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Fluorinated greenhouse gases 2018

Data reported by companies on the production, import, export and destruction of fluorinated greenhouse gases in the European Union, 2007-2017

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European Environment Agency

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Acknowledgements

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Executive summary

The 2018 edition of the European Environment Agency (EEA) report on fluorinated greenhouse gases (F-gases) confirms the good progress achieved in 2017 by the European Union (EU) in phasing down the use of hydrofluorocarbons (HFCs), a set of fluorinated gases with a high global warming potential (GWP) that is significantly contributing to climate change.

The report evaluates and presents the data reported by companies in 2018 about their activities involving F-gases in 2017, assessing both the progress made under the ongoing EU-wide HFC phase-down and the outlook towards the global HFC phase-down, which is due to begin in 2019 under the Kigali Amendment to the Montreal Protocol. The report also details the amounts of F-gases supplied to different industrial applications.

The report uses two different metrics: F-gas amounts expressed in physical tonnes reflect the use patterns of F-gases in European industries, while their GWP (in tonnes of carbon dioxide (CO_2) equivalents (tCO_2e)) are relevant for climate change policy.

Context

The EU Regulation on F-gases, No 517/2014, implements an EU-wide phase-down for HFCs, which started in 2015, with the aim of cutting emissions by two thirds by 2030 in the EU compared with 2014. It mandates companies to report their annual production, imports, exports and other activities involving HFCs, as well as other F-gases, and includes all the F-gases covered by the Kyoto Protocol: HFCs, perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3), as well as others such as unsaturated HFCs and HCFCs (hydrochlorofluorocarbons).

Many ozone-depleting substances (ODS) also contain fluorine and have very high GWPs. Those ODS are regulated separately under Regulation (EC) No 1005/2009.

The use of F-gases, most prominently in refrigeration and air conditioning, has been increasing since the early 1990s, in particular as a replacement for ODS globally phased out under the Montreal Protocol. F-gases, mostly HFCs (more than 90 %), accounted for approximately 3 % of overall greenhouse gas emissions expressed in t CO_2e in the EU in 2016 (EEA, 2018a). 2015 had been the first year of declining EU F-gases emissions (3 %) in 15 years. In 2016, total F-gas emissions rose by 0.6 % due to increases observed for PFCs and SF_6, while HFCs further decreased by 0.1 %.

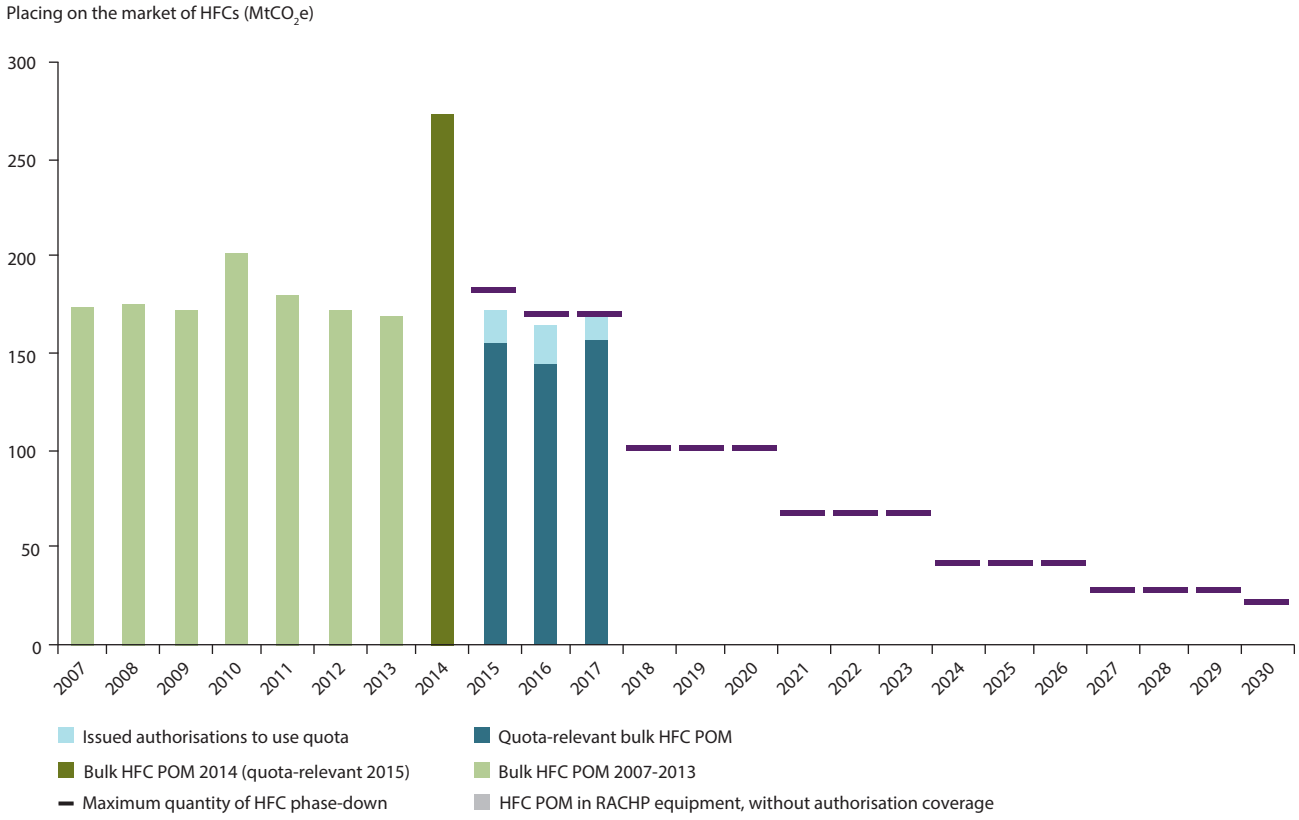
The EU has committed, under the United Nations Framework Convention on Climate Change (UNFCCC), to reduce emissions of greenhouse gases by 20 % by 2020 compared with 1990 levels. F-gases are included in this target. Under the Paris Agreement, the EU is committed to a 40 % reduction in domestic emissions by 2030, compared with 1990.

Phase-down of HFCs under the EU F-Gas Regulation

The HFC phase-down under the F-Gas Regulation is being implemented by the introduction of annual quantitative limits (quotas) to the placing on the EU market of HFCs by producers and importers. In 2017, imports of refrigeration, air conditioning and heat pump (RACHP) equipment containing HFCs became, for the first time, subject to the phase-down. In 2017, EU-wide placing on the market (POM) of HFCs was 0.4 % below the 2017 overall market limit set by the quota system (Figure ES.1). In previous years, quotas were used less efficiently by companies (4-6 % below the limit). The few cases of quota exceedance, both by importers of bulk HFCs and by equipment importers, were balanced by companies that did not fully use their quota.

The reserve of quota authorisations, built up by a number of equipment importers during 2015 and 2016, decreased by 14 % during 2017. However, the size of this reserve is still almost twice the amount of actual annual equipment imports or 30 % of the maximum available HFC amount for 2018. This accumulated reserve of authorisations reduces the overall strain on the quota issued for the following years, as RACHP equipment imports in those years will, at least theoretically, not need to be covered by the quota issued for those years.

Figure ES.1 Progress of the EU HFC phase-down



Notes: Mt, million tonnes.
POM, placing on the market. Values from 2007 to 2013 are based on the reporting obligations of the old F-Gas Regulation ((EC) No 842/2006), and are therefore not fully comparable with data from 2014 onwards (based on the obligations of the new F-Gas Regulation ((EU) No 517/2014)). Similarly, the maximum quantities of the EU HFC phase-down may be recalculated for 2019 and are for indicative purposes only.

Sources: EC, 2011, 2014 and 2018; EEA, 2017 and 2018b.

EU contribution to the global phase-down of HFCs under the Kigali Amendment to the Montreal Protocol

The global HFC phase-down under the Montreal Protocol Kigali Amendment introduces limits to the consumption of HFCs, starting in 2019. In 2017, HFC consumption in the EU increased by 3 % but nevertheless was already 12 % below the first limit for the EU under the Montreal Protocol Kigali Amendment (to be achieved in 2019) (Figure ES.2).

Supply of F-gases in the EU

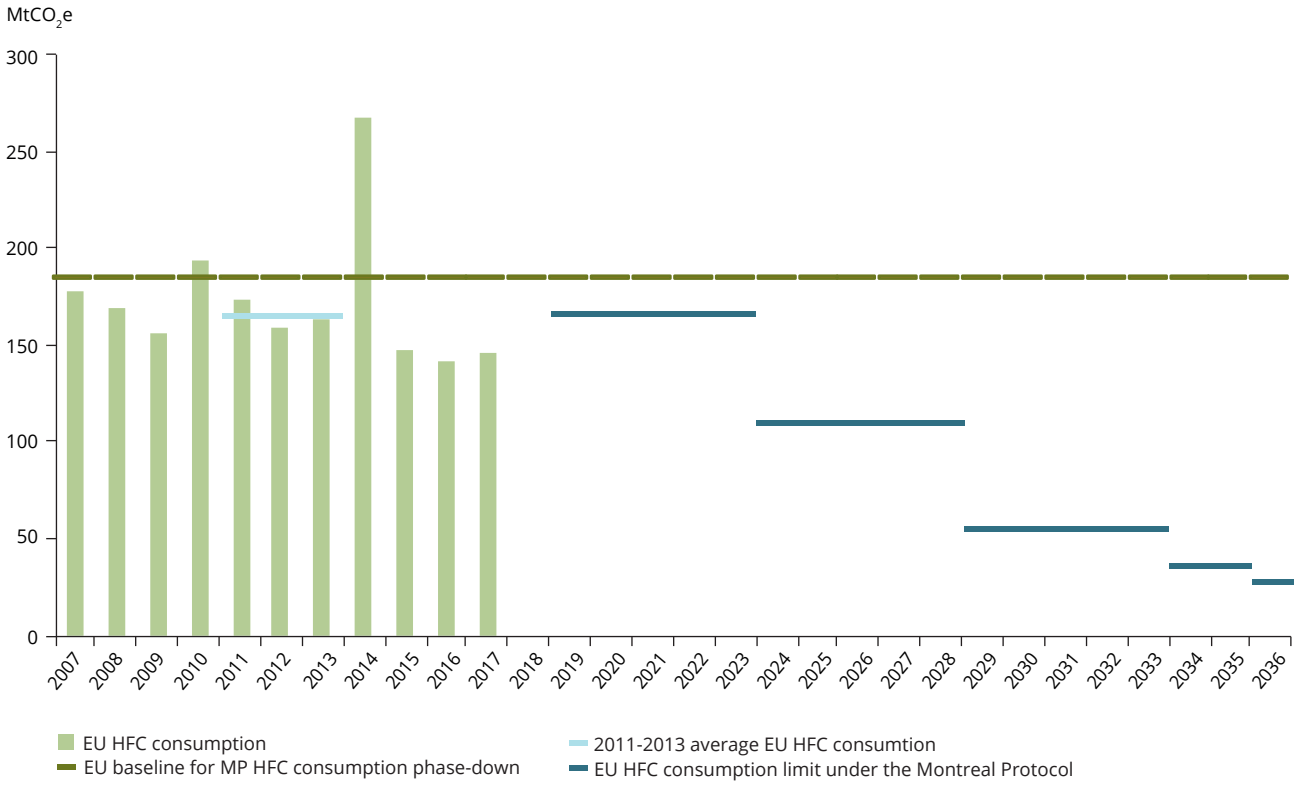
In 2017, the supply of total F-gases, reflecting the actual use of F-gases by EU industries, increased by 3 % in mass (Figure ES.3) but decreased by 2 % in CO_2e (Figure ES.4). This indicates a move towards gases with lower GWPs. Refrigeration and air conditioning continue to be key applications. Large increases can be observed for unsaturated HFCs and HCFCs with very low GWPs, replacing HFCs with significantly higher GWPs. In contrast, HFC supply decreased by 4 % in mass or 7 % in CO_2e. Looking at the gases with the highest GWPs, SF_6, NF_3 and PFCs, all of which do not fall under the quota system, their supply increased by 20-40 %, partly outweighing the decrease in HFC supply.

Detailed physical flows of F-gases

The key findings presented above are based on the following trends in physical F-gases flows in 2017, reported by companies in 2018 (see Figures ES.3 and ES.4):

- Production of virgin F-gases in the EU in 2017 decreased by more than 10 % compared with 2016, caused primarily by reductions in the production of HFC-134a and of SF_6. HFC production in 2017 was the lowest since reporting started in 2007.

Figure ES.2 Approaching the Montreal Protocol HFC phase-down



Notes: HFCs covered under the Montreal Protocol include all HFCs covered under EU F-Gas Regulation No 517/2014, except HFC-161.

Sources: EC, 2011, 2014 and 2017; EEA, 2017 and 2018b.

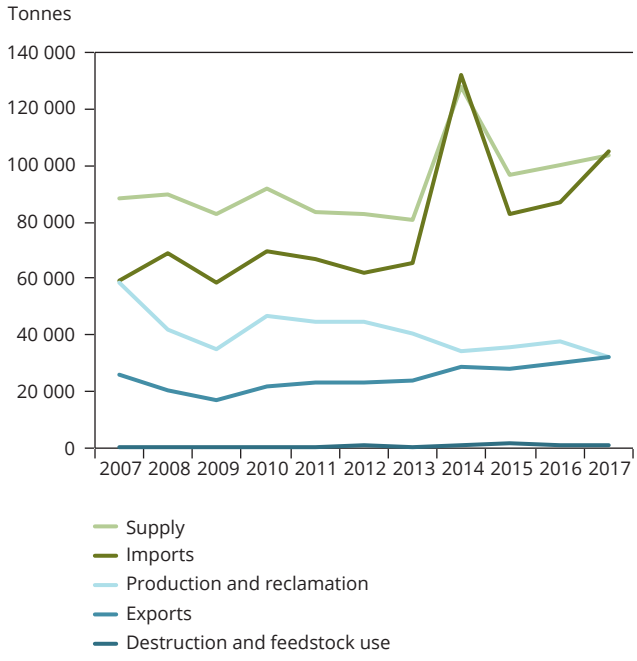
- Reclamation of used F-gases meeting the specifications of virgin gases has increased by about 30 %, compared with 2016, and approximately quadrupled since 2013. Under the HFC phase-down, 2017 HFC reclamation has risen to a level equivalent to 8 % (CO_2e) of virgin HFC production or more than 2 % (CO_2e) of HFC supply.

- Imports of F-gases into the EU in 2017 increased by 21 % compared with 2016 or by 8 % if measured in CO_2e. The increase in mass is primarily due to a doubling in low-GWP unsaturated HFCs and a 12 % rise in HFC imports. The rise in HFC imports was caused by a 16 % increase (in tonnes) in bulk HFC imports, as HFC imports in equipment decreased by approximately 10 %. The increase in imports measured in CO_2e was triggered by a 6 % increase in the GWP of imported HFCs, complemented by a rise in PFC and SF_6 imports of more than 30 %.

- Bulk exports of F-gases from the EU in 2017 increased by 6 % by mass but decreased by 8 % in CO_2e, compared with 2016. HFC exports have been rising since 2009; 2017 exports exceeded 2016 exports by 6 % by mass while the GWP of exported HFCs was approximately constant. The drop in the GWP of F-gas exports is due to a 17 % decrease in exports of SF_6, which coincides with the decrease observed for SF_6 production. Exports of F-gases contained in products and equipment are not subject to obligatory reporting.

- Destruction and feedstock use of F-gases is reported mainly for HFCs. Destruction declined by about 20 % (CO_2e) compared with 2016, while feedstock use remained constant. The joint negative contribution to HFC consumption calculated in CO_2e thus declined from 9 % in 2015 to 5 % in 2017.

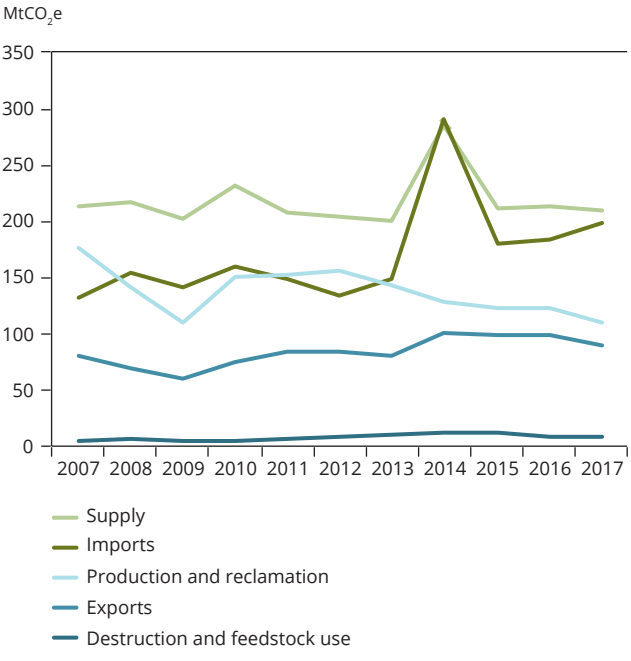
Figure ES.3 Supply, production, import, export and destruction of fluorinated gases in the EU



Notes: Annex II F-gases (unsaturated HFCs and HCFCs, hydrofluoroethers (HFEs) and alcohols, and 'other' perfluorinated compounds) and HFCs, PFCs and SF_6 in products and equipment were not subject to reporting for the period 2007-2013. Data presented for import and supply between 2007 and 2013 are thus limited to bulk import and bulk supply. Export is limited to bulk export for the whole time series.

Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

Figure ES.4 Supply, production, import, export and destruction of fluorinated gases in the EU



Notes: Annex II F-gases (unsaturated HFCs and HCFCs, HFEs and alcohols, and 'other' perfluorinated compounds) and HFCs, PFCs and SF_6 in products and equipment were not subject to reporting for the period 2007-2013. Data presented for import and supply between 2007 and 2013 are thus limited to bulk import and bulk supply. Export is limited to bulk export for the whole time series.

Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

1 Introduction

1.1 Background

1.1.1 International policy framework

The United Nations Framework Convention on Climate Change (UNFCCC) addresses several groups of fluorinated greenhouse gases (F-gases). The majority of these F-gases have very high global warming potentials (GWPs) in comparison with other greenhouse gases. Among them are hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3). They are also covered by the Kyoto Protocol and included in the European Union's (EU's) commitment under the Paris Agreement.

Certain F-gases have come into use since the 1990s for the replacement of ozone-depleting substances (ODS) that were phased out under the Montreal Protocol and Regulation (EC) No 1005/2009 ([1]). Their use in many different applications has been increasing and has considerable potential for further growth. F-gases accounted for approximately 3 % of overall greenhouse gas emissions expressed in carbon dioxide (CO_2) equivalents (CO_2e) in the 28 Member States of EU in 2016 (EEA, 2018a). F-gases emissions, of which more than 90 % are HFCs, declined for the first time in 15 years in 2015 (by 3 %). In 2016, total F-gases emissions rose by 0.6 % due to the increases observed for PFCs and SF_6, while HFCs further decreased by 0.1 %.

The EU has committed, under the UNFCCC, to reduce emissions of greenhouse gases by 20 % by 2020 compared with 1990 levels. F-gases are included in this target. Under the Paris Agreement, the EU is committed to a 40 % reduction in domestic emissions by 2030, compared with 1990.

The strong policy mechanisms adopted under the EU F-Gas Regulation of 2014 (EU, 2014b), which implements an EU-wide phase-down of HFCs, as well as measures taken by other industrialised countries, gave momentum to the global development of HFC regulation (EC, 2016). This culminated in October 2016 in Kigali, when the Montreal Protocol was amended to regulate HFCs. Both developed and developing countries have taken on mandatory commitments to reduce the production and consumption of HFCs in the next three decades ([2]).

1.1.2 EU legal framework on fluorinated gases

Old F-Gas Regulation

Regulation (EC) No 842/2006 (EU, 2006), the old F-Gas Regulation, employed two tracks of action from 2007:

1. improving the leak-tightness of equipment containing F-gases: measures comprised labelling of equipment containing F-gases, training and certification of personnel and companies handling these gases, containment of F-gases within equipment and proper recovery of F-gases from equipment that is no longer used;

2. avoiding the use of F-gases in some applications in which more environmentally superior alternatives are already cost effective: measures included restrictions on the use and marketing of F-gases in these cases.

New F-Gas Regulation (2014)

In 2015, the new F-Gas Regulation (No 517/2014) ([3]) was implemented, which aims to reduce F-gas emissions by two thirds of the 2010 level by 2030. The relevant

([1]) Regulation (EC) No 1005/2009 of the European Parliament and of the Council of 16 September 2009 on substances that deplete the ozone layer (EU, 2009).
([2]) The Kigali Amendment regulates production and consumption, while reducing emissions of HFCs remains within the remit of the UNFCCC and the Paris Agreement.
([3]) Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Regulation (EC) No 842/2006 (EU, 2014b).

measures from the 2006 regulation remain in force. This regulation includes a phase-down timeline for HFCs with GWP. Sales of HFCs on the EU market are progressively capped, reaching 21 % of baseline levels by 2030. In addition, F-gases with very high GWPs are banned entirely.

