

Fluorinated greenhouse gases 2011

Aggregated data reported by companies on the production, import and export of fluorinated greenhouse gases in the European Union
— Summary

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European Environment Agency
Kongens Nytorv 6
1050 Copenhagen K
Denmark
Tel.: + 45 33 36 71 00
Fax: + 45 33 36 71 99
Web: eea.europa.eu
Enquiries: eea.europa.eu/enquiries

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Summary

Greenhouse gases covered by the UNFCCC Kyoto Protocol include amongst others, three groups of fluorinated greenhouse gases (the so-called 'F-gases'): hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆). These F-gases typically have very long lifetimes in the atmosphere and high global warming potentials (GWPs).

The European Union Regulation (EC) No 842/2006 on certain fluorinated greenhouse gases (the 'F-Gas Regulation') introduced a requirement for each producer, importer and exporter of more than one tonne of F-gases to report to the European Commission on the quantities produced, imported and exported in each calendar year, and provide related data such as the main intended applications of the F-gases. This report summarises the most recent data reported under the F-Gas Regulation. Imports and exports of F-gases contained in products or equipment are not covered by the report.

The year 2011 was the fifth reporting year under the F-Gas Regulation. Companies were required to submit F-gas reports covering 2011 by 31 March 2012. For the reporting year 2011 and onward, the European Environment Agency (EEA) has taken over the collection, data storage and quality control, and analysis of the companies' reports as well as responsibility for the provision of support to the reporting companies. Data submitted by companies are commercially confidential. For this reason, only aggregated data are provided in this summary.

In total, 120 companies submitted reports for the year 2011; the number of companies that reported data for 2011 was 12 % higher than for the previous year. An increase was observed for data reported in all categories, i.e. for producers, importers and exporters. A number of quality checks were also performed on the reported data to ensure completeness and consistency. These checks showed more than 50 % of the initial reports were

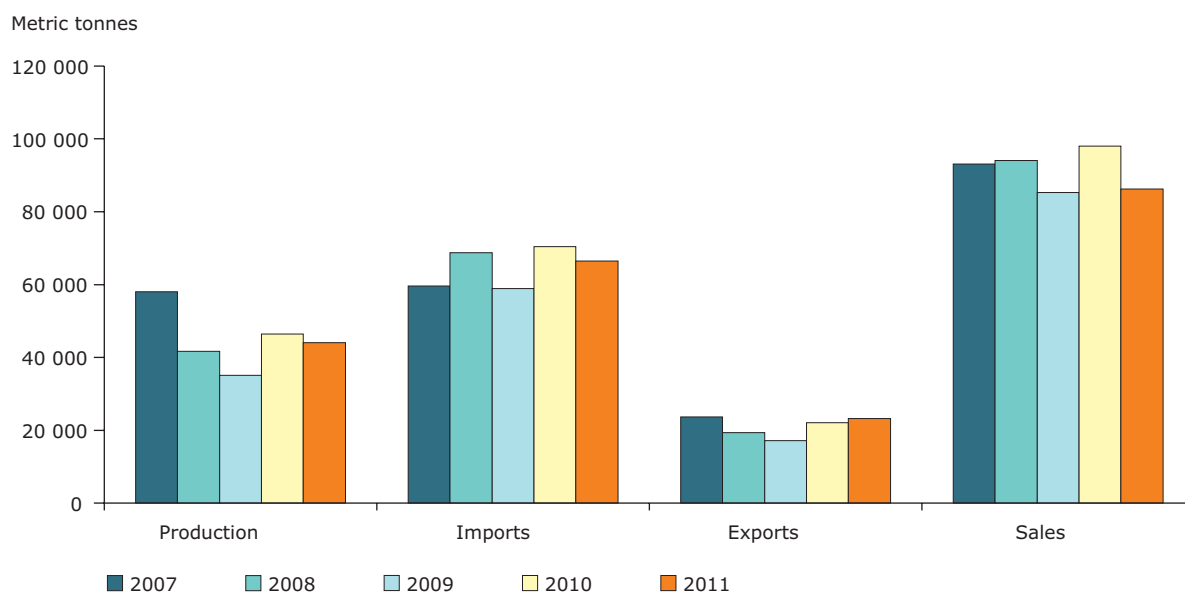
incomplete or inconsistent in some way. The main problems observed were: missing or inconsistent data in the reported information concerning the intended applications of F-gases placed on the EU market; inconsistency in stocks data compared to the previous year's reporting; other internal inconsistencies; and wrong use of units (e.g. reporting data in kilograms instead of tonnes).

