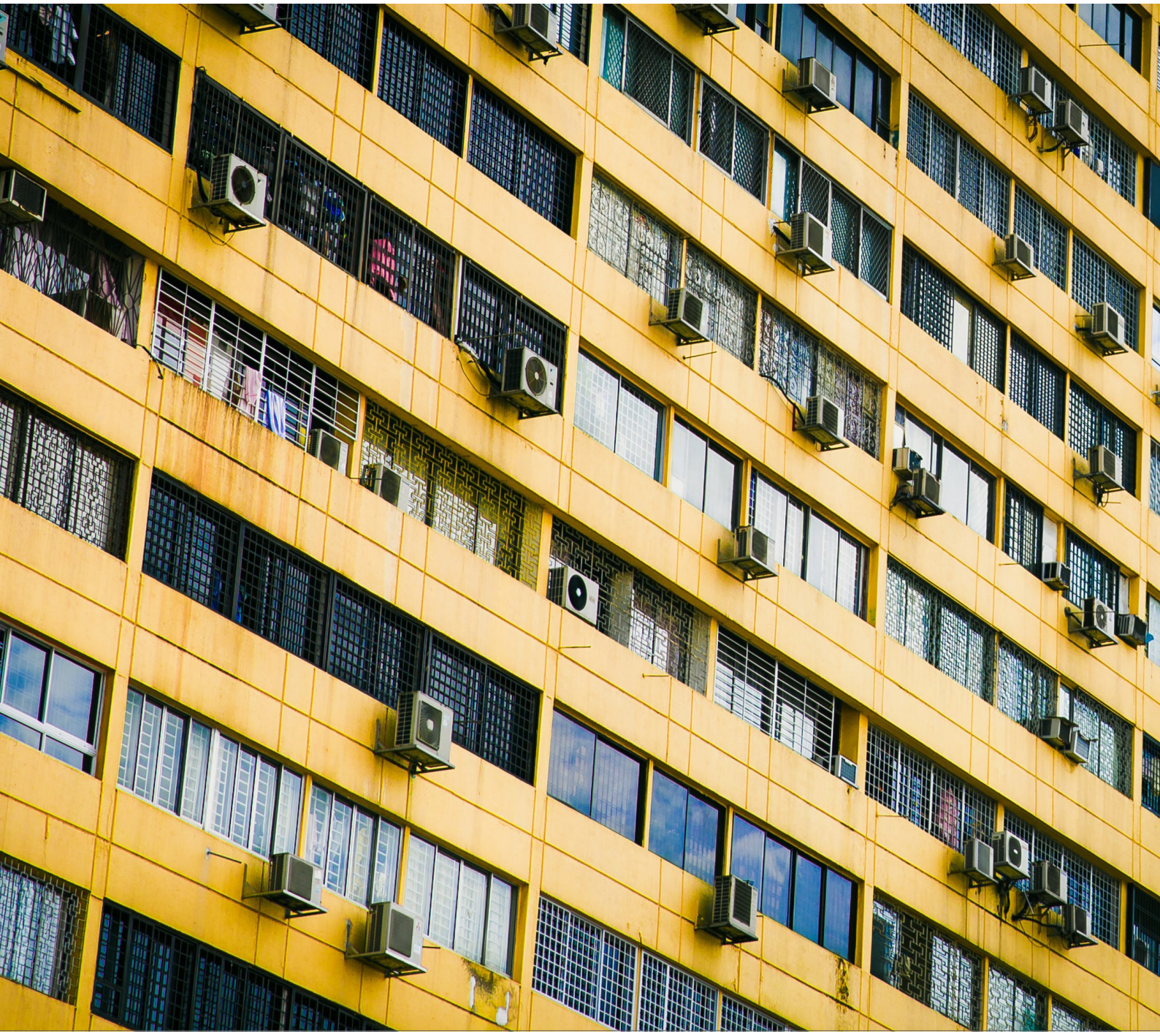
EEA Report | No 15/2020

Fluorinated greenhouse gases 2020

Data reported by companies on the production, import, export and destruction of fluorinated greenhouse gases in the European Union, 2007-2019

ISSN 1977-8449



European Environment Agency

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Cover design: EEA
Cover photo: © Isaac Benhesed, on Unsplash
Layout: Formato Verde

Luxembourg: Publications Office of the European Union, 2020

ISBN 978-92-9480-294-1
ISSN 1977-8449
doi: 10.2800/08599

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Acknowledgements

This report was prepared for the EEA by its European Topic Centre on Climate Change Mitigation and Energy (ETC/CME). The authors of this report were Wolfram Jörß, Victoria Liste and Sylvie Ludig (ETC/CME partner Öko-Institut).

The EEA report coordinator was Peder Gabrielsen and the ETC/CME task manager was Wolfram Jörß. François Dejean (EEA) and the European Commission Directorate-General for Climate Action are thanked for their input and support in finalising the report.

Executive summary

The 2020 edition of the EEA report on fluorinated greenhouse gases (F-gases) confirms the good progress achieved up to 2019 by the 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 2020 about their activities involving F-gases in 2019, assessing the progress on HFC phase-down made under both EU legislation and the Kigali Amendment to the Montreal Protocol. The report also details the amount of F-gases supplied to various industrial applications.

The report expresses F-gas amounts in two different metrics: physical tonnes, to reflect the use patterns of F-gases in European industries, and tonnes of carbon dioxide equivalent (tCO_2e), to account for their global warming potential (GWP).

Context

The Montreal Protocol was established in 1987 to cut the consumption and production of synthetic substances that destroy the protective ozone layer (ozone-depleting substances, ODS). In the EU, ODS are regulated separately under Regulation (EC) No 1005/2009.

Phasing down ODS has led to the increased use of certain F-gases, most prominently in refrigeration and air conditioning, since the early 1990s, as these chemicals present similar properties to ODS while they do not affect the ozone layer. Consequently, emissions of F-gases in the EU-28, of which more than 90 % are HFCs, increased by 72 % between 1990 and 2014.

Because F-gases are potent greenhouse gases, they have been regulated in the EU since 2014 and their emissions have started to decline since peaking in 2014 (-11 %) (EEA, 2020a). The EU Regulation on F-gases, No 517/2014 (FGR), implements an EU-wide phase-down of HFCs, which started in 2015, with the aim of cutting emissions by two thirds by 2030 in the EU compared with 2014 levels. 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 hydrochlorofluorocarbons (HCFCs).

The EU aims to achieve net-zero greenhouse gas emissions by 2050. F-gases are included in this objective. It 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. Under the Paris Agreement, the EU is committed to a 40 % reduction in domestic emissions by 2030 compared with 1990. In line with the European Green Deal, the European Commission has proposed to the European Parliament and the Council to increase the ambition for the 2030 climate target from a reduction of 40 % to a reduction of at least 55 %.

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

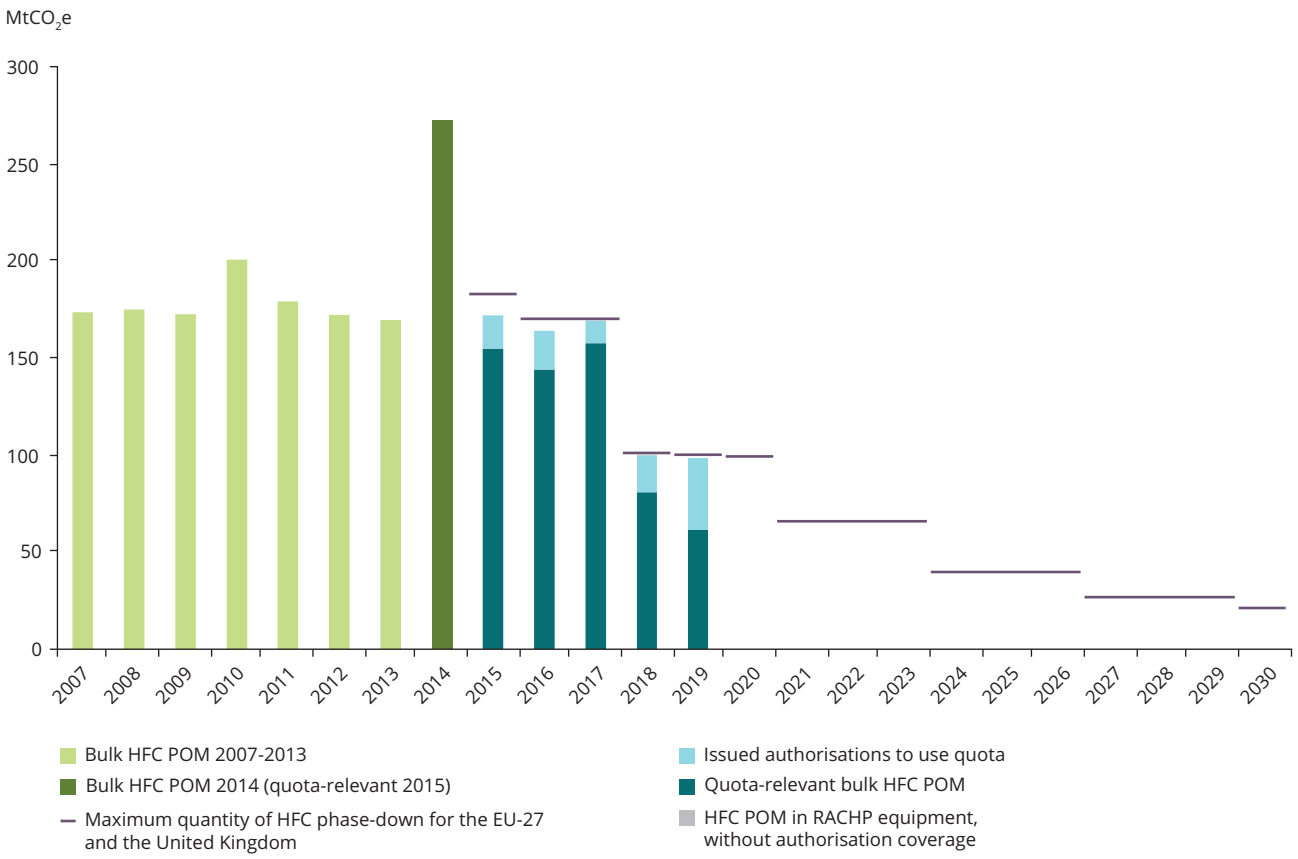
The HFC phase-down under the F-gas Regulation is being implemented by annual quantitative limits (quotas) on the placing on the EU market of HFCs by producers and importers. The EU-wide maximum quantity for HFCs is subject to a stepwise reduction, as displayed in Figure ES.1. In 2019, EU-wide placing on the market (POM) of HFCs was 2 % below the 2019 overall market limit set by the quota system (1 % in 2017 and 2018). 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.

As EU industries have been moving to low-GWP alternatives, the demand for HFCs has been decreasing. Between 2017 and 2019, the placing on the market of bulk HFCs decreased by 22 %. This resulted in an increase in unused quotas. The reserve of quota authorisations, built up by a number of equipment importers during 2015 and 2016, and almost stable until 2018, increased by 66 % during 2019. The current size of this reserve

is five times the amount of actual annual equipment imports or 61 % of the maximum available HFC amount for 2020. This accumulated reserve of authorisations reduces the overall strain on the quota issued for the following years, as imports of refrigeration, air conditioning and heat pump (RACHP) equipment containing HFCs will, at least theoretically, not need to be covered by the quota issued for those years.

In addition, allegations of illegal HFC imports outside the reporting and compliance system under the FGR have been made. These were explored in a recent study for the Directorate-General for Climate Action of the European Commission (DG CLIMA) (EC, 2019) ([1]).

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

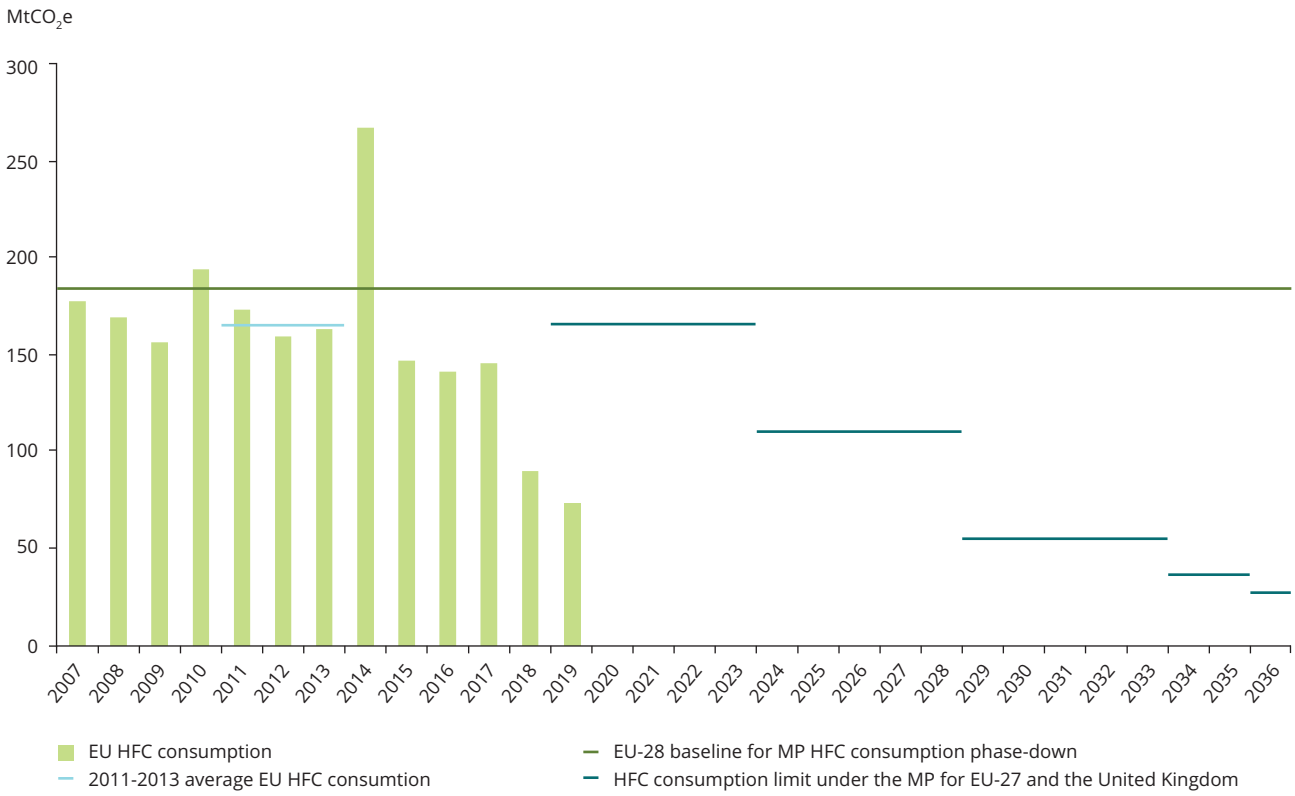


Notes: Values from 2007 to 2013 are based on the reporting obligations of the old F-gas Regulation (EC) No 842/2006 and are therefore not fully comparable with data from 2014 onwards (based on the obligations of the new F-gas Regulation (EU) No 517/2014). The geographical scope of presented POM data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. The maximum quantities of the EU HFC phase-down shown for 2019 onwards are given for the EU-28. EU-27 maximum quantities for 2021 onwards will need to be recalculated for the period after the Brexit transition period.
Mt, million tonnes; POM, placing on the market.

Sources: EC (2011, 2014, 2020); EEA (2019, 2020b).

([1]) That study concludes that, at this stage, it does not appear possible to quantify customs evasion, and that the HFC phase-down continues to be successful in promoting innovation and a shift towards climate-friendly solutions, in particular as gas prices remain significantly higher than on the world market.

Figure ES.2 EU progress under 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 (see Annex 1). The geographical scope of presented HFC consumption data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019.
MP, Montreal Protocol.

Sources: EC (2011, 2014); EEA (2019, 2020b).

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 2019, HFC consumption in the EU-28 dropped by 22 % and was thus 55 % below the limit for the EU-28 under the Montreal Protocol's Kigali Amendment (Figure ES.2).

Supply of F-gases in the EU

The total supply of F-gases decreased significantly for the second consecutive year in 2019, with a 20 % reduction compared with 2018 (Figure ES.3). Refrigeration and air conditioning continue to be key applications. This trend reflects a 3 % growth observed for unsaturated HFCs and HCFCs with very low GWPs, while HFC supply decreased by 20 % in mass (22 % as CO_2e). Looking at the gases with the highest GWPs, there was a 14 % decrease for SF_6, a 7 % decrease for NF_3 and a 21 % decrease for PFCs.

The trend in F-gas supply in the EU reflects trends in physical flows of F-gases: production, reclamation, imports, exports and destruction in the EU-28.

- Production of F-gases has seen a steady decline since 2012. In 2019, while the volume of production fell by 3 %, the average GWP of produced substances increased by 30 % due to more complete reporting on the by-production of high-GWP HFC-23, which is mostly destined for destruction or feedstock use. SF_6 production in 2019 rose by 6 % compared with 2018.

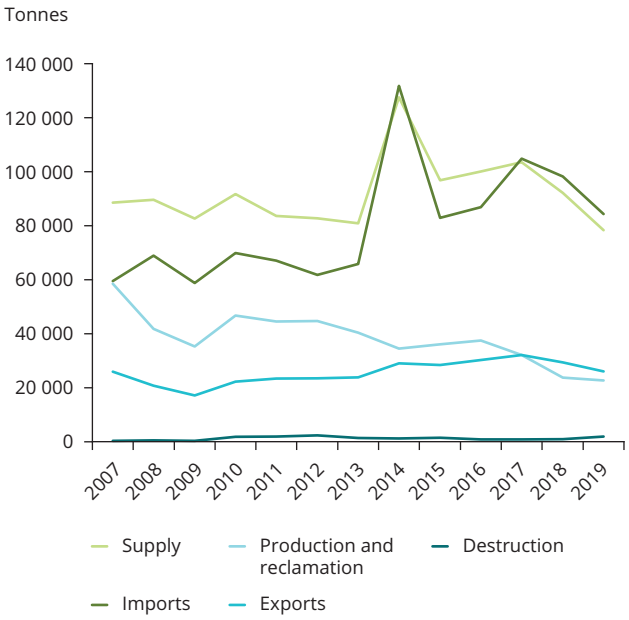
- The quantities reported as reclaimed F-gases decreased by about 20 % compared with 2018, due mostly to less complete reporting. Reclaimed HFCs now make up 8 % of the produced amount, or 3 % of the EU supply of virgin HFCs (or 9 % and 4 %, respectively, as CO_2e). While 97 % of reclaimed amounts are HFCs, SF_6 contributes to 20 % of the GWP of reclaimed gas.

- Total imports have decreased over the past 2 years: 2019 amounts were 20 % below those of 2017, or 39 % as CO_2e. Imports of HFCs fell by about 30 % since 2017, while imports of unsaturated HFCs/HCFCs increased by 40 %. The share of HFCs in total imports was 74 % in 2019. Imports of F-gases contained in products and equipment appear to have levelled off since 2017.

- Bulk exports of fluorinated gases from the EU-28 decreased annually by about 10 % since 2017. The year-on-year decrease in CO_2e, however, is less steep at 1 %, compared with 2018. There are different trends for different gases: 2019 HFC exports were about 25 % lower than 2 years before in 2017. For other gases, mostly SF_6 and unsaturated HFCs and HCFCs, 2019 exports were about 20 % higher than in 2017. The rise in SF_6 exports compensates for reductions in HFC exports when assessing trends in total bulk exports on a GWP basis. 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. The amounts destroyed increased by 145 % and the GWP of destroyed F-gases increased by about 200 % compared with 2018, mostly due to more complete reporting as discussed for production. Feedstock use amounts have been almost constant since 2015 with a small peak in 2018.

Figure ES.3 Supply, production, import, export and destruction of F-gases (CO_2e)



Notes: The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. 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. Data available for Croatia for the period 2009-2012 are limited to HFCs and do not cover PFCs and SF_6.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Note on Brexit

The withdrawal of the United Kingdom from the European Union did not affect the production of this assessment. Data for the United Kingdom appears here in agreement with the terms of the Withdrawal Agreement, which entered into force on 1 February 2020. In this assessment, in line with guidance from the EU Publications Office:

- EU-28: refers to the first 28 countries of the EU.
- EU-27: refers to the 27 Member States comprising the EU since the departure of the UK.