Under the regulation, companies are obliged to report on produced, imported and exported quantities of F-gases and mixtures as before. The new regulation extends the reporting obligation to:

- use of HFCs, PFCs and SF_6 as feedstocks for chemical reaction processes;
- destruction of F-gases;
- import of products or equipment containing F-gases.

Furthermore, under the new regulation, the list of reportable fluorinated gases (see Annex 1) was extended beyond HFCs, PFCs and SF_6 (as listed in Annex I of the new F-Gas Regulation) to include:

- unsaturated hydrochlorofluorocarbons (HCFCs);
- fluorinated ethers and alcohols;
- other perfluorinated compounds.

Commission Implementing Regulation (EU) No 1191/2014 ([4]), last amended by Commission Implementing Regulation (EU) 2017/1375 ([5]), establishes the format in which the reports are to be submitted.

1.2 Report structure

The report consists of six chapters.

The introductory chapter, Chapter 1, outlines legal arrangements and their implementation.

Chapter 2 details the reporting arrangements and the technical facilities used and gives an overview of the reporting companies.

Chapter 3 presents an overview of the data on production, imports, exports and destruction of fluorinated greenhouse gases as reported by companies.

Chapter 4 presents key indicators for the EU, based on data reported about the supply of F-gases to the EU market and their intended applications.

Chapter 5 discusses progress under the EU HFC phase-down.

Chapter 6 presents an outlook towards the global HFC phase-down under the Montreal Protocol.

1.3 Institutional arrangements

Companies that need to report are obliged to register with the European Commission's F-gas portal ([6]), which also hosts the HFC registry pursuant to Article 17 of the 2014 F-Gas Regulation.

Since 2012, the European Commission has given the responsibility for collecting, archiving and evaluating the data reported by companies to the European Environment Agency (EEA). The reporting process is executed through the EEA's online platform, the Business Data Repository (BDR), while technical support for the F-gas reporting process is provided by the EEA's European Topic Centre for Air Pollution and Climate Change Mitigation (ETC/ACM) ([7]).

1.4 Scope

The report is based on submissions for the year 2017 as received by 12 June 2018 (which includes some late reports and corrections received after the legal deadline of 31 March 2018). Data for previous years were changed slightly after some corrections were submitted, mostly for equipment imports, and data for Croatian HFC imports and exports (EC, 2014) were considered.

Data for 2007-2013 are covered by the old, 2006, F-Gas Regulation, while data for 2014 and onwards are

([4]) Commission Implementing Regulation (EU) No 1191/2014 of 30 October 2014 determining the format and means for submitting the report referred to in Article 19 of Regulation (EU) No 517/2014 of the European Parliament and of the Council on fluorinated greenhouse gases (EU, 2014a).
([5]) Commission Implementing Regulation (EU) 2017/1375 of 25 July 2017 amending Implementing Regulation (EU) No 1191/2014 determining the format and means for submitting the report referred to in Article 19 of Regulation (EU) No 517/2014 of the European Parliament and of the Council on fluorinated greenhouse gases (EU, 2017).
([6]) https://webgate.ec.europa.eu/ods2
([7]) http://acm.eionet.europa.eu

covered by the new, 2014 F-Gas Regulation. Because of the different reporting frameworks, data from the two periods are not always directly comparable.

1.5 Confidentiality

The new F-Gas Regulation requires that the confidentiality of the information submitted by companies is protected (Article 19(8)). The EEA takes appropriate measures to protect confidentiality and prevent publication of commercially sensitive information. These measures include public reporting of F-gases data only at higher levels of aggregation, to protect data that are the result of reports from fewer than three corporate groups, and additional steps to prevent deduction of sensitive information. It is for confidentiality reasons that some of the statements about fluorinated gas activity in this report are of a general nature and do not refer to figures or percentages. A summary of the confidentiality measures applied to the data published in this report is included at the beginning of Annex 5.

2 Reporting arrangements

2.1 Reporting format and quality control

The format for the reporting by companies in accordance with Article 19 of the new F-Gas Regulation (EU, 2014b) is laid down in Commission Implementing Regulation (EU) No 1191/2014 (EU, 2014a) last amended by Commission Implementing Regulation (EU) 2017/1375 (EU, 2017). A further specification of data to be reported is given in Annex 2. An overview of the reporting format applied for 2007-2013 under the old F-Gas Regulation is given in Annex 3.

Company registration for reporting and the reporting process are two separate procedures. Registration for reporting is centralised in the European Commission's F-gas portal at https://webgate.ec.europa.eu/ods2. This provides 'one-stop-shop' access for both the HFC Registry (for quota purposes) and for reporting under Article 19.

From their account in the F-gas portal, companies have a direct link to the BDR at https://bdr.eionet.europa.eu. This reporting platform ensures that the reporting process maintains traceability, confidentiality and transparency for all stakeholders.

2.1.1 Support for reporting companies

Reporters received support regarding the reporting procedure and technical questions from the EEA and the ETC/ACM reporting support team and various guidance documents made available at https://bdr.eionet.europa.eu/help/fgases:

- How to register? The F-gas portal registration manual ([8]);
- How to use the BDR reporting platform? The BDR user manual ([9]);
- What (numbers) should be reported? Frequently asked questions (FAQ) document ([10]).

2.1.2 Companies that are not obliged to support

The companies that considered that they were not covered by Article 19 of the new F-Gas Regulation in the past year were invited to communicate this through the web questionnaire in the BDR ('nil report') or by email in the event of technical difficulties.

2.1.3 Data quality control

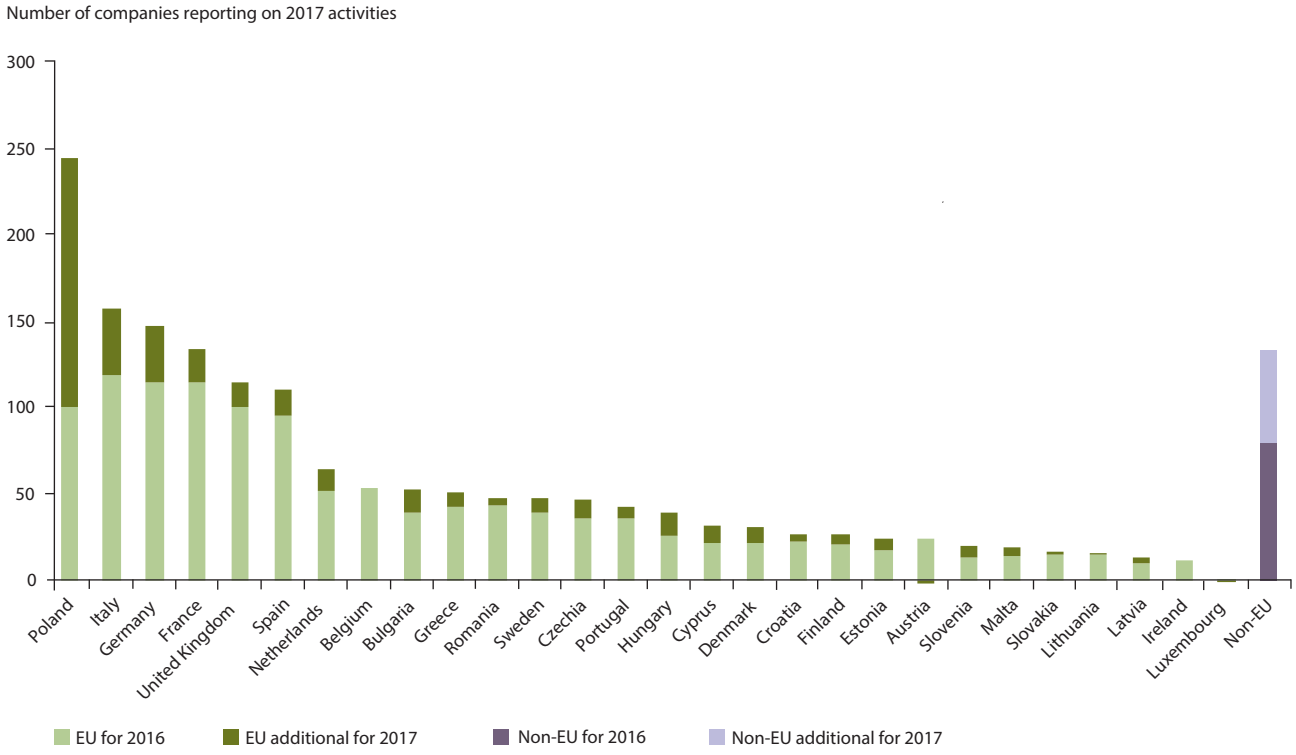
Data quality checking procedures included an automatic quality control implemented in the online questionnaire, which could also be invoked by the reporters manually. It was followed by manual quality control applied after submission of the reports. If problems were identified, reporters were contacted and invited to submit a revised report where necessary. All submissions were done via the BDR and never via informal communications or manual modifications in order to ensure the transparency of the reporting process. This process was repeated until submissions passed all quality checks.

2.2 Companies reporting in 2018

By 12 June 2018, 1 699 companies had reported on their F-gas activity during 2017, 33 % more than in the previous year. A further 983 companies reported no reportable activity during 2017 (nil report). As shown in Figure 2.1, companies are distributed across all EU Member States, the largest numbers are located in Poland, Italy, Germany, France, the United Kingdom and Spain. Polish companies contribute about one third to the observed rise of reporting companies. Of the 80 non-EU companies, most are Chinese that export

([8]) https://ec.europa.eu/clima/sites/clima/files/f-gas/docs/guidance_document_en.pdf
([9]) https://bdr.eionet.europa.eu/help/bdr_user_manual.pdf
([10]) https://ec.europa.eu/clima/sites/clima/files/f-gas/docs/faq_reporting_en.pdf

Figure 2.1 Reporting companies and new registrations in 2018 by Member State



Notes: Nil reports not included.
Non-EU countries: British Virgin Islands, China, Gibraltar, Hong Kong, Japan, Korea, Malaysia, Monaco, Norway, Serbia, Switzerland, Taiwan and the United States.

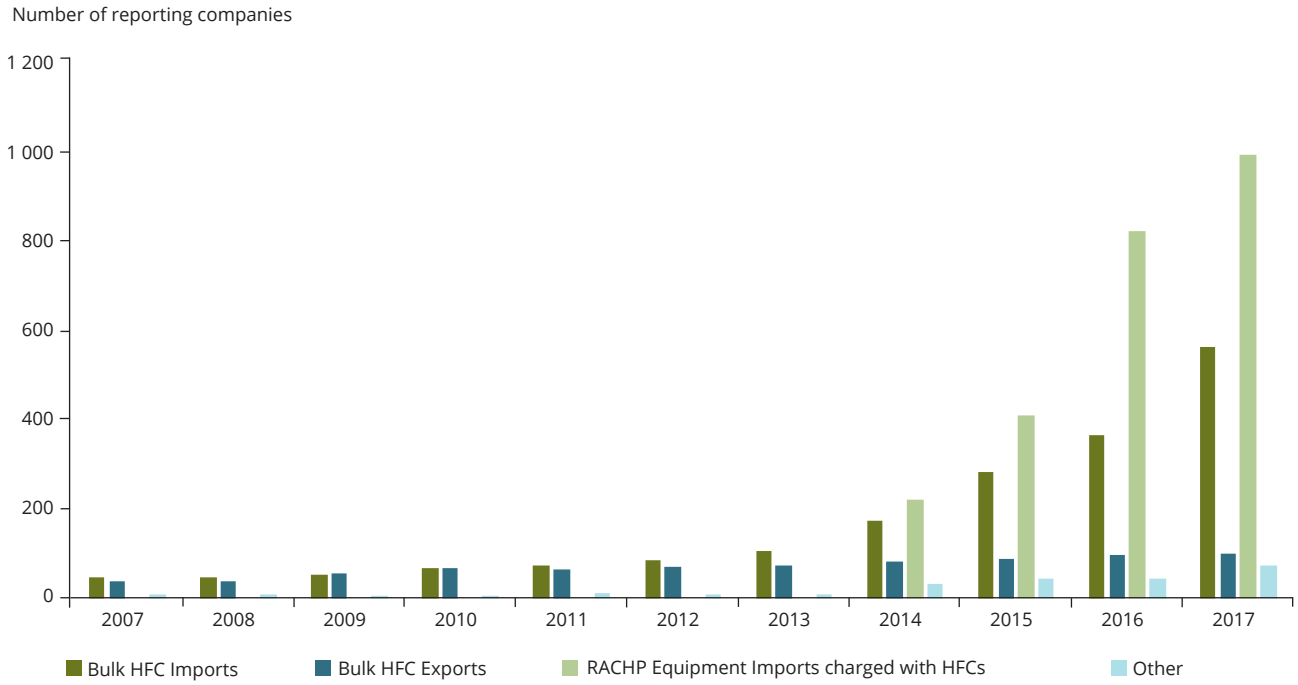
Source: EEA, 2018b.

gases or equipment to European subsidiaries and partners.

The activities reported by the majority of companies are the import of refrigeration, air conditioning and heat pump (RACHP) equipment charged with HFCs and the imports of bulk HFCs (Figure 2.2). Table A5.23 in Annex 5 (page 67) presents a breakdown of reporting companies by country and by reported activity for 2017.

Compared with last year, the number of bulk HFC importers increased by 55 %. This is linked to the large number of new entrant companies that had applied for the 2017 HFC quota. For RACHP equipment importers, the increase in reporting companies was only 18 % following a doubling of the number of reporters in the previous year. For a more detailed breakdown of reported activities over time, please refer to Table A5.25 in Annex 5 (page 69).

Figure 2.2 Reported activities, 2007-2017



Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

3 F-gas activity in the EU

This chapter presents data reported by companies on:

- production and reclamation (Section 3.1);
- imports, both bulk and in products/equipment, and bulk exports (Section 3.2);
- destruction and feedstock use (Section 3.3).

These data are the basis for the calculation of the EU F-gases supply (Chapter 4), the assessment of progress under the EU HFC phase-down (Chapter 5) and the calculation of EU HFC consumption (Chapter 6).

Table A4.1 in Annex 4 (page 49) explains the differences in the definitions of EU 'supply', as used in this report, compared with the compliance metrics of the HFC phase-down schemes, i.e. 'placing on the market' (POM), for the EU-wide HFC phase-down under the EU F-Gas Regulation, and 'consumption', for the global HFC phase-down under the Montreal Protocol.

All numbers are presented both as tonnes of fluorinated gases and as tonnes of CO_2e (t CO_2e). The statistics in physical tonnes reflect the usage patterns of fluorinated gases in European industries, while the usage of fluorinated gases expressed as CO_2e reflects the potential relevance for climate change policy and the HFC phase-down.

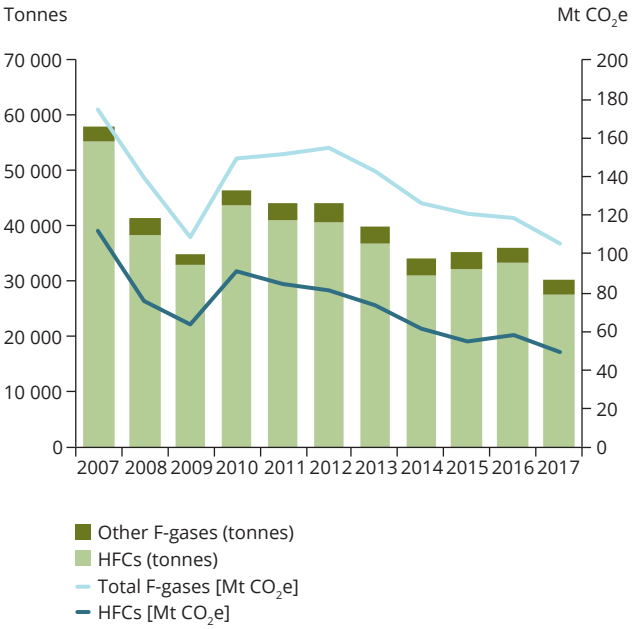
3.1 Production and reclamation

'Production' refers to the production of virgin F-gases. The F-Gas Regulation defines 'reclamation' as 'the reprocessing of a recovered fluorinated greenhouse gas in order to match the equivalent performance of a virgin substance, taking into account its intended use'. Note that reclaimed HFCs do not count as 'placed on the market' and are not subject to the limits of the HFC phase-down.

3.1.1 Production

Production of fluorinated gases in Europe showed a declining trend from 2007 to 2014 (Figure 3.1), not taking into account the dip in production induced by the financial crisis in 2008 and 2009. After 2014, there was a slight increase in production (green bars) together with a continued decrease in the GWP of the produced gas (blue line). This indicates a shift to F-gases with lower GWPs. In 2017, both the volume and the GWP of production declined by more than 10 %, a reflection of the 30 % reduction in HFC-134a production.

Figure 3.1 EU production of fluorinated gases



Note: Annex II F-gases (unsaturated HFCs and hydrochlorofluorocarbons (HCFCs), hydrofluoroethers (HFEs) and alcohols, and NF_3 and other perfluorinated compounds) were not subject to reporting for the years 2007-2013.

Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

Production of F-gases is dominated by HFCs, which account for more than 90 % of the total, with HFC-134a and HFC-365mfc accounting for the largest parts. Other HFCs produced in the EU are HFC-143a, HFC-227ea and HFC-23. The production of HFC-32 and HFC-125 in the EU ceased after 2013 and 2014, respectively. While SF_6 accounts for only 8 % of EU F-gas production, it constitutes about 50 % of the total GWP of production. SF_6 production declined by 10 % compared with 2016. Other F-gases produced in the EU are four PFCs and unsaturated HFC-1234yf; however, these are produced in comparatively small amounts.

A tabular overview on the F-gases produced in the EU since 2007 in tonnes and CO_2e is given in Table A5.1 and Table A5.2 in Annex 5 (page 53).

3.1.2 Reclamation

Reclamation of fluorinated gases in the EU has fluctuated, but there has been a steady increase since 2014 (Figure 3.2). In 2017, the reclaimed amount increased by more than one quarter compared with 2016, an increase mostly caused by the reclamation of HFCs. Reclaimed HFCs now make up 8 % of the produced amount, or 2 % of the EU supply of virgin HFCs (both measured in CO_2e). While 95 % of reclaimed amounts are HFCs, SF_6 contributes to 30 % of the GWP of reclaimed gases. Details can be found in Table A5.3 and Table A5.4 in Annex 5 (page 54).

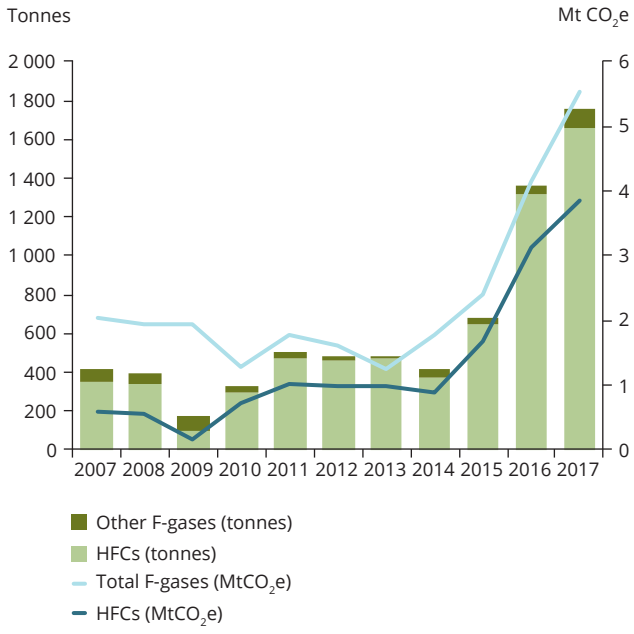
3.2 Imports and exports

3.2.1 Imports

Imports of F-gases into the EU, including both bulk imports and imports contained in products and equipment, increased by 21 % compared with 2016 (Figure 3.3). That increase is approximately equally divided between HFCs and unsaturated HFCs/hydrochlorofluorocarbons (HCFCs). This means that the imports of HFCs rose by 10 % and the imports of unsaturated HFCs and HCFCs more than doubled compared with the previous year. The proportion of HFCs as a percentage of total imports thus declined from 91 % in 2016 to 85 % in 2017.

Given the low GWP of unsaturated gases, the GWP of total F-gas imports increased by only 8 %. Of that increase in the GWP of imports, 70 % is due to a rise in HFC imports, and the remainder is caused by increases in SF_6 and PFC imports. Detailed data on total imports can be found in Table A5.5 and Table A5.6 in Annex 5 (page 55).