The assessment of trends is dependent upon the unit used to express the amounts of F-gases, i.e. physical metric tonnes or GWP-weighted tonnes (CO₂-equivalents). A statistic in metric tonnes reflects the use patterns of F-gases in absolute terms, while F-gas usage statistics expressed as CO₂-equivalents also reflects the potential relevance for climate change policy. When expressed in metric tonnes, data for the reporting year 2011 show a decrease in production (5 %), import (6 %) and intra-EU sales (12 %) of F-gases (see Figure 1) compared to the previous year. In contrast, exports increased by 5 %.

Due to the large differences between the GWP values for certain F-gases, when data are expressed in CO₂-equivalents⁽¹⁾ however (see Figure 2), the interpretation of certain trends differs. An increase is still observed for exported F-gases (+ 12 %) but now also for production (+ 1 %), while a decrease is still observed for both imports (8 %) and sales (11 %). This can mainly be attributed to a strong decrease in HFC sales (13 % when expressed in metric tonnes, 17 % when expressed in CO₂-equivalents). By contrast, EU sales and exports of SF₆ both increased, by 17 % and 16 % respectively. SF₆ is mainly used for electrical equipment. While export levels expressed in CO₂-equivalents are higher compared to the preceding years, EU sales dropped in 2011 to levels similar to those observed in the 'financial crisis' year of 2009. Imports generally increased over the period 2007–2011, while EU production appears to have stabilised at levels that are around 20 % lower than those reported in 2007.

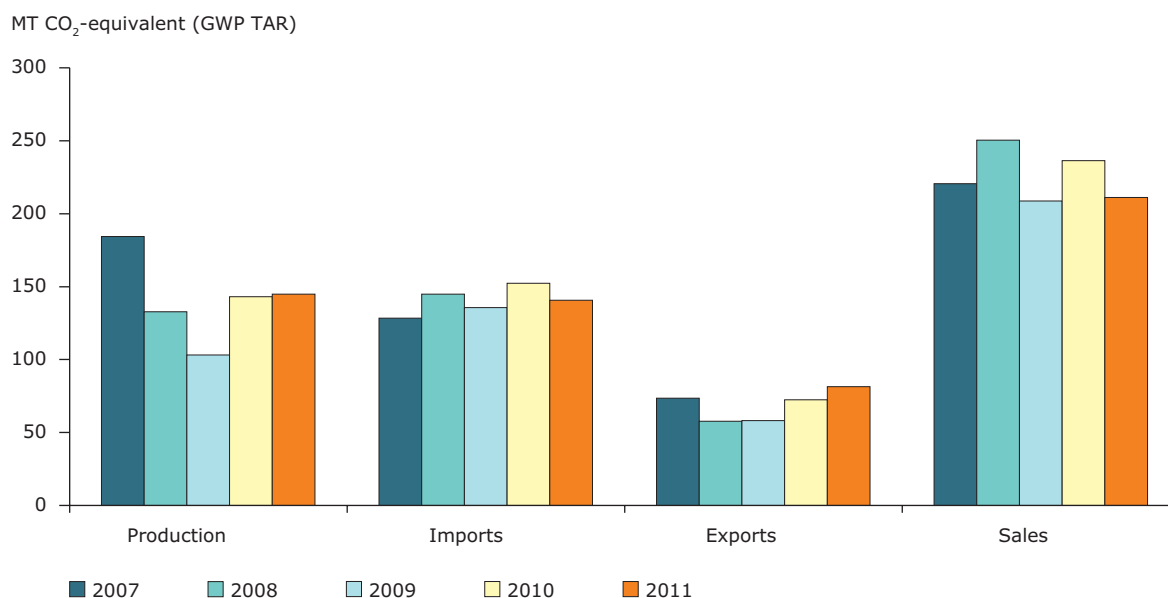
⁽¹⁾ Unless specified otherwise, the GWP values used in this report are the same as those specified in the F-Gas Regulation, which are in line with the published values in the IPCC's Third Assessment Report (TAR).