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). Most 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 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 (UNEP Ozone Secretariat, 1987) and Regulation (EC) No 1005/2009 (EU, 2009). Their use in many different applications has been increasing and has considerable potential for further growth. In 2018, F-gases accounted for approximately 3 % of overall greenhouse gas emissions expressed in carbon dioxide equivalent (CO_2e) in the 28 Member States of the EU. Emissions of F-gases, of which approximately 90 % are HFCs, increased from 2000 to 2014 by more than 50 %, then declined significantly after peaking in 2014 (-11 % until 2018) (EEA, 2020a).

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. In line with the European Green Deal, the European Commission proposed in September 2020 to the European Parliament and the Council to increase the ambition for the 2030 climate target from a reduction of 40 % to a reduction of at least 55 %.

The strong policy mechanisms adopted under the EU F-gas Regulation of 2014 (EU, 2014b), which implements an EU-wide phase-down of HFC use, as well as measures taken by other industrialised countries, gave momentum to the global development of HFC regulation. 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 production and consumption of HFCs in the next three decades ([2]).

1.1.2 EU fluorinated greenhouse gases legal framework

Old F-gas Regulation

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

- 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.

- 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) (EU, 2014b) was implemented, which aims to reduce F-gas emissions by two thirds of the 2010 level by 2030. The relevant 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.

([2]) The Kigali Amendment regulates production and consumption, while reducing emissions of HFCs remains within the remit of the UNFCCC and the Paris Agreement.

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 a feedstock 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 F-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 hydro(chloro)fluorocarbons;
- fluorinated ethers and alcohols;
- other perfluorinated compounds.

Commission Implementing Regulation (EU) No 1191/2014 (EU, 2014a), last amended by Commission Implementing Regulation (EU) 2019/522 (EU, 2019), establishes the format in which the reports are to be submitted.

1.2 Report structure

The report consists of six chapters:

This introductory 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 F-gases as reported by companies.

Chapter 4 presents key indicators for the EU, based on reported data 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 discusses progress under 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 and HFC Licensing System ([3]), which also hosts the HFC registry pursuant to Article 17 of the 2014 F-gas Regulation (Figure 1.1).

Since 2012, the European Commission has given the responsibility for collecting, archiving and evaluating the data reported by companies to the 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 on Climate Change Mitigation and Energy (ETC/CME) ([4]).

1.4 Scope

The report is based on submissions for the year 2019, as received by 4 August 2020 (which includes some late reports and corrections received after the legal deadline of 31 March 2020). Data for previous years were changed slightly after some corrections were submitted.

Data for the period 2007-2013 are covered by the old 2006 F-gas Regulation, while data for 2014 and onwards are covered by the new 2014 Regulation. Because of the different reporting frameworks, data from the two periods are not always directly comparable.

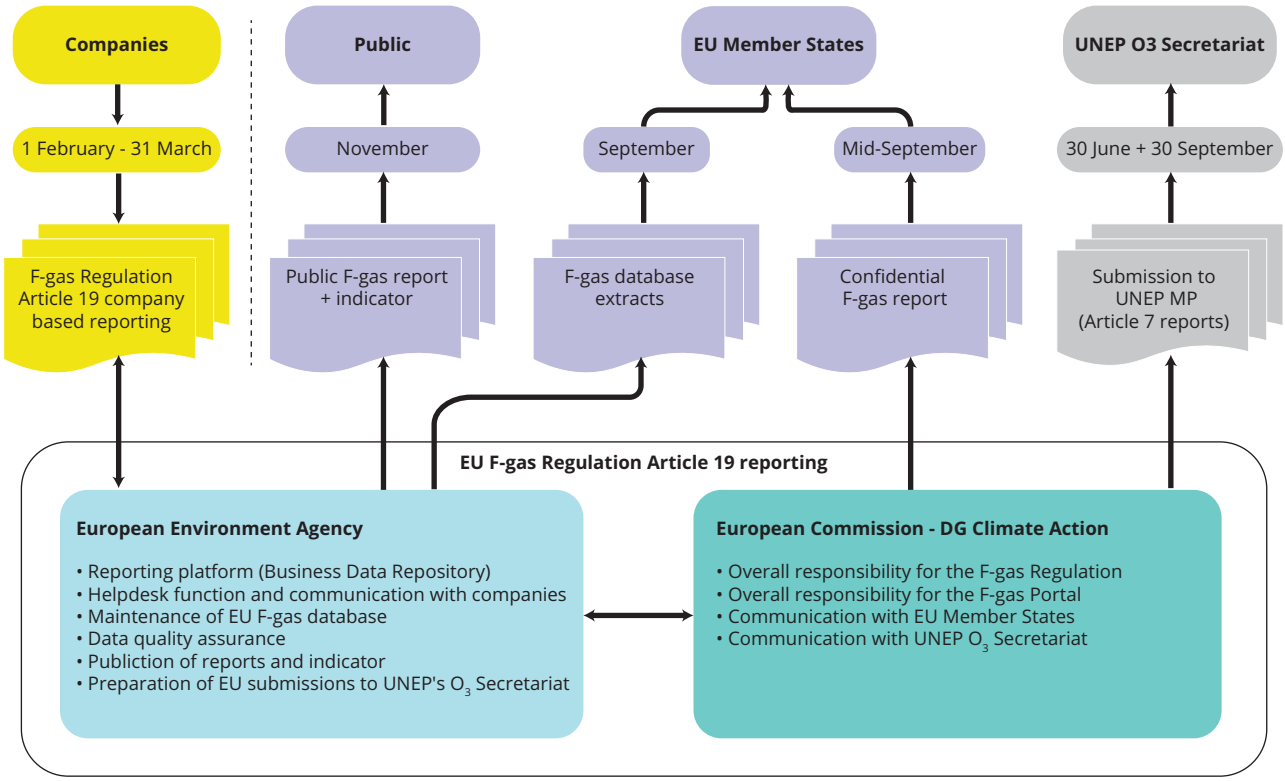
The geographical scope for data presented for the years up to 2018 is the EU. Data for 2019 relate to the EU-28.

1.5 Confidentiality

The 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 F-gas activity in this report are of a general nature and do not refer to exact 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.

([3]) https://webgate.ec.europa.eu/ods2
([4]) https://www.eionet.europa.eu/etcs/etc-cme

Figure 1.1 Institutional arrangements



Source: EEA (2019).

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), amended by Commission Implementing Regulation (EU) 2017/1375 (EU, 2017), Commission Implementing Regulation (EU) 2018/1992 (EU, 2018) and Commission Implementing Regulation (EU) 2019/522 (EU, 2019). A further specification of data to be reported is given in Annex 2. An overview of the reporting format applied for the period 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 hydrofluorocarbon (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 EEA's Business Data Repository (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 European Topic Centre on Climate Change Mitigation and Energy (ETC/CME) 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 ([5]).
- How to use the BDR reporting platform? The BDR user manual ([6]).
- What (numbers) should be reported? Frequently asked questions (FAQ) document ([7]).

2.1.2 Companies that are not obliged to report

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.

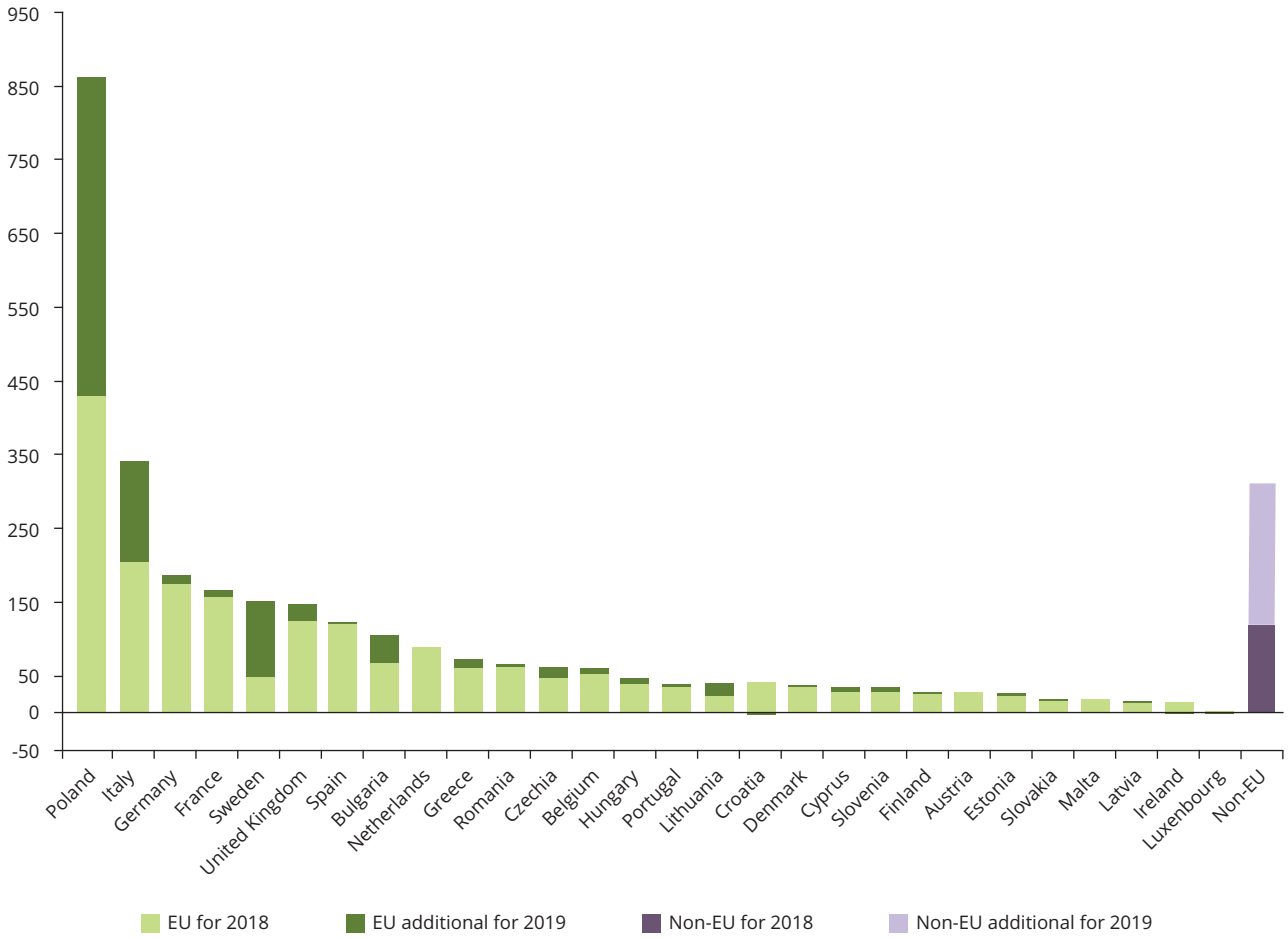
2.1.3 Data quality control

Data quality checking procedures are included in an automatic quality control implemented in the online questionnaire, which can also be invoked by the reporters manually. It is 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 to ensure the transparency of the reporting process. This process was repeated until submissions passed all quality checks. More details on the quality control procedures are given in Annex 6.

([5]) https://ec.europa.eu/clima/sites/clima/files/f-gas/docs/guidance_document_en.pdf
([6]) https://bdr.eionet.europa.eu/help/bdr_user_manual.pdf
([7]) https://bdr.eionet.europa.eu/help/fgases

Figure 2.1 Reporting companies by Member State

Number of companies reporting on 2019 activities



Notes: Nil reports not included.
Non-EU countries: British Virgin Islands, Canada, China, Egypt, Gibraltar, Hong Kong, India, Japan, Korea, Malaysia, Marshall Islands, Mexico, Monaco, Norway, Saudi Arabia, Singapore, Switzerland, Taiwan, Thailand, Turkey, United States, United Arab Emirates and Vietnam.

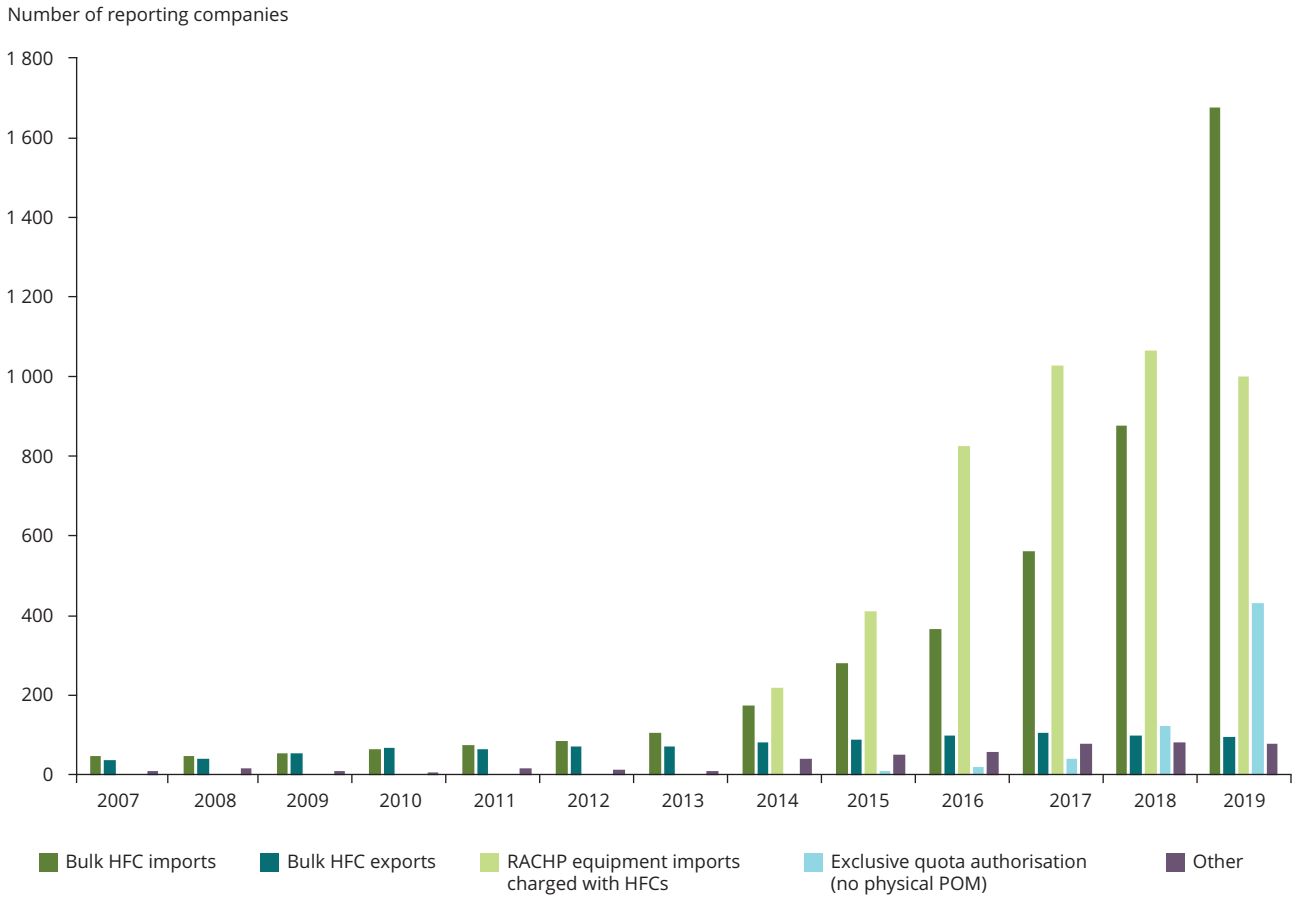
Source: EEA (2020b).

2.2 Companies reporting in 2020

By 4 August 2020, 3 146 companies had reported on F-gas activity during 2019, an increase of 47 % on the previous year. A further 1 621 companies reported no reportable activity during 2019 (nil report). As shown in Figure 2.1, companies are distributed across the EU-28 Member States, with the largest amounts located in Poland (27 %), Italy (11 %), Germany (6 %), France (5 %), Sweden (5 %) and the United Kingdom (5 %). About 10 % of reporting companies are non-EU companies; most are Chinese companies that export gases or equipment to European subsidiaries and partners. The majority of non-EU companies are represented in the EU by 'only representatives' located in Ireland (see breakdown in Table A5.28 in Annex 5. The rise in reporting companies compared with the previous year can largely be attributed to four countries, namely Poland (43 % of the total increase), China (15 %), Italy (13 %) and Sweden (10 %).

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 A5.27 in Annex 5 presents a breakdown of reporting companies by country and reported activity for 2019.

Figure 2.2 Reported activities, 2007-2019



Note: POM, placing on the market.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Compared with the previous year, the number of bulk HFC importers almost doubled to reach approximately 1 700 companies. This is linked to the additional number of new entrant companies that had applied for the 2019 HFC quota. The increase in quota-holding companies also affected the rise in the number of 'exclusive quota authorisers', i.e. quota-holding companies that do not engage at all in HFC imports but instead authorise their quota to RACHP equipment importers. About 430 quota holders acted that way in 2019, which is approximately a 250 % increase compared with 2018.

For RACHP equipment importers, the number of reporting companies decreased by 6 % in 2019. Following strong growth since reporting started for this category, the number of companies seems to have stabilised at around 1 000 since 2017. For a more detailed breakdown of reported activities over time, please refer to Table A5.29 in Annex 5.

3 Fluorinated greenhouse 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 fluorinated greenhouse gases (F-gases) supply (Chapter 4), the assessment of progress under the EU hydrofluorocarbon (HFC) phase-down (Chapter 5) and the calculation of the EU HFC consumption (Chapter 6).

Table A4.2 in Annex 4 explains the differences between the definitions of EU 'supply' used in this report and the compliance metrics of the HFC phase-down schemes, i.e. 'placing on the market' (POM), used for the EU-wide HFC phase-down under the EU F-gas Regulation, and 'consumption', used for the global HFC phase-down under the Montreal Protocol.

All numbers are presented both as tonnes of F-gases and as tonnes of carbon dioxide equivalent (CO_2e). The statistics in physical tonnes reflect the use patterns of F-gases in European industries, while use of F-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 'POM' and are not subject to the limits of the HFC phase-down.

3.1.1 Production

Production of F-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 global warming potential (GWP) of the produced gas (blue line). This indicates a shift to F-gases with lower GWPs. In 2018, the volume of production fell by 28 % and the GWP of production decreased by 16 %, with large reductions in HFC-134a, HFC-143a and HFC-365mfc production. In 2019, a significant increase in the GWP of produced gases was reported, while the production volume in tonnes continued to slightly decrease. This effect is mainly due to the more complete reporting on the by-production of HFC-23 (GWP: 14 800), both amounts captured for destruction and amounts not captured. Explicit reporting on uncaptured amounts of F-gases was new in 2020, based on the 2019 amendment of the reporting questionnaire (EU, 2019). 97 % of uncaptured HFC production in 2019 was reported to have been destroyed (96 % of GWP).

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 EU production of HFC-32 and HFC-125 ceased after 2013 and 2014, respectively ([8]). For the sum of HFCs, 2019 production was 4 % below 2018 in tonnes but 30 % above 2018 in GWP. That is because HFC-134a production (GWP: 1 430) fell by about one quarter, while reported production of HFC-143a (GWP: 4 470) and HFC-23 (GWP: 14 800) approximately doubled.

While sulphur hexafluoride (SF_6) accounts for roughly 10 % of EU F-gas production, it now constitutes about half of the total GWP of production. SF_6 production in 2019 rose by 6 % compared with 2018 and thus returned to 2017 levels. Other F-gases produced in the

([8]) Relatively small amounts of uncaptured production of HFC-125 were reported in 2019, however they were fully destroyed.

EU are five perfluorocarbons (PFCs). The production of low quantities of HFC-1234yf had been reported for the period 2015-2017 and of hydrochlorofluorocarbon (HCFC)-1233zd for 2018. However, no production of these gases was reported for 2019.

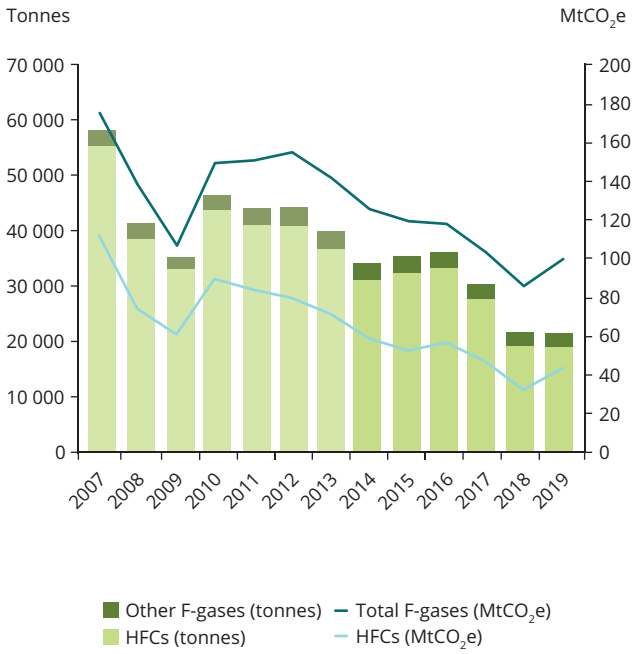
A tabular overview of F-gases produced in the EU since 2007 in tonnes and CO_2e is given in Table A5.1 and Table A5.2 in Annex 5.