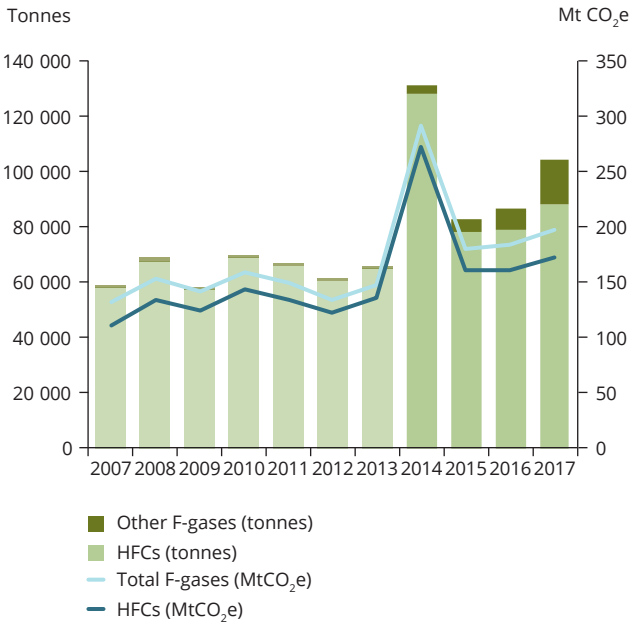
Figure 3.2 EU reclamation of fluorinated gases



Note: Annex II F-gases (unsaturated HFCs and HCFCs, HFEs and alcohols, and NF_3 and other perfluorinated compounds) were not subject to reporting for the years 2007-2013.

Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

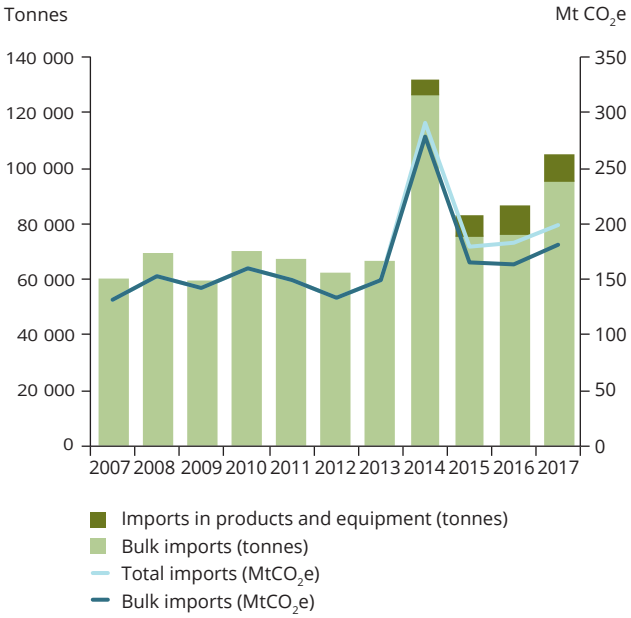
Figure 3.3 EU imports of fluorinated gases



Note: Annex II F-gases (unsaturated HFCs and HCFCs, HFEs and alcohols, and NF_3 and other perfluorinated compounds) and gases contained in products and equipment were not subject to reporting before 2014.

Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

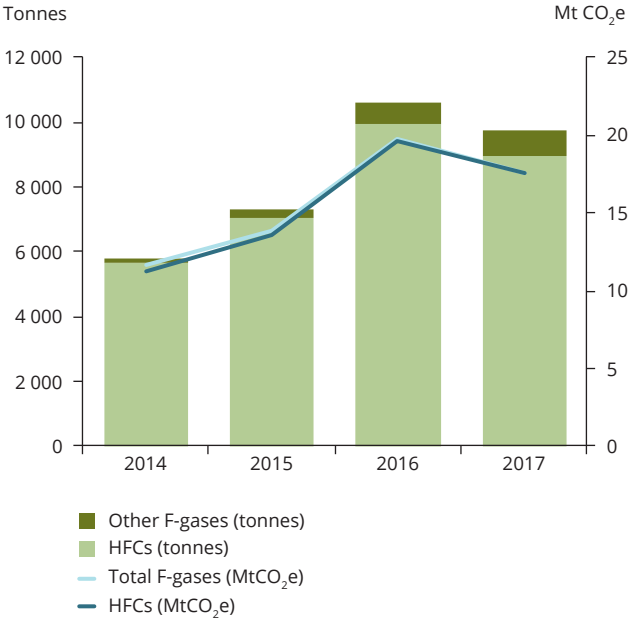
Figure 3.4 EU imports by type



Note: Annex II F-gases (unsaturated HFCs and HCFCs, HFEs and alcohols, and NF_3 and other perfluorinated compounds) were not subject to reporting for the years 2007-2013.

Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

Figure 3.5 EU imports of fluorinated gases within products and equipment



Sources: EEA, 2017 and 2018b.

Note that, for the years 2014 to 2017, Figure 3.3 includes both bulk and equipment imports, which were not reported before 2014. The figures before 2014 include only bulk imports. In 2017, equipment imports made up 9 % of the total imported amount (Figure 3.4), compared with 12 % in 2016.

As F-gases imports in products and equipment have been decreasing in 2017, the rise in total imports was triggered by a 25 % increase in bulk imports (10 % increase of the GWP). Patterns in gas groups affecting the increase in bulk imports are similar as described for total imports above. The exceptionally high bulk imports in 2014 (mostly HFCs) resulted from the fact that company prepared for the start of the quota system in 2015.

Detailed data on bulk imports are contained in Table A5.7 and Table A5.8 in Annex 5 (page 56).

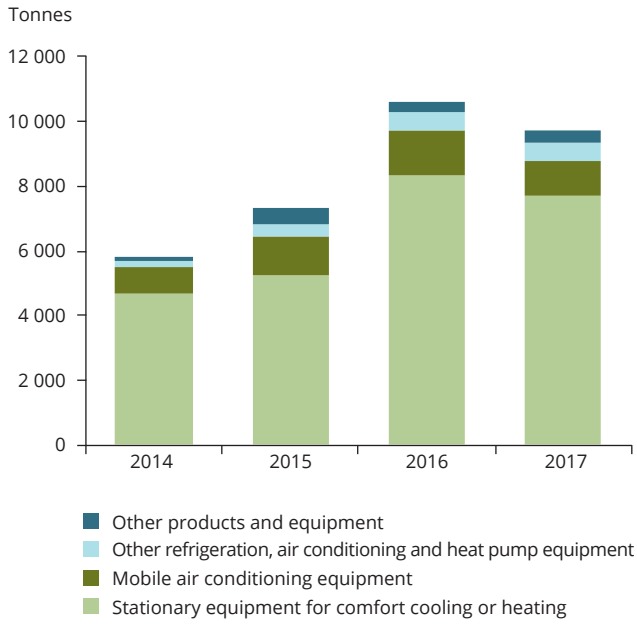
Imports contained in products and equipment

Imports of F-gases contained in products and equipment ([11]) have been subject to reporting since 2014, and reported amounts have risen significantly since then (Figure 3.5). However, a large part of past increases may be attributable to more complete reporting and not to actual increases in equipment imports. In 2017, reported imports decreased for the first time, the contained gases were 8 % less than that of 2016 and the GWP was 11 % lower. This drop may be linked to the fact that, as of 2017, HFCs contained in RACHP equipment are covered by the HFC phase-down under the EU F-gas Regulation.

HFCs make up 92 % of F-gases imported in equipment, the remainder being almost completely unsaturated HFC-1234yf, used as the refrigerant in the air conditioning equipment of vehicles.

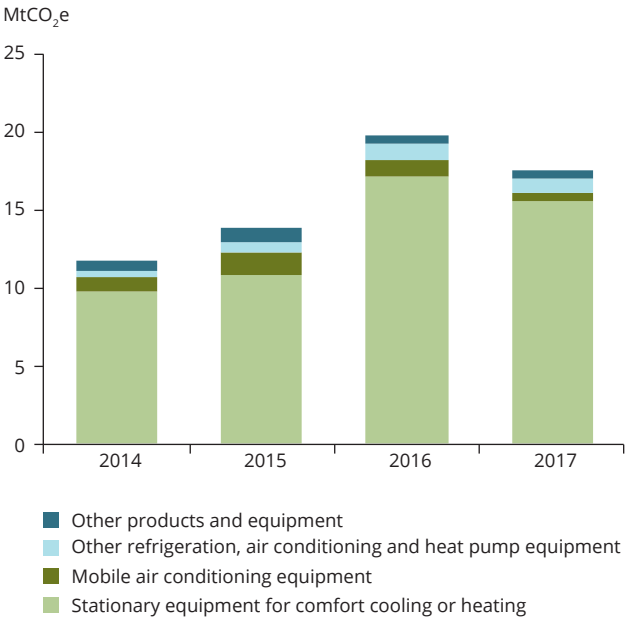
([11]) Data reported by importers of products or equipment under the F-Gas Regulation (EU) No 517/2014 are defined as including quantities imported **and** placed on the market. Products and equipment that are imported but not placed on the market (e.g. for re-export) are not to be reported. Considering this limitation, the import of gases within products and equipment presented here have been approximated using the reported data.

Figure 3.6 **Categories of EU supply in products and equipment of fluorinated gases (tonnes)**



Sources: EEA, 2017 and 2018b.

Figure 3.7 **Categories of EU supply in products and equipment of fluorinated gases (CO_2e)**



Sources: EEA, 2017 and 2018b.

The most important category in equipment imports (Figure 3.6 and Figure 3.7) is 'stationary equipment for comfort cooling or heating' (mostly air conditioning). Reported imports in that category make up 79 % of total F-gases in equipment imports or 88 % of the total GWP. This category also accounts for about 70 % of the decrease observed for 2017.

F-gases in mobile air conditioning equipment (mostly in passenger cars and light duty vehicles) make up about 30 % of the observed decrease. In 2017, it accounted for 12 % of total gases contained in imported equipment, but only 3 % of the GWP. Figure 3.8 illustrates how unsaturated HFC-1234yf is gradually replacing HFCs (in particular HFC-134a) in imported vehicles, reaching a proportion of almost 70 % in 2017.

The data reported for unsaturated HFC-1234yf contained in imported vehicles may not be complete. This is due to its low GWP, of 4, in combination with the threshold for the reporting obligation for equipment importers of 500 tCO_2e. With a specific charge of approximately 0.5 kg per passenger car, the 500 tCO_2e threshold corresponds to 250 000 passenger cars. For air conditioning systems still using the traditional refrigerant classification of HFC-134 (R-134a) (GWP: 1 430), however, the 500 tCO_2e threshold corresponds to approximately 700 passenger cars. Thus, car importers specialising in models using HFC-1234yf may often not be affected by the reporting obligation. However, several of such car importing companies having been reporting on HFC-1234yf imports in the past years, despite not being obliged to as they were below the threshold.

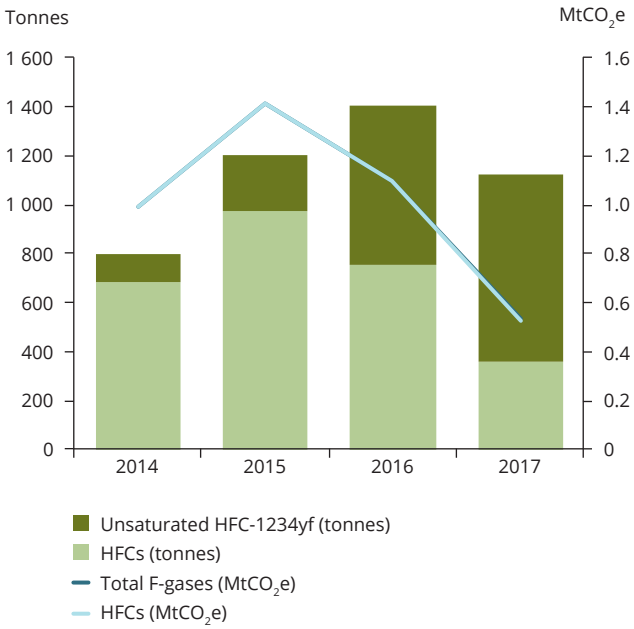
Detailed data on F-gases in imported products and equipment are listed in Table A5.9 and Table A5.10 in Annex 5 (page 57). Equipment imports by equipment category are given in Table A5.11and Table A5.12 (page 58).

3.2.2 Exports

In 2017, bulk exports ([12]) of fluorinated gases from the EU rose by 6 % compared with 2016. However, the GWP of exports decreased by 8 % (Figure 3.9). This is due to different trends observed for different gases: HFC exports have been rising since 2009, with 2017 exports exceeding those of 2016 by 6 %. However,

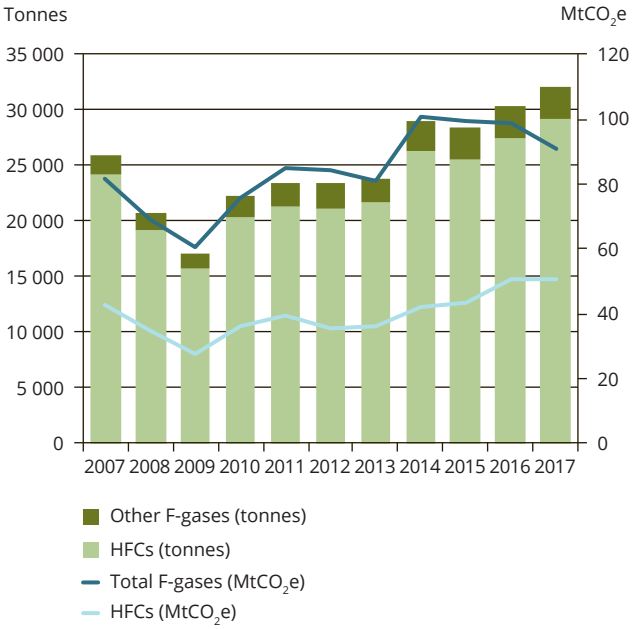
([12]) The F-Gas Regulations do not stipulate data collection on exports of products and equipment.

Figure 3.8 EU imports of fluorinated gases within air conditioning equipment for vehicles



Sources: EEA, 2017 and 2018b.

Figure 3.9 EU bulk exports of fluorinated gases



Note: Annex II F-gases (unsaturated HFCs and HCFCs, HFEs and alcohols, and NF_3 and other perfluorinated compounds) were not subject to reporting for the years 2007-2013.

Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

the GWP of exported HFCs was almost the same as last year. The drop in the GWP of F-gas exports is due to a 17 % decrease in exports of SF_6, which coincides with the decrease observed for SF_6 production.

The composition of exports mirrors that of production. Exports are dominated by HFCs (about 90 % of the total). Other gases make up a small proportion of exports but contribute almost 50 % to their total GWP (mostly due to SF_6).

Detailed data on exports can be found in Table A5.13 and Table A5.14 in Annex 5 (page 59).

3.3 Destruction and feedstock use of fluorinated gases

This section presents the amounts of F-gases reported as destroyed or used for feedstock. Use for feedstock means that the gas undergoes a chemical transformation that converts it to a different substance, which will result in insignificant emissions. Note that some industrial processes that use F-gases, for example etching or cleaning chemical vapour deposition chambers in the electronics industry, do result in considerable destruction rates, but they do not qualify as destruction or feedstock use.

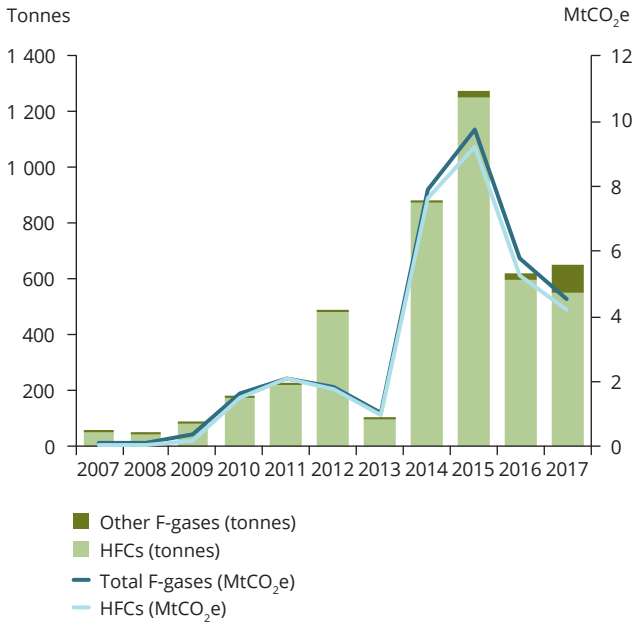
3.3.1 Destruction

Destruction of fluorinated gases in the EU consistently and strongly increased from 2008 to 2015, with the exception of very low reported levels for 2013 ([13]). However, since 2015 destruction has been declining (Figure 3.10). In 2017, destroyed amounts increased compared with 2016 by 5 %, due to a large amount of isofluorane (HCFE-235da2) reported for destruction for the first time. However, the GWP of destroyed F-gases declined by 21 % compared with 2016.

Destruction is focused on HFCs (85 % of total amount in 2017), of which about half is HFC-23. HFC-23 occurs as a by-product in certain production processes of fluorinated gases, and its destruction or reclamation is obligatory under the F-Gas Regulation. HFC-23 alone accounts for about 80 % of the GWP of destroyed F-gases.

([13]) A thorough analysis of the confidential data indicates that this is likely to be due to incomplete reporting, which manifested itself most strikingly in 2013.

Figure 3.10 EU destruction of fluorinated gases



Note: Annex II F-gases (unsaturated HFCs and HCFCs, HFEs and alcohols, and NF_3 and other perfluorinated compounds) were not subject to reporting for the years 2007-2013.

Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

HFC destruction plays a role in determining consumption because HFCs that are destroyed are subtracted from the amounts of HFCs that are produced and imported in that calculation (see Chapter 6, page 37). In comparison with EU HFC consumption, the amount of destroyed HFCs has decreased from 6 % in 2015 to 3 % in 2017 (measured in CO_2e).

3.3.2 Feedstock use

EU feedstock use has been fluctuating since reporting started in 2007. However, the reported amounts have been almost constant since 2015 and at the lowest level since reporting started. Feedstock use consists almost exclusively of HFCs, most of which is HFC-23, and small amounts of unsaturated HCFCs. As for destruction, HFCs that are used as feedstock do not count towards consumption (see Chapter 6, page 37). The percentage of HFCs used as feedstock, as a proportion of HFC consumption, was about 2 % in 2017 (measured in CO_2e).

4 Supply of fluorinated gases to the EU

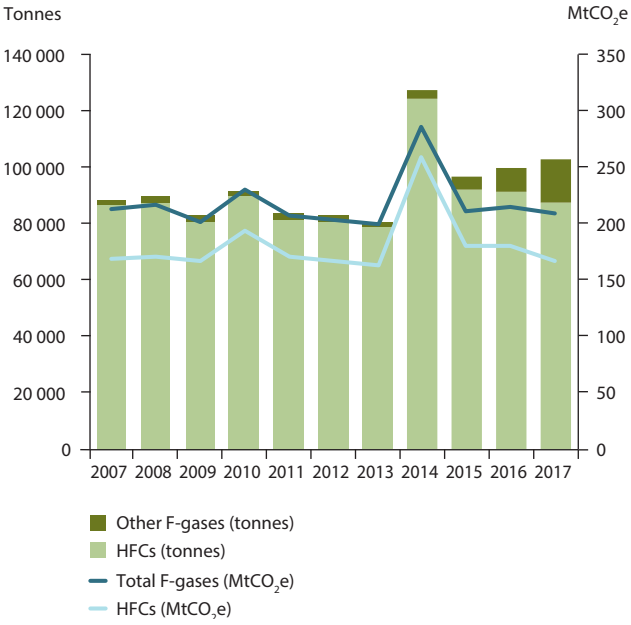
EU supply is a metric used by the EEA that provides information on the actual use of fluorinated gases by EU industries. It is calculated primarily from reported production, imports and exports ([14]).

The supply of fluorinated gases to the EU declined slightly from 2010 to 2013. As discussed in Section 3.2 on bulk imports, the exceptionally high supply in 2014 was driven by preparations for the HFC quota system entering into force the following year. Total supply in 2017 was slightly (3 %) higher than in 2016, but with a lower total GWP (2 % decrease) than in 2016 (Figure 4.1). That increase in supply was caused by a doubling of the supply of unsaturated HFCs while the supply of HFCs decreased by 4 %. The decreasing trend in the GWP of supply reflects the 7 % decrease for HFCs, partly counterbalanced by a 20 % increase for SF_6, a 30 % increase for NF_3 and a 40 % increase for PFCs. None of the latter three substances is covered by the quota system. Note that the trends observed for the GWP of supply are influenced by stock effects, beyond the trends for production, import and export presented in Chapter 3. During 2016, producers and importers had significantly reduced their HFC stocks, which was accounted for as supply in 2016. During 2017, however, the stocks were slightly increased, thus decreasing 2017 supply. The supply of F-gases is dominated by HFCs, which accounted for 85 % (in tonnes) or 80 % (in CO_2e) of the total in 2017.

The HFC supply shown in Figure 4.1 for the year 2014-2017 includes equipment imports, while amounts given for 2007-2013 reflect HFC bulk supply only. If corrected for that difference, HFC bulk supply for 2015-2017 is well below 2007-2013 levels, and decreasing. The proportion of equipment imports in the total supply has slightly decreased since 2016, and was 9 % (in tonnes) or 8 % (in CO_2e) in 2017 (Figure 4.2).

While previous figures focus on analyses split either by gas or by supply type, Figure 4.3 and Figure 4.4 (page 22) combine these perspectives and show the amounts of HFCs (bulk and in products and equipment) alongside PFCs, SF_6 and Annex II F-gases that were not subject to reporting before 2014. The figures show that, of all the F-gases that are subject to reporting, only HFCs are imported in products and equipment in significant amounts (the dark green parts of the columns in Figure 4.3 and Figure 4.4). However, HFCs in bulk imports constitute the lion's share (light blue).