Figure 1 Trend in the production, imports, exports and sales of aggregated fluorinated gases within the European Union (metric tonnes)



Sources: 2007–2010: previous F-gas reports (TouchDown Consulting, Umweltbundesamt GmbH); 2011: EEA.

Figure 2 Trend in the production, imports, exports and sales of aggregated fluorinated gases within the European Union (expressed in CO₂-equivalents)



Sources: 2007–2010: previous F-gas reports (TouchDown Consulting, Umweltbundesamt GmbH); 2011: EEA.

For the different F-gases, the compounds contributing the major share of 2011 production, imports, exports and sales were HFCs. SF₆ is of relatively minor relevance if expressed in metric tonnes (8 % or less), but its very high GWP increases its contribution to the overall share if expressed in CO₂-equivalents. In GWP-weighted tonnes, SF₆ accounts for more than 40 % of production, more than 50 % of exports and more than 20 % of sales. Imports were very much HFC-based, with only 9 % being SF₆. PFCs were of almost negligible relevance in 2011 for all mentioned parameters (comprising 2 % or less of the total statistics).

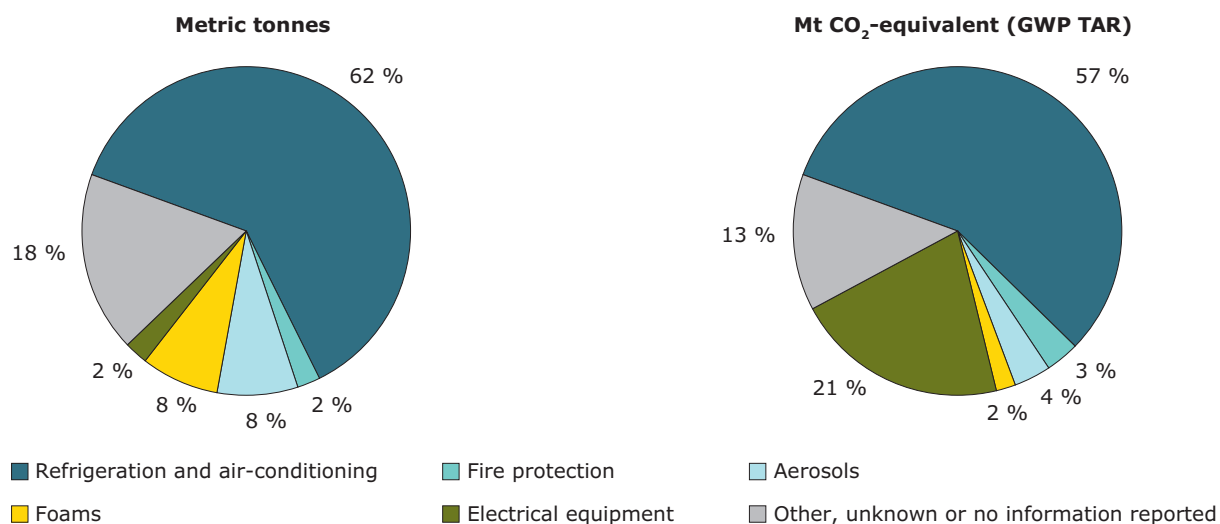
With respect to HFCs, HFC-134a, HFC-365mfc, HFC-143a and HFC-125 are the substances produced in the largest quantities. This is similar to data for preceding years.

The majority of the intended applications for F-gases in 2011 was for refrigeration and air-conditioning

purposes (Figure 3), applications that use almost only HFCs. The foams and aerosols sectors are also significant in terms of their use of HFC metric tonnes. SF₆ used in electrical equipment contributes a significant share of the intended applications of EU sales when expressed in terms of CO₂-equivalents as described above. Although there are some uncertainties due to changes in the quality of reported data over the past years, the 2007–2011 trends show that there is a strong decrease in the use of F-gases for foams. Use of F-gases in aerosols and refrigeration/air conditioning has also declined since 2007. However, it should be noted that the quantities of F-gases contained in imported equipment are not captured in the reporting data, and this may affect the observed trends.