3.1.2 Reclamation

Reclamation of F-gases in the EU has fluctuated, but there was a steady increase from 2014 to 2018 (Figure 3.2). In 2019, however, the reported reclamation amount decreased by about 20 % compared with 2018. It must be noted, though, that the reporting on reclamation is incomplete, as no self-standing reporting obligation is in place for undertakings involved in reclamation. Reported reclamation amounts are based on the reclamation activities of undertakings that have a reporting obligation as gas importers. The 2019 decrease can be largely explained by the fact that one single gas importer stopped including their reported data amounts reclaimed by an independent sub-contractor.

Reclaimed HFCs as reported now make up 8 % of the produced amount, or 3 % of the EU supply of virgin HFCs (or 9 % and 4 %, respectively, as CO_2e). While 97 % of reclaimed amounts are HFCs, SF_6 contributes to about 20 % of the GWP of reclaimed gas. Details can be found in Table A5.3 and Table A5.4 in Annex 5.

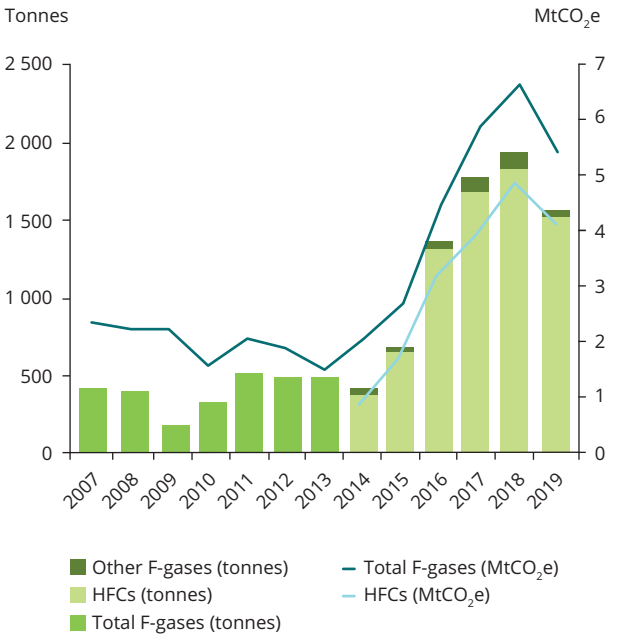
Figure 3.1 EU production of F-gases



Notes: The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. Annex II F-gases (unsaturated HFCs and HCFCs; hydrofluoroethers, HFEs, and alcohols; and nitrogen trifluoride, NF_3, and other perfluorinated compounds) were not subject to reporting for the years 2007-2013.
Mt, million tonnes.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Figure 3.2 EU reclamation of F-gases



Notes: The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2012 and the EU-28 for the period 2013-2019. Annex II F-gases (unsaturated HFCs and HCFCs; hydrofluoroethers, HFEs, and alcohols; and nitrogen trifluoride, NF_3, and other perfluorinated compounds) were not subject to reporting for the years 2007-2013. HFC reclamation in the years 2007-2013 is not identified for confidentiality reasons.
Mt, million tonnes.

Sources: EC (2011, 2014); EEA (2019, 2020b).

3.2 Imports and exports

3.2.1 Imports

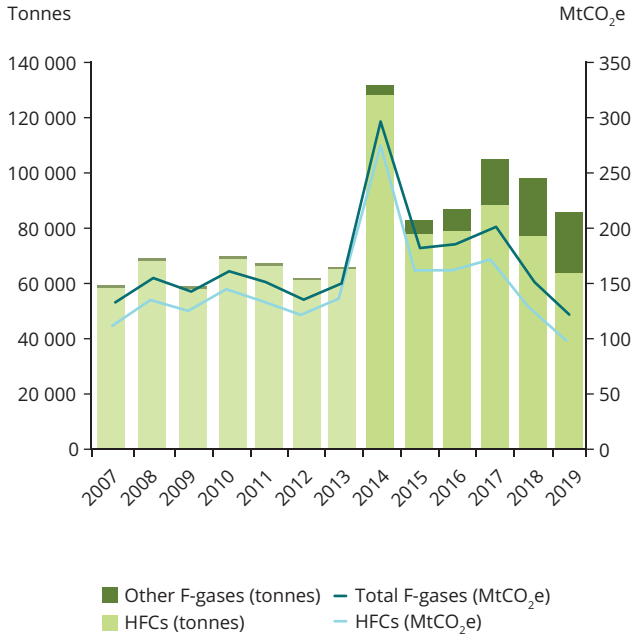
Imports of F-gases into the EU-28, including both bulk imports and imports contained in products and equipment, decreased by 14 % compared with 2019 (Figure 3.3). Imports of HFCs fell by 19 %, while imports of unsaturated HFCs/HCFCs increased by 6 %. The share of HFCs in total imports decreased from 79 % in 2018 to 74 % in 2019.

With the low GWP of the unsaturated gases, the GWP of total F-gas imports decreased by 19 %. Most of that decrease in the GWP of imports is due to the lower HFC imports, and the remainder is caused by decreases in SF_6 and PFCs. Detailed data on total imports can be found in Table A5.5 and Table A5.6 in Annex 5.

Note that, for the years 2014-2019, Figure 3.3 includes both bulk and equipment imports, which were not reported before 2014. The figures before 2014 include only bulk imports. In 2019, equipment imports made up 12 % of the total imported amount or 10 % of the GWP (Figure 3.4), compared with 10 % (tonnes) or 11 % (GWP) in 2018.

The 14 % decrease in total F-gas imports is the result of a 22 % reduction in bulk imports, partly outweighed by a 4 % decrease in products and equipment imports. In terms of CO_2e, bulk gas and imports in equipment fell by 19 % and 22 %, respectively. In both cases this reflects a switch to lower GWP gases.

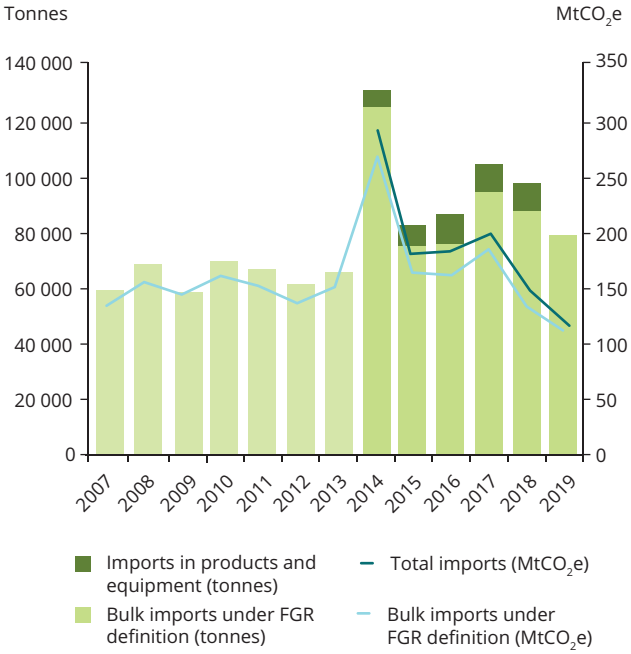
Figure 3.3 EU imports of F-gases



Notes: The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. Annex II F-gases (unsaturated HFCs and HCFCs; hydrofluoroethers, HFEs, and alcohols; and nitrogen trifluoride, NF_3, and other perfluorinated compounds) and HFCs, PFCs and SF_6 imported in products and equipment were not subject to reporting for the years 2007-2013. Data available for Croatia for the period 2009-2012 are limited to HFCs and do not cover PFCs and SF_6.
Mt, million tonnes.

Sources: EC (2011, 2014); EEA (2019, 2020b).

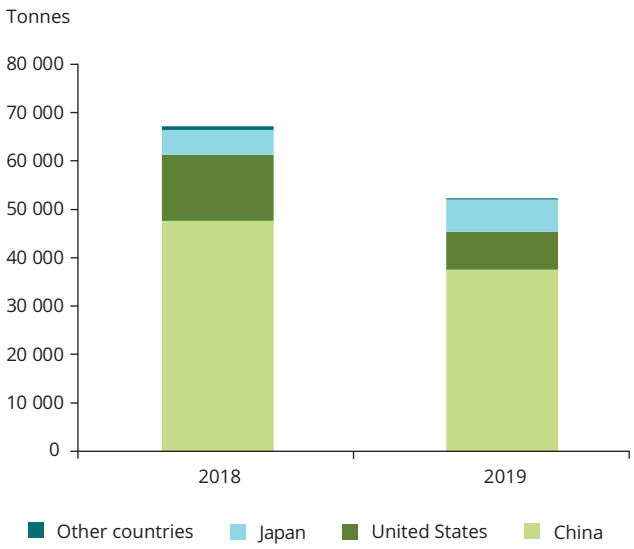
Figure 3.4 EU imports by type



Notes: The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. Annex II F-gases (unsaturated HFCs and HCFCs; hydrofluoroethers, HFEs, and alcohols; and nitrogen trifluoride, NF_3, and other perfluorinated compounds) and HFCs, PFCs and SF_6 imported in products and equipment were not subject to reporting for the years 2007-2013. Data available for Croatia for the period 2009-2012 are limited to HFCs and do not cover PFCs and SF_6. Bulk imports under the FGR definition starting in 2014 include imports of pre-blended polyols. These substances are hence not included in the amounts shown for imports in products and equipment.
FGR, F-gas Regulation; Mt, million tonnes.

Sources: EC (2011, 2014); EEA (2019, 2020b).

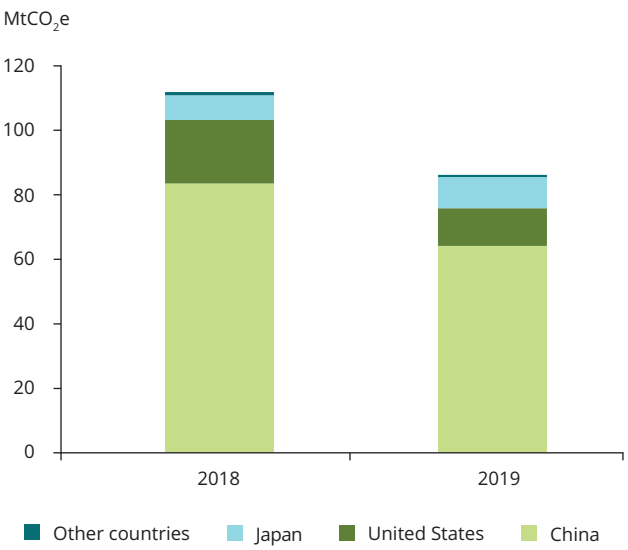
Figure 3.5 Origin of bulk HFC imports



Note: The geographical scope of presented data is the EU-28. Bulk imports presented here do not include imports of pre-blended polyols and are thus compatible with the MP definition.

Sources: EEA (2019, 2020b).

Figure 3.6 Origin of bulk HFC imports



Note: The geographical scope of presented data is the EU-28. Bulk imports presented here do not include imports of pre-blended polyols and are thus compatible with the MP definition.

Sources: EEA (2019, 2020b).

3.2.2 Bulk imports

New reporting details necessary under the Kigali Amendment to the Montreal Protocol (MP), which entered into force in 2019, include country-specific reporting on imports and exports of bulk HFCs ([9]). This means that HFC imports and exports need to be distinguished by country of origin/destination. Figure 3.5 shows the countries of origin for bulk imports by mass, while Figure 3.6 displays the origin of bulk HFC imports in relation to their GWP. In both 2018 and 2019, 99 % of all imports originated from three countries: China, the United States and Japan, with China being the largest supply country of EU HFC imports. While overall bulk HFC imports in 2019 decreased by about 20 % compared with 2018, Chinese imports followed the same trend. US imports decreased by about 40 % while imports from Japan increased by 30 %. Figure 3.6 also shows that HFC imports from China have a slightly higher GWP.

Detailed data on bulk F-gas imports are contained in Table A5.7 and Table A5.8 in Annex 5.

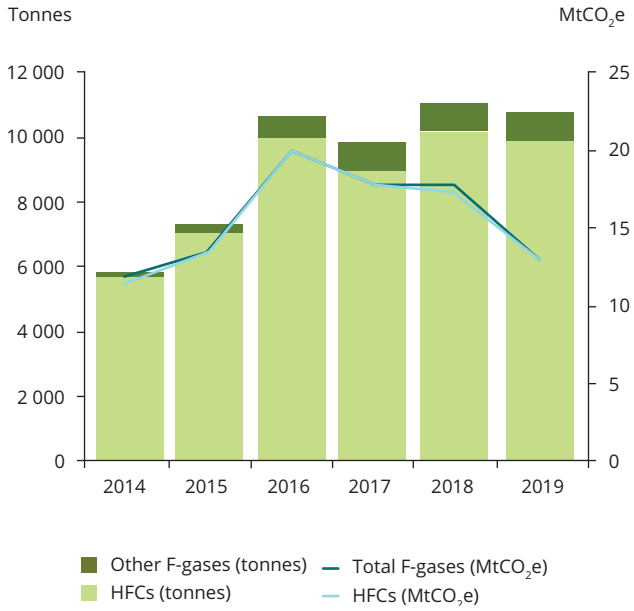
3.2.3 Imports contained in products and equipment

Imports of F-gases contained in products and equipment ([10]) have been subject to reporting since 2014, and reported amounts rose significantly until 2016 (Figure 3.7). Part of the increases up to 2016 may be attributable to more complete reporting and not to actual increases in equipment imports. Since 2016, imports of F-gases appear to have levelled off when measured in mass of gases: 2019 imports were 4 % above 2018 and almost back at 2016 levels. The strong decreasing trend in CO_2e observed since 2016 reflects a shift to gases with lower GWPs given that HFCs contained in imported refrigeration, air conditioning and heat pump (RACHP) equipment have been covered by the HFC phase-down under the EU F-gas Regulation since 2017. Measured in CO_2e, 2019 equipment imports were 22 % below 2018, or 38 % below 2016.

([9]) Country-specific reporting is not required for the reporting of non-HFC imports.

([10]) 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. Starting in 2018, imports of pre-blended polyols are included. Pre-blended polyols are included in the definition of bulk gases in F-gas Regulation (EU) No 517/2014. However, under the Montreal Protocol, pre-blended polyols are considered products and are thus not covered.

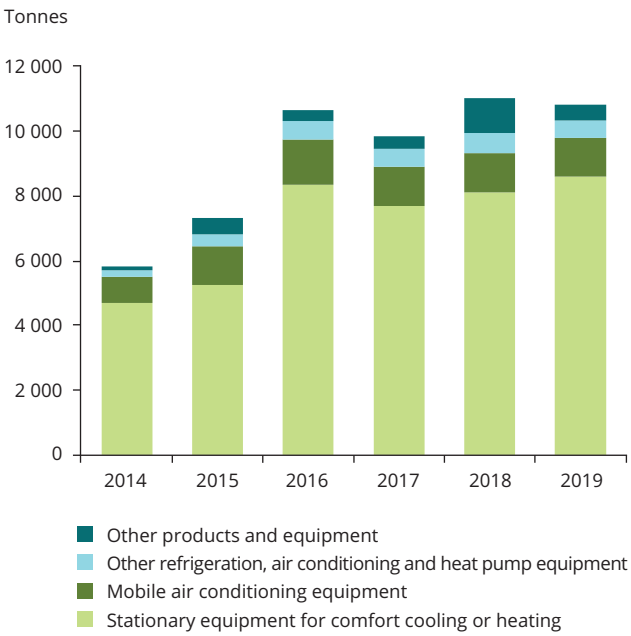
Figure 3.7 EU imports of F-gases within products and equipment



Notes: The geographical scope of presented data is the EU-28. Imports of pre-blended polyols are included from 2018. The amounts shown in this graph for 2018 significantly deviate from the amounts given in the previous report (EEA, 2019), as imports of pre-blended polyols had not been included previously.
Mt, million tonnes.

Sources: EEA (2019, 2020b).

Figure 3.8 Categories of EU supply in products and equipment of F-gases



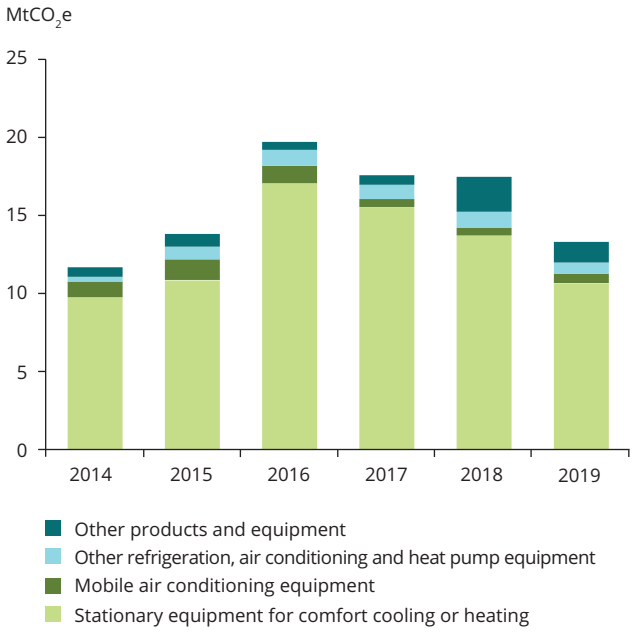
Note: The geographical scope of presented data is the EU-28. Imports of pre-blended polyols are included from 2018. The amounts shown in this graph for 2018 significantly deviate from the amounts given in the previous report (EEA, 2019), as imports of pre-blended polyols had not been included previously.

Sources: EEA (2019, 2020b).

HFCs make up more than 90 % of F-gases imported in equipment, the remainder being almost completely unsaturated HFC-1234yf, used as the refrigerant in air conditioning equipment of vehicles.

The most important category in equipment imports (Figure 3.8 and Figure 3.9) is 'stationary equipment for comfort cooling or heating' (mostly air conditioning). That category makes up approximately 80 % of total equipment imports, both in tonnes and in GWP. The large increase visible for 'other products and equipment' between 2017 and 2018 is due to imports of pre-blended polyols, for which specific data have been available since 2018.

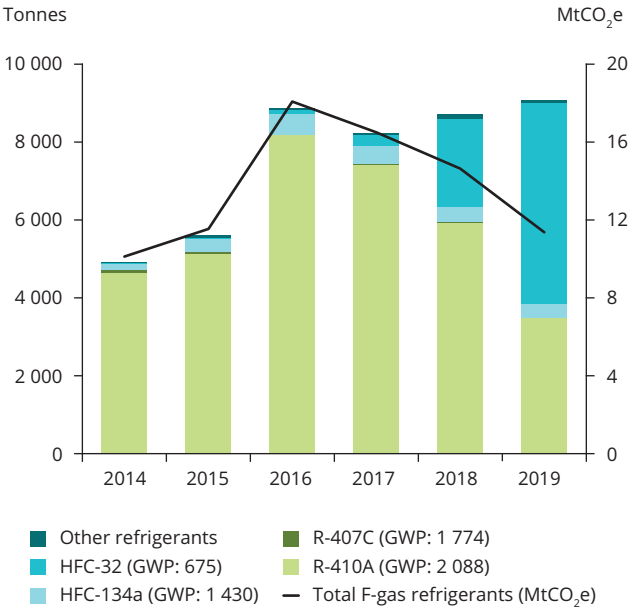
Figure 3.9 Categories of EU supply in products and equipment of F-gases



Notes: The geographical scope of presented data is the EU-28. Imports of pre-blended polyols are included from 2018. The amounts shown in this graph for 2018 significantly deviate from the amounts given in the previous report (EEA, 2019), as imports of pre-blended polyols had not been included previously.
Mt, million tonnes.

Sources: EEA (2019, 2020b).

Figure 3.10 Refrigerants in imported stationary RACHP equipment



Notes: The geographical scope of presented data is the EU-28.
Mt, million tonnes.