Figure 4.1 EU supply of fluorinated gases

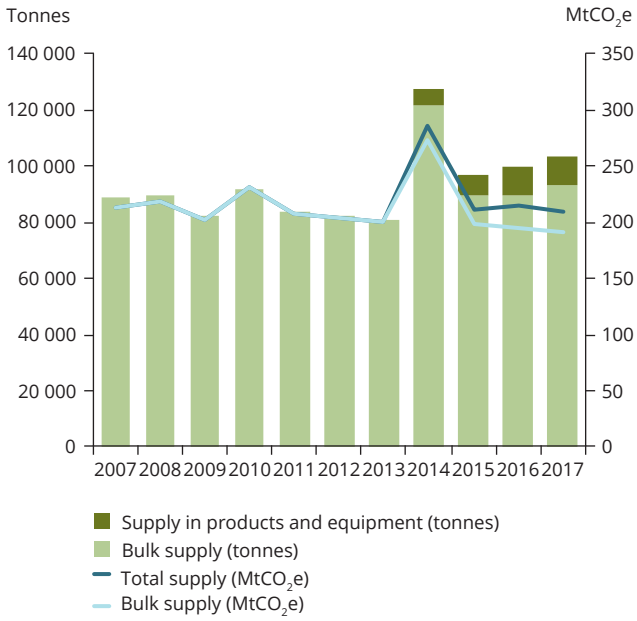


Note: Annex II F-gases (unsaturated HFCs and HCFCs, HFEs and alcohols, and NF_3 and other perfluorinated compounds) and gases contained in products and equipment were not subject to reporting before 2014.

Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

([14]) For methodological details on the calculation of EU supply, please refer to Annex 4, in particular Table A4.1 (page 50), which explains the difference between the metrics of 'EU supply', 'placing on the market' and 'consumption', which are relevant for different aspects of the legal framework.

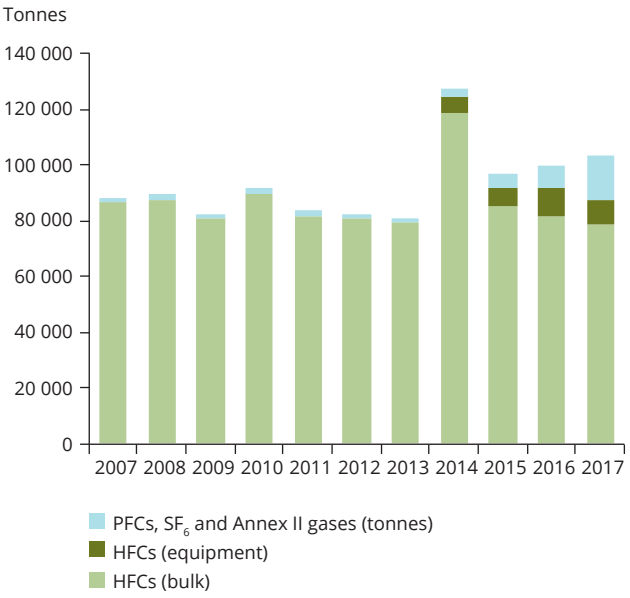
Figure 4.2 EU supply of fluorinated gases by types



Note: Annex II F-gases (unsaturated HFCs and HCFCs, HFEs and alcohols, and NF_3 and other perfluorinated compounds) and gases contained in products and equipment were not subject to reporting before 2014.

Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

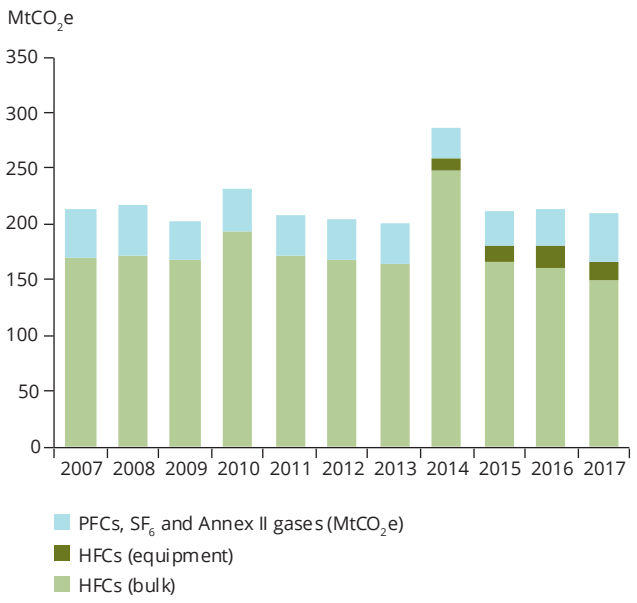
Figure 4.3 EU supply by supply types and groups of fluorinated gases (tonnes)



Note: Annex II F-gases (unsaturated HFCs and HCFCs, HFEs and alcohols, and NF_3 and other perfluorinated compounds) and gases contained in products and equipment were not subject to reporting before 2014.

Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

Figure 4.4 EU supply by supply types and groups of fluorinated gases (CO_2e)



Note: Annex II F-gases (unsaturated HFCs and HCFCs, HFEs and alcohols, and NF_3 and other perfluorinated compounds) and gases contained in products and equipment were not subject to reporting before 2014.

Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

HFCs, both in bulk and in equipment, are decreasing under the influence of the EU HFC phase-down.

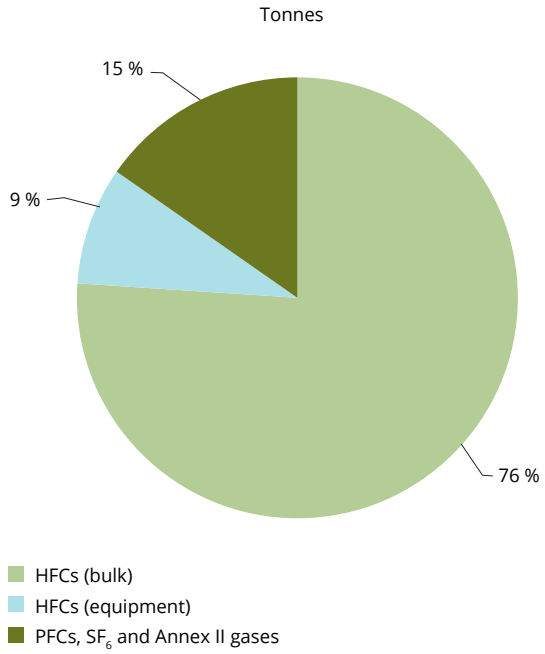
Figure 4.5 shows the make-up of supply in 2017 in more detail: the largest proportion is HFCs delivered in bulk (76 % of total EU supply of F-gases) and about 9 % is HFCs delivered in products and equipment. The proportion of unsaturated HFCs has risen to 13 %. PFCs, SF_6 and other gases are supplied almost exclusively in bulk. The picture looks slightly different when looking at the total GWP of the EU supply (Figure 4.6). The proportion of non-HFCs is much higher, approximately 20 % of the total GWP, which is mainly due to the very high GWP of SF_6.

Detailed data on total supply and bulk supply are given in Table A5.15 to Table A5.18 in Annex 5 (page 60). For data on supply in imports and equipment, please refer to Table A5.9 and Table A5.10 (page 57).

4.1 Intended applications of EU supply

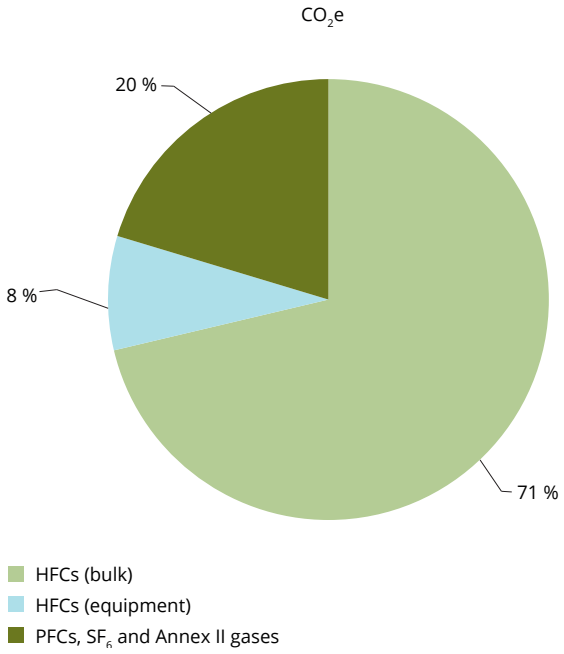
Figure 4.7 and Figure 4.8 show the proportions of intended applications calculated for the 2017 supply of F-gases, while Figure 4.9 and Figure 4.10 (page 24) show the trends over time since 2007. When interpreting

Figure 4.5 2017 EU total supply by types and groups of fluorinated gases (% tonnes)



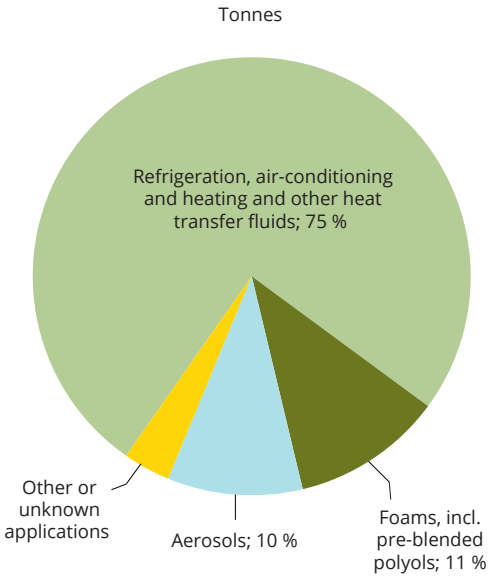
Source: EEA, 2018b.

Figure 4.6 2017 EU total supply by types and groups of fluorinated gases (% CO_2e)



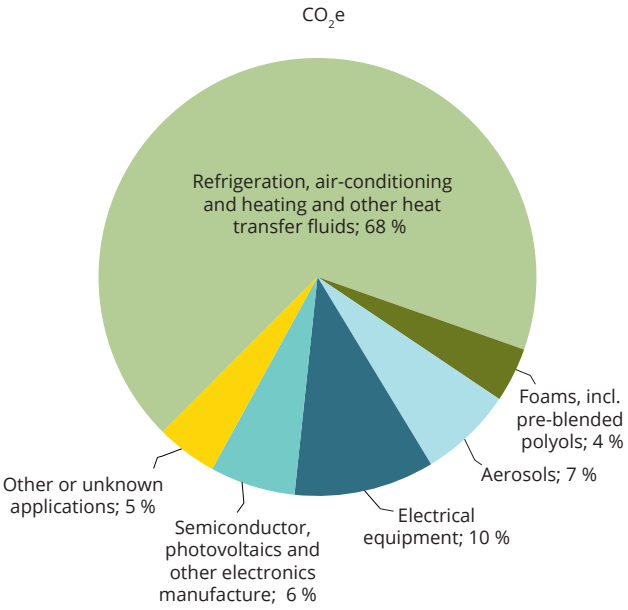
Source: EEA, 2018b.

Figure 4.7 2017 EU supply by intended applications (% tonnes)



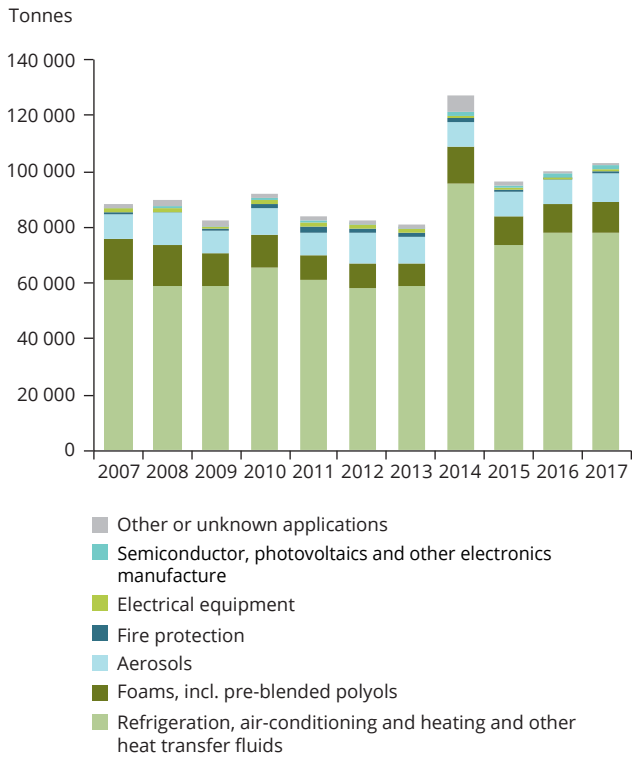
Source: EEA, 2018b.

Figure 4.8 2017 EU supply by intended applications (% CO_2e)



Source: EEA, 2018b.

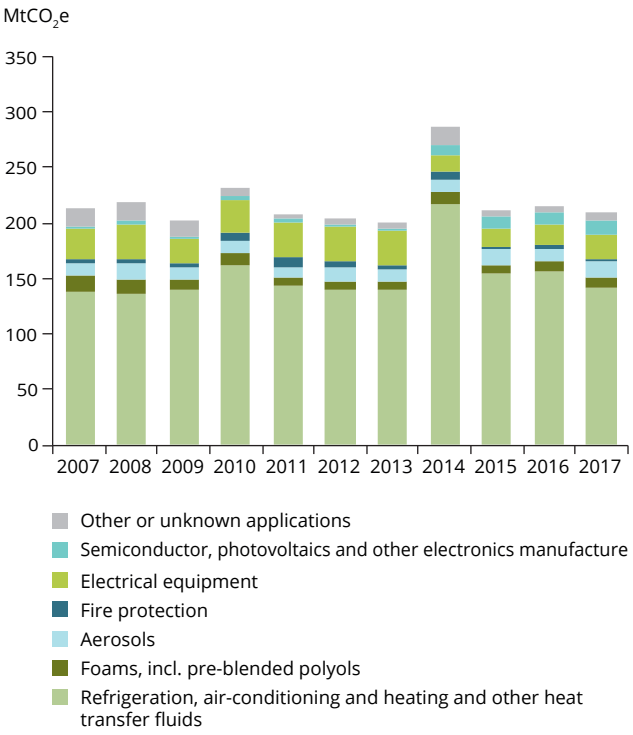
Figure 4.9 **Intended applications of EU total supply of fluorinated gases (tonnes)**



Note: Annex II F-gases (unsaturated HFCs and HCFCs, HFEs and alcohols, and NF_3 and other perfluorinated compounds) and gases contained in products and equipment were not subject to reporting before 2014.

Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

Figure 4.10 **Intended applications of EU total supply of fluorinated gases (CO_2e)**



Note: Annex II F-gases (unsaturated HFCs and HCFCs, HFEs and alcohols, and NF_3 and other perfluorinated compounds) and gases contained in products and equipment were not subject to reporting before 2014.

Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

trends, the limitations of the consistency of the results between 2013 and 2014 because of new reporting requirements on equipment imports and Annex II gases should be kept in mind.

Refrigeration, air conditioning and heating are by far the most relevant applications of supplies of F-gases to the EU, representing three quarters of the 2017 supply. The supplied quantity of refrigerants remained almost constant (decreasing by 0.2 %) compared with 2016, while its total GWP measured in CO_2e decreased by 10 %, mostly because of the larger proportion of HFC-1234yf. This confirms the trend of using refrigerants with lower GWPs, as described in a previous EEA report (EEA, 2017).

F-gases used for foam blowing account for 11 % of the 2017 supply, when measured in tonnes. The gases used here, mostly HFCs, have comparatively low GWPs; therefore, foams account for only 4 % of total GWP. In absolute numbers, the supply for foam blowing increased by 14 % compared with 2016, an increase of mostly unsaturated HFCs and HCFCs. Consequently, the total GWP of F-gases used for foam blowing has decreased by 4 % compared with 2016.

The use of F-gases, mainly HFC-134a, for aerosols increased by about 18 % compared with the previous year, which equals an increase of 25 % of the GWP. These uses now each account for 10 % of the total use, or 7 % of the total CO_2e. The use of F-gases for fire protection has further declined by about 20 % compared with 2016 and is now at approximately 20 % of the 2011 amount. It now stands at less than 1 % of total supply, in both tonnes and CO_2e.

Some smaller applications use F-gases with very high GWPs, which means they will represent a large proportion of total GWP, even though the amounts of F-gases used are small. These are primarily SF_6, PFCs and NF_3 used in electrical equipment (10 % of total GWP in 2017) and in semiconductor, photovoltaics and other electronics manufacture (6 %). In both applications, there has been an increase in the quantities of these gases reported of about 20 % compared with 2016. Note that the time

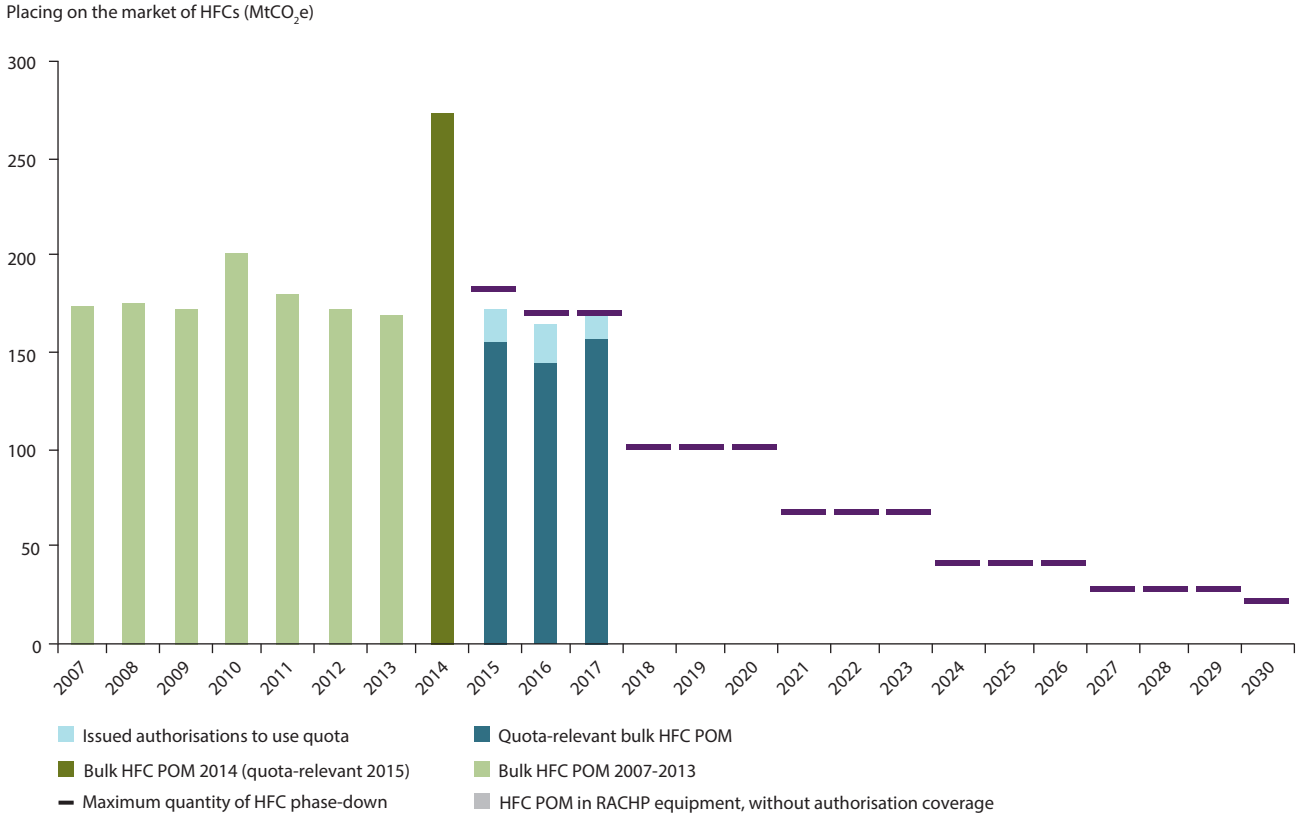
series in Figure 4.10 shows a substantial increase in semiconductor, photovoltaics and electronics manufacturing use between 2013 and 2014: this is mainly because companies were not obliged to report use of NF_3 before 2014.

Detailed data on intended applications can be found in Table A5.19 and Table A5.20, in Annex 5 (page 65). For categories of supply in products and equipment, please refer to Table A5.11 and Table A5.12 (page 58). For details of the calculation methods, please refer to Annex 4.

5 Progress of the EU HFC phase-down

Starting in 2015, the amount of HFCs that can be placed on the EU market annually is capped to a limited HFC quota, which is being progressively reduced ('EU HFC phase-down'). Companies that deal in HFCs receive quotas annually that are transferrable only under certain conditions, and, unlike emissions allowances under the EU Emissions Trading System (ETS), they are not freely tradable ([15]). In order to legally place HFC bulk gases on the EU market, companies must hold a sufficient quota. Companies exceeding their quota face a penalty of twice the exceedance amount, applied to the subsequent quota allocation by the European Commission. Additional consequences for non-compliant companies are subject to Member States' legislation.