Finally, this year's report contains a new parameter: 'EU net supply'. This parameter provides more precise information on the actual use of (bulk) F-gases by EU industries compared to the 'EU sales' figures.

Figure 3 Percentage of the main intended applications of EU sales of F-gases in 2011 as reported by companies in the European Union, expressed in metric tonnes (left) and CO₂-equivalents (right)



The 'EU net supply' parameter balances, on an aggregated EU level, positive contributions i.e:

- production;
- imports (bulk shipments);
- other amounts collected for reclamation or destruction from within the EU; and
- stocks held 1 January of the reporting year

with negative contributions i.e:

- exports (bulk shipments);
- destruction (on-site by reporting companies and off-site within the EU on reporting companies' behalf);
- amounts used as feedstock by reporting companies; and
- stocks held 31 December of the reporting year.

For the 2011 data, 'EU net supply' is ca. 5 % lower than 'EU sales' if expressed in metric tonnes. If expressed in CO₂-equivalents, the difference is more significant. EU net supply' in this case is 11 % lower than 'EU sales'. An 'EU net supply' value lower than 'EU sales' implies that the use of F-gases in various applications 'within the EU' is actually lower than the sales figures alone would indicate. This highlights that use of 'EU sales' values as a proxy for the actual use of F-gases in the EU can potentially be misleading.

For HFCs, this difference between 'EU net supply' and 'EU sales' amounts to approximately 5 %, both in metric tonnes and in CO₂-equivalents; for PFCs the difference is below 1 %, but for SF₆, the difference is considerable, amounting to 31 %. No data on the 'EU net supply' are available for the 2007 to 2010 reporting years.

Data factsheet: Fluorinated greenhouse gases in the European Union 2007–2011

Table 1 Production of F-gases in the period 2007 to 2011 (metric tonnes)

	2007	2008	2009	2010	2011
Gas	Metric tonnes				
HFC-125	6 553	< 3 comp.	< 3 comp.	< 3 comp.	< 3 comp.
HFC-134a	31 246	21 529	18 609	21 476	< 3 comp.
HFC-143a	6 159	5 224	< 3 comp.	< 3 comp.	5 122
SF ₆ & other HFCs and PFCs	14 079	14 894	16 514	24 983	38 908
Total F-gases	58 037	41 647	35 123	46 459	44 030

Note: In this and following tables, '< 3 comp.' indicates less than three companies reported information. Data are not provided for reasons of commercial confidentiality but instead are included under the 'other' F-gas category.

Table 2 Production of F-gases in the period 2007 to 2011 (expressed in CO₂-equivalents – GWP TAR)

	2007	2008	2009	2010	2011
Gas	Million tonnes of CO₂-equivalents				
HFC-125	22.3	< 3 comp.	< 3 comp.	< 3 comp.	< 3 comp.
HFC-134a	40.6	28.0	24.2	27.9	< 3 comp.
HFC-143a	26.5	22.5	< 3 comp.	< 3 comp.	22.0
SF ₆ & other HFCs and PFCs	94.9	82.4	79.1	115.2	122.8
Total F-gases	184.3	132.8	103.3	143.1	144.8

Table 3 Imports of F-gases in the period 2007 to 2011 (metric tonnes)

	2007	2008	2009	2010	2011
Gas	Metric tonnes				
HFC-32	2 302	2 429	1 766	3 010	3 282
HFC-125	10 171	10 816	13 756	15 406	13 653
HFC-134a	34 511	37 799	27 619	33 380	33 223
HFC-143a	4 445	6 510	4 448	5 073	5 597
HFC-152a	4 440	6 401	5 262	6 448	6 622
HFC-227ea	273	1 738	1 634	1 551	1 574
HFC-23	129	187	124	144	128
HFC-236fa	49	< 3 comp.	< 3 comp.	34	51
CF ₄	13	87	37	61	67
C ₂ F ₆	112	186	77	150	140
C ₃ F ₈	121	< 3 comp.	10	< 3 comp.	< 3 comp.
c-C ₄ F ₈	< 3 comp.	6	5	< 3 comp.	8
SF ₆	801	691	671	539	587
Other HFCs and PFCs	2 280	1 869	3 496	4 644	1 564
Total F-gases	59 647	68 721	58 904	70 439	66 497