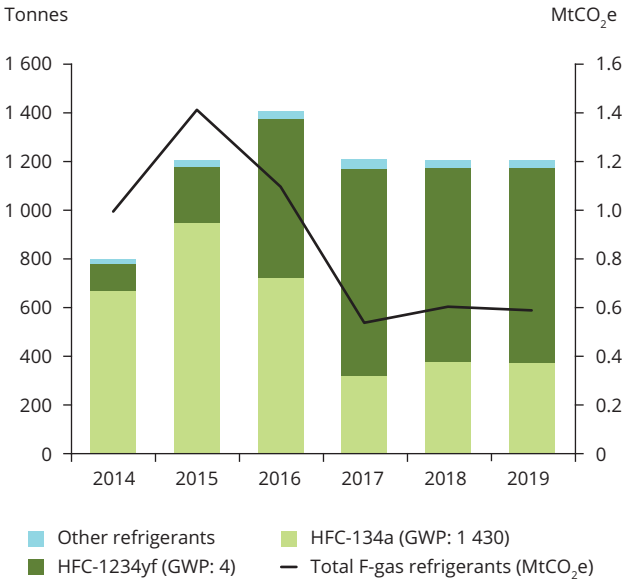
Sources: EEA (2019, 2020b).

The HFC phase-down is reflected in the choice of refrigerants in imported RACHP equipment. As illustrated in Figure 3.10, HFC-32 with a moderate GWP of 675 is on the rise in stationary applications, replacing R-410A (refrigerant mixture of HFCs, 50 % HFC-125, 50 % HFC-32) with its higher GWP of 2 088.

F-gases in mobile air conditioning (mostly in passenger cars and light duty vehicles) account for 11 % of total gases contained in imported equipment in 2019 but only 4 % of the GWP. Figure 3.11 illustrates how the ratio of unsaturated HFC-1234yf compared with HFCs (in particular HFC-134a) in imported vehicles stabilised at around 65 % in 2017 after increasing strongly since 2014.

The data reported for unsaturated HFC-1234yf contained in imported vehicles may not be fully 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 R-134a (refrigerant classification of HFC-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 have been reporting on HFC-1234yf imports in the past, despite being below the obligation threshold.

Figure 3.11 EU imports of F-gases within air conditioning equipment for vehicles

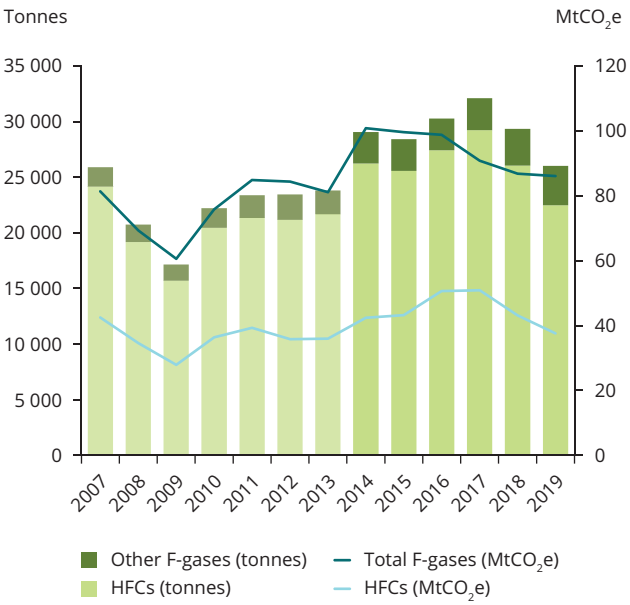


Notes: The geographical scope of presented data is the EU-28.
Mt, million tonnes.

Sources: EEA (2019, 2020b).

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

Figure 3.12 EU bulk exports of F-gases



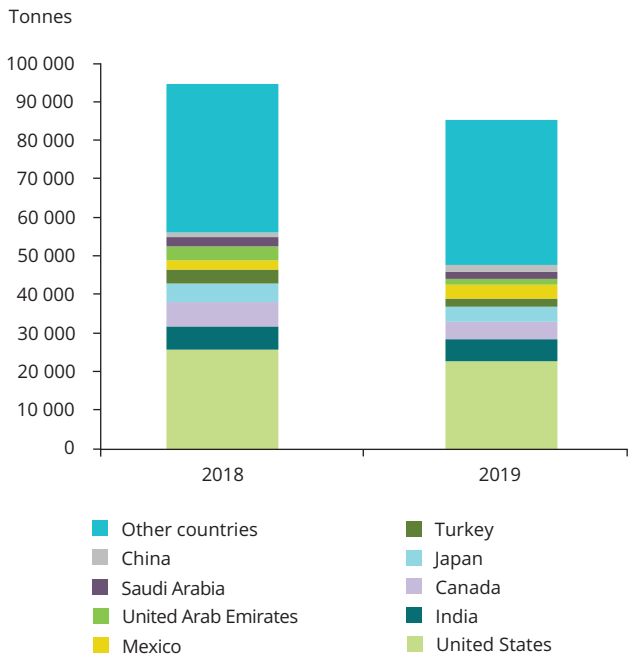
Notes: The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. Annex II F-gases (unsaturated HFCs and HCFCs; hydrofluoroethers, HFEs, and alcohols; and nitrogen trifluoride, NF_3, and other perfluorinated compounds) were not subject to reporting for the years 2007-2013. Bulk exports shown for the period 2014-2017 include gases exported in pre-blended polyols. Data available for Croatia for the period 2009-2012 are limited to HFCs and do not cover PFCs and SF_6. 2018 HFC exports given here are significantly below the amounts given in the previous report (EEA, 2019) due to erroneous data identified during quality control.
Mt, million tonnes.

Sources: EC (2011, 2014); EEA (2019, 2020b).

3.2.4 Exports

Bulk exports of F-gases from the EU-28 have been decreasing by about 10 % annually since 2017. Measured in CO_2e, the declining trend is less steep, with a 1 % reduction in 2019 compared with 2018, following a 4 % decrease the year before (Figure 3.12). There are different trends for different gases: 2019 HFC exports are about 25 % lower than in 2017. For other gases, mostly SF_6 and unsaturated HFCs and HCFCs, 2019 exports are about 20 % higher than in 2017. In particular, the rise in SF_6 exports compensates for reductions in HFC exports when assessing trends in total bulk exports on a GWP basis. Exports of F-gases contained in products and equipment are not subject to obligatory reporting.

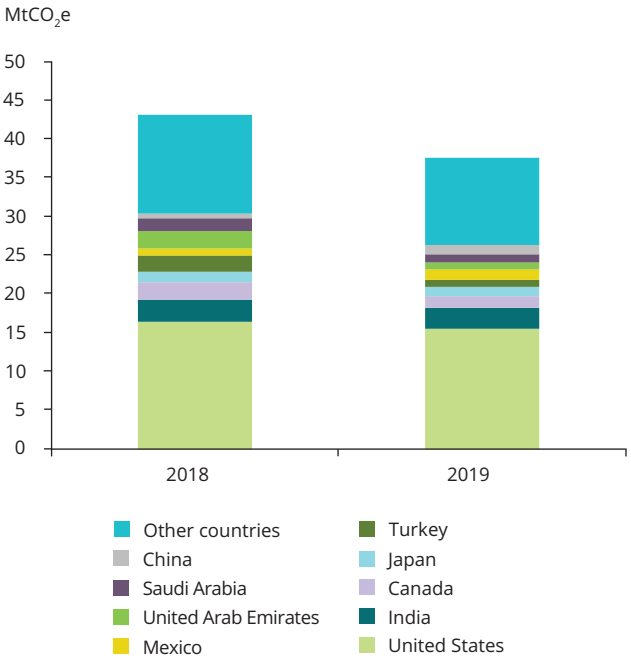
Figure 3.13 Destination of bulk HFC imports



Note: The geographical scope of presented data is the EU-28. Bulk imports presented here do not include imports of pre-blended polyols and are thus compatible with the MP definition. 2018 HFC exports to China given here are significantly below the amounts given in the previous report (EEA, 2019) due to erroneous data identified during quality control.

Sources: EEA (2019, 2020b).

Figure 3.14 Destination of bulk HFC exports



Note: The geographical scope of presented data is the EU-28. Bulk imports presented here do not include imports of pre-blended polyols and are thus compatible with the MP definition. 2018 HFC exports to China given here are significantly below the amounts given in the previous report (EEA, 2019) due to erroneous data identified during quality control.

Sources: EEA (2019, 2020b).

Figure 3.13 and Figure 3.14 show the destination countries of bulk HFC exports by mass and in CO_2e, which have been available since 2018. The United States commands about one third of the HFC exports from Europe, about 40 % if measured in GWP. Other notable countries of export include India, Canada, China, Japan, Turkey, Mexico, the United Arab Emirates and Saudi Arabia. About 70 % of all exports are destined for those nine countries, while the remaining 30 % are destined for about 100 other different countries.

The composition of bulk F-gas exports mirrors that of production. Exports are dominated by HFCs (almost 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 in Table A5.13 and Table A5.14 in Annex 5.

3.3 Destruction and feedstock use of fluorinated greenhouse gases

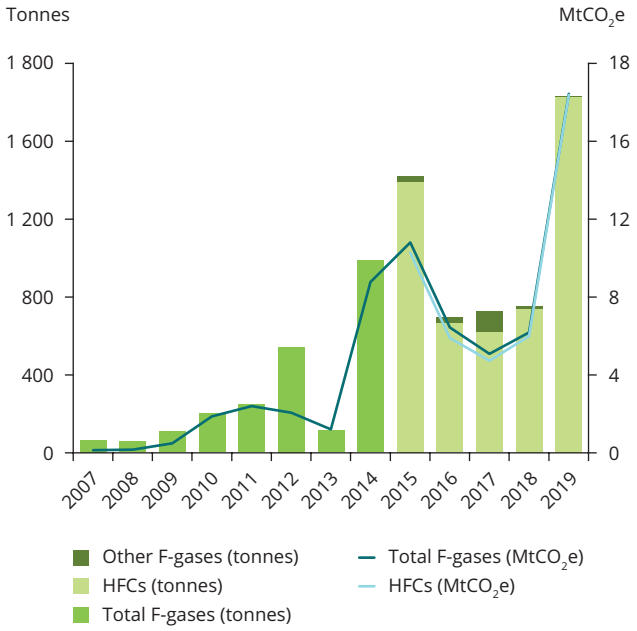
This section presents the amounts of F-gases reported as destroyed or used for feedstock. Use for feedstock means that the gas undergoes a chemical transformation that converts it to a different substance, which will result in insignificant emissions. Note that some industrial processes that use F-gases, 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 F-gases in the EU increased strongly from 2008 to 2015, except for very low reported levels for 2013 ([11]). Destruction amounts reported for

([11]) 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 3.15 EU destruction of F-gases



Notes: The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2012 and the EU-28 for the period 2013-2019. Annex II F-gases (unsaturated HFCs and HCFCs; hydrofluoroethers, HFEs, and alcohols; and nitrogen trifluoride, NF_3, and other perfluorinated compounds) were not subject to reporting for the years 2007-2013. HFC destruction prior to 2014 is not identified for confidentiality reasons.
Mt, million tonnes.

Sources: EC (2011, 2014); EEA (2019, 2020b).

the period 2016-2018 were about 50 % below 2015 levels (Figure 3.15). The steep rise in 2019 destruction compared with 2018 (more than doubling in tonnes, tripling in CO_2e) is mostly due to more complete reporting on the by-production of HFC-23 and subsequent destruction, as discussed in Section 3.1 on production.

Destruction is focused on HFCs (98 % of the total amount in 2019), of which about 60 % is HFC-23. HFC-23 occurs as a by-product in certain production processes of F-gases, and its destruction or reclamation is obligatory under the F-gas Regulation. HFC-23 alone accounts for about 90 % of the GWP of F-gases destroyed in 2019.

HFC destruction plays a role in determining consumption under the Montreal Protocol because HFCs that are destroyed are subtracted from the amounts of HFCs that are produced and imported in that calculation (see Chapter 6). In comparison with the declining amounts of EU HFC consumption, HFC destruction jumped from 6 % in 2018 to 22 % in 2019 (measured in CO_2e).

Detailed data on HFC destruction can be found in Table A5.15 and Table A5.16 in Annex 5.

3.3.2 Feedstock use

EU feedstock use has been almost constant since 2015, following stronger variations in the years between 2007 and 2014. Since 2014, feedstock use has consisted almost exclusively of HFC-23. In addition, very small amounts have occasionally been reported for a couple of other gases, among them HFCs, PFCs, hydrofluoroethers (HFEs) and unsaturated HFCs ([12]). Between 2010 and 2013, large amounts of HFC-152a were reported by a gas importer identifying feedstock use as the intended application in the EU. It is possible, though, that the indication of feedstock use as intended application was erroneous and should instead have been foam or aerosols. Given the relatively low GWP of 124 for HFC-152a, however, these amounts hardly affect the total expressed in CO_2e calculated for feedstock use.

As with destruction, any HFCs that are used as feedstock do not count towards consumption (see Chapter 6). Given the significant reduction in HFC consumption, the proportion of HFCs used as feedstock, in comparison with HFC consumption, more than doubled from 2 % in 2015 to 5 % in 2019 (measured as CO_2e).

Detailed data on feedstock cannot be presented for confidentiality reasons.

([12]) Note that the reporting obligation for feedstock use covers only the Annex I F-gases HFCs, PFCs and SF_6. Thus, data reported on Annex II F-gases (unsaturated HFCs/HCFCs, HFE and alcohols; and nitrogen trifluoride, NF_3, and other perfluorinated compounds) may not necessarily be complete.

4 Supply of fluorinated greenhouse gases to the EU

Supply of fluorinated greenhouse gases (F-gases) is a metric used by the EEA that provides information on the actual use of F-gases by EU industries. It is calculated primarily from reported production, imports and exports ([13]).

In Section 4.1, some key trends are analysed in the development of the EU supply of total F-gases and specific gases and gas groups and in differentiating bulk supply and supply in products and equipment. In Section 4.2, trends in the intended application of supply are presented.

4.1 Trends in the EU supply by gas

The supply of F-gases to the EU-28 was reasonably stable from 2007 until the 2014 peak, prior to the hydrofluorocarbon (HFC) quota system entering into force. Following relative stability in the years 2015 to 2017, the supply of total F-gases has strongly declined since 2017: the 2019 supply measured in tonnes was 15 % below 2018 and almost 25 % below 2017. Expressed in carbon dioxide equivalent (CO_2e), the reduction is even more significant at 20 % below 2018 and 42 % below 2017 (Figure 4.1).

The supply of F-gases was dominated by HFCs, which accounted for approximately three quarters (in tonnes and in CO_2e) of the total in 2019.

For HFCs, the reduction compared with the previous year was stronger than for total F-gases: the 2019 HFC supply in tonnes was 20 % below 2018 (22 % below 2018 in CO_2e), caused by a reduction in HFC demand from EU industries moving to alternatives with low global warming potential (GWP).

In addition, allegations of illegal HFC imports outside the reporting and compliance system under the F-gases Regulation (FGR) have been made and were explored in a recent study for the Directorate-General for Climate Action of the European Commission (DG CLIMA) (EC, 2019). Total quantities as collected by Eurostat and the F-gas reporting data match well. The study therefore concluded that at this stage it does not appear possible to quantify customs evasion and that the HFC phase-down continues to be successful in promoting innovation and a shift towards climate-friendly solutions, in particular as gas prices remain significantly higher than before the EU HFC phase-down. Any illegal imports of HFCs would be reflected neither in the HFC imports nor in the HFC supply totals in the present report, which is based on officially reported data.

HFC quotas allocated for 2019 were basically at the same level as 2018, and the next reduction step will not take place before 2021, when total quotas for the EU-28 will be reduced by about one third compared with 2018-2020 levels (see Chapter 5).

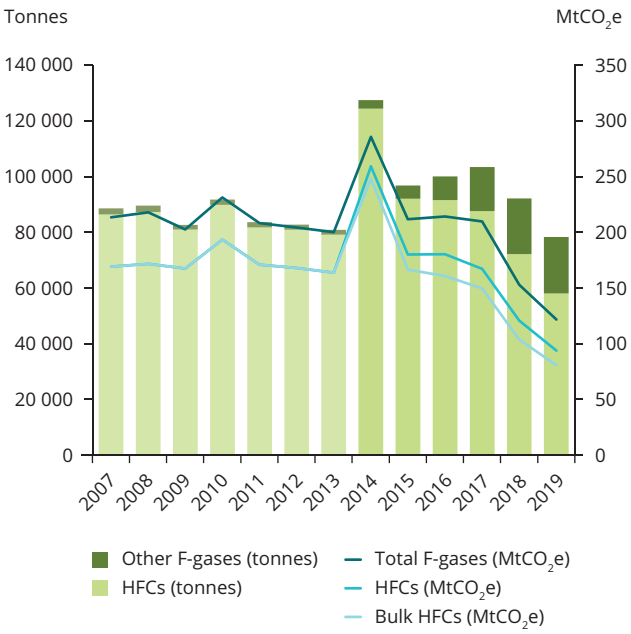
Beyond HFCs, there was a 23 % decrease for perfluorocarbons (PFCs), a 14 % decrease for sulphur hexafluoride (SF_6), an 8 % decrease for hydrofluoroethers (HFEs) and alcohols, as well as a 7 % decrease for nitrogen trifluoride (NF_3), all outweighed by a 3 % increase in unsaturated HFCs and hydrochlorofluorocarbons (HCFCs) which now make up 23 % of supply if measured in tonnes. Expressed in CO_2e, the supply of F-gases except HFCs in 2019 was 13 % below 2018. None of the latter substances are covered by the quota system.

([13]) For methodological details on the calculation of EU supply, please refer to Annex 4, in particular Table A4.2, 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.

The HFC supply shown in Figure 4.1 for the years 2014-2018 includes equipment imports, while the levels for the period 2007-2013 reflect HFC bulk supply only. When corrected for this discontinuity, HFC bulk supply for the period 2015-2017 was well below 2007-2013 levels, and decreasing. The proportion of equipment imports in the total supply increased over time to reach a level of 14 % in 2019 (11 % as CO_2e) (Figure 4.2).

Figure 4.3 shows the make-up of supply in 2019 in more in detail: the largest proportion is HFCs delivered in bulk (61 % of total EU supply of F-gases) and about 13 % is HFCs delivered in products and equipment. Unsaturated HFCs have risen to a share of 23 %. PFCs, SF_6 and other gases are supplied almost exclusively in bulk. The picture looks somewhat different when looking at the total GWP of total supply (Figure 4.4). While non-HFCs make up about a quarter of the total supply both in tonnes and in CO_2e, the relevant non-HFC gases in terms of GWP are SF_6, NF_3 and PFCs.

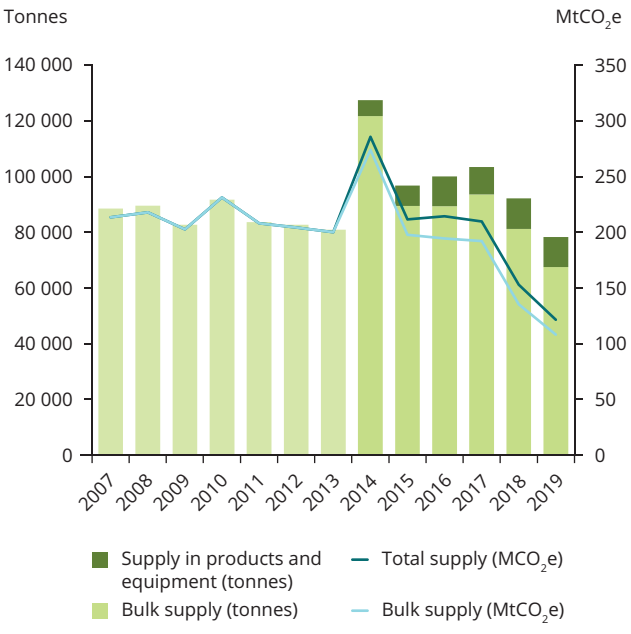
Figure 4.1 EU supply of F-gases



Notes: The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. Annex II F-gases (unsaturated HFCs and HCFCs; HFEs and alcohols; and NF_3 and other perfluorinated compounds) and HFCs, PFCs and SF_6 imported in products and equipment were not subject to reporting for the years 2007-2013. Data available for Croatia for the period 2009-2012 is limited to HFCs and does not cover PFCs and SF_6.
Mt, million tonnes.

Sources: EC (2011, 2014); EEA (2019, 2020b).