Figure 5.1 Progress of the EU HFC phase-down



Notes: POM, placing on the market. Values from 2007 to 2013 are based on the reporting obligations of the old F-Gas Regulation ((EC) No 842/2006) and are therefore not fully comparable with data from 2014 onwards (based on the obligations of the new F-Gas Regulation ((EU) No 517/2014)). Similarly, the maximum quantities of the EU HFC phase-down may be recalculated for 2019 and are for indicative purposes only.

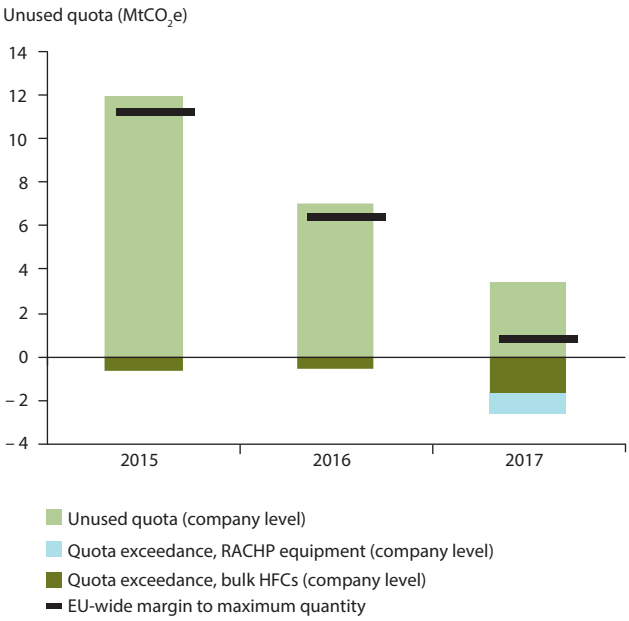
Sources: EC, 2011, 2014 and 2018; EEA, 2017 and 2018b.

([15]) Quota allocations are set out in Article 16 and Annexes V and VI of the F-Gas Regulation (EU) No 517/2014. Transfers and authorisations are regulated in Article 18. Penalties are covered in Article 25.

Quotas are expressed in CO_2e, rather than physical tonnes of gases, to create an incentive to use gases with lower GWPs. The initial total allocation in 2015 was 183.1 $MtCO_2e$ (EC, 2018). In 2016 and 2017, the first stage of reduction applied and only 170.3 $MtCO_2e$ was allocated (93 % of the 2015 allocation) ([16]). Following a recalculation of the maximum quantity for 2018, which allowed for the substraction of exempted gases as stipulated in Annex V of the F-Gas Regulation, an HFC quota totalling 101.2 $MtCO_2e$ was allocated for 2018 (EC, 2018).

From 2017 onwards, HFCs contained in RACHP equipment are also covered by the quota mechanism. In order to import such equipment, importers must acquire authorisations to use quota from quota-holding companies. Notably, it is the sale of authorisations by the quota holder and not the actual import of RACHP equipment by the authorised party that counts as placed on the market ([17]) for the purpose of the annual quotas. Therefore, equipment imports can physically occur in a later year, while the sale of authorisations must be covered by the quota for the year of the sale. Contrary to authorisations, a quota is time-stamped for a specific year and an unused quota cannot be carried over to the following year. Issued authorisations are already accounted for in the following figures on bulk placing on the market (POM).

Figure 5.2 Balance between placing on the market of HFCs and related quotas at EU level



Note: The data for 2017 have not yet undergone scrutiny by the European Commission.

Sources: EC, 2018; EEA, 2017 and 2018b.

The EU is on track for the HFC phase-down (Figure 5.1). In 2017, the total quota-relevant POM was 0.4 % below the maximum quantity ([18]). For the previous years, overachievements of 6 % (2015) and 4 % (2016) were observed.

The EU-level assessment presented in Figure 5.1 is based on company-level data concerning amounts of bulk HFCs placed on the market and the quotas held by these companies ([19]). Starting in 2017, HFCs placed on the market within imported RACHP equipment are considered in those cases where the importers did not hold sufficient quota authorisations.

Figure 5.2 shows how the EU-wide overachievement breaks down into quota compliance at company level. In 2015 and 2016, the sum of unused quotas was much larger than the quota exceedances observed for some companies. In 2017, the margin was much narrower, especially as non-compliant RACHP equipment importers are also considered. Note that data on 2017 quota exceedance both for bulk HFCs and for equipment importers are preliminary and have not yet undergone in-depth compliance scrutiny by the European Commission. Thus, final numbers may change and would be reflected in next year's report.

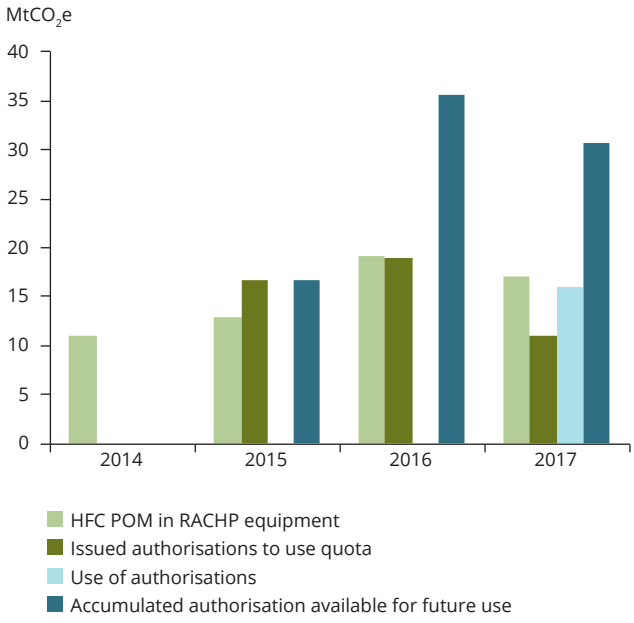
Quota-relevant POM as shown in Figure 5.1 does not include amounts of HFCs placed on the market under the exemptions of Article 15(2) of the F-Gas Regulation. The exemptions for HFCs supplied to bulk export, to the production of pharmaceutical metered dose inhalers (MDIs) and to feedstock use are quantitatively most relevant. The exemptions for supply to semiconductor industry and to military use and for imports for destruction are used in significantly lower amounts. Reported amounts for the total of Art 15(2) exemptions have been rising from 2014-2016, but have dropped by

([16]) See the phase-down schedule in Annex V of the F-Gas Regulation (EU) No 517/2014.
([17]) The monitoring of the EU HFC phase-down relies on the metric 'placing on the market' (POM). For calculation details, please refer to Annex 4 (page 47). Compliance-relevant POM is the physical POM of bulk HFCs, where not covered by one of the exemptions of Article 15 of the F-Gas Regulation, in addition to authorisations issued by quota holders. Starting in 2017, HFCs placed on the market within imported RACHP equipment are also considered in the overall assessment of the phase-down in those cases where the importers did not hold sufficient quota authorisation.
([18]) Data for 2017 are preliminary and subject to scrutiny by the European Commission.
([19]) Data at company level are confidential and cannot be disclosed further.

12 % in 2017. In total, about 11 % of HFCs reported fall under the Article 15(2) exemptions (see Table A5.21, page 66). The exemption under Article 15(2)(f) for pharmaceutical metered dose inhalers (MDIs) was not applicable before 2018.

As mentioned above, HFCs contained in imported RACHP equipment have been included in the EU HFC phase-down since 2017. Since then, equipment importers have needed to hold authorisations to use quota issued by HFC producers or bulk importers that were allocated quota by the European Commission. Figure 5.3 compares the levels of HFCs in imported RACHP equipment (reported since 2014) with authorisations issued since 2014 and with authorisations used since 2017. Quota authorisation stockpiled by equipment importers by the end of 2017 was almost double the amount of 2017 RACHP equipment imports in need of authorisation.

Figure 5.3 Authorisations for HFCs in RACHP equipment imports



Notes: POM, placing on the market. RACHP, refrigeration, air conditioning and heat pumps.

HFCs placed on the market in RACHP equipment before 2016 are not subject to the EU HFC phase-down.

Sources: EEA, 2017 and 2018b.

This reserve is equivalent to 30 % of the 2018 maximum quota allocation and can be used to cover equipment imports in 2018 and future years under the EU HFC phase-down because acquired authorisations are not earmarked for a particular year. At the same time, this accumulated reserve of authorisations reduces the overall strain on the quota issued for the following years, as RACHP equipment imports in those years will, at least theoretically, not need to be covered by quota issued for those years.

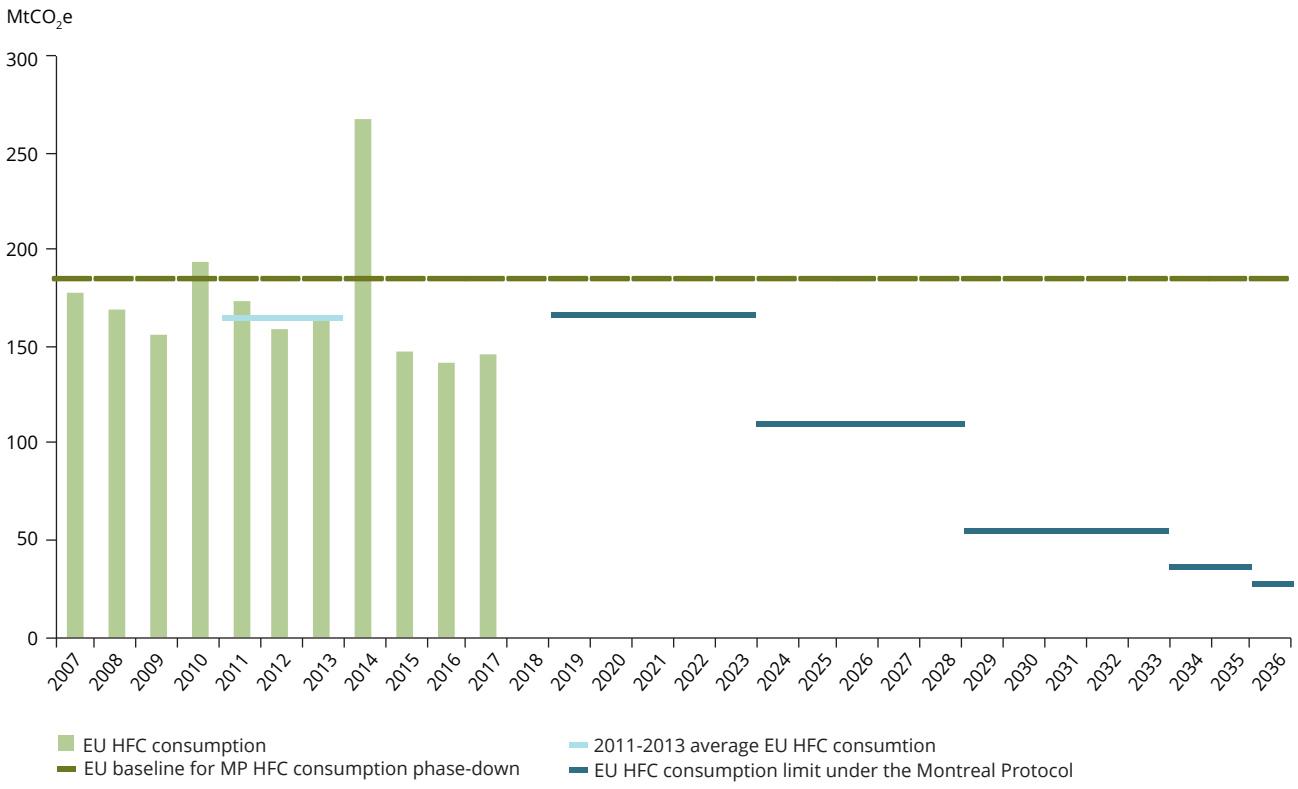
The quota authorisations issued in 2015 and 2016 (dark green bars in Figure 5.3) were stockpiled by equipment importers, as the use of authorisations did not start before 2017. The accumulated reserve of authorisations (dark blue bars in Figure 5.3) available at the end of 2016 was partly drawn from in 2017 and decreased by 14 %: quota authorisations freshly issued by quota holders in 2017 (dark green bars) amounted to only 70 % of authorisation use in 2017 (light blue bar). That difference of about 5 Mt CO_2e is reflected in the 2017 accumulated authorisations, which are lower than for 2016. The difference between the RACHP equipment imports in 2017 (light green bar) and the 2017 use of authorisations (light blue bar) illustrates that some importers (6 % of contained HFCs) did not hold sufficient quota authorisations.

6 Approaching the international HFC phasedown under the Montreal Protocol

In October 2016, in Kigali, Rwanda, the Montreal Protocol was amended to regulate HFCs (the Kigali Amendment). Both developed and developing countries have taken on mandatory commitments on reducing production and consumption of HFCs in the next three decades. Under the amended protocol, for the EU and other developed countries, HFC consumption is limited to 90 % of the baseline starting in 2019, with further reduction steps until a 15 % level is reached from 2036 onwards (Figure 6.1). Measuring progress of this phase-down relies on the metric of 'consumption', which is similar, but not identical, to the metrics of 'supply' used by the EEA (Chapter 4) and 'placing on the market' (POM) used for the EU HFC phase-down (Chapter 5) ([20]).

The baseline for the Montreal Protocol HFC phase-down is defined as the average HFC consumption during 2011-2013, plus 15 % of the HCFC baseline in 1989, all expressed in CO_2e. As set out in the Montreal

Figure 6.1 Approaching the Montreal Protocol HFC phase-down



Notes: MP, Montreal Protocol.

HFCs covered under the Montreal Protocol include all HFCs covered under EU F-Gas Regulation No 517/2014, except HFC-161 (see Annex 1).

Sources: EC, 2011, 2014 and 2017; EEA, 2017 and 2018b.

([20]) For details on how the metrics are calculated, please refer to Annex 4 (page 47).

Protocol, the HCFC baseline also includes 2.8 % of 1989 chlorofluorocarbon (CFC) consumption. The 2011-2013 average EU HFC consumption, according to reporting under the F-Gas Regulation, was 165.2 $MtCO_2e$ (EEA, 2018b; Figure 6.1) ([21]). The HCFC/CFC part of the EU baseline was calculated as 19.0 $MtCO_2e$ (EC, 2017). In total, the EU baseline under the Montreal Protocol HFC phase-down is estimated ([22]) as 184.2 $MtCO_2e$.

In Figure 6.1, EU consumption of HFCs covered under the Montreal Protocol since 2007 is presented and contrasted with the Montreal Protocol phase-down steps applying to the EU starting in 2019. With the exception of 2014 (where consumption was probably inflated as a result of the upcoming phase-down; see Section 3.2), HFC consumption had been experiencing a downward trend until 2016. However, 2017 HFC consumption is 3 % above 2016 levels, but is still below 2015 consumption.

HFC consumption has risen by 3 % compared with 2016, while HFC supply has decreased by 7 % (both measured in CO_2e). This can be explained by the differing definitions (see Annex 4, page 47). The downward trend for HFC supply is strengthened by the decline in HFC imports in equipment (Section 3.2) and by the stock effects discussed in Chapter 4, both of which are not accounted for by HFC consumption. On the other hand, the upward trend in HFC consumption is supported by the decline observed for HFC destruction (Section 3.3), which does not count towards supply.

Nevertheless, HFC consumption is still 12 % below the allowed amount for 2019, when the Montreal Protocol phase-down begins.

A tabular overview of HFC consumption is given in Table A5.22 in Annex 5 (page 66).

([21]) This number slightly deviates from the amount reported in the previous EEA F-gases report (EEA, 2017) because of the exclusion of erroneous data on feedstock use identified for the base period.

([22]) The quantification of the EU baseline is preliminary, subject to confirmation by the United Nations Environment Programme Ozone Secretariat.

Terminology

Fluorinated gases (F-gases)

F-gases covered by this report can be grouped into:

- gases contained in Annex I of the new F-Gas Regulation, as listed in Annex 1 of this report;
- gases contained in Annex II of the new F-Gas Regulation, as listed in Annex 2 of this report.

Jointly, those gases are referred to in this report as 'fluorinated gases' or 'F-gases'.

The list of reportable fluorinated gases under the old F-Gas Regulation was restricted to HFCs, PFCs and SF_6, as identified in Annex 1 (page 38).

Annex I F-gases

F-gases under Annex I of the new F-Gas Regulation include HFCs, PFCs and SF_6. The majority of these gases have high GWPs.

The gases of Annex I of the new F-Gas Regulation are given in Annex 1 to this report.

Hydrofluorocarbons (HFCs)

HFCs are relatively short aliphatic organic compounds that contain fluorine, carbon and hydrogen. They are most commonly used as refrigerants. Nineteen HFCs and their GWPs are listed in Annex 1. All HFCs in Annex 1, except HFC-152 and HFC-161, were previously covered by the old F-Gas Regulation ((EC) No 842/2006). Any mixture (blend) that includes at least one HFC is considered an HFC under the F-Gas Regulation and therefore is covered by the quota system. The GWP of such a mixture is calculated according to Annex IV of the F-Gas Regulation.

Perfluorocarbons (PFCs)

PFCs are relatively short aliphatic organic compounds that contain fluorine and carbon only. They are most commonly used in semiconductor manufacture. Seven PFCs and their GWPs are listed in Annex 1. All PFCs in Annex 1 were previously covered by the old F-Gas Regulation.

Sulphur hexafluoride (SF_6)

SF_6 is an inorganic compound; because it is an excellent electrical insulator, its main use is in the electrical industry. SF_6 is a potent greenhouse gas; its GWP is given in Annex 1. SF_6 was also covered by the old F-Gas Regulation.

Annex II F-gases

'Other fluorinated greenhouse gases' are listed in Annex II of Regulation No 517/2014 and include:

- unsaturated hydro(chloro)fluorocarbons (Section 1 of Annex II);
- fluorinated ethers and alcohols (Section 2 of Annex II);
- other perfluorinated compounds, including NF_3 (Section 3 of Annex II).

All these gases and their GWPs are listed in Annex 1 of this report. The Annex II F-gases were not covered by the reporting obligations under the old FGas Regulation ((EC) No 842/2006).

Bulk gases and gases contained in equipment

Gases contained in gas containers, including bottles and isotanks, are referred to as bulk gases, irrespective of the absolute amounts of gases handled. Bulk gases are to be differentiated from gases contained in products or equipment, as different reporting obligations apply.

Mixtures

Mixtures of fluorinated gases are often used in industrial applications. In their reports under Article 19 of the F-Gas Regulation ((EU) No 517/2014), companies report on their transactions (import, export, etc.) of such mixtures, while specifying their composition. For the purpose of the present aggregation report, the amounts of mixtures are recalculated as the proportions of their constituent fluorinated gases as listed in Annex 1, unless indicated otherwise.

Annex IV gases

Annex IV of the new F-Gas Regulation lists some non-fluorinated greenhouse gases that have GWPs that also need to be considered when determining the GWP of a mixture. These gases and their GWPs are also listed in Annex 1 of this report. For all other substances included in a mixture, a default value of zero is used for the calculation the GWP.

Nil report

A nil report is a notification by a company that it considers itself not obliged to report under the F-Gas Regulation.

Global warming potentials (GWPs)

GWPs are used to make different gases comparable in terms of their potential impact on climate change. The multiplication of a quantity of a gas by its GWP results in that quantity expressed as CO_2e.

The GWPs used under the new F-Gas Regulation are in line with those published in the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4) (IPCC, 2007). The old F-Gas Regulation ((EC) No 842/2006) used the earlier set of GWPs published by the IPCC in its Third Assessment Report (TAR) (IPCC, 2001). Accordingly, previous EEA technical reports on fluorinated gases up to 2014 used TAR GWPs.

Quantities of F-gases are reported in physical tonnes. Conversion of the figures into CO_2e based on gas-specific GWPs facilitates a focus on the potential warming effect caused by these gases after release to the atmosphere. Both metrics are used in this report when analysing the data.

The GWPs of gases used for the present report are listed in Annex 1. GWPs of mixtures are calculated according to Annex IV of the new F-Gas Regulation (EU, 2014b).