Table 4 Imports of F-gases in the period 2007 to 2011 (expressed in CO₂-equivalents – GWP TAR)

	2007	2008	2009	2010	2011
Gas	Million tonnes of CO₂-equivalents				
HFC-32	1.3	1.3	1.0	1.7	1.8
HFC-125	34.6	36.8	46.8	52.4	46.4
HFC-134a	44.9	49.1	35.9	43.4	43.2
HFC-143a	19.1	28.0	19.1	21.8	24.1
HFC-152a	0.5	0.8	0.6	0.8	0.8
HFC-227ea	1.0	6.1	5.7	5.4	5.5
HFC-23	1.6	2.2	1.5	1.7	1.5
HFC-236fa	0.5	< 3 comp.	< 3 comp.	0.3	0.5
CF ₄	0.1	0.5	0.2	0.4	0.4
C ₂ F ₆	1.3	2.2	0.9	1.8	1.7
C ₃ F ₈	1.0	< 3 comp.	0.1	< 3 comp.	< 3 comp.
c-C ₄ F ₈	< 3 comp.	0.1	0.0	< 3 comp.	0.1
SF ₆	17.8	15.4	14.9	12.0	13.0
Other HFCs and PFCs	4.7	2.3	8.8	10.6	1.7
Total F-gases	128.3	144.8	135.6	152.2	140.7

Table 5 Exports of F-gases in the period 2007 to 2011 (metric tonnes)

	2007	2008	2009	2010	2011
Gas	Metric tonnes				
HFC-32	1 245	771	605	1 319	1 335
HFC-125	2 622	2 041	1 420	2 267	3 520
HFC-134a	14 142	11 374	9 780	10 469	11 079
HFC-143a	1 351	1 455	701	984	1 236
HFC-152a	< 3 comp.	158	< 3 comp.	632	262
HFC-227ea	120	135	356	351	433
HFC-245fa	16	< 3 comp.	< 3 comp.	< 3 comp.	1
HFC-365mfc	2 254	2 110	1 932	2 813	3 264
HFC-43-10mee	< 3 comp.	46	16	48	< 3 comp.
HFC-23	< 3 comp.	15	1	4	8
CF ₄	< 3 comp.	1	< 3 comp.	11	4
C ₂ F ₆	< 3 comp.	28	< 3 comp.	< 3 comp.	< 3 comp.
SF ₆	1 659	1 185	1 423	1 697	1 964
Other HFCs and PFCs	245	54	928	1 491	106
Total F-gases	23 654	19 373	17 162	22 086	23 210

Table 6 Exports of F-gases in the period 2007 to 2011 (expressed in CO₂-equivalents – GWP TAR)

	2007	2008	2009	2010	2011
Gas	Million tonnes of CO₂-equivalents				
HFC-32	0.7	0.4	0.3	0.7	0.7
HFC-125	8.9	6.9	4.8	7.7	12.0
HFC-134a	18.4	14.8	12.7	13.6	14.4
HFC-143a	5.8	6.3	3.0	4.2	5.3
HFC-152a	< 3 comp.	0.0	< 3 comp.	0.1	0.0
HFC-227ea	0.4	0.5	1.2	1.2	1.5
HFC-245fa	0.0	< 3 comp.	< 3 comp.	< 3 comp.	0.0
HFC-365mfc	2.0	1.9	1.7	2.5	2.9
HFC-43-10mee	< 3 comp.	0.1	0.0	0.1	< 3 comp.
HFC-23	< 3 comp.	0.2	0.0	0.0	0.1
CF ₄	< 3 comp.	0.0	< 3 comp.	0.1	0.0
C ₂ F ₆	< 3 comp.	0.2	< 3 comp.	< 3 comp.	< 3 comp.
SF ₆	36.8	26.3	31.6	37.7	43.6
Other HFCs and PFCs	0.4	0.3	2.7	4.5	0.8
Total F-gases	73.5	57.8	58.2	72.4	81.4

Table 7 Sales of F-gases in the period 2007 to 2011 (metric tonnes)