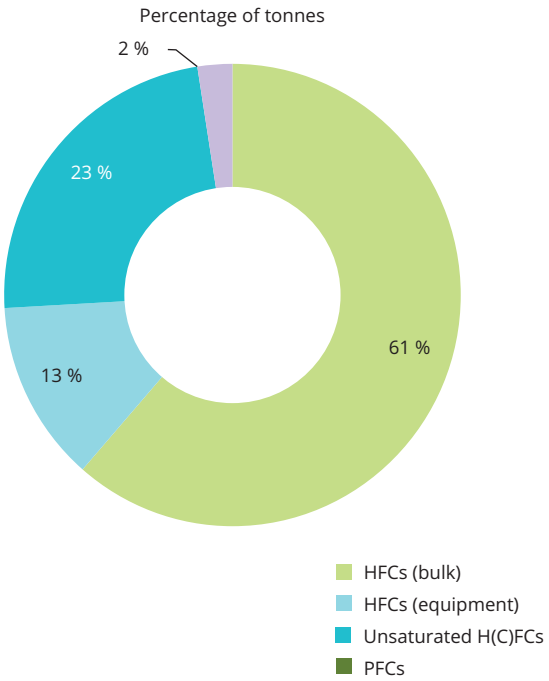
Figure 4.2 EU supply of F-gases by type



Notes: The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. Annex II F-gases (unsaturated HFCs and HCFCs; HFEs and alcohols; and NF_3 and other perfluorinated compounds) and HFCs, PFCs and SF_6 imported in products and equipment were not subject to reporting for the years 2007-2013. Data available for Croatia for the period 2009-2012 is limited to HFCs and does not cover PFCs and SF_6. Imports of pre-blended polyols, available since 2018, were assigned to the supply in products and equipment.
Mt, million tonnes.

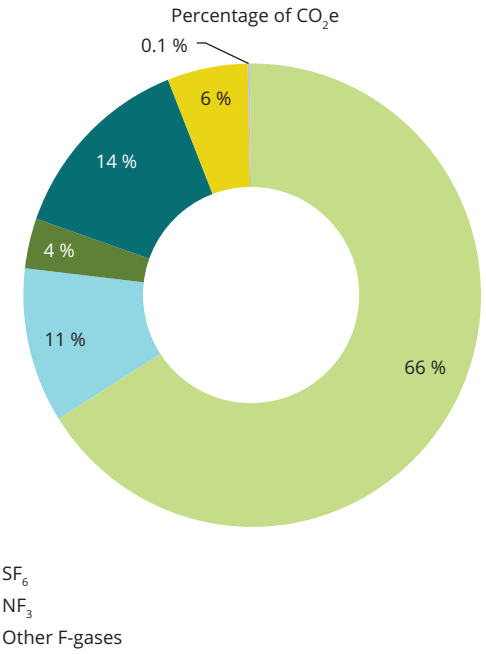
Sources: EC (2011, 2014); EEA (2019, 2020b).

Figure 4.3 **2019 total supply by types and groups of F-gases**



Note: The geographical scope of presented data is the EU-28.
Source: EEA (2020b).

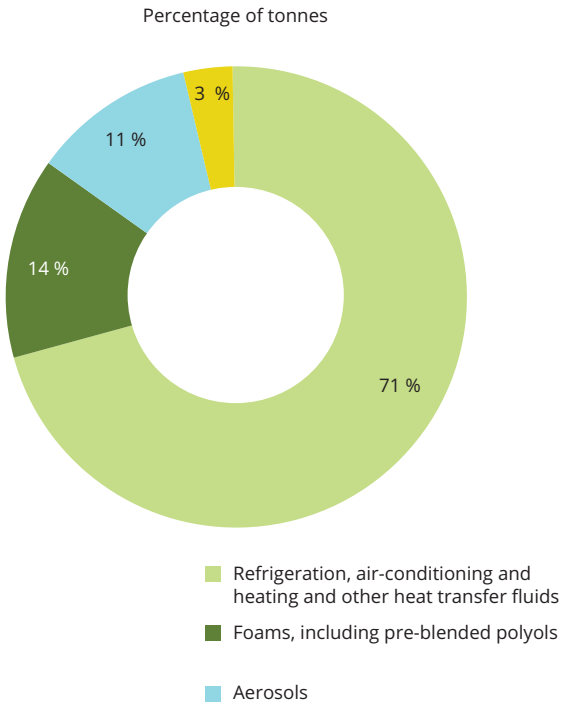
Figure 4.4 **2019 total supply by types and groups of F-gases**



Note: The geographical scope of presented data is the EU-28.
Source: EEA (2020b).

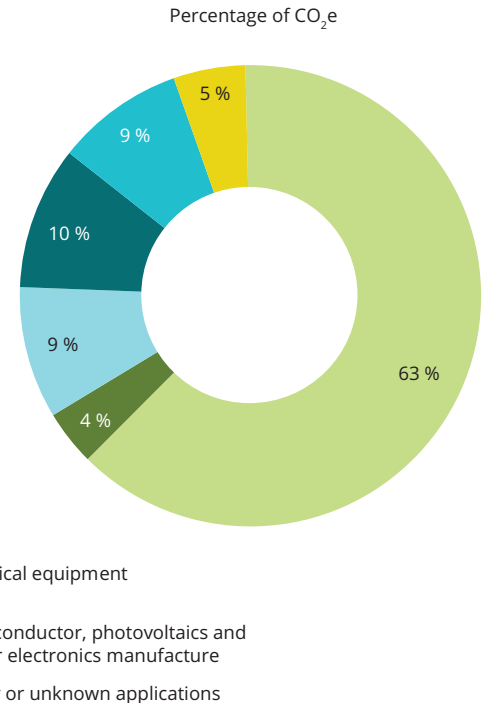
Detailed data on total supply and bulk supply are given in Table A5.17 to Table A5.20 in Annex 5. For supply in imports and equipment, please refer to Table A5.9 and Table A5.10.

Figure 4.5 **2019 EU supply by intended applications**



Note: The geographical scope of presented data is the EU-28.
Source: EEA (2020b).

Figure 4.6 **2019 EU supply by intended applications**



Note: The geographical scope of presented data is the EU-28.
Source: EEA (2020b).

4.2 Intended applications of EU supply

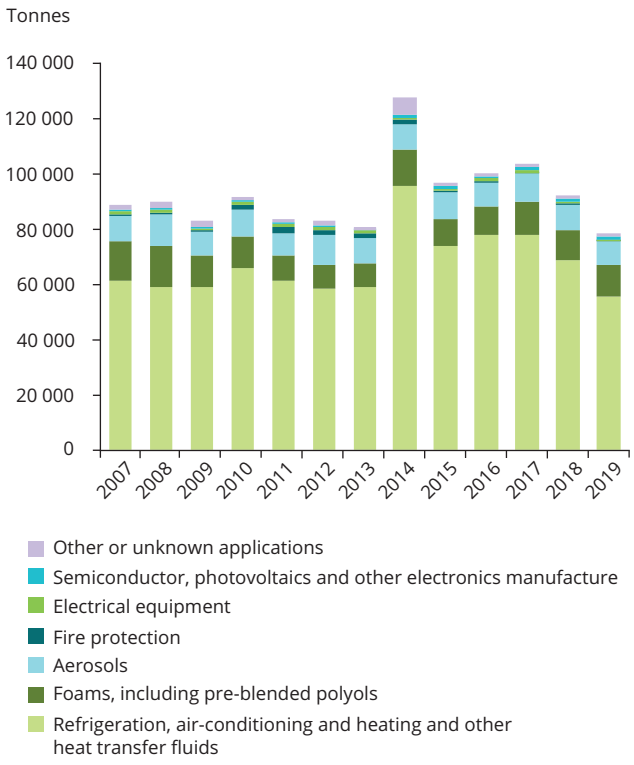
Figure 4.5 and Figure 4.6 show the proportions of intended applications calculated for the 2019 supply of F-gases, while Figure 4.7 and Figure 4.8 show the trends over time since 2007. When analysing the trends, the discontinuity between 2013 and 2014 due to the change in reporting requirements on equipment 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 71 % of the 2019 supply in tonnes and 63 % in CO_2e. However, the supplied quantity of refrigerants fell by 20 % compared with 2018, and its total GWP measured in CO_2e decreased by 22 %. Compared with 2017, the 2019 supply of refrigerants was 34 % lower, or 44 % expressed in GWP. While the change in GWP of supplied refrigerants may be largely explained by the trend towards using refrigerants with lower GWPs, this does not hold for the trend in tonnes of F-gases supplied as refrigerants. The air conditioning and refrigerant industry must be making use of non-F-gas refrigerants ('natural refrigerants', e.g. CO_2, hydrocarbons, ammonia, water) which by definition will not need to be reported. As discussed in Section 4.1, the potential impact of alleged illegal imports cannot presently be quantified.

F-gases used for foam blowing account for 14 % of the 2019 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 remained constant compared with 2018. However, the total GWP of F-gases used for foam blowing decreased by 31 % compared with 2018, which is explained by a switch from HFCs to unsaturated HFCs and HCFCs.

The use of F-gases, mainly HFC-134a, for aerosols decreased by about 2 % compared with the previous year, which equals a decrease of 4 % of the GWP. Aerosols account for 11 % of the total use, or 9 % of the total CO_2e.

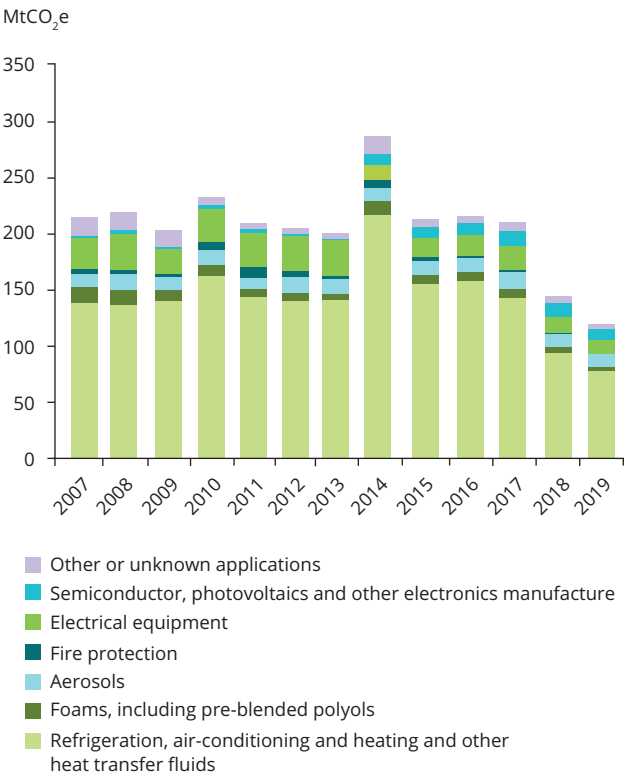
Figure 4.7 Intended applications of EU total supply of F-gases



Notes: The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. Annex II F-gases (unsaturated HFCs and HCFCs; HFEs and alcohols; and NF_3 and other perfluorinated compounds) and HFCs, PFCs and SF_6 imported in products and equipment were not subject to reporting for the years 2007-2013. Data available for Croatia for the period 2009-2012 is limited to HFCs and does not cover PFCs and SF_6.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Figure 4.8 Intended applications of EU total supply of F-gases



Notes: The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. Annex II F-gases (unsaturated HFCs and HCFCs; HFEs and alcohols; and NF_3 and other perfluorinated compounds) and HFCs, PFCs and SF_6 imported in products and equipment were not subject to reporting for the years 2007-2013. Data available for Croatia for the period 2009-2012 is limited to HFCs and does not cover PFCs and SF_6.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Some niche applications make use of F-gases that have very high GWPs, which means that they represent a significant proportion of total GWP, although the amounts of F-gases used are small. These F-gases are primarily SF_6, PFCs and NF_3, which are used in electrical equipment (10 % of total GWP in 2019) and in semiconductor, photovoltaics and other electronics manufacture (9 % of total GWP). The supply into both of these applications decreased by about 15 % compared with 2018. Note that the time series in Figure 4.8 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.

Data on intended applications can be found in Table A5.21 to Table A5.24 in Annex 5. For categories of supply in products and equipment, please refer to Table A5.11 and Table A5.12. 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 hydrofluorocarbons (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 annual quotas, which are transferrable only under certain conditions and, unlike emissions allowances under the EU Emissions Trading System (ETS), are not freely tradable ([14]). In order to legally place HFC bulk gases on the EU market, companies must have sufficient annual 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 including criminal prosecution, depending on the severity of the non-compliance.

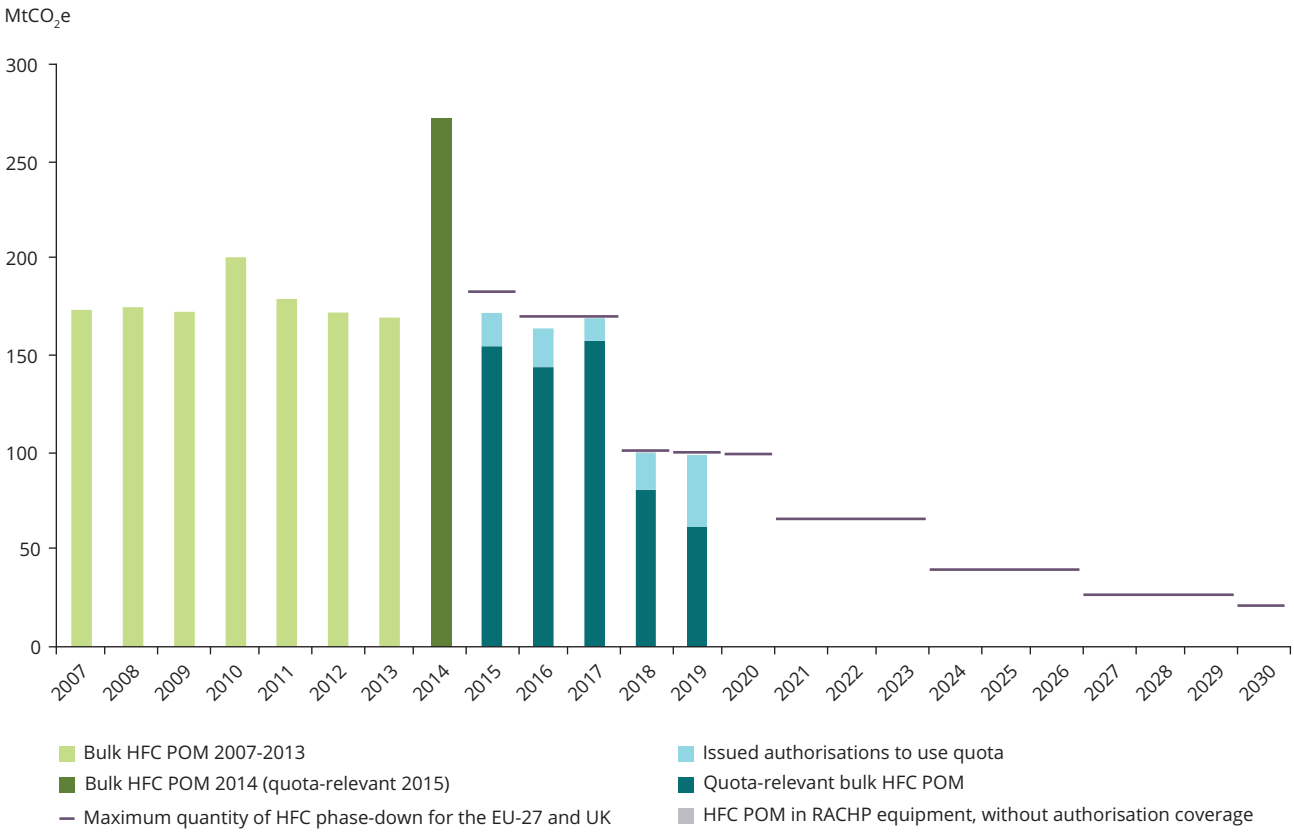
Quotas are expressed in carbon dioxide equivalent (CO_2e), rather than physical tonnes of gases, to create an incentive to use gases with lower GWPs. The initial total allocation in 2015 was 183.1 million tonnes CO_2e (EC, 2020). In 2016 and 2017, the first stage of reduction applied, and only 170.3 $MtCO_2e$ was allocated (93 % of the 2015 allocation ([15]). Following a recalculation of the maximum quantity for 2018, which allowed for the subtraction of exempted gases as stipulated in Annex V of the F-gas Regulation (FGR), an HFC quota totalling 101.2 $MtCO_2e$ was allocated for 2018, about 40 % less than for 2017. For 2019 and 2020, the maximum quantities were again recalculated to consider the latest available data on exemptions, resulting in allocations of 100.3 $MtCO_2e$ and 99.5 $MtCO_2e$, respectively (EC, 2020). After the United Kingdom's withdrawal from the EU on 31 January 2020 (Brexit), the FGR and the EU HFC phase-down continue to apply in the United Kingdom until the end of the Brexit transition period (which is scheduled for 31 December 2020). For the period after the transition period, maximum quantities for the EU-27 will need to be recalculated.

Since 2017, the HFCs contained in refrigeration, air conditioning and heat pump (RACHP) equipment have also been 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 placing on the market (POM) ([16]) for the purpose of the annual quotas, as authorisations do not expire at the end of a year and can be used in subsequent years ([17]). 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. Issued authorisations are already accounted for in the following figures on bulk POM.

In 2019, the EU-28 Member States were on track for meeting the HFC phase-down obligation (Figure 5.1). The total quota-relevant POM was 2.0 $MtCO_2e$ or 2.0 % below the maximum quantity ([18]) for this year. In 2018 and 2017, the margin was smaller (0.7 $MtCO_2e$ or 0.7 % of the maximum quantity in 2018 and 0.8 $MtCO_2e$ or 0.5 % of the maximum quantity in 2017), while for the first 2 years of the phase-down more significant overachievements of 6 % (2015) and 4 % (2016) were observed ([19]).

([14]) 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.
([15]) See the phase-down schedule in Annex V of the F-gas Regulation (EU) No 517/2014.
([16]) The monitoring of the EU HFC phase-down relies on the metric POM. For calculation details, please refer to Annex 4. 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.
([17]) In contrast to authorisations, quotas are time-stamped for a specific year and unused quotas cannot be carried over to the following year.
([18]) Data for 2019 are preliminary and subject to scrutiny by the European Commission.
([19]) Numbers for 2017 and 2018 slightly deviate from the previous F-gases report (EEA, 2019) due to compliance scrutiny decisions by the European Commission.

Figure 5.1 Progress of the EU HFC phase-down



Notes: 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). The geographical scope of presented POM data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. The maximum quantities of the EU HFC phase-down shown for 2019 onwards are given for the EU-28. EU-27 maximum quantities for 2021 onwards will need to be recalculated for the period after the Brexit transition period.
Mt, million tonnes; POM, placing on the market.

Sources: EC (2011, 2014 and 2020); EEA (2019, 2020b).

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. Starting in 2017, HFCs placed on the market within imported RACHP equipment are considered in those cases in which the importers did not hold enough quota authorisation ([20]).

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, 2018 and 2019, the margin was much closer, especially as non-compliant RACHP equipment importers are also considered. Note that data on the 2019 quota exceedance for both bulk HFCs and equipment importers are preliminary and have not yet undergone in-depth compliance scrutiny by the European Commission. Thus, final numbers may change and this 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 FGR. 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 the semiconductor industry and to military use and for imports for destruction are used in significantly lower amounts. The share of quota-exempted amounts

([20]) The amounts of 0.4 $MtCO_2e$ for 2017, 0.7 $MtCO_2e$ for 2018 and 0.2 $MtCO_2e$ for 2019, subject to scrutiny by the European Commission, are too small to be discernible in Figure 5.1. Note that, for 2017, as the first year of the obligation to have RACHP imports covered by quota authorisation, the European Commission had proposed that Member States also consider for compliance checking authorisations acquired in the course of 2018. The accounting of authorisations applied in this report follows this approach.

in total bulk HFCs physically placed on the market increased from almost 21 % in 2018 to 26 % in 2019 (see Table A5.25 in Annex 5. Note that the exemption under Article 15(2)(f) for pharmaceutical MDIs entered into force on 1 January 2018.