Abbreviations

BDR	Business Data Repository of the EEA
CFC	Chlorofluorocarbon
CO_2	Carbon dioxide
CO_2e	CO_2 equivalent
EC	European Commission
DG CLIMA	Directorate-General for Climate Action of the European Commission
EEA	European Environment Agency
ETC/ACM	European Topic Centre for Air Pollution and Climate Change Mitigation
EU	European Union
EU-28	Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the United Kingdom
AR4	Fourth Assessment Report of the IPCC
F-gases	Fluorinated gases
GWP	Global warming potential
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
HFE	Hydrofluoroether
IPCC	Intergovernmental Panel on Climate Change
kg	Kilogramme
MDI	Metered dose inhaler
MP	Montreal Protocol
Mt	Megatonne
NF_3	Nitrogen trifluoride
ODS	Ozone-depleting substances

PFCs	Perfluorocarbons
PFPMIE	Perfluoropolymethylisopropylether
POM	Placing on the market
QA/QC	Quality assurance/quality control
R-134a	Refrigerant classification of HFC-134a
R-404A	Refrigerant mixture of HFCs (52 % HFC-143a, 44 % HFC-125, 4 % HFC-134a)
R-407C	Refrigerant mixture of HFCs (52 % HFC-134a, 25 % HFC-125, 23 % HFC-32)
R-410A	Refrigerant mixture of HFCs (50 % HFC-125, 50 % HFC-32)
R-507A	Refrigerant mixture of HFCs (50 % HFC-143a, 50 % HFC-125)
RACHP	Refrigeration, air conditioning and heat pump
SF_6	Sulphur hexafluoride
t	Tonne
tCO_2e	Tonne of carbon dioxide equivalent
TAR	Third Assessment Report of the IPCC
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

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IPCC, 2007, *IPCC fourth assessment report — Climate change*, Intergovernmental Panel on Climate Change (http://www.ipcc.ch/report/ar4/) accessed 14 November 2017.

Montreal Protocol on Substances That Deplete the Ozone Layer, international treaty, adopted in Montreal on 16 September 1987.

Annexes

Annex 1 Gases covered by Regulation (EU) No 517/2014

Table A1.1 Annex I of Regulation (EU) No 517/2014

Gas	GWP (AR4)	Gas group	Reference	Coverage in the 'old' FGas Regulation ((EC) No 842/2006)
HFC-23	14 800	HFCs	Annex I Section 1	covered
HFC-32	675	HFCs	Annex I Section 1	covered
HFC-41	92	HFCs	Annex I Section 1	covered
HFC-125	3 500	HFCs	Annex I Section 1	covered
HFC-134	1 100	HFCs	Annex I Section 1	covered
HFC-134a	1 430	HFCs	Annex I Section 1	covered
HFC-143	353	HFCs	Annex I Section 1	covered
HFC-143a	4 470	HFCs	Annex I Section 1	covered
HFC-152	53	HFCs	Annex I Section 1	not covered
HFC-152a	124	HFCs	Annex I Section 1	covered
HFC-161	12	HFCs	Annex I Section 1	not covered
HFC-227ea	3 220	HFCs	Annex I Section 1	covered
HFC-236cb	1 340	HFCs	Annex I Section 1	covered
HFC-236ea	1 370	HFCs	Annex I Section 1	covered
HFC-236fa	9 810	HFCs	Annex I Section 1	covered
HFC-245ca	693	HFCs	Annex I Section 1	covered
HFC-245fa	1 030	HFCs	Annex I Section 1	covered
HFC-365mfc	794	HFCs	Annex I Section 1	covered
HFC-43-10mee	1 640	HFCs	Annex I Section 1	covered
PFC-14 (CF_4)	7 390	PFCs	Annex I Section 2	covered
PFC-116 (C_2F_6)	12 200	PFCs	Annex I Section 2	covered
PFC-218 (C_3F_8)	8 830	PFCs	Annex I Section 2	covered
PFC-3-1-10 (C_4F_{10})	8 860	PFCs	Annex I Section 2	covered
PFC-4-1-12 (C_5F_{12})	9 160	PFCs	Annex I Section 2	covered
PFC-5-1-14 (C_6F_{14})	9 300	PFCs	Annex I Section 2	covered
PFC-c-318 (c-C_4F_8)	10 300	PFCs	Annex I Section 2	covered
SF_6	22 800	SF_6	Annex I Section 3	covered

Sources: EU, 2006 and 2014b.

Table A1.2 Annex II of Regulation (EU) No 517/2014 (not covered by old F-Gas Regulation ((EC) No 842/2006))

Gas	GWP (AR4)	Gas group	Reference
HFC-1234yf	4	Unsaturated HFCs/HCFCs	Annex II Section 1
HFC-1234ze	7	Unsaturated HFCs/HCFCs	Annex II Section 1
HFC-1336mzz	9	Unsaturated HFCs/HCFCs	Annex II Section 1
HCFC-1233zd	5	Unsaturated HFCs/HCFCs	Annex II Section 1
HCFC-1233xf	1	Unsaturated HFCs/HCFCs	Annex II Section 1
HFE-125	14 900	HFEs and alcohols	Annex II Section 2
HFE-134	6 320	HFEs and alcohols	Annex II Section 2
HFE-143a	756	HFEs and alcohols	Annex II Section 2
HCFE-235da2 (isofluorane)	350	HFEs and alcohols	Annex II Section 2
HFE-245cb2	708	HFEs and alcohols	Annex II Section 2
HFE-245fa2	659	HFEs and alcohols	Annex II Section 2
HFE-254cb2	359	HFEs and alcohols	Annex II Section 2
HFE-347 mcc3 (HFE-7000)	575	HFEs and alcohols	Annex II Section 2
HFE-347pcf2	580	HFEs and alcohols	Annex II Section 2
HFE-356pcc3	110	HFEs and alcohols	Annex II Section 2
HFE-449sl (HFE-7100)	297	HFEs and alcohols	Annex II Section 2
HFE-569sf2 (HFE-7200)	59	HFEs and alcohols	Annex II Section 2
HFE-43-10pccc124	1 870	HFEs and alcohols	Annex II Section 2
HFE-236ca12 (HG-10)	2 800	HFEs and alcohols	Annex II Section 2
HFE-338pcc13 (HG-01)	1 500	HFEs and alcohols	Annex II Section 2
HFE-347mmy1	343	HFEs and alcohols	Annex II Section 2
2,2,3,3,3-pentafluoropropanol	42	HFEs and alcohols	Annex II Section 2
bis(trifluoromethyl)-methanol	195	HFEs and alcohols	Annex II Section 2
HFE-227ea	1 540	HFEs and alcohols	Annex II Section 2
HFE-236ea2 (desfluoran)	989	HFEs and alcohols	Annex II Section 2
HFE-236fa	487	HFEs and alcohols	Annex II Section 2
HFE-245fa1	286	HFEs and alcohols	Annex II Section 2
HFE 263fb2	11	HFEs and alcohols	Annex II Section 2
HFE-329mcc2	919	HFEs and alcohols	Annex II Section 2
HFE-338mcf2	552	HFEs and alcohols	Annex II Section 2
HFE-338mmz1	380	HFEs and alcohols	Annex II Section 2
HFE-347mcf2	374	HFEs and alcohols	Annex II Section 2
HFE-356mec3	101	HFEs and alcohols	Annex II Section 2
HFE-356mm1	27	HFEs and alcohols	Annex II Section 2
HFE-356pcf2	265	HFEs and alcohols	Annex II Section 2
HFE-356pcf3	502	HFEs and alcohols	Annex II Section 2
HFE 365mcf3	11	HFEs and alcohols	Annex II Section 2
HFE-374pc2	557	HFEs and alcohols	Annex II Section 2
$-(CF_2)_4CH(OH)-$	73	HFEs and alcohols	Annex II Section 2
NF_3 (nitrogen trifluoride)	17 200	Other perfluorinated compounds	Annex II, Section 3
$c\text{-}C_3F_6$ (perfluorocyclopropane)	17 340	Other perfluorinated compounds	Annex II, Section 3
PFPMIE (perfluoropolymethylisopropylether)	10 300	Other perfluorinated compounds	Annex II, Section 3
SF_5CF_3	17 700	Other perfluorinated compounds	Annex II, Section 3

Note: Annex II F-gases were not covered under the old F-Gas Regulation ((EC) No 842/2006).

Source: EU, 2014b.

Non-fluorinated gases in Annex IV of Regulation (EU) No 517/2014 (not covered by the old Regulation ((EC) No 842/2006))

According to Annex IV of the new F-Gas Regulation ((EU) No 517/2014), the GWP of mixtures containing gases outside the scope of Annexes I and II of Regulation (EU) No 517/2014 are to be calculated using the GWPs given here for the non-fluorinated gases. For other constituents of mixtures that are not listed here (e.g. ODS), a GWP value of zero shall be used.

Substance	Formula	GWP (AR4)
R-170 (ethane)	CH_3CH_3	6
R-290 (propane)	$CH_3CH_2CH_3$	3
R-600 (butane)	$CH_3CH_2CH_2CH_3$	4
R-600A (isobutane)	$CH(CH_3)_2CH_3$	3
R-601 (pentane)	$CH_3CH_2CH_2CH_2CH_3$	5
R-601A (isopentane)	$(CH_3)_2CHCH_2CH_3$	5
C5H10 (cyclopentane)	C_5H_{10}	5
R-610 (ethoxyethane, diethyl ether)	$CH_3CH_2OCH_2CH_3$	4
R-611 (methyl formate)	HCOOCH3	25
R-702 (hydrogen)	H_2	6
R-717 (ammonia)	NH_3	0
R-744 (carbon dioxide)	CO_2	1
R-1150 (ethylene)	C_2H_4	4
R-1270 (propylene)	C_3H_6	2
E-170 (dimethyl ether)	CH_3OCH_3	1
CH_3Cl (methyl chloride)	CH_3Cl	13
$CHCl_3$ (chloroform)	$CHCl_3$	31
Methylene chloride	CH_2Cl_2	9
CH_4 (methane)	CH_4	25
N_2O (nitrous oxide)	N_2O	298

Source: EU, 2014b.

Annex 2 F-gases reporting form

The reporting format for submitting the F-gas reports under Article 19 of Regulation (EU) No 517/2014 is laid out in Commission Implementing Regulation (EU) No 1191/2014. It was implemented as an online questionnaire on the BDR reporting platform at https://bdr.eionet.europa.eu. Reporting is mandatory for every company that engages in the activities listed in Article 19 of Regulation (EU) No 517/2014.

Cover sheet

On the cover sheet, companies provide their current data and the activities during the reporting year, which may be one or more of the following:

- producer of HFCs or other fluorinated gases;
- importer of HFCs or other fluorinated gases;
- exporter of bulk gases;
- EU feedstock user;
- EU destruction company;
- importer of products or equipment containing F-gases of Annexes I or II;
- undertaking having given an authorisation to use its HFC quota to another undertaking.

In addition, companies select F-gases that will be reported and specify the mixtures used by them.

If none of these sections applies, companies may state that they are not obliged to report, skipping the quantitative part of the reporting process (nil report).

Large companies with subsidiaries in several EU countries are required to report separately for each country. To protect their data, companies may voluntarily list affiliated companies on the cover sheet. Numbers for such groups of affiliates are treated in aggregate when the confidentiality of figures is determined, thus increasing the likelihood that a figure remains confidential and cannot be included in the public EEA report.

Section 1 (producers only)

Section 1 contains data about production of F-gases and mixtures:

- total quantity of production (1A);
- destroyed by-products, mandatory specification of destruction company (1B, 1C);
- sum of destroyed production (1D);
- net production (1E, which equals 1A minus 1D);
- production of mixtures (1F to 1H);
- **voluntary:** sales and purchases on the EU market (1I to 1K).

From the data specified by the reporters, the total production available for sale (1E), relevant for calculating supply, is determined by subtracting destroyed side-products (1B, 1C) from total production (1A).

Section 2 (importers only)

- Total imports of bulk gases (2A).
- Imports that were destined for re-export contained in products or equipment and never released for free circulation in the EU (2B).

Section 3 (exporters only)

Section 3 contains data about bulk exports only (exporters of products containing F-gases must not report here):

- total exports (3A);
- thereof: amounts from own production or purchased amounts (3B);
- thereof: determined amount of exports purchased in the Union (3C);
- breakdown of destination of exports (recycling, reclamation, destruction) (3D to 3F).

Section 4 (producers and importers)

Section 4 contains data on stocks of F-gases and their sources:

- stocks on 1 January (4A) and breakdown by source and previous status of free circulation (4B to 4E);
- stocks on 31 December (4F) and breakdown by source and previous status of free circulation (4G to 4J);
- reclaimed and recycled amounts (4K, 4L).

From the data provided on production, imports, exports and stocks, the total amount physically placed on the market by the reporter (4M) is determined using the formula:

4M = Net production (1E) + Total imports (2A) – Imports for reexport (2B)
– Export of own production (3B)
+ 1st Jan stocks previously not placed on the market (4C)
– 31st Dec stocks previously not placed on the market (4D)

Section 5 (producers and importers of HFCs)

Section 5 contains data about quantities of HFCs imported for uses exempted under the F-Gas Regulation, Article 15(2). For all these transactions, trade partners must be specified and uses broken down by company:

- destruction (5A);
- feedstock applications (5B);
- supply to other undertakings for re-export in bulk (5C exempted);
- military equipment (5D);
- semiconductor manufacturing (5E);
- production of medical dose inhalers (5F).

From the values, the total amounts of HFCs supplied to exempted uses and the resulting quota requirement are determined (5G to 5H). Reporters may voluntarily state their supply to other undertakings for production of equipment that is destined for re-export (5C voluntary); however, this figure does not feed into the total amount for exempted uses.

Section 6 (producers and importers)

Section 6 contains a breakdown of the intended applications of the total amounts supplied to the EU market by the reporting company. In this section, companies must account for the full amount as determined by the formula:

6X = Net production (1E) + Total imports (2A) – Imports for reexport (2B)
– Export of own production (3B)
+ 1st Jan stocks of own production (4B)
– 31st Dec stocks of own production (4G) – Own reclamation (4K)

Note that this formula differs from the POM determination in Section 4 in the method of correction for stocks. The full list of applications is:

- export (in bulk, not in equipment or smaller packages);
- destruction;
- military equipment;
- refrigeration, air conditioning and heating;
- other heat transfer fluids;
- foams;
- production of pre-blended polyols, e.g. for polyurethane foam;
- fire protection;
- aerosols — medical dose inhalers;

- aerosols — other uses;
- solvents;
- feedstock;
- semiconductor manufacture;
- photovoltaics manufacture;
- other electronics manufacture;
- electrical equipment;
- particle accelerators;
- magnesium die casting operations;
- anaesthetics;
- other or unknown application;
- leakage during storage, transport or transfer.

Section 7 (feedstock users)

Contains the amount of gas used as feedstock by the undertaking itself (7A). The reporting obligation on feedstock use is limited to Annex I gases (see Annex 1). Feedstock use of Annex II gases is not subject to reporting.

Section 8 (destruction companies)

Section 8 contains data on destruction during the reporting year using different methods (8A to 8C), summed as total destruction in 8D, as well as stocks intended for destruction (8E, 8F).

Section 9 (producers and importers)

Starting in 2015, companies reported for the first time on authorisations they have issued to third parties to use their HFC quota, specifying each recipient in Section 9A.

Section 10 (producers and importers that received quota through the new entrants' reserve)

In Section 10, companies specify physical supplies of F-gases accompanying authorisations, as reported in Section 9A. Reporters specify each recipient and are required to supplement proof of delivery (receipts, etc.) for each one. This reporting section applies only to companies that received HFC quota fully based on a declaration according to Article 16(2) of the new F-Gas Regulation and was used in 2016 for the first time.

Section 11 (importers of equipment containing F-gases)

Section 11 contains a detailed breakdown of the types of equipment imported by the reporting company. It differentiates between:

- equipment for refrigeration, air conditioning, and heat pumps (RACHP containing HFCs in lines 11A to 11F; summed in 11G;
- other types of equipment (11H to 11P).

The total content is found in line 11Q.

For each type of equipment, users must specify:

- total quantity of equipment expressed in a suitable unit;
- total amount of F-gases contained in this equipment.

From these numbers, specific charges per piece of equipment are determined. Where equipment does not fall into pre-defined categories, users must report them in the respective 'Other' sections and provide a description of the equipment (11A3, 11D, 11E4, 11F9, 11H4, 11P) and/or the intended use of the equipment (11A9, 11A12, 11B3, 11B5, 11B7, 11B9, 11D). The full list of categories is contained in Table A2.1.

Section 12 (applied for the first time in reporting on 2017 in 2018)

In Section 12, companies may specify those amounts of HFCs in imported RACHP equipment, where the contained gas had been previously placed on the EU market under the quota limit, subsequently exported in bulk from the EU, then charged into equipment outside the EU, and finally reimported within equipment.

The companies that had placed the HFCs on the EU market in bulk, and the companies that had exported the HFCs from the EU need to be specified, along with the respective years.

Such quantities of HFCs do not need to be covered by quota authorisations.

Table A2.1 Equipment categories for reporting

Code	Description
11A	Stationary equipment for comfort cooling or heating
11B	Stationary equipment for refrigeration
11C	Heat pump tumble dryers
11D	Stationary heating/air conditioning including heat pumps as well as refrigeration (HACR) equipment for any other purposes
11E	Mobile refrigeration equipment
11F	Mobile air conditioning equipment
11G	Total refrigeration, air conditioning or heat pump equipment
11H	Foam products
11I	Fire protection equipment (including systems incorporated in vehicles)
11J	Medical or pharmaceutical aerosols
11K	Non-medical aerosols
11L	Medical equipment (without aerosols)
11M	Switch gear for transmission and distribution of electricity
11N	Other electrical transmission and distribution equipment
11O	Particle accelerators
11P	Other products and equipment containing gases listed in Annex I or Annex II of Regulation (EU) No 517/2014
11Q	Total of products and equipment containing fluorinated gases listed in Annex I or Annex II of Regulation (EU) No 517/2014

Source: EU, 2014a.

Annex 3 Reporting forms under the old F-Gas Regulation ((EC) No 842/2006)

The reporting format for submitting the F-gas reports under the old F-Gas Regulation ((EC) No 842/2006) was described in Regulation (EC) No 1493/2007 (EU, 2007b). The reported information is contained in the following sets of forms:

- Part 3 of the Reporting Form for Producers, Importers and Exporters of Fluorinated Greenhouse Gases (company information) ([23]).
  This is to be completed by all companies and includes a statement of whether the company that reports is a producer of F-gases within the EU, is an importer of F-gases into the EU and/or is an exporter of F-gases out of the EU. For production and import activities, the gas groups HFCs, PFCs and SF_6 need to be differentiated. Based on the choice of F-gas activities, a tailored set of data reporting sheets is offered to the user of the form.

- Co-producer forms — specific for HFCs, PFCs and SF_6.
  These are to be completed by producers only. In these forms, purchases from and sales to other producers in the EU are to be reported by substance.

- Producer and importer forms — specific for HFCs, PFCs and SF_6.
  These are to be completed by producers and importers. In these forms, companies report by substance on:

  — production (A);

  — import (B);

  — export (C);

  — other amounts collected for reclamation or destruction from within the EU ([24]) (D);

  — purchases from (E) and sales to (F) EU co-producers (item for producers only, sums of the figures in the respective co-producer forms);

  — amounts purchased from other EU sources (G) (item for producers only);

  — stocks at 1 January (H) and 31 December (I) (for non-producers, covering previously imported quantities only; for producers, full stocks);

  — amount reclaimed by the reporting company (J);

  — amount destroyed by the reporting company (on-site) (K);

  — amount destroyed on behalf of the reporting company (off-site within the EU) (L);

  — amount used as a feedstock by the reporting company (M).

Of these amounts, a calculated total for the 'net amount available for sale in the EU' is determined according to the formula (A + B - C + D + E - F + G + H - I - K - L - M).

Furthermore, reporting companies need to give their best estimates of the intended applications of the amounts 'placed on the EU market for the first time'. The total amount placed on the EU market does not include any quantities previously held by EU importers and/or distributors. Therefore, for non-producing importers, the sum of the figures reported for intended applications should equal the calculated total mentioned above. For producers, the sum of the figures reported for the intended applications should equal the calculated total minus any quantities sold on the EU market that were previously purchased from EU importers/distributors in the present reporting year or in previous years.

([23]) Part 3 of the Reporting Form for Producers, Importers and Exporters of Fluorinated Greenhouse Gases (Annex to Commission Regulation (EC) No 1493/2007) was labelled 'company information' within the implementation of the spreadsheet of the reporting form used up to 2012. The term 'company information' was also used in the implementation of the online questionnaire in the BDR.

([24]) In Regulation (EC) No 842/2006 and Commission Regulation (EC) No 1493/2007, the terms 'European Community', 'Community' and 'EC' are used. In this report, the terminology 'European Union', 'Union' and 'EU', respectively, are used, as the European Community has been replaced by the European Union in accordance with the Treaty of Lisbon (EU, 2007a).

- Importer form 3: HFC preparations/HFC blend importer form ([25]).
  This form is to be completed by HFC importers. The sheet is structured as in the 'producer and importer forms'. However, the producer-specific lines (A, E, F and G above) are missing. Instead of single substances, companies report on HFC preparations.

- Exporter form.
  This form is to be completed by exporters with amounts exported from the EU per substance/preparation. In addition, the amounts exported for recycling, reclamation or destruction are also to be reported. All substances and preparations (HFCs, PFCs and SF_6) are covered in the 'Exporter Form'.

The form sheets concerning HFCs and PFCs, as well as the exporter form, offer the possibility to add substances or preparations in addition to those that are pre-defined. If a reporting company uses this option, the composition of an added preparation has to be stated. These functionalities were also implemented in the BDR online questionnaire.