	2007	2008	2009	2010	2011
Gas	Metric tonnes				
HFC-32	4 186	5 545	4 328	5 437	4 957
HFC-125	12 933	15 427	13 438	18 345	15 592
HFC-134a	51 693	48 123	42 005	45 580	40 844
HFC-143a	9 605	10 487	8 940	10 118	8 644
HFC-152a	4 301	2 782	5 182	6 213	6 352
HFC-227ea	857	2 336	2 075	2 199	1 566
HFC-245fa			1 248	< 3 comp.	< 3 comp.
HFC-365mfc	< 3 comp.	3 785	3 054	3 554	4 102
HFC-43-10mee			50	56	< 3 comp.
HFC-23	267	194	192	240	182
HFC-236fa	29	37	25	30	43
CF ₄	< 3 comp.	88	42	60	57
C ₂ F ₆	87	183	113	154	131
C ₃ F ₈	168	61	18	24	23
c-C ₄ F ₈			3	6	10
SF ₆	2 223	3 011	1 928	1 851	2 174
Other HFCs and PFCs	6 777	1 984	2 590	4 128	1 576
Total F-gases	93 126	94 043	85 230	97 995	86 253

Table 8 Sales of F-gases in the period 2007 to 2011 (expressed in CO₂-equivalents – GWP TAR)

	2007	2008	2009	2010	2011
Gas	Million tonnes of CO₂-equivalents				
HFC-32	2.3	3.1	2.4	3.0	2.7
HFC-125	44.0	52.5	45.7	62.4	53.0
HFC-134a	67.2	62.6	54.6	59.3	53.1
HFC-143a	41.3	45.1	38.4	43.5	37.2
HFC-152a	0.5	0.3	0.6	0.8	0.8
HFC-227ea	3.0	8.2	7.3	7.7	5.5
HFC-245fa			1.2	< 3 comp.	< 3 comp.
HFC-365mfc	< 3 comp.	3.4	2.7	3.2	3.7
HFC-43-10mee			0.1	0.1	< 3 comp.
HFC-23	3.2	2.3	2.3	2.9	2.2
HFC-236fa	0.3	0.4	0.2	0.3	0.4
CF ₄	< 3 comp.	0.5	0.2	0.3	0.3
C ₂ F ₆	1.0	2.2	1.3	1.8	1.6
C ₃ F ₈	1.4	0.5	0.2	0.2	0.2
c-C ₄ F ₈			0.0	0.1	0.1
SF ₆	49.4	66.8	42.8	41.1	48.3
Other HFCs and PFCs	6.9	2.7	8.6	9.8	2.1
Total F-gases	220.5	250.4	208.7	236.3	211.0

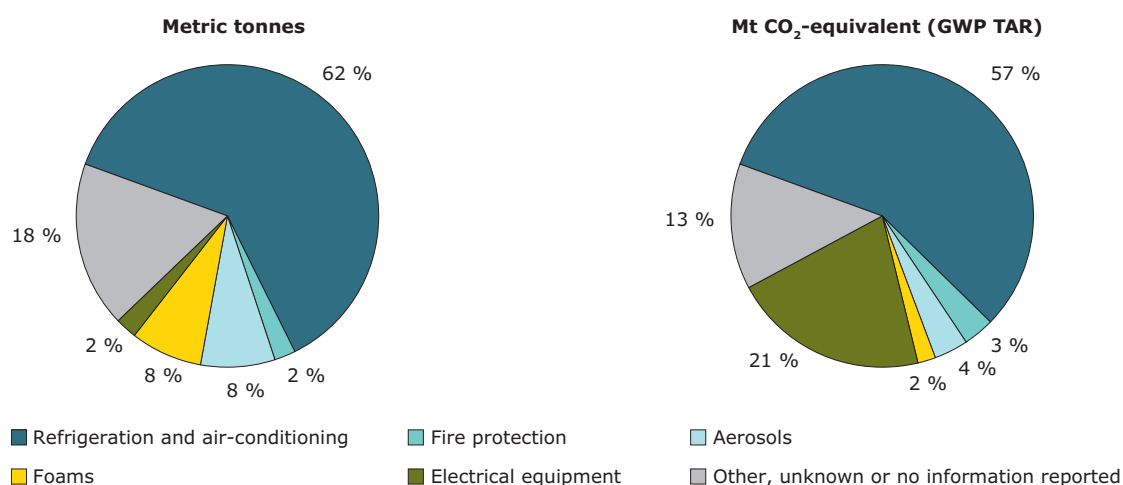
Table 9 Intended applications of F-gas sales in the period 2007 to 2011 (metric tonnes)