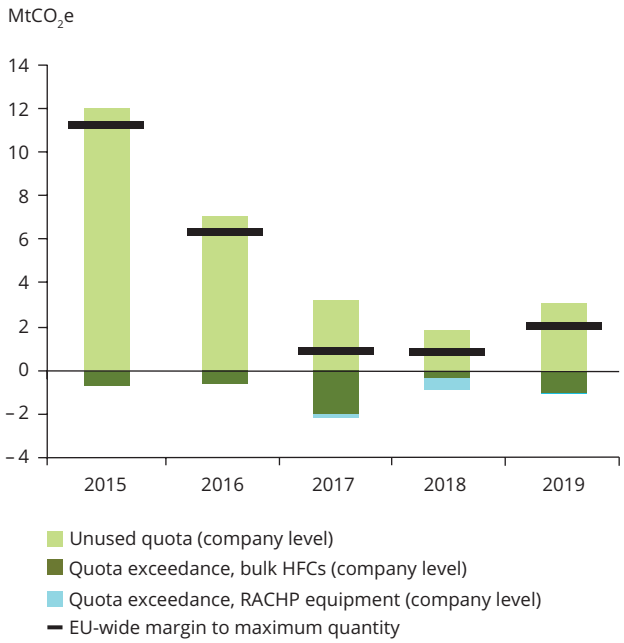
HFCs contained in imported RACHP equipment (as mentioned above) have been included in the EU HFC phase-down since 2017. Since then, equipment importers have needed to hold authorisations to use quotas issued by HFC producers or bulk importers that were allocated quotas by the European Commission. Figure 5.3 compares the authorisations issued since 2014 with authorisations used since 2017. The difference between authorisations issued and authorisations used results in a bank of authorisations stockpiled by equipment importers. By the end of 2019, this bank of stockpiled authorisations amounted to five times the amount of authorisations used in 2019. This is because the amount of authorisations issued in 2019 was about twice the amount in 2018. At the same time, the use of authorisations, which is equivalent to the lawful import of HFCs in RACHP equipment, declined by 22 %.

The reserve of authorisations built up by the end of 2019 is equivalent to 61 % of the 2020 maximum quota allocation and can be used to cover equipment imports in 2020 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 quotas issued for the following years, as RACHP equipment imports in those years will, at least partially, not need to be covered by quotas issued for those years.

The rise in issued authorisations can be understood as a joint attempt by quota holders and equipment importers to make use of surplus 2019 quota in future years, as the physical quota-relevant POM of bulk HFCs (Figure 5.1) declined by 23 % compared with 2018 ([21]).

A tabular overview of data related to the progress of the HFC phase-down under the FGR is given in Table A5.25 in Annex 5.

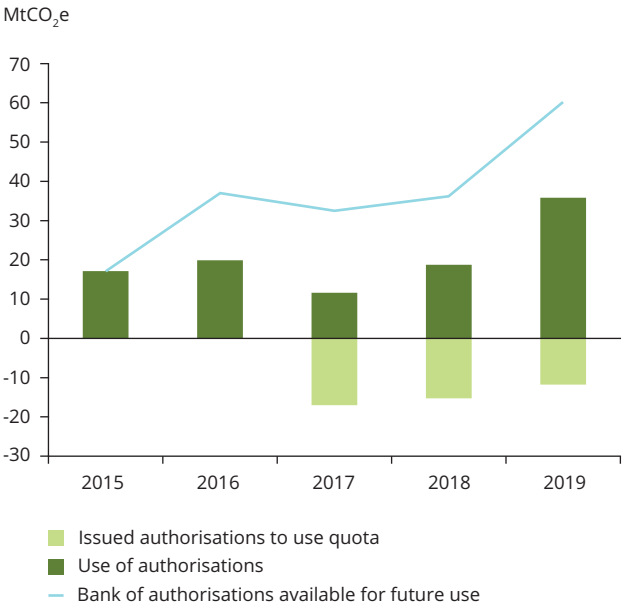
Figure 5.2 Balance between placing on the market of HFCs and related quotas at EU level



Notes: The data for 2019 have not yet undergone scrutiny by the European Commission. The geographical scope of presented data is the EU-28.
Mt, million tonnes.

Sources: EC (2020); EEA (2019, 2020b).

Figure 5.3 Bank of authorisations for HFCs in RACHP equipment imports



Notes: The geographical scope of presented data is the EU-28.
Mt, million tonnes.

Sources: EC (2020); EEA (2020b).

([21]) This trend in physical quota-relevant POM is largely in line with the trend observed for bulk HFC supply and total HFC supply (both -22 %; Figure 4.1) and also for HFC consumption (-22 %; Figure 6.1).

6 The international HFC phase-down under the Montreal Protocol

In October 2016, in Kigali, Rwanda, the Montreal Protocol was amended to regulate hydrofluorocarbons (HFCs) (the Kigali Amendment). Both developed and developing countries have taken on mandatory commitments on reducing the 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 in 2019, with further reductions to be made until a 15 % level is reached from 2036 onwards (Figure 6.1). Measuring the 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) ([22]).

The baseline for the Montreal Protocol HFC phase-down is defined as the average HFC consumption during the period 2011-2013, plus 15 % of the HCFC baseline in 1989, all expressed in carbon dioxide equivalent (CO_2e). As set out in the Montreal Protocol, the hydrochlorofluorocarbon (HCFC) baseline also includes 2.8 % of the 1989 chlorofluorocarbon (CFC) consumption. The 2011-2013 average HFC consumption of the EU-28, according to reporting under the F-gas Regulation (FGR) and additional data collected in Croatia, was 165.2 $MtCO_2e$ (EEA, 2019). The HCFC/CFC part of the EU baseline was calculated as 19.0 $MtCO_2e$ (EC, 2017). In total, the baseline for the EU-28 under the Montreal Protocol HFC phase-down is 184.2 $MtCO_2e$.

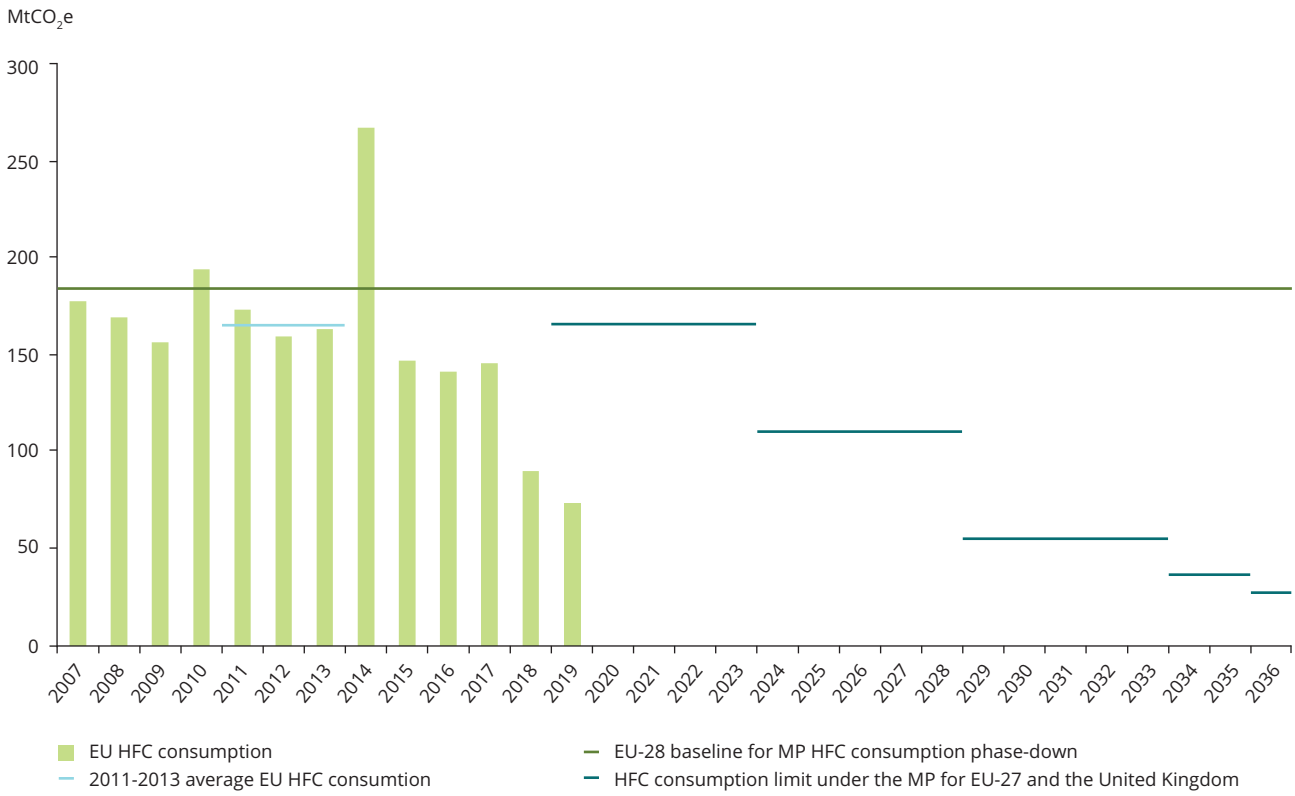
In Figure 6.1, EU consumption of HFCs covered under the Montreal Protocol since 2007 is presented and contrasted with the Montreal Protocol phase-down steps applying to the EU-28 starting from 2019. With the exception of 2014 (when consumption was probably inflated as a result of the upcoming phase-down; see Section 3.2, page 18), HFC consumption had been experiencing a downward trend. In 2018, HFC consumption dropped by 38 % compared with 2017, in line with the 41 % drop in the maximum HFC quantity for that year under the EU HFC phase-down (see Chapter 5). In 2019, HFC consumption was 22 % below 2018, corresponding to the 22 % drop in HFC supply (see Chapter 4). The minor differences in the reduction of consumption, POM and supply of HFCs is due to the slightly differing definitions of these metrics (see Annex 4, page 61). The variation between consumption and POM is mostly influenced by quota authorisations, equipment imports and quota-exempt HFC supplies.

As a result, for 2019, the first compliance year of the HFC phase-down under the Montreal Protocol, the HFC consumption of the EU-28 amounts to only 45 % of the permitted amount.

A tabular overview of HFC consumption is given in Table A5.26 in Annex 5.

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

Figure 6.1 EU progress under 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 (see Annex 1). The geographical scope of presented HFC consumption data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019.
MP, Montreal Protocol.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Terminology

Fluorinated greenhouse 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 greenhouse gases' or 'F-gases'.

The list of reportable F-gases under the old F-gas Regulation was restricted to hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride SF_6, as identified in Annex 1.

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 global warming potentials (GWPs).

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

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.

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.

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 listed 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 (H(C)FCs) (Section 1 of Annex II);
- fluorinated ethers and alcohols (Section 2 of Annex II);
- other perfluorinated compounds, including nitrogen trifluoride (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 F-gas 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 F-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 F-gases as listed in Annex 1, unless indicated otherwise.

Annex IV gases

Annex IV of the new F-gas Regulation lists some non-F-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 0 is used for the calculation of 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.

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 carbon dioxide equivalent (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 F-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 into 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

AR4	Fourth Assessment Report of the Intergovernmental Panel on Climate Change
BDR	Business Data Repository of the European Environment Agency
BS	Bulk supply
CFC	Chlorofluorocarbon
CO_2e	Carbon dioxide equivalent
EC	European Commission
DG CLIMA	Directorate-General for Climate Action of the European Commission
EEA	European Environment Agency
ETC/CME	European Topic Centre for Climate Change Mitigation and Energy
EU	European Union
EU-27	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 and Sweden
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
F-gases	Fluorinated greenhouse gases
FGR	F-gas Regulation (EU) 517/2014
GWP	Global warming potential
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
HFE	Hydrofluoroether
IPCC	Intergovernmental Panel on Climate Change
kg	Kilogrammes
MDI	Metered dose inhaler
MP	Montreal Protocol

Mt	Million tonnes (equivalent to megatonnes)
$MtCO_2e$	Million tonnes carbon dioxide equivalent
NF_3	Nitrogen trifluoride
ODS	Ozone-depleting substances
PFCs	Perfluorocarbons
PFPMIE	Perfluoropolymethylisopropylether
POM	Placing on the market
QC	Quality control
R-134a	Refrigerant classification of HFC-134a
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
SPE	Supply in products/equipment
t	Tonne
TAR	Third Assessment Report of the Intergovernmental Panel on Climate Change
TS	Total supply
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

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EU, 2007b, Commission Regulation (EC) No 1493/2007 of 17 December 2007, establishing, pursuant to Regulation (EC) No 842/2006 of the European Parliament and of the Council, the format for the report to be submitted by producers, importers and exporters of certain fluorinated greenhouse gases (OJ L 332, 18.12.2007, p. 7-24).

EU, 2009, Regulation (EC) No 1005/2009 of the European Parliament and of the Council of 16 September 2009 on substances that deplete the ozone layer (OJ L 286, 31.10.2009, p. 1-30).

EU, 2014a, 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 (OJ L 318, 5.11.2014, p. 5-20).

EU, 2014b, 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 (OJ L 150, 20.5.2014, p. 195-230).

EU, 2017, 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 (OJ L 194, 26.7.2017, p. 4-8).

EU, 2018, Commission Implementing Regulation (EU) 2018/1624 of 23 October 2018 laying down implementing technical standards with regard to procedures and standard forms and templates for the provision of information for the purposes of resolution plans for credit institutions and investment firms pursuant to Directive 2014/59/EU of the European Parliament and of the Council, and repealing Commission Implementing Regulation (EU) 2016/1066 (OJ L 277, 7.11.2018, p. 1-65).

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

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' F-gas Regulation 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 (CF4)	7 390	PFCs	Annex I Section 2	Covered
PFC-116 (C2F6)	12 200	PFCs	Annex I Section 2	Covered
PFC-218 (C3F8)	8 830	PFCs	Annex I Section 2	Covered
PFC-3-1-10 (C4F10)	8 860	PFCs	Annex I Section 2	Covered
PFC-4-1-12 (C5F12)	9 160	PFCs	Annex I Section 2	Covered
PFC-5-1-14 (C6F14)	9 300	PFCs	Annex I Section 2	Covered
PFC-c-318 (c-C4F8)	10 300	PFCs	Annex I Section 2	Covered
SF_6	22 800	SF6	Annex I Section 3	Covered

Note: GWP, global warming potential; HFC, hydrofluorocarbon; PFC, perfluorocarbon; SF_6, sulphur hexafluoride.

Sources: EU (2006, 2014b).

Table A1.2 Annex II of Regulation (EU) No 517/2014 (not covered by old 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-347mcc3 (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-C_3F_6 (perfluorocyclopropane)	17 340	Other perfluorinated compounds	Annex II, Section 3
PFPMIE	10 300	Other perfluorinated compounds	Annex II, Section 3
SF_5CF_3	17 700	Other perfluorinated compounds	Annex II, Section 3

Notes: Annex II F-gases were not covered under the old F-gas Regulation (EC) No 842/2006.
GWP, global warming potential; HCFC, hydrochlorofluorocarbon; HFC, hydrofluorocarbon; HFE, hydrofluoroether; PFPMIE, perfluoropolymethylisopropylether; SF5CF3, trifluoromethyl sulphur pentafluoride.

Source: EU (2014b).

Non-F- 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 global warming potential (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-F-gases. For other constituents of mixtures that are not listed here (e.g. ozone-depleting substances, ODS), a GWP value of zero must be used.

Table A1.3 Annex IV of the new F-gases Regulation

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)	$HCOOCH_3$	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

Note: AR4, Fourth Assessment Report of the Intergovernmental Panel on Climate Change; GWP, global warming potential.

Source: EU (2014b).

Annex 2 F-gases reporting form

The reporting format for submitting the fluorinated greenhouse gas (F-gas) reports under Article 19 of Regulation (EU) No 517/2014 is laid out in Commission Implementing Regulation (EU) No 1191/2014, and in the updated Implementing Regulation (EU) 2017/1375, Implementing Regulation (EU) 2018/1992 and Regulation (EU) 2019/552. These are implemented as an online questionnaire on the EEA's Business Data Repository (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 hydrofluorocarbons (HFCs) or other F-gases;
- importer of HFCs or other F-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 apply, 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 the production of F-gases and mixtures:

- total quantity of production, including uncaptured amounts (1A):
  - thereof: uncaptured amounts (1Aa):
    - thereof: uncaptured amounts destroyed, mandatory specification of destruction company (1A_a);
  - thereof: captured amounts (1Ab, which equals 1A minus 1Aa):
    - thereof: destroyed by-products, mandatory specification of destruction company (1B, 1C);
    - sum of destroyed captured production (1D);
- net production available for feedstock use or sale (1E, which equals 1A minus 1D minus 1A_a);
- production for feedstock use (1A_fs):
  - thereof: uncaptured amounts (1A_fs1);
- production for other exempted use under the Montreal Protocol (1A_Ex) ([23]);
- production of mixtures (1F to 1H);

([23]) 1A_Ex was not active in the 2020 reporting round as no exemptions were agreed on under the Montreal Protocol.

- **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):
  - thereof HFCs contained in pre-blended polyols (2A_pp).
- Imports that were destined for re-export contained in products or equipment and never released for free circulation in the EU (2B):
  - thereof: amount of used, recycled or reclaimed HFCs (2C);
  - thereof: amount of virgin HFCs imported for feedstock use (2D);
  - thereof: amount of virgin HFCs imported for uses exempted under the Montreal Protocol (2E) ([24]).

Values for 2A, 2A_pp, 2C, 2D and 2E have to be reported by country of import. Country-specific reporting for 2A is limited to HFCs.

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: contained in pre-blended polyols (3A_pp);
  - thereof: amounts from own production or purchased amounts (3B);
  - thereof: determined amount of exports purchased in the EU (3C);
  - breakdown of destination of exports (recycling, reclamation, destruction) (3D to 3F);
  - thereof: amount of used, recycled or reclaimed HFCs exported (3G);
  - thereof: amount of virgin HFCs exported for feedstock use (3H);
  - thereof: amount of virgin HFCs exported for uses exempted under the Montreal Protocol (3I) ([25]).

Values for 3A, 3A_pp, 3G, 3H and 3I have to be reported by country of import. Country-specific reporting for 3A is limited to HFCs.

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 re-export (2B)
– Export of own production (3B)
+ 1 January stocks previously not placed on the market (4C)
– 31 December 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);

([24]) 2E was not active in the 2020 reporting round, as no exemptions were agreed on under the Montreal Protocol.
([25]) 3I was not active in the 2020 reporting round, as no exemptions were agreed on under the Montreal Protocol.

- 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 re-export (2B) – Export of own production (3B) + 1 January stocks of own production (4B) – 31 December stocks of own production (4G) – Own reclamation (4K)

Note that this formula differs from the placing on the market (POM) determination in Chapter 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 applications;
- 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)

Since 2015, companies have reported 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 quotas 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 supply 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 (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:

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

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 RACHP equipment
11H	Foam products
11I	Fire protection equipment (including systems incorporated into 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 F-gases listed in Annex I or Annex II of Regulation (EU) No 517/2014

Source: EU (2014a).

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 limitation, subsequently exported in bulk from the EU, then charged into equipment outside the EU, and finally reimported within equipment.

The companies that placed the HFCs on the EU market in bulk and the companies that 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 authorisation.

Section 13a (producers and importers of bulk gases)

In Section 13a, producers and importers of bulk gases have to specify the amount of gas placed on the market in the United Kingdom for the first time in the reporting year.

Section 13a is applicable to reporting data for 2018 and until and including the year in which EU law ceases to apply in the United Kingdom.

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) ([26]). This is to be completed by all companies and includes a statement of whether the company that reports as 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 hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (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 ([27]) (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

([26]) 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 spreadsheet implementation of the reporting form used up to 2012. The term 'company information' was also used in the implementation of the online questionnaire in the EEA's Business Data Repository (BDR).

([27]) 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' or 'EU' is used, respectively, as the European Community has been replaced by the European Union in accordance with the Treaty of Lisbon (EU, 2007a).

the EU market that were previously purchased from EU importers/distributors in the present reporting year or in previous years.

- Importer Form 3: HFC preparations/HFC blend importer form ([28]).
  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 of adding 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 EEA's Business Data Repository (BDR) online questionnaire.

([28]) 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 imports;
- calculation of EU exports;
- calculation of EU supply;
- calculation of hydrofluorocarbon (HFC) amounts placed on the market (POM) under the EU HFC phase-down;
- calculation of HFC consumption under the international HFC phase-down under the Montreal Protocol.

Table A4.2 provides a summary of the comparison between the three metrics supply, POM and consumption.

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 the period 2007-2013 are discussed, these refer to the reporting items as presented in Annex 3.

Calculation of EU imports

HFC imports reported for intermediate storage under customs warehousing after inward processing are not considered for the EU imports statistics. This data have been available since 2018. However, such data are relevant for the calculation of amounts placed on the market.

Calculation of EU exports

HFC exports reported for intermediate storage under customs warehousing after inward processing are not considered for the EU export statistics. These data have been available since 2018. However, such data are relevant for the calculation of amounts placed on the market.