([25]) In part 4 of the Reporting Form for Producers, Importers and Exporters of Fluorinated Greenhouse Gases (Annex to Commission Regulation (EC) No 1493/2007) this form is called 'Importer Form 3: HFC preparations', while it is labelled 'HFC Blends Importer Form' in the spreadsheet implementation of the reporting form. In this report, the names as set in Commission Regulation (EC) No 1493/2007) are used. The term 'blend' is commonly used by industry for 'preparations' as defined in Commission Regulation (EC) No 1493/2007.

Annex 4 Calculation methods

This annex provides documentation for:

- calculation of EU supply (page 47);
- calculation of HFC amounts placed on the market (POM) under the EU HFC phase-down (page 58);
- calculation of HFC consumption under the international HFC phase-down under the Montreal Protocol (page 48).

Table A4.1 (page 49) provides a summary of the comparison of these three metrics.

The codes, (1A), (2A), etc., used in the following paragraphs refer to the codes of reportable transactions in the reporting form; see Annex 2.

Where calculation details for 2007-2013 are discussed, these refer to the reporting items as presented in Annex 3.

Calculation of EU supply

Total supply (TS)

'EU total supply' is a parameter that provides information on the actual use of fluorinated gases by EU industries. Notably, TS also includes gases that are contained in exported products and equipment. In the logic of the supply metrics used in this report, such gases count towards the gas demand of EU industries. 'EU total supply' is the sum of 'EU bulk supply' and 'EU supply in products/equipment'. It is comparable to the net supply metric used in previous EEA reports on F-gases.

Bulk supply (BS)

The 'bulk supply' metric is focused on emission-relevant supplies of bulk gases to EU industries and therefore does not cover EU supplies intended for feedstock or destruction. Since 2014, BS has been defined as:

> Bulk supply (BS) = (net) production (1E = 1A to 1D) + full imports (2A) - full exports (3A) + 1 January stocks from own import/production (4B) – 31 December stocks from own import/production (4G) + reclamation (4K) - POM intended for destruction (6B) - feedstock use (7A).

For the years 2007-2013, bulk supply (BS) is calculated as follows:

> BS = production + imports - exports + 1 January stocks – 31 December stocks + reclamation - own feedstock use - intended application: feedstock.

EU supply in products/equipment

The 'EU supply in products/equipment' (SPE) metric covers the amount of fluorinated gases that are imported into the EU within products or equipment and placed on the market. Exports of F-gases within products and equipment are not reported under the new F-Gas Regulation (No 517/2014) or subtracted for the SPE metric. Thus, the SPE metric covers only imports and it is not intended to cover the net flows of F-gases within products or equipment across EU borders.

SPE is calculated as the sum of all gases reported in Section 11 of the reporting questionnaire. No data on SPE were collected before 2014.

Intended applications of bulk or total supply

In Section 6 of the reporting questionnaire, companies report on the intended applications of bulk gases supplied to the EU market (6X). This metric differs from bulk supply in the way it accounts for re-exports, amounts intended for destruction and feedstock. It is calculated as follows:

> 6X = (net) production (1E = 1A - 1D) + full imports (2A) - re-exports within products of own bulk imports (2B) - bulk re-exports of own imports (3B) + 1 January stocks from own import/production (4B) – 31 December stocks from own import/production (4G) + reclamation (4K).

To estimate the intended applications of EU bulk or total supply, a four-step process is used:

1. Per gas, determine the proportion of each reported application in a subset of categories without export (6A), destruction (6B), leakage (6U) and accountancy adjustments (6V).

2. Assume leakage and accountancy adjustments in bulk or total supply to be equal to the amounts reported in Section 6 and subtract those from total bulk or total supply.

3. Apply the proportions determined in step 1 to the remainder of bulk or total supply.

4. Assign any remainder to the category 'Other or unknown applications' (6T).

Calculation of HFC amounts placed on the market (POM) under the EU HFC phase-down

The quota of relevant POM starting in 2015 is calculated as:

bulk HFCs physically placed on the market (4M), converted into CO_2e
minus
exemptions under Article 15(2) (5A + (5B) + 5C_ exempted + 5D + 5E), converted into CO_2e
(5F is included in the exemptions from 2017)
plus
issued authorisations (9A).

Bulk HFC POM 2007-2013 is calculated per year and per company based on data reported under the old F-Gas Regulation (see Annex 3) as:

HFC production, converted into CO_2e
plus
HFC imports, converted into CO_2e
minus
HFC exports, converted into CO_2e
plus
1 January HFC stocks, converted into CO_2e
minus
31 December HFC stocks, converted into CO_2e
minus
HFCs used for feedstock, converted into CO_2e
minus
HFC supplies intended for feedstock use, converted into CO_2e.

Where the amount thus calculated is negative for a given company in a given year, the POM is set to zero before calculating the EU total as the sum of all companies.

Calculation of HFC consumption under the international HFC phase-down under the Montreal Protocol

The HFCs considered under the Montreal Protocol are all HFCs listed in Annex I, Section 1, of the new F-Gas Regulation ((EU) No 517/2014) (see Annex 1, page 38), except HFC-161.

HFC consumption starting in 2014 is calculated as follows:

HFC production (1A), converted into CO_2e
plus
HFC imports (2A), converted into CO_2e
minus
HFC exports (3A), converted into CO_2e
minus
HFC feedstock use (7A), converted into CO_2e
minus
Total HFC destruction (8D), converted into CO_2e.

HFC consumption until 2013 is calculated from data reported under the old F-Gas Regulation (see Annex 3) as follows:

HFC production, converted into CO_2e
plus
HFC imports, converted into CO_2e
minus
HFC exports, converted into CO_2e
minus
reporting companies' own HFC destruction, converted into CO_2e
minus
HFC amounts supplied by reporting companies to third parties for destruction, converted into CO_2e
minus
HFCs used for feedstock, converted into CO_2e
minus
HFC supplies intended for feedstock use, converted into CO_2e.

Comparison of supply, POM and consumption metrics

Table A4.1 Scope of supply, POM and consumption metrics

			Supply	Placing on the market (POM), relevant for compliance with the EU HFC phase-down	Consumption, relevant for compliance with the MP HFC phase-down
		Covered gases	**Applicable to total F-gases and single gases/gas groups (e.g. HFCs)**	**HFCs of Annex I of EU F-Gas Regulation (No 517/2014), including HFC shares and non-HFC shares of HFC-containing mixtures**	**HFCs of Annex I of EU F-Gas Regulation (No 517/2014) except HFC-161, including HFC shares of HFC-containing mixtures**
		Units used	**Both physical tonnes and tCO_2e**	**tCO_2e**	**tCO_2e**
Transactions covered		**Type of contribution**			
Production		Plus	Yes	Yes	Yes
Reclamation		Plus	Yes	No	No
Recycling		Plus	No	No	No
Bulk imports		Plus	Yes	Yes	Yes
Imports in products and equipment	Refrigeration, air conditioning and heat pump (RACHP) equipment	Plus	Yes	2015-2016: no Since 2017: only amounts not covered by quota authorisations	No
	Other products and equipment	Plus	Yes	No	No
Bulk exports		Minus	Yes	Exports from own production and exports from own imports are subtracted Other bulk exports subtracted if directly supplied by the importer/ producer to the exporter (exemption Art. 15(2)c)	Yes
Exports in products and equipment		Minus	No	Considered in cases in which the contained gases had never been placed on the market after bulk import (re-export)	No
Destruction		Minus	Only destruction of EU production, destroyed before POM and imports for destruction Destruction of used gases recovered within the EU is not subtracted	Only destruction of EU production, destroyed before POM, and imports for destruction (exemption Art. 15(2)a) Destruction of used gases recovered within the EU is not subtracted	Yes
Feedstock use		Minus	Yes	Yes (exemption Art. 15(2)b)	Yes
Supplies to military uses		Minus	No	Yes (exemption Art. 15(2)d)	No
Supplies to semiconductor industry		Minus	No	Yes (exemption Art. 15(2)e)	No

Table A4.1 Scope of supply, POM and consumption metrics (cont.)

		Supply	Placing on the market (POM), relevant for compliance with the EU HFC phase-down	Consumption, relevant for compliance with the MP HFC phase-down
	Covered gases	**Applicable to total F-gases and single gases/gas groups (e.g. HFCs)**	**HFCs of Annex I of EU F-Gas Regulation (No 517/2014), including HFC shares and non-HFC shares of HFC-containing mixtures**	**HFCs of Annex I of EU F-Gas Regulation (No 517/2014) except HFC-161, including HFC shares of HFC-containing mixtures**
	Units used	**Both physical tonnes and tCO_2e**	**tCO_2e**	**tCO_2e**
Transactions covered	**Type of contribution**			
Supplies to pharmaceutical MDIs	Minus	No	Not considered 2015-2017 Considered 2018 onwards (exemption Art. 15(2)f)	No
1 January stocks	Plus	Full stocks from own production or own import considered Stocks from EU purchases not considered	Only those stocks from own production or own import considered that have not yet been placed on the market Stocks from EU purchases and stocks from own imports/own production already placed on the market not considered	No
31 December stocks	Minus			
HFC quota authorisations issued by producers/importers	Plus	No	Yes	No

Annex 5 Data tables

Measures to protect confidential data

The EEA takes appropriate steps to protect the confidentiality of commercially sensitive information in accordance with Article 19(8) of the new F-Gas Regulation. Throughout the report, three rules are applied to all numbers and figures to determine whether or not a data item must remain confidential.

The three-company group rule: this rule stipulates that any value that is published must be the sum of at least three different companies. In addition, companies are invited to specify affiliates in their report. These groups of affiliates, if mutually confirmed, count as one company for the purpose of this evaluation.

The 5 % significance rule: the contributions of small companies to any value may be insignificant, and larger companies' confidentiality may be compromised in spite of the first rule. Therefore, a value remains confidential if fewer than three companies make up more than 95 % of the total, discounting the smallest contributors that make up 5 % of the sum.

Preventing deduction: deduction might be possible where a confidential value is part of a sum of substances or transactions. For example, a confidential value for SF_6 may be deduced if there are figures published for PFCs as well as a total for SF_6 and PFCs. In the case of metrics such as 'Supply', a confidential value, e.g. for 'Production', may be deduced if values for both 'Import' and 'Export' are known and the value of the remainder of small transactions that make up 'Supply' is very small. Therefore, two steps are taken:

- In cases where a sum across substances or transactions is published, and there is only one contributing value to that sum that is confidential according to the above rules, a second part of the sum is made confidential to make sure that the lone confidential value cannot be deduced from the sum and remaining parts.

- In the case of supply metrics, a second of the major contributors ('Production', 'Import' and 'Export') is made confidential if one of them is confidential according to the above rules and the remainder of small transactions makes up less than 5 % of the total.

List of data tables in Annex 5

Table A5.1 EU production of fluorinated gases (tonnes)

Gas group	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Tonnes										
HFCs	55 235	38 519	33 106	43 792	41 040	40 854	36 717	31 050	32 339	33 380	27 713
PFCs	C	C	C	C	C	C	C	C	209	C	328
SF_6	C	C	C	C	C	C	C	C	C	C	C
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	C	C	C
HFEs and alcohols	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	-	-	-
NF_3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	-	-	-
Total fluorinated gases	**58 098**	**41 359**	**35 123**	**46 440**	**44 030**	**44 220**	**39 909**	**34 049**	**35 377**	**36 159**	**30 345**
Average GWP	*3 012*	*3 361*	*3 088*	*3 226*	*3 432*	*3 508*	*3 573*	*3 723*	*3 419*	*3 293*	*3 470*

Table A5.2 EU production of fluorinated gases (CO_2e)

Gas group	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Million tonnes of CO_2 equivalents										
HFCs	112.2	75.6	63.3	91.1	85.0	81.4	73.1	61.1	54.6	58.6	49.6
PFCs	C	C	C	C	C	C	C	C	1.9	C	3.1
SF_6	C	C	C	C	C	C	C	C	C	C	C
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	C	C	C
HFEs and alcohols	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	-	-	-
NF_3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	-	-	-
Total fluorinated gases	**175.0**	**139.0**	**108.4**	**149.8**	**151.1**	**155.1**	**142.6**	**126.8**	**121.0**	**119.1**	**105.3**

Notes: '-', no data reported; C, confidential; n.a., not applicable: Annex II gases (unsaturated HFCs and HCFCs, HFEs and alcohols, and NF_3 and other perfluorinated compounds) were not subject to reporting for the years 2007-2013.

Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

Table A5.3 EU reclamation of fluorinated gases (tonnes)

Gas group	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Tonnes										
HFCs	353	337	100	301	475	460	474	377	647	1 314	1 659
PFCs	-	-	-	-	-	C	-	C	C	C	C
SF_6	C	C	77	C	C	C	C	C	C	C	69
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	C	C	C
HFEs and alcohols	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	-	-	-
NF_3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	-	-	C
Total fluorinated gases	**417**	**398**	**177**	**326**	**508**	**487**	**484**	**416**	**679**	**1 364**	**1 752**
Average GWP	*4 919*	*4 860*	*10 963*	*3 961*	*3 498*	*3 321*	*2 555*	*4 250*	*3 527*	*3 033*	*3 153*

Table A5.4 EU reclamation of fluorinated gases (CO_2e)

Gas group	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Million tonnes of CO_2 equivalents										
HFCs	0.6	0.5	0.2	0.7	1.0	1.0	1.0	0.9	1.7	3.1	3.9
PFCs	-	-	-	-	-	C	-	C	C	C	C
SF_6	C	C	1.8	C	C	C	C	C	C	C	1.6
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	C	C	C
HFEs and alcohols	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	-	-	-
NF_3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	-	-	C
Total fluorinated gases	**2.1**	**1.9**	**1.9**	**1.3**	**1.8**	**1.6**	**1.2**	**1.8**	**2.4**	**4.1**	**5.5**

Notes: '-', no data reported; C, confidential; n.a., not applicable: Annex II gases (unsaturated HFCs and HCFCs, HFEs and alcohols, and NF_3 and other perfluorinated compounds) were not subject to reporting for the years 2007-2013

Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

Table A5.5 Total EU imports of fluorinated gases (tonnes)

Gas group	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Tonnes										
HFCs	58 519	67 951	57 946	69 089	66 269	61 071	65 221	128 452	78 026	78 920	88 657
PFCs	253	306	129	230	238	310	155	350	409	363	498
SF_6	747	691	671	539	587	374	483	430	382	420	565
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1 900	3 413	C	14 524
HFEs and alcohols	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
NF_3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	333	305	492	494
Total fluorinated gases	**59 518**	**68 948**	**58 746**	**69 858**	**67 094**	**61 755**	**65 859**	**131 794**	**82 910**	**86 860**	**104 875**
Average GWP	*2 215*	*2 227*	*2 412*	*2 287*	*2 232*	*2 172*	*2 257*	*2 209*	*2 170*	*2 114*	*1 890*

Table A5.6 Total EU imports of fluorinated gases (CO_2e)

Gas group	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Million tonnes of CO_2 equivalents										
HFCs	112.2	134.6	125.1	145.0	133.9	122.4	136.0	272.1	161.9	161.9	172.0
PFCs	2.6	3.2	1.4	2.5	2.5	3.2	1.6	3.4	3.9	3.6	4.7
SF_6	17.0	15.8	15.3	12.3	13.4	8.5	11.0	9.8	8.7	9.6	12.9
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.0	0.0	C	0.1
HFEs and alcohols	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
NF_3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	5.7	5.2	8.5	8.5
Total fluorinated gases	**131.8**	**153.6**	**141.7**	**159.7**	**149.7**	**134.1**	**148.7**	**291.1**	**179.9**	**183.6**	**198.2**

Notes: '-', no data reported; C, confidential; n.a., not applicable: Annex II F-gases (unsaturated HFCs and HCFCs, HFEs and alcohols, and NF_3 and other perfluorinated compounds) and HFCs, PFCs and SF_6 in products and equipment were not subject to reporting for the years 2007-2013. The data shown for 2007-2013 are thus limited to bulk imports.

Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

Table A5.7 EU bulk imports of fluorinated gases (tonnes)

Gas group	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Tonnes										
HFCs	58 519	67 951	57 946	69 089	66 269	61 071	65 221	122 781	70 993	68 962	79 712
PFCs	C	306	129	230	C	310	155	C	388	355	496
SF_6	C	691	671	539	C	374	483	412	377	417	563
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
HFEs and alcohols	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
NF_3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	305	492	494
Total fluorinated gases	**59 518**	**68 948**	**58 746**	**69 858**	**67 094**	**61 755**	**65 859**	**125 986**	**75 606**	**76 238**	**95 147**
Average GWP	*2 215*	*2 227*	*2 412*	*2 287*	*2 232*	*2 172*	*2 257*	*2 218*	*2 196*	*2 149*	*1 898*

Table A5.8 EU bulk imports of fluorinated gases (CO_2e)

Gas group	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Million tonnes of CO_2 equivalents										
HFCs	112.2	134.6	125.1	145.0	133.9	122.4	136.0	260.9	148.3	142.2	154.5
PFCs	C	3.2	1.4	2.5	C	3.2	1.6	C	3.8	3.5	4.7
SF_6	C	15.8	15.3	12.3	C	8.5	11.0	9.4	8.6	9.5	12.8
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
HFEs and alcohols	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
NF_3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	5.2	8.5	8.5
Total fluorinated gases	**131.8**	**153.6**	**141.7**	**159.7**	**149.7**	**134.1**	**148.7**	**279.4**	**166.0**	**163.8**	**180.6**

Notes: '-', no data reported; C, confidential; n.a., not applicable: Annex II gases (unsaturated HFCs and HCFCs, HFEs and alcohols, and NF_3 and other perfluorinated compounds) were not subject to reporting for the years 2007-2013

Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

Table A5.9 EU imports of fluorinated gases within products and equipment (tonnes)

Gas group	2014	2015	2016	2017
	Tonnes			
HFCs	5 671	7 033	9 958	8 945
PFCs	C	21	C	2
SF_6	C	C	2	2
Unsaturated HFCs and HCFCs	C	C	652	778
HFEs and alcohols	-	C	C	C
NF_3 and other perfluorinated compounds	-	-	-	-
Total fluorinated gases	**5 808**	**7 304**	**10 622**	**9 729**
Average GWP	*2 015*	*1 898*	*1 860*	*1 808*

Table A5.10 EU imports of fluorinated gases within products and equipment (CO_2e)

Gas group	2014	2015	2016	2017
	Million tonnes of CO_2 equivalents			
HFCs	11.2	13.6	19.6	17.5
PFCs	C	0.2	C	0.0
SF_6	C	C	0.1	0.1
Unsaturated HFCs and HCFCs	C	C	0.0	0.0
HFEs and alcohols	-	C	C	C
NF_3 and other perfluorinated compounds	-	-	-	-
Total fluorinated gases	**11.7**	**13.9**	**19.8**	**17.6**

Notes: '-', no data reported; C, confidential.

Sources: EEA, 2017 and 2018b.

Table A5.11 Categories of imports of fluorinated gases in products and equipment (tonnes)

Categories of products and equipment	2014	2015	2016	2017
	Tonnes			
Stationary equipment for comfort cooling or heating	4 698	5 239	8 316	7 678
Stationary equipment for refrigeration	32	76	96	76
Heat pump tumble dryers	C	144	189	218
Other stationary refrigeration, air conditioning or heat pump equipment	86	127	265	246
Mobile refrigeration equipment	C	C	20	15
Mobile air conditioning equipment	798	1 205	1 405	1 122
Foam products	C	C	C	-
Fire protection equipment	-	10	C	-
Medical or pharmaceutical aerosols	69	131	143	C
Non-medical aerosols	C	C	C	291
Other medical equipment (without aerosols)	-	-	-	-
Electrical switchgear	C	5	2	2
Other electrical equipment	C	C	C	C
Particle accelerators	-	-	-	-
Other products and equipment	C	C	-	-
Total supply in products and equipment	**5 808**	**7 304**	**10 622**	**9 729**

Table A5.12 Categories of imports of fluorinated gases in products and equipment (CO_2e)

Categories of products and equipment	2014	2015	2016	2017
	Million tonnes of CO_2 equivalents			
Stationary equipment for comfort cooling or heating	9.8	10.8	17.1	15.6
Stationary equipment for refrigeration	0.1	0.3	0.2	0.2
Heat pump tumble dryers	C	0.2	0.3	0.3
Other stationary refrigeration, air conditioning or heat pump equipment	0.1	0.2	0.4	0.4
Mobile refrigeration equipment	C	C	0.0	0.0
Mobile air conditioning equipment	1.0	1.4	1.1	0.5
Foam products	C	C	C	-
Fire protection equipment	-	0.0	C	-
Medical or pharmaceutical aerosols	0.1	0.2	0.2	C
Non-medical aerosols	C	C	C	0.4
Other medical equipment (without aerosols)	-	-	-	-
Electrical switchgear	C	0.1	0.0	0.1
Other electrical equipment	C	C	C	C
Particle accelerators	-	-	-	-
Other products and equipment	C	C	-	-
Total supply in products and equipment	**11.7**	**13.9**	**19.8**	**17.6**

Notes: '-', no data reported; C, confidential.

Sources: EEA, 2017 and 2018b.

Table A5.13 EU bulk exports of fluorinated gases (tonnes)

Gas group	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Tonnes										
HFCs	24 162	19 187	15 720	20 455	21 330	21 171	21 699	26 239	25 577	27 414	29 120
PFCs	83	57	25	C	C	255	253	91	95	132	176
SF_6	1 670	1 499	1 423	C	C	2 021	1 871	2 522	2 426	C	1 669
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
HFEs and alcohols	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	8
NF_3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	10
Total fluorinated gases	**25 915**	**20 742**	**17 168**	**22 233**	**23 383**	**23 448**	**23 822**	**29 065**	**28 417**	**30 274**	**31 995**
Average GWP	*3 140*	*3 342*	*3 531*	*3 411*	*3 630*	*3 599*	*3 405*	*3 469*	*3 506*	*3 263*	*2 831*

Table A5.14 EU bulk exports of fluorinated gases (CO_2e)

Gas group	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Million tonnes of CO_2 equivalents										
HFCs	42.5	34.6	27.9	36.4	39.3	35.9	36.0	42.4	43.2	50.7	50.6
PFCs	0.8	0.5	0.2	C	C	2.4	2.4	0.8	0.9	1.3	1.7
SF_6	38.1	34.2	32.4	C	C	46.1	42.7	57.5	55.3	C	38.0
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
HFEs and alcohols	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	0.0
NF_3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	0.2
Total fluorinated gases	**81.4**	**69.3**	**60.6**	**75.8**	**84.9**	**84.4**	**81.1**	**100.8**	**99.6**	**98.8**	**90.6**

Notes: '-', no data reported; C, confidential; n.a., not applicable: Annex II gases (unsaturated HFCs and HCFCs, HFEs and alcohols, and NF_3 and other perfluorinated compounds) were not subject to reporting for the years 2007-2013.

Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

Table A5.15 Total EU supply of fluorinated gases (tonnes)

Gas	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Tonnes										
HFC-23	C	C	C	299	306	137	C	94	78	63	90
HFC-32	3 987	5 086	4 430	5 390	4 930	5 024	5 334	11 060	9 384	11 022	12 101
HFC-41	C	-	C	C	C	C	C	1	2	1	1
HFC-125	12 371	12 501	13 992	18 248	15 345	15 591	15 116	25 476	17 916	18 701	17 342
HFC-134	C	C	-	C	-	-	-	-	C	C	-
HFC-134a	49 080	46 174	41 440	43 657	40 201	40 052	39 334	60 771	46 282	44 166	40 886
HFC-143	C	-	-	C	C	-	-	-	-	-	-
HFC-143a	8 998	9 817	9 620	10 572	8 854	9 000	8 817	13 512	7 069	7 205	6 008
HFC-152a	4 292	6 162	5 182	4 695	4 676	4 175	3 657	6 227	3 914	3 431	3 552
HFC-227ea	C	C	C	C	C	C	C	2 695	1 977	1 754	1 626
HFC-236fa	C	C	C	C	44	31	C	52	40	42	36
HFC-245ca	-	-	-	-	-	-	-	-	-	C	-
HFC-245fa	C	C	C	C	C	C	C	C	C	C	C
HFC-365mfc	C	C	C	C	C	C	C	C	C	C	C
HFC-43-10mee	C	C	50	C	C	C	C	C	C	C	C
PFC-14	C	C	42	59	56	C	C	147	168	152	196
PFC-116	93	178	113	C	C	C	C	157	164	129	148
PFC-218	C	59	C	24	23	40	38	41	59	37	23
PFC-c-318	C	6	3	6	10	C	C	14	27	26	39
PFC-3-1-10	C	C	-	C	C	C	C	C	C	C	C
PFC-4-1-12	-	-	-	-	-	-	-	C	C	C	-
PFC-5-1-14	C	C	C	C	C	C	C	C	C	117	C
SF_6	C	C	C	C	C	C	C	C	C	C	1 225
HCFC-1233xf	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	-	C	C
HCFC-1233zd	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
HFC-1234yf	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	826	1 928	5 214	10 493
HFC-1234ze	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
HFC-1336mzz	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
HFE-236fa	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	-	-	-0
HFE-245fa1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	-	C	-
HFE-347mcc3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
HFE-347pcf2	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	-	-	0
HFE-449sl	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
HFE-569sf2	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
2,2,3,3,3-pentafluoropropanol	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	0	C	C
bis(trifluoromethyl)-methanol	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	1	C	C
NF_3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	321	339	381	492
PFPMIE	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	-	-	-

Table A5.15 Total EU supply of fluorinated gases (tonnes) (cont.)

Gas group	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
HFCs	86 477	87 311	81 005	89 924	81 829	80 958	79 224	124 408	92 090	91 575	87 533
PFCs	C	398	C	C	C	C	C	C	C	C	649
SF_6	C	C	C	C	C	C	C	C	C	C	1 225
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1 306	2 544	6 305	13 321
HFEs and alcohols	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
NF_3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	321	339	381	492
Total fluorinated gases	**88 586**	**89 569**	**82 681**	**91 749**	**83 620**	**82 691**	**80 898**	**127 547**	**96 779**	**100 032**	**103 346**
Average GWP	*2 410*	*2 433*	*2 451*	*2 521*	*2 489*	*2 470*	*2 474*	*2 241*	*2 187*	*2 142*	*2 027*

Notes: '-', no data reported; C, confidential; n.a., not applicable: Annex II F-gases (unsaturated HFCs and HCFCs, HFEs and alcohols, and NF_3 and other perfluorinated compounds) and HFCs, PFCs and SF_6 in products and equipment were not subject to reporting for the years 2007-2013. The data shown for 2007-2013 are thus limited to bulk supply.

Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

Table A5.16 Total EU supply of fluorinated gases (CO_2e)

Gas	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Million tonnes of CO_2 equivalents										
HFC-23	C	C	C	4.4	4.5	2.0	C	1.4	1.2	0.9	1.3
HFC-32	2.7	3.4	3.0	3.6	3.3	3.4	3.6	7.5	6.3	7.4	8.2
HFC-41	C	-	C	C	C	C	C	0.0	0.0	0.0	0.0
HFC-125	43.3	43.8	49.0	63.9	53.7	54.6	52.9	89.2	62.7	65.5	60.7
HFC-134	C	C	-	C	-	-	-	-	C	C	-
HFC-134a	70.2	66.0	59.3	62.4	57.5	57.3	56.2	86.9	66.2	63.2	58.5
HFC-143	C	-	-	C	C	-	-	-	-	-	-
HFC-143a	40.2	43.9	43.0	47.3	39.6	40.2	39.4	60.4	31.6	32.2	26.9
HFC-152a	0.5	0.8	0.6	0.6	0.6	0.5	0.5	0.8	0.5	0.4	0.4
HFC-227ea	C	C	C	C	C	C	C	8.7	6.4	5.6	5.2
HFC-236fa	C	C	C	C	0.4	0.3	C	0.5	0.4	0.4	0.4
HFC-245ca	-	-	-	-	-	-	-	-	-	C	-
HFC-245fa	C	C	C	C	C	C	C	C	C	C	C
HFC-365mfc	C	C	C	C	C	C	C	C	C	C	C
HFC-43-10mee	C	C	0.1	C	C	C	C	C	C	C	C
PFC-14	C	C	0.3	0.4	0.4	C	C	1.1	1.2	1.1	1.4
PFC-116	1.1	2.2	1.4	C	C	C	C	1.9	2.0	1.6	1.8
PFC-218	C	0.5	C	0.2	0.2	0.4	0.3	0.4	0.5	0.3	0.2
PFC-c-318	C	0.1	0.0	0.1	0.1	C	C	0.1	0.3	0.3	0.4
PFC-3-1-10	C	C	-	C	C	C	C	C	C	C	C
PFC-4-1-12	-	-	-	-	-	-	-	C	C	C	-
PFC-5-1-14	C	C	C	C	C	C	C	C	C	1.1	C
SF_6	C	C	C	C	C	C	C	C	C	C	27.9
HCFC-1233xf	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	-	C	C
HCFC-1233zd	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
HFC-1234yf	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.0	0.0	0.0	0.0
HFC-1234ze	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
HFC-1336mzz	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
HFE-236fa	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	-	-	0.0
HFE-245fa1	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	-	C	-
HFE-347mcc3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
HFE-347pcf2	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	-	-	0.0
HFE-449sl	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
HFE-569sf2	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
2,2,3,3,3-pentafluoropropanol	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	0.0	C	C
bis(trifluoromethyl)-methanol	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	0.0	C	C
NF_3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	5.5	5.8	6.6	8.5
PFPMIE (perfluoropolymethyl-isopropylether)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	-	-	-

Table A5.16 Total EU supply of fluorinated gases (CO_2e) (cont.)

Gas group	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
HFCs	169.3	171.5	167.4	193.5	171.0	167.8	163.8	259.2	179.9	180.3	166.9
PFCs	C	4.0	C	C	C	C	C	C	C	C	6.1
SF_6	C	C	C	C	C	C	C	C	C	C	27.9
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0.0	0.0	0.0	0.1
HFEs and alcohols	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
NF_3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	5.5	5.8	6.6	8.5
Total fluorinated gases	**213.5**	**218.0**	**202.6**	**231.3**	**208.2**	**204.3**	**200.1**	**285.8**	**211.6**	**214.3**	**209.5**

Notes: '-', no data reported; n.a., not applicable: Annex II F-gases (unsaturated HFCs and HCFCs, HFEs and alcohols, and NF_3 and other perfluorinated compounds) and HFCs, PFCs and SF_6 in products and equipment were not subject to reporting for the years 2007-2013. The data shown for 2007-2013 are thus limited to bulk supply.

Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

Table A5.17 EU bulk supply of fluorinated gases (tonnes)

Gas group	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Tonnes										
HFCs	86 477	87 311	81 005	89 924	81 829	80 958	79 224	118 737	85 057	81 617	78 588
PFCs	C	398	C	C	C	C	C	C	C	457	647
SF_6	C	C	C	C	C	C	C	C	C	C	1 223
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
HFEs and alcohols	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
NF_3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	321	339	381	492
Total fluorinated gases	**88 586**	**89 569**	**82 681**	**91 749**	**83 620**	**82 691**	**80 898**	**121 739**	**89 475**	**89 410**	**93 617**
Average GWP	*2 410*	*2 433*	*2 451*	*2 521*	*2 489*	*2 470*	*2 474*	*2 251*	*2 210*	*2 176*	*2 050*

Table A5.18 EU bulk supply of fluorinated gases (CO_2e)

Gas group	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Million tonnes of CO_2 equivalents										
HFCs	169.3	172	167	193	171	168	164	248	166	161	149
PFCs	C	4	C	C	C	C	C	C	C	4	6
SF_6	C	C	C	C	C	C	C	C	C	C	28
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
HFEs and alcohols	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C
NF_3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	6	6	7	8
Total fluorinated gases	**214**	**218**	**203**	**231**	**208**	**204**	**200**	**274**	**198**	**195**	**192**

Notes: '-', no data reported; C, confidential; n.a., not applicable: Annex II gases (unsaturated HFCs and HCFCs, HFEs and alcohols, and NF_3 and other perfluorinated compounds) were not subject to reporting for the years 2007-2013.

Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

Table A5.19 Intended applications of EU total supply of fluorinated gases (tonnes)

Intended applications of total supply	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Tonnes										
Refrigeration, air conditioning and heating and other heat transfer fluids	61 377	58 720	58 678	65 964	61 045	58 552	58 999	95 688	74 023	77 998	77 899
Foams, including pre-blended polyols	14 286	15 284	11 709	11 503	9 234	8 526	8 202	12 967	9 572	10 157	11 529
Aerosols	9 090	11 131	8 425	9 547	7 808	10 948	9 690	8 954	9 421	8 728	10 317
Fire protection	649	491	531	1 677	2 508	1 451	1 385	1 858	818	585	478
Electrical equipment	1 197	1 422	969	1 290	1 344	1 362	1 419	622	745	813	952
Semiconductor, photovoltaics and other electronics manufacture	127	301	184	265	243	169	71	1 057	715	755	924
Other or unknown applications	1 861	2 219	2 185	1 501	1 437	1 684	1 132	6 402	1 485	997	1 247
Total supply	**88 586**	**89 569**	**82 681**	**91 749**	**83 620**	**82 691**	**80 898**	**127 547**	**96 779**	**100 032**	**103 346**

Table A5.20 Intended applications of EU total supply of fluorinated gases (CO_2e)

Intended applications of total supply	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Million tonnes of CO_2 equivalents										
Refrigeration, air conditioning and heating and other heat transfer fluids	138.5	136.5	139.6	161.6	143.7	140.2	140.4	216.5	155.3	157.0	142.2
Foams, including pre-blended polyols	13.4	12.9	9.8	10.4	6.5	6.1	5.9	11.7	7.2	8.8	8.5
Aerosols	12.2	14.5	11.2	12.5	9.9	14.1	12.7	11.7	13.1	11.6	14.5
Fire protection	4.0	3.0	3.2	7.5	9.7	5.8	2.6	6.6	3.0	2.2	1.8
Electrical equipment	27.3	32.4	22.1	29.4	30.7	31.0	32.4	14.2	17.0	18.5	21.7
Semiconductor, photovoltaics and other electronics manufacture	1.5	3.2	2.1	3.1	2.8	2.1	1.0	9.4	9.9	10.6	13.2
Other or unknown applications	16.7	15.4	14.7	6.7	4.9	4.9	5.3	15.8	6.1	5.5	7.7
Total supply	**213.5**	**218.0**	**202.6**	**231.3**	**208.2**	**204.3**	**200.1**	**285.8**	**211.6**	**214.3**	**209.5**

Notes: Annex II gases (unsaturated HFCs and HCFCs, HFEs and alcohols, and NF_3 and other perfluorinated compounds) and data on products and equipment were not subject to reporting for the years 2007-2013. The data presented for these years thus equal data presented for bulk supply.
Since 2014, the category 'aerosols' has been replaced by separate categories for medical and non-medical aerosols. Feedstock use does not appear in these tables as it is excluded from the scope of EU total supply.

Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

Table A5.21 HFCs placed on the market and quota compliance

	POM category		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
			Million tonnes of CO_2 equivalents										
(1)	Bulk HFC POM 2007-2013		173.5	174.9	172.4	200.6	179.0	172.0	169.6				
(2)	Bulk HFC POM 2014 onwards	*= Sum (3) - (9)*								279.4	162.8	159.1	166.6
(3)	*Thereof for exempted uses Art. 15(2)a-e*									*7.0*	*7.6*	*14.1*	*9.2*
(4)	*Exemption Art. 15(2)f: Pharmaceutical MDIs*									*C*	*C*	*C*	*C*
(5)	Bulk HCF POM (quota-relevant)	*= (2) - (3)*									155.2	145.0	157.4
(5)	POM of HFCs in equipment	*= (7) + (9)*								11.2	13.6	19.6	18.6
	Thereof:												
(7)	*HFC POM in RACHP equipment*									*11.1*	*12.8*	*19.2*	*17.0*
(8)	*Thereof: without quota authorisation coverage*												*1.0*
(9)	*HFC POM in other equipment*									*0.1*	*0.7*	*0.5*	*0.5*
(10)	Total physical HFC POM 2014 onwards (bulk + equipment)	*= (2) + (6)*								290.6	176.4	178.7	185.2
(11)	Quota authorisations issued										16.7	18.9	11.1
(12)	Quota-relevant POM 2015 onwards	*= (5) + (8) + (11)*									171.8	163.9	169.5
(13)	Maximum quantity of HFC phase-down (= total allocated quota)										183.1	170.3	170.3
	Quota balance												
(14)	Unused quota (company level)										12.0	7.0	3.4
(15)	Quota exceedance (company level)										0.7	0.6	2.7
(16)	*Thereof: production/bulk import of HFCs*	*= (15) - (8)*									*0.7*	*0.6*	*1.7*
(17)	EU-wide margin to maximum quantity	*= (13) - (12)* *= (14) - (15)*									11.2	6.3	0.8

Notes: C, confidential; POM, placing on the market; RACHP: refrigeration, air conditioning, and heat pump.

Sources: EC, 2011, 2014 and 2018; EEA, 2017 and 2018b.

Table A5.22 Consumption of HFCs covered under the Montreal Protocol

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
	Million tonnes of CO_2 equivalents										
EU consumption of HFCs covered under the Montreal Protocol	177.5	169.1	156.3	194.0	173.2	159.3	163.2	267.0	146.9	141.4	145.7

Sources: EC, 2011 and 2014; EEA, 2017 and 2018b.

Table A5.23 Companies reporting on 2017, breakdown by Member State and reported activities

Country	Total	Thereof:						
		Producers	Importers	Exporters	Equipment importers	Feedstock users	Destruction companies	Quota authorisers
Austria	22	-	2	-	20	-	-	-
Belgium	54	1	16	9	36	-	-	2
Bulgaria	53	-	18	1	30	-	-	6
Croatia	27	-	8	2	20	-	-	2
Cyprus	32	-	9	-	21	-	-	3
Czechia	47	-	13	1	31	-	1	3
Denmark	31	-	7	5	21	-	-	-
Estonia	24	-	14	-	9	-	1	2
Finland	27	-	5	1	21	-	1	-
France	134	3	22	10	105	1	1	3
Germany	148	2	36	20	104	2	4	6
Greece	51	-	11	2	38	-	-	-
Hungary	39	-	11	1	25	-	-	1
Ireland	12	-	6	-	7	-	-	-
Italy	158	-	58	16	94	-	-	2
Latvia	13	-	4	-	9	-	-	1
Lithuania	16	-	9	2	6	-	-	4
Luxembourg	-	-	-	-	-	-	-	-
Malta	19	-	3	1	16	-	-	-
Netherlands	65	1	17	5	45	-	1	3
Poland	245	-	181	5	59	-	-	8
Portugal	43	-	11	3	29	-	-	-
Romania	48	-	8	-	37	-	1	1
Slovakia	17	-	5	1	10	-	1	1
Slovenia	20	-	4	1	14	-	-	-
Spain	111	-	26	14	75	-	-	3
Sweden	48	-	10	4	37	-	1	-
United Kingdom	115	1	39	9	71	-	1	4
EU Total	**1 619**	**8**	**553**	**113**	**990**	**3**	**13**	**55**
Non-EU	**80**	**n.a.**	**24**	**3**	**18**	**n.a.**	**n.a.**	**39**

Notes: Companies may report for more than one activity type.
'-', no data reported; n.a., not applicable: non-EU companies are not eligible to report as producers, feedstock users or destruction companies.

Source: EEA, 2018b.

Table A5.24 Non-EU companies reporting on 2017, breakdown of location of only representative

EU country of only representative	Total represented non-EU companies	thereof from											
		Switzerland	China	Gibraltar	Hong Kong	Japan	Korea, Republic of	Monaco	Norway	Serbia	Taiwan, Province of China	United States	Virgin Islands, British
Belgium	1	-	-	-	-	1	-	-	-	-	-	-	-
Bulgaria	1	-	-	-	-	-	-	-	-	1	-	-	-
Czechia	1	-	-	-	-	-	1	-	-	-	-	-	-
France	2	-	-	-	-	-	-	1	1	-	-	-	-
Germany	11	-	4	-	1	1	1	-	-	-	1	3	-
Ireland	48	-	47	-	-	-	-	-	-	-	-	-	1
Italy	5	1	2	-	-	1	-	-	1	-	-	-	-
Netherlands	5	1	-	-	1	1	-	-	1	-	-	1	-
Sweden	3	-	-	-	-	-	-	-	3	-	-	-	-
United Kingdom	3	1	-	1	-	-	-	-	-	-	-	1	-
EU Total	**80**	**3**	**53**	**1**	**2**	**4**	**2**	**1**	**6**	**1**	**1**	**5**	**1**

Note: '-', no data reported.

Source: EEA, 2018b.

Table A5.25 Activities reported 2007-2017

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Reports received	77	86	94	110	125	132	153	468	780	1 284	1 699
Of which mention:											
Production of F-gases	6	12	8	7	9	10	9	10	9	9	8
Thereof: HFC production	4	9	6	5	7	8	7	6	6	6	5
Bulk import of F-gases	55	53	58	70	77	90	112	187	293	378	577
Thereof: bulk HFC import	48	47	53	66	73	85	107	173	282	365	564
Bulk export of F-gases	44	47	64	75	74	80	82	92	99	111	116
Thereof: bulk HFC export	37	39	55	67	64	69	72	81	89	98	101
Import of products or equipment pre-charged with F-gases	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	228	427	839	1 008
Thereof: RACHP equipment charged with HFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	220	409	825	997
Destruction	6	8	7	8	10	11	10	10	15	13	13
Feedstock use	2	2	2	2	1	1	1	3	3	3	3
Supply of quota authorisation	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	20	34	94
Thereof: quota authorisation without any EU production, import or export	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	7	7	23

Notes: N.a., not applicable: the reporting obligation for equipment importers applied for reporting on 2014 for the first time. Reporting on quota authorised to other companies has been applying since 2015.
Companies may report on more than one activity.
RACHP equipment: refrigeration, air conditioning, and heat pumps.

Sources: EEA, 2018b.

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