	2007	2008	2009	2010	2011
Intended application	Metric tonnes				
Refrigeration and air-conditioning	64 600	64 176	60 049	69 404	53 571
Fire protection	685	598	735	1 686	1 938
Aerosols	9 545	11 614	8 572	9 922	6 861
Solvents	209	173	162	205	< 3 comp.
Foams	14 578	10 664	11 799	11 893	6 611
Feedstock	9	2	< 3 comp.	1 340	< 3 comp.
Electrical equipment	1 568	2 386	1 384	1 614	1 992
Magnesium die casting operations	31	8	< 3 comp.	< 3 comp.	< 3 comp.
Semiconductor manufacture	129	312	184	269	248
Other or unknown	1 773	4 110	2 278	1 622	2 766
No information available	-	-	-	-	12 268
Total	93 127	94 043	85 163	97 955	86 253

Table 10 Intended applications of F-gas sales in the period 2007 to 2011 (expressed in CO₂-equivalents – GWP TAR)

	2007	2008	2009	2010	2011
Intended application	Million tonnes of CO₂-equivalents				
Refrigeration and air-conditioning	137.5	144.6	135.1	160.3	119.8
Fire protection	3.8	3.1	3.7	6.8	7.0
Aerosols	11.8	13.7	10.5	11.9	7.7
Solvents	0.4	0.4	0.3	0.4	< 3 comp.
Foams	13.4	11.9	9.7	10.5	4.0
Feedstock	0.1	0.0	< 3 comp.	0.5	< 3 comp.
Electrical equipment	34.8	53.1	30.7	35.8	44.2
Magnesium die casting operations	0.7	0.2	< 3 comp.	< 3 comp.	< 3 comp.
Semiconductor manufacture	1.5	3.1	2.0	3.0	2.7
Other or unknown	16.7	20.4	15.5	6.6	5.0
No information available	-	-	-	-	20.5
Total	220.6	250.4	207.5	235.8	211.0

Figure 4 Percentage of the main intended applications of EU sales of F-gases in 2011 as estimated by companies in the European Union, in metric tonnes (left) and expressed in CO₂-equivalents (right)



- Notes:**
- Discrepancies between the totals given and the sum of the individual values making up these totals may be due to rounding.
 - These data were aggregated from reports submitted by EU producers, importers and exporters, pursuant to Regulation (EC) No 842/2006, who produce, import and export more than 1 tonne of fluorinated greenhouse gases per year. Data on the period 2007–2010 were taken over from the 2011 factsheet.
 - Fluorinated greenhouse gases contained in imported or exported equipment are not included in these statistics.
 - Amounts of F-gases in these statistics are disclosed only if reported by three or more companies in order to protect confidentiality. Amounts based on information submitted by fewer companies are aggregated in the respective 'other' categories.
 - 'Blends' or 'preparations' are reported according to their constituent gases.
 - 'EU production' refers only to production that takes place in the EU, and excludes purchases and sales between EC companies for the purposes of manufacturing blends.
 - 'EU Sales' refers to amounts of F-gases placed on the EU market for the first time.
 - 'Intended Applications' are best estimates by reporting entities of the amounts they sold for a range of intended uses.
 - Metric tonnes of F-gases produced, imported, exported and sold in the EU are converted to GWP-weighted tonnes (Mt CO₂-equivalents) on the basis of the GWP (100-year) values listed in Annex I, Part I of Regulation (EC) No 842/2006 of the European Parliament and of the Council of 17 May 2006 on certain fluorinated greenhouse gases, which correspond to those published in the IPCC Third Assessment Report (GWP TAR).

Sources: 2007–2010 data: previous F-gas reports (TouchDown Consulting, Umweltbundesamt GmbH); 2011 data: EEA.

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European Environment Agency
Kongens Nytorv 6
1050 Copenhagen K
Denmark

Tel.: + 45 33 36 71 00
Fax: + 45 33 36 71 99

Web: eea.europa.eu
Enquiries: eea.europa.eu/enquiries

