3	ammonia
N_2O	nitrous oxide
NA	not applicable
NE	not estimated
NFI	national forest inventory

NIR	national inventory report
NO	not occurring
PFCs	perfluorocarbons
QA/QC	quality assurance/quality control
QM	quality management
QMS	quality management system
RIVM	National Institute of Public Health and the Environment (The Netherlands)
SF_6	sulphur hexafluoride
SNE	Single National Entity
UNFCCC	United Nations Framework Convention on Climate Change

Abbreviations in the source category tables in Chapters 3 to 9

Methods applied	**EF: methods applied for determining the emission factor**	**AD: methods applied for determining the activity data**	**Estimate: assessment of completeness**	**Quality: assessment of the uncertainty of the estimates**
C — Corinair	C — Corinair	AS — associations, business organizations	All — full	H — high
CS — country-specific	CS — country-specific	IS — international statistics	F — full	M — medium
COPERT X — Copert Model X = version	D — default	NS — national statistics	Full — full	L — low
D — default	M — model	PS — plant specific data	IE — included elsewhere	
M — model	MB — mass balance	Q — specific questionnaires, surveys	NE — not estimated	
NA — not applicable	PS — plant-specific	RS — regional statistics	NO — not occurring	
RA — reference approach			P — partial	
T1 — IPCC Tier 1			Part — partial	
T1a — IPCC Tier 1a				
T1b — IPCC Tier 1b				
T1c — IPCC Tier 1c				
T2 — IPCC Tier 2				
T3 — IPCC Tier 3				