Data reported for the export of pre-blended polyols, available since 2018, are not considered for the EU statistics on bulk exports.

Calculation of EU supply

Total supply (TS)

'EU total supply' is a parameter that provides information on the actual use of F-gases by EU industries. Notably, TS also includes gases that are contained in exported products and equipment. Following 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 earlier 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:

> (BS) = production (1A) – destroyed (captured) production (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).
>
> Since 2018, the new reporting items on imports (2A_pp) and exports (3A_pp) of pre-blended polyols are considered — imports of pre-blended are subtracted and exports of pre-blended polyols are added in the equation for BS.
>
> Since 2019, the explicit inclusion of non-captured production in the reporting scheme has been reflected in order to exclude the emissions of non-captured production from supply — non-captured production totals (1Aa) are subtracted

and amounts of non-captured production used as feedstock (1A_fs1) are added in the equation for BS. Furthermore, imports from and exports to EU intermediate storage under customs warehousing after inward processing were excluded from the BS calculation (those amounts are also excluded from the data presented in this report for imports and exports, respectively).

For the years 2007-2013, 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 (SPE)

The 'EU supply in products/equipment' metric covers the amount of F-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. Since 2018, the new reporting item on imports of pre-blended polyols (2A_pp) has been added. 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 BS in the way it accounts for re-exports and 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 BS or TS, a five-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 BS or TS to be equal to the amounts reported in Section 6 and subtract those from total BS or TS.
3. Apply the proportions determined in step 1 to the remainder of BS or TS.
4. Assign any remainder to the category 'Other or unknown applications' (6T).
5. Assign all net exports of pre-blended polyols (3A_pp-2A_pp) to the intended application 6G (pre-blended polyols).

Calculation of HFC amounts placed on the market 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).

For years when the POM compliance exercise by the Directorate-General for Climate Change of the European Commission (DG CLIMA) has been completed, the POM amounts given are based on the POM established in the HFC registry.

Bulk HFC POM in the years 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 (MP) are all HFCs as listed in Annex I, Section 1 of the new F-gas Regulation No 517/2014 (see Annex 1, page 66), except HFC-161.

HFC consumption from 2019 is calculated as follows:

From 2019, HFC consumption under the MP is calculated separately for HFC-23 (Annex F, Group II under the MP) and all other HFCs (Group I) covered by the MP:

For Group I HFCs, the calculation approach as shown below for 2018 is continued, with the additional element that imports from and exports to dependent overseas territories are not considered. A list of dependent territories is given in Table A4.1 (page 81).

For Group II HFCs/HFC-23, generated amounts not captured are not taken into account. In addition to the calculation scheme for Group I HFCs, the following data are thus subtracted/added:

minus
uncaptured HFC production (1Aa), converted into CO_2e
plus
destroyed uncaptured HFC production (1A_a), converted into CO_2e
plus
uncaptured HFC production used as feedstock (1A_fs1), converted into CO_2e.

HFC consumption in 2018 is calculated as follows:

HFC production (1A), converted into CO_2e
minus
HFC production for feedstock use within the EU (1A_fs), converted into CO_2e
minus
HFC production for other uses exempted under the MP (1A_ex), converted into CO_2e
(1A_ex is not yet applicable as no exemptions have been agreed upon under the MP so far)
plus
HFC imports (2A), converted into CO_2e
minus
HFC imports of pre-blended polyols (2A_pp), converted into CO_2e
minus
imports of used, recycled or reclaimed HFCs (2C), converted into CO_2e
minus
virgin HFC imports for feedstock use (2D), converted into CO_2e
minus
virgin HFC imports exempted under the MP (2E), converted into CO_2e
(2E is not yet applicable as no exemptions have been agreed so far under the MP)
minus
HFC exports (3A), converted into CO_2e
plus
HFC exports of pre-blended polyols (3A_pp), converted into CO_2e
plus
exports of used, recycled or reclaimed HFCs (3G), converted into CO_2e
plus
virgin HFC exports for feedstock use (3H), converted into CO_2e
plus
virgin HFC exports exempted under the MP (3I), converted into CO_2e
(3I is not yet applicable as no exemptions have been agreed so far under the MP)
minus
total HFC destruction (8D), converted into CO_2e.

Imports reported from and exports reported to intermediate storage under customs warehousing after inward processing are not considered as imports or exports for the purpose of consumption under the MP.

HFC consumption for the period 2014-2017 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
plus
HFC exports for recycling (3D), converted into CO_2e
plus

HFC exports for reclamation (3E), converted into CO_2e
plus
HFC exports for destruction (3F), converted into CO_2e
minus
HFC feedstock use (7A), converted into CO_2e
minus
Total HFC destruction (8D), converted into CO_2e.

HFC consumption up to 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
plus
HFC exports for recycling, reclamation or destruction, 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.

Table A4.1 Dependent overseas territories of the EU-27 and the United Kingdom

Territory	Country dependency relation
Anguilla	UK
Aruba	NL
Bermuda	UK
Bonaire, Sint Eustatius and Saba	NL
British Indian Ocean Territory	UK
British Virgin Islands	UK
Cayman Islands	UK
Curaçao	NL
Falkland Islands	UK
Faroes	DK
French Polynesia	FR
French Southern and Antarctic Lands	FR
Gibraltar	UK
Greenland	DK
Guernsey	UK
Isle of Man	UK
Jersey	UK
Montserrat	UK
New Caledonia	FR
Pitcairn Islands	UK
Saint Barthélemy	FR
Saint Helena, Ascension and Tristan da Cunha	UK
Saint Pierre and Miquelon	FR
Sint Maarten (Dutch part)	NL
South Georgia and the South Sandwich Islands	UK
Turks and Caicos Islands	UK
Wallis and Futuna	FR

Note: DK, Denmark; FR, France; NL, Netherlands; UK, United Kingdom.

Source: EEA (2020b).

Comparison of supply, POM and consumption metrics

Table A4.2 Scope of supply, POM and consumption metrics

			Supply	POM, relevant to compliance with the EU HFC phase-down	Consumption, relevant to 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 (GWP: AR4)**	**tCO_2e (GWP: AR4)**	**tCO_2e (GWP: AR4)**
Transactions covered		**Type of contribution**			
Production	Captured amounts	Plus	Yes	Yes	Yes
	Uncaptured amounts	Plus	Yes	Yes	Yes, but excluded for HFC-23
	Emissions of Uncaptured amounts	Minus	Yes	No	No, not applicable for HFC-23
Reclamation		Plus	Yes	No	No
Recycling		Plus	No	No	No
Bulk imports	from EU intermediate storage under customs warehousing after inward processing	Plus	No	Yes	No
	from dependent overseas territories	Plus	Yes	Yes	No
	from other origins	Pus	Yes	Yes	Yes (except import of recycled and used bulk HFCs)
Imports in products and equipment	Pre-blended polyols	Plus	Yes	Yes	No
	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	into EU intermediate storage under customs warehousing after inward processing	Minus	No	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)	No
	to dependent overseas territories	Minus	Yes		No
	to other destinations	Minus	Yes		Yes (except export of recycled and used bulk HFCs)

Table A4.2 Scope of supply, POM and consumption metrics (cont.)

			Supply	POM, relevant to compliance with the EU HFC phase-down	Consumption, relevant to 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 (GWP: AR4)**	**tCO_2e (GWP: AR4)**	**tCO_2e (GWP: AR4)**
Transactions covered		**Type of contribution**			
Exports in products and equipment	Pre-blended polyols	Minus	No	Yes	No
	Other products and equipment	Minus	No	Subtracted in case the contained gases had never been placed on the market after bulk import (re-export, reported in section 2B)	No
Destruction	of EU production, destroyed before POM and imports for destruction	Minus	Yes	Yes (exemption Art. 15(2)a)	Yes
	of used gases recovered within the EU	Minus	No	No	Yes
Feedstock use		Minus	Yes	Yes (exemption Art. 15(2)b)	Yes (HFC production for feedstock use in the EU and HFC import for feedstock use)
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
Supplies to pharmaceutical MDIs		Minus	No	Not considered 2015-2017, considered 2018 onwards (exemption Art. 15(2)f)	No
1 January stocks		Plus	Full EU-based stocks from own production or own import considered, stocks under customs warehousing not considered, stocks from EU purchases not considered	Only those EU-based stocks from own production or own import considered that have not yet been placed on the market, stocks under customs warehousing not considered, 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

Note: AR4, Fourth Assessment Report of the Intergovernmental Panel on Climate Change; GWP, global warming potential; MDI, metered dose inhaler; POM, placing on the market; RACHP, refrigeration, air conditioning and heat pump.

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 a data item must remain confidential.

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.

5 % significance rule. The contributions of small companies to any value may be insignificant, and larger companies' confidentiality may be compromised despite 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 sulphur hexafluoride (SF_6) may be deduced if there are figures published for perfluorocarbons (PFCs) as well as a total for SF6 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 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 value contributing 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.

A practical guide to applying the 'three-company group rule' and '5 % significance rule' measures to data

Operationalisation of the combined three-company group rule and 5 % significance rule.

Step 1:all values reported by companies of a given company group for a given transaction year were added up for a given transaction and substance or substance group.

$$\sum X_i = X_1 + X_2 + \ldots + X_n$$

X_i = *individual repoerted value by a single reporting undertaking*

$\sum X_i$ = *sum of individual reported values by reporting undertakings belonging to the same company group*

Step 2: the sum of all absolute contributions ($\sum | \sum X_i$) across company groups was calculated.

Step 3: the percentage of step 1 in relation to step 2 was calculated for each company group.

$$\% = \frac{|\sum X_i|}{\sum |\sum X_i|} \cdot 100$$

Step 4: the company groups were sorted in ascending order of the percentages calculated in step 3.

Step 5: an accumulated percentage was calculated across the sorted company groups.

Step 6: the number of company groups for which the accumulated percentage was larger than 5 % was counted.

If the number of company groups counted in step 6 was one or two, the full aggregated value across company groups was hidden as confidential. If the number was three or more, the full aggregated value across company groups was reported and was thus not confidential.

List of data tables in Annex 5

Table A5.1 EU production of F-gases

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Gas group							**Tonnes**						
HFCs	55 235	38 519	33 106	43 792	41 040	40 854	36 717	31 050	32 339	33 380	27 713	19 270	18 499
PFCs	C	C	C	C	C	C	C	C	C	C	C	C	C
SF_6	C	C	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	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 F-gases	**58 098**	**41 359**	**35 123**	**46 440**	**44 030**	**44 220**	**39 909**	**34 049**	**35 377**	**36 159**	**30 345**	**21 787**	**21 160**
Average GWP	*3 012*	*3 361*	*3 088*	*3 226*	*3 432*	*3 508*	*3 573*	*3 723*	*3 419*	*3 293*	*3 470*	*4 054*	*4 820*

Notes: 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. The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019.
'—', no data reported; C, confidential; HCFCs, hydrochlorofluorocarbons; hydrofluorocarbons, HFCs; HFEs, hydrofluoroethers; n.a., not applicable; NF_3, nitrogen trifluoride.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Table A5.2 EU production of F-gases

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Gas group							**Million tonnes of CO_2e**						
HFCs	112.2	75.6	63.3	91.1	85.0	81.4	73.1	61.1	54.6	58.6	49.6	35.3	45.8
PFCs	C	C	C	C	C	C	C	C	C	C	C	C	C
SF_6	C	C	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	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 F-gases	**175.0**	**139.0**	**108.4**	**149.8**	**151.1**	**155.1**	**142.6**	**126.8**	**121.0**	**119.1**	**105.3**	**88.3**	**102.0**
Average GWP	*3 012*	*3 361*	*3 088*	*3 226*	*3 432*	*3 508*	*3 573*	*3 723*	*3 419*	*3 293*	*3 470*	*4 054*	*4 820*

Notes: 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. The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019.
'—', no data reported; C, confidential; n.a., not applicable.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Table A5.3 EU reclamation of F-gases

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Gas group							**Tonnes**						
HFCs	C	C	100	C	C	460	C	377	647	1 314	1 659	1 829	1 478
PFCs	—	—	—	—	—	C	—	C	C	C	C	C	C
SF_6	C	C	77	C	C	C	C	C	C	C	69	C	C
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	—	C	C	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 F-gases	**417**	**398**	**177**	**326**	**508**	**487**	**484**	**416**	**679**	**1 364**	**1 751**	**1 934**	**1 523**
Average GWP	*4 919*	*4 860*	*10 963*	*3 961*	*3 498*	*3 321*	*2 555*	*4 250*	*3 527*	*3 033*	*3 145*	*3 223*	*3 313*

Notes: 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. The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2012 and the EU-28 for the period 2013-2019.
'—', no data reported; C, confidential; n.a., not applicable.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Table A5.4 EU reclamation of F-gases

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Gas group							**Million tonnes of CO_2e**						
HFCs	C	C	0.2	C	C	1.0	C	0.9	1.7	3.1	3.8	4.8	4.0
PFCs	—	—	—	—	—	C	—	C	C	C	C	C	C
SF_6	C	C	1.8	C	C	C	C	C	C	C	1.6	C	C
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	—	C	C	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 F-gases	**2.1**	**1.9**	**1.9**	**1.3**	**1.8**	**1.6**	**1.2**	**1.8**	**2.4**	**4.1**	**5.5**	**6.2**	**5.0**
Average GWP	*4 919*	*4 860*	*10 963*	*3 961*	*3 498*	*3 321*	*2 555*	*4 250*	*3 527*	*3 033*	*3 145*	*3 223*	*3 313*

Notes: 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. The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2012 and the EU-28 for the period 2013-2019.
'—', no data reported; C, confidential; n.a., not applicable.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Table A5.5 Total EU imports of F-gases

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Gas group							**Tonnes**						
HFCs	58 519	67 951	57 946	69 089	66 269	61 102	65 221	128 452	78 026	78 938	88 530	77 286	62 266
PFCs	253	306	129	230	238	310	155	350	409	363	498	416	397
SF_6	747	691	671	539	587	374	483	430	382	420	565	420	410
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1 900	3 413	6 356	14 609	19 235	20 435
HFEs and alcohols	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	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	C	C	C	C	C
Total F-gases	**59 518**	**68 948**	**58 746**	**69 858**	**67 094**	**61 787**	**65 859**	**131 794**	**82 910**	**86 878**	**104 835**	**98 223**	**84 284**
Average GWP	*2 215*	*2 227*	*2 412*	*2 287*	*2 232*	*2 172*	*2 257*	*2 209*	*2 170*	*2 113*	*1 887*	*1 525*	*1 432*

Notes: Annex II F-gases (unsaturated HFCs and HCFCs; HFEs and alcohols; and NF_3 and other perfluorinated compounds) and HFCs, PFCs and SF6 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. The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. Data available for Croatia for the period 2009-2012 are limited to HFCs and do not cover PFCs and SF_6.
C, confidential; n.a., not applicable.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Table A5.6 Total EU imports of F-gases

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Gas group							**Million tonnes of CO_2e**						
HFCs	112.2	134.6	125.1	145.0	133.9	122.5	136.0	272.1	161.9	161.9	171.7	129.0	99.5
PFCs	2.6	3.2	1.4	2.5	2.5	3.2	1.6	3.4	3.9	3.6	4.7	4.0	3.8
SF_6	17.0	15.8	15.3	12.3	13.4	8.5	11.0	9.8	8.7	9.6	12.9	9.6	9.3
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	0.1	0.1
HFEs and alcohols	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	0.0	C	C
NF_3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	8.5	C	C
Total F-gases	**131.8**	**153.6**	**141.7**	**159.7**	**149.7**	**134.2**	**148.7**	**291.1**	**179.9**	**183.6**	**197.8**	**149.8**	**120.7**
Average GWP	*2 215*	*2 227*	*2 412*	*2 287*	*2 232*	*2 172*	*2 257*	*2 209*	*2 170*	*2 113*	*1 887*	*1 525*	*1 432*

Notes: 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. The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. Data available for Croatia for the period 2009-2012 are limited to HFCs and do not cover PFCs and SF_6.
C, confidential; n.a., not applicable.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Table A5.7 EU bulk imports of F-gases

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Gas group							**Tonnes**						
HFCs	58 519	67 951	57 946	69 089	66 269	61 102	65 221	122 781	70 993	68 971	79 577	67 152	52 320
PFCs	253	306	129	230	238	310	155	C	C	355	496	416	396
SF_6	747	691	671	539	587	374	483	C	377	417	563	400	401
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	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	C	C
NF_3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C	C	C
Total F-gases	**59 518**	**68 948**	**58 746**	**69 858**	**67 094**	**61 787**	**65 859**	**125 986**	**75 606**	**76 247**	**95 013**	**87 221**	**73 478**
Average GWP	*2 215*	*2 227*	*2 412*	*2 287*	*2 232*	*2 172*	*2 257*	*2 218*	*2 196*	*2 149*	*1 897*	*1 517*	*1 461*

Notes: 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. Bulk imports under F-gas Regulation definition. The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. Data available for Croatia for the period 2009-2012 are limited to HFCs and do not cover PFCs and SF_6.
C, confidential; n.a., not applicable.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Table A5.8 EU bulk imports of F-gases

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Gas group							**Million tonnes of CO_2e**						
HFCs	112.2	134.6	125.1	145.0	133.9	122.5	136.0	260.9	148.3	142.3	154.1	111.9	86.4
PFCs	2.6	3.2	1.4	2.5	2.5	3.2	1.6	C	C	3.5	4.7	4.0	3.8
SF_6	17.0	15.8	15.3	12.3	13.4	8.5	11.0	C	8.6	9.5	12.8	9.1	9.1
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	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	C	C
NF_3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	8.5	C	C
Total F-gases	**131.8**	**153.6**	**141.7**	**159.7**	**149.7**	**134.2**	**148.7**	**279.4**	**166.0**	**163.8**	**180.2**	**132.3**	**107.4**
Average GWP	*2 215*	*2 227*	*2 412*	*2 287*	*2 232*	*2 172*	*2 257*	*2 218*	*2 196*	*2 149*	*1 897*	*1 517*	*1 461*

Notes: 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. Bulk imports under F-gas Regulation definition. The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. Data available for Croatia for the period 2009-2012 are limited to HFCs and do not cover PFCs and SF_6.
C, confidential; n.a., not applicable.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Table A5.9 EU imports of F-gases within products and equipment

	2014	2015	2016	2017	2018	2019
Gas group			**Tonnes**			
HFCs	5 671	7 033	9 967	8 953	10 134	9 946
PFCs	C	C	7	2	1	1
SF_6	C	6	2	2	19	9
Unsaturated HFCs and HCFCs	C	C	C	C	C	C
HFEs and alcohols	—	C	C	C	C	C
NF_3 and other perfluorinated compounds	—	—	—	—	—	—
Total F-gases	**5 808**	**7 304**	**10 631**	**9 823**	**11 002**	**10 806**
Average GWP	*2 015*	*1 898*	*1 860*	*1 792*	*1 591*	*1 235*

Notes: The geographical scope of presented data is the EU-28. Imports of pre-blended polyols were not subject to separate reporting before 2018. The HFC amounts given for 2018 significantly deviate from the amounts given in the previous report (EEA, 2019) as imports of pre-blended polyols had not been included previously.
'—', no data reported; C, confidential.

Sources: EEA (2019, 2020b).

Table A5.10 EU imports of F-gases within products and equipment

	2014	2015	2016	2017	2018	2019
Gas group			**Million tonnes of CO_2e**			
HFCs	11.2	13.6	19.7	17.5	17.1	13.1
PFCs	C	C	0.1	0.0	0.0	0.0
SF_6	C	0.1	0.1	0.1	0.4	0.2
Unsaturated HFCs and HCFCs	C	C	C	C	C	C
HFEs and alcohols	—	C	C	C	C	C
NF_3 and other perfluorinated compounds	—	—	—	—	—	—
Total F-gases	**11.7**	**13.9**	**19.8**	**17.6**	**17.5**	**13.3**
Average GWP	*2 015*	*1 898*	*1 860*	*1 792*	*1 591*	*1 235*

Notes: The geographical scope of presented data is the EU-28. Imports of pre-blended polyols were not subject to separate reporting before 2018. HFC amounts given for 2018 significantly deviate from the amounts given in the previous report (EEA, 2019) as imports of pre-blended polyols had not been included previously.
'—', no data reported; C, confidential.

Sources: EEA (2019, 2020b).

Table A5.11 Categories of imports of F-gases in products and equipment

	2014	2015	2016	2017	2018	2019
Categories of products and equipment			**Tonnes**			
Stationary equipment for comfort cooling or heating	4 698	5 239	8 325	7 680	8 093	8 578
Mobile air conditioning equipment	798	1 205	1 405	1 210	1 206	1 207
Other refrigeration, air conditioning and heat pump equipment	208	363	570	559	628	527
Other products and equipment	104	496	331	373	1 076	494
Total supply in products and equipment	**5 808**	**7 304**	**10 631**	**9 823**	**11 002**	**10 806**

Note: The geographical scope of presented data is the EU-28. Imports of pre-blended polyols were not subject to separate reporting before 2018.

Sources: EEA (2019, 2020b).

Table A5.12 Categories of imports of F-gases in products and equipment

	2014	2015	2016	2017	2018	2019
Categories of products and equipment			**Million tonnes of CO_2e**			
Stationary equipment for comfort cooling or heating	9.8	10.8	17.1	15.6	13.7	10.6
Mobile air conditioning equipment	1.0	1.4	1.1	0.5	0.6	0.6
Other refrigeration, air conditioning and heat pump equipment	0.4	0.7	1.0	1.0	1.0	0.8
Other products and equipment	0.6	0.9	0.6	0.5	2.2	1.4
Total supply in products and equipment	**11.7**	**13.9**	**19.8**	**17.6**	**17.5**	**13.3**

Note: The geographical scope of presented data is the EU-28. Imports of pre-blended polyols were not subject to separate reporting before 2018.

Sources: EEA (2019, 2020b).

Table A5.13 EU bulk exports of F-gases

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Gas group							**Tonnes**						
HFCs	24 162	19 187	15 720	20 455	21 330	21 171	21 699	26 239	25 577	27 414	29 224	26 039	22 475
PFCs	83	57	25	C	C	255	253	91	95	132	176	C	297
SF_6	1 670	1 499	1 423	C	C	2 021	1 871	2 522	2 426	2 012	1 669	1 862	2 000
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C	C	1 246
HFEs and alcohols	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	8	C	10	C
NF_3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	10	6	C
Total F-gases	**25 915**	**20 742**	**17 168**	**22 233**	**23 383**	**23 448**	**23 822**	**29 065**	**28 417**	**30 274**	**32 105**	**29 350**	**26 033**
Average GWP	*3 140*	*3 342*	*3 531*	*3 411*	*3 630*	*3 599*	*3 405*	*3 469*	*3 506*	*3 263*	*2 828*	*2 958*	*3 308*

Notes: 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. Data given for the period 2014-2017 include gases exported in pre-blended polyols. The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. Data available for Croatia for the period 2009-2012 are limited to HFCs and do not cover PFCs and SF6. 2018 HFC exports given here are significantly below the amounts given in the previous report (EEA, 2019) due to erroneous data identified during quality control.
C, confidential; n.a., not applicable.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Table A5.14 EU bulk exports of F-gases

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Gas group	**Million tonnes of CO_2e**												
HFCs	42.5	34.6	27.9	36.4	39.3	35.9	36.0	42.4	43.2	50.7	50.9	43.2	37.6
PFCs	0.8	0.5	0.2	C	C	2.4	2.4	0.8	0.9	1.3	1.7	C	2.8
SF_6	38.1	34.2	32.4	C	C	46.1	42.7	57.5	55.3	45.9	38.0	42.5	45.6
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	0.0	C	0.0
HFEs and alcohols	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	0.0	C	C
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	0.1	C
Total F-gases	**81.4**	**69.3**	**60.6**	**75.8**	**84.9**	**84.4**	**81.1**	**100.8**	**99.6**	**98.8**	**90.8**	**86.8**	**86.1**
Average GWP	*3 140*	*3 342*	*3 531*	*3 411*	*3 630*	*3 599*	*3 405*	*3 469*	*3 506*	*3 263*	*2 828*	*2 958*	*3 308*

Notes: 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. Data given for the period 2014-2017 include gases exported in pre-blended polyols. The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. Data available for Croatia for the period 2009-2012 are limited to HFCs and do not cover PFCs and SF6. 2018 HFC exports given here are significantly below the amounts given in the previous report (EEA, 2019) due to erroneous data identified during quality control.
C, confidential; n.a., not applicable.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Table A5.15 EU destruction of F-gases

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Gas group	**Tonnes**												
HFCs	56	47	86	173	C	485	99	878	1 251	596	555	664	1 645
PFCs	C	C	C	C	—	C	C	C	C	C	C	C	C
SF_6	C	C	C	C	C	C	C	C	16	16	C	8	2
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	—	C	C	C	3	C
HFEs and alcohols	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	—	C	—	C	C	—
NF_3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	—	C	C	C	C	—
Total F-gases	**56**	**49**	**96**	**179**	**221**	**487**	**101**	**887**	**1 277**	**624**	**652**	**674**	**1 648**
Average GWP	*1 748*	*2 395*	*4 338*	*9 249*	*9 690*	*3 763*	*10 497*	*8 879*	*7 612*	*9 270*	*6 991*	*8 225*	*10 067*

Notes: 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. The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2012 and the EU-28 for the period 2013-2019.
'—', no data reported; C, confidential; n.a., not applicable.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Table A5.16 EU destruction of F-gases

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Gas group	**Million tonnes of CO_2e**												
HFCs	0.1	0.1	0.2	C	C	1.8	1.0	C	9.2	5.3	4.2	5.4	16.5
PFCs	C	C	C	C	—	C	C	C	C	C	C	C	C
SF_6	C	C	C	C	C	C	C	C	0.4	0.4	C	0.2	0.1
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	—	C	C	C	0.0	C
HFEs and alcohols	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	—	C	—	C	C	—
NF_3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	—	C	C	C	C	—
Total F-gases	**0.1**	**0.1**	**0.4**	**1.7**	**2.1**	**1.8**	**1.1**	**7.9**	**9.7**	**5.8**	**4.6**	**5.5**	**16.6**
Average GWP	*1 748*	*2 395*	*4 338*	*9 249*	*9 690*	*3 763*	*10 497*	*8 879*	*7 612*	*9 270*	*6 991*	*8 225*	*10 067*

Notes: 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. The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2012 and the EU-28 for the period 2013-2019.
'—', no data reported; C, confidential; n.a., not applicable.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Table A5.17 Total EU supply of F-gases

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Gas	**Tonnes**												
HFC-23	247	184	190	299	306	137	73	94	78	63	95	54	45
HFC-32	3 987	5 086	4 430	5 390	4 930	5 025	5 334	11 060	9 384	11 022	12 053	15 535	14 483
HFC-41	C	—	C	C	C	C	C	1	2	1	1	1	1
HFC-125	12 371	12 501	13 992	18 248	15 345	15 598	15 116	25 476	17 916	18 701	17 409	13 770	9 581
HFC-134	C	—	—	C	—	—	—	—	C	C	—	—	—
HFC-134a	49 080	46 174	41 440	43 657	40 201	40 060	39 334	60 771	46 282	44 184	40 912	33 750	25 733
HFC-143	C	—	—	—	—	—	—	—	—	—	—	—	—
HFC-143a	8 998	9 817	9 620	10 572	8 854	9 007	8 817	13 512	7 069	7 205	6 006	843	1 268
HFC-152a	4 292	6 162	5 182	4 695	4 676	4 175	3 657	6 227	3 914	3 431	3 552	3 245	3 157
HFC-227ea	789	1 767	1 776	2 082	2 052	1 479	1 610	2 695	1 977	1 754	1 628	1 501	1 252
HFC-236fa	C	C	C	30	44	31	38	52	40	42	37	C	C
HFC-245ca	—	—	—	—	—	—	—	—	—	C	—	—	—
HFC-245fa	C	C	C	C	C	C	C	C	C	C	C	C	876
HFC-365mfc	C	C	C	C	C	C	C	C	C	C	C	C	C
HFC-43-10mee	C	C	C	C	C	C	C	C	C	C	C	C	C
PFC-14	C	86	42	59	56	28	2	147	168	152	196	170	143
PFC-116	C	178	113	153	C	C	C	157	164	129	148	137	156
PFC-218	112	59	C	24	23	40	38	41	59	37	23	32	20
PFC-c-318	C	C	C	C	10	C	C	14	27	C	C	C	C
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	C	C
SF_6	1 810	1 860	1 435	1 522	1 502	1 490	1 535	716	909	1 004	1 225	843	727
HCFC-1233xf	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	—	—	C	C	—	—

Table A5.17 Total EU supply of F-gases (tonnes) (cont.)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Gas							**Tonnes**						
HCFC-1233zd	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C	C	C
HFC-1234yf	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	5 214	10 574	11 451	10 294
HFC-1234ze	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C	C	C
HFC-1336mzz	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C	C	C
HFE-236fa	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	—	—	—	C	—	—
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	C	C
HFE-347pcf2	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	—	—	—	C	—	C
HFE-449sl	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	90	C	C
HFE-569sf2	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C	C	C
2,2,3,3,3-penta-fluoropropanol	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	—	C	C	C	C	C
bis(trifluoromethyl)-methanol	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C	C	C
NF_3	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	321	339	381	492	433	402
PFPMIE	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	—	—	—	C	C
Gas group													
HFCs	86 477	87 311	81 005	89 924	81 829	80 982	79 224	124 408	92 090	91 593	87 582	72 179	58 015
PFCs	299	398	241	303	289	243	139	480	524	464	649	563	436
SF_6	1 810	1 860	1 435	1 522	1 502	1 490	1 535	716	909	1 004	1 225	843	727
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	6 305	13 400	17 767	18 350
HFEs and alcohols	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	303	127	C	C
NF_3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	339	381	492	C	C
Total F-gases	**88 586**	**89 569**	**82 681**	**91 749**	**83 620**	**82 715**	**80 898**	**127 547**	**96 779**	**100 050**	**103 475**	**92 179**	**78 293**
Average GWP	*2 410*	*2 433*	*2 451*	*2 521*	*2 489*	*2 470*	*2 474*	*2 241*	*2 187*	*2 142*	*2 027*	*1 658*	*1 552*

Notes: 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 the period 2007-2013 are thus limited to bulk supply. The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. Data available for Croatia 2009-2012 are limited to HFCs and do not cover PFCs and SF6. 2018 supply of HFC-32, HFC-125 and HFC-134a given here is significantly above the amounts given in the previous report (EEA, 2019) due to erroneous data identified during quality control.
'—', no data reported; C, confidential; n.a., not applicable; PFPMIE, perfluoropolymethylisopropylether.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Table A5.18 Total EU supply of F-gases

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Gas	**Million tonnes of CO_2e**												
HFC-23	3.7	2.7	2.8	4.4	4.5	2.0	1.1	1.4	1.2	0.9	1.4	0.8	0.7
HFC-32	2.7	3.4	3.0	3.6	3.3	3.4	3.6	7.5	6.3	7.4	8.1	10.5	9.8
HFC-41	C	—	C	C	C	C	C	0.0	0.0	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	60.9	48.2	33.5
HFC-134	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	48.3	36.8
HFC-143	C	—	—	—	—	—	—	—	—	—	—	—	—
HFC-143a	40.2	43.9	43.0	47.3	39.6	40.3	39.4	60.4	31.6	32.2	26.8	3.8	5.7
HFC-152a	0.5	0.8	0.6	0.6	0.6	0.5	0.5	0.8	0.5	0.4	0.4	0.4	0.4
HFC-227ea	2.5	5.7	5.7	6.7	6.6	4.8	5.2	8.7	6.4	5.6	5.2	4.8	4.0
HFC-236fa	C	C	C	0.3	0.4	0.3	0.4	0.5	0.4	0.4	0.4	C	C
HFC-245ca	—	—	—	—	—	—	—	—	—	C	—	—	—
HFC-245fa	C	C	C	C	C	C	C	C	C	C	C	C	0.9
HFC-365mfc	C	C	C	C	C	C	C	C	C	C	C	C	C
HFC-43-10mee	C	C	C	C	C	C	C	C	C	C	C	C	C
PFC-14	C	0.6	0.3	0.4	0.4	0.2	0.0	1.1	1.2	1.1	1.4	1.3	1.1
PFC-116	C	2.2	1.4	1.9	C	C	C	1.9	2.0	1.6	1.8	1.7	1.9
PFC-218	1.0	0.5	C	0.2	0.2	0.4	0.3	0.4	0.5	0.3	0.2	0.3	0.2
PFC-c-318	C	C	C	C	0.1	C	C	0.1	0.3	C	C	C	C
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	C	C
SF_6	41.3	42.4	32.7	34.7	34.2	34.0	35.0	16.3	20.7	22.9	27.9	19.2	16.6
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	C	C
HFC-1234yf	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	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	C	C
HFC-1336mzz	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C	C	C
HFE-236fa	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	—	—	—	C	—	—
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	C	C
HFE-347pcf2	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	—	—	—	C	—	C
HFE-449sl	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	0.0	C	C
HFE-569sf2	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C	C	C
2,2,3,3,3-penta-fluoropropanol	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	-	C	C	C	C	C
bis(trifluoromethyl)-methanol	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	C	C	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	7.4	6.9
PFPMIE	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	—	—	—	C	C
Gas group													
HFCs	169.3	171.5	167.4	193.5	171.0	167.9	163.8	259.2	179.9	180.4	167.2	120.6	93.6
PFCs	3.0	4.0	2.5	3.1	3.0	2.4	1.4	4.6	5.0	4.4	6.1	5.4	4.3

Table A5.18 Total EU supply of F-gases (cont.)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Gas	**Million tonnes of CO_2e**												
SF_6	41.3	42.4	32.7	34.7	34.2	34.0	35.0	16.3	20.7	22.9	27.9	19.2	16.6
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	0.0	0.1	C	0.1
HFEs and alcohols	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	0.1	0.0	C	C
NF_3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	5.8	6.6	8.5	C	C
Total F-gases	**213.5**	**218.0**	**202.6**	**231.3**	**208.2**	**204.3**	**200.1**	**285.8**	**211.6**	**214.3**	**209.8**	**152.8**	**121.5**
Average GWP	*2 410*	*2 433*	*2 451*	*2 521*	*2 489*	*2 470*	*2 474*	*2 241*	*2 187*	*2 142*	*2 027*	*1 658*	*1 552*

Notes: 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 the period 2007-2013 are thus limited to bulk supply. The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. Data available for Croatia for the period 2009-2012 are limited to HFCs and do not cover PFCs and SF6. 2018 supply of HFC-32, HFC-125 and HFC-134a given here is significantly above the amounts given in the previous report (EEA, 2019) due to erroneous data identified during quality control.
'—', no data reported; C, confidential; n.a., not applicable; PFPMIE, perfluoropolymethylisopropylether.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Table A5.19 EU bulk supply of F-gases

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Gas group	**Tonnes**												
HFCs	86 477	87 311	81 005	89 924	81 829	80 982	79 224	118 737	85 057	81 626	78 629	62 044	48 069
PFCs	299	398	241	303	289	243	139	C	C	457	647	562	435
SF_6	1 810	1 860	1 435	1 522	1 502	1 490	1 535	C	903	1 001	1 223	824	718
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	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	C	C
NF_3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	339	381	492	C	C
Total F-gases	**88 586**	**89 569**	**82 681**	**91 749**	**83 620**	**82 715**	**80 898**	**121 739**	**89 475**	**89 419**	**93 653**	**81 177**	**67 487**
Average GWP	*2 410*	*2 433*	*2 451*	*2 521*	*2 489*	*2 470*	*2 474*	*2 251*	*2 210*	*2 176*	*2 052*	*1 667*	*1 603*

Notes: 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. The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. Data available for Croatia for the period 2009-2012 are limited to HFCs and do not cover PFCs and SF_6. Imports of pre-blended polyols are not included since 2018. 2018 bulk HFC supply given here is significantly above the amounts given in the previous report (EEA, 2019) due to erroneous data identified during quality control.
C, confidential; n.a., not applicable.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Table A5.20 EU bulk supply of F-gases

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Gas group	**Million tonnes of CO_2e**												
HFCs	169.3	171.5	167.4	193.5	171.0	167.9	163.8	248.0	166.4	160.7	149.6	103.5	80.5
PFCs	3.0	4.0	2.5	3.1	3.0	2.4	1.4	C	C	4.3	6.1	5.4	4.2
SF_6	41.3	42.4	32.7	34.7	34.2	34.0	35.0	C	20.6	22.8	27.9	18.8	16.4
Unsaturated HFCs and HCFCs	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	C	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	C	C
NF_3 and other perfluorinated compounds	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	C	5.8	6.6	8.5	C	C
Total F-gases	**213.5**	**218.0**	**202.6**	**231.3**	**208.2**	**204.3**	**200.1**	**274.1**	**197.8**	**194.6**	**192.2**	**135.3**	**108.2**
Average GWP	*2 410*	*2 433*	*2 451*	*2 521*	*2 489*	*2 470*	*2 474*	*2 251*	*2 210*	*2 176*	*2 052*	*1 667*	*1 603*

Notes: 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. The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. Data available for Croatia for the period 2009-2012 are limited to HFCs and do not cover PFCs and SF_6. Imports of pre-blended polyols are not included since 2018. 2018 bulk HFC supply given here is significantly above the amounts given in the previous report (EEA, 2019) due to erroneous data identified during quality control.
C, confidential; n.a., not applicable.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Table A5.21 Intended applications of EU total supply of F-gases

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Intended applications of bulk supply	**Tonnes**												
Refrigeration, air conditioning and heating and other heat transfer fluids	61 377	58 720	58 678	65 964	61 045	58 574	58 999	95 688	74 023	78 016	78 012	68 676	55 600
Foams, incl. pre-blended polyols	14 286	15 284	11 709	11 503	9 234	8 526	8 202	12 967	9 572	10 157	11 521	11 083	11 041
Aerosols	9 090	11 131	8 425	9 547	7 808	10 950	9 690	8 954	9 421	8 728	10 300	9 109	8 964
Fire protection	649	491	531	1 677	2 508	1 451	1 385	1 858	818	585	502	324	130
Electrical equipment	1 197	1 422	969	1 290	1 344	1 362	1 419	622	745	813	951	640	534
Semiconductor, photovoltaics and other electronics manufacture	127	301	184	265	243	169	71	1 057	715	755	924	897	769
Other or unknown applications	1 861	2 219	2 185	1 501	1 437	1 684	1 132	6 402	1 485	997	1 266	1 450	1 255
Total F-gases — total supply	**88 586**	**89 569**	**82 681**	**91 749**	**83 620**	**82 715**	**80 898**	**127 547**	**96 779**	**100 050**	**103 475**	**92 179**	**78 293**

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. The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. Data available for Croatia for the period 2009-2012 are limited to HFCs and do not cover PFCs and SF_6. 2018 supply given here is significantly above the amounts given in the previous report (EEA, 2019) due to erroneous data identified during quality control. Feedstock use does not appear in this table as it is excluded from the scope of EU total supply.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Table A5.22 Intended applications of EU total supply of F-gases

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Intended applications of bulk supply	**Million tonnes of CO_2e**												
Refrigeration, air conditioning and heating and other heat transfer fluids	138.5	136.5	139.6	161.6	143.7	140.3	140.4	216.5	155.3	157.0	142.3	100.2	76.3
Foams, incl. pre-blended polyols	13.4	12.9	9.8	10.4	6.5	6.1	5.9	11.7	7.2	8.8	8.4	6.8	4.7
Aerosols	12.2	14.5	11.2	12.5	9.9	14.1	12.7	11.7	13.1	11.6	14.4	11.7	11.3
Fire protection	4.0	3.0	3.2	7.5	9.7	5.8	2.6	6.6	3.0	2.2	1.8	1.1	0.5
Electrical equipment	27.3	32.4	22.1	29.4	30.7	31.0	32.4	14.2	17.0	18.5	21.7	14.6	12.2
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	12.4	10.9
Other or unknown applications	16.7	15.4	14.7	6.7	4.9	4.9	5.3	15.8	6.1	5.5	7.9	6.0	5.7
Total F-gases — total supply	**213.5**	**218.0**	**202.6**	**231.3**	**208.2**	**204.3**	**200.1**	**285.8**	**211.6**	**214.3**	**209.8**	**152.8**	**121.5**

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. The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. Data available for Croatia for the period 2009-2012 are limited to HFCs and do not cover PFCs and SF6. 2018 supply given here is significantly above the amounts given in the previous report (EEA, 2019) due to erroneous data identified during quality control. Feedstock use does not appear in this table as it is excluded from the scope of EU total supply.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Table A5.23 Intended applications of EU bulk supply of F-gases

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Intended applications of bulk supply	**Tonnes**												
Refrigeration, air conditioning and heating and other heat transfer fluids	61 377	58 720	58 678	65 964	61 045	58 574	58 999	89 984	67 216	67 715	68 562	58 750	45 288
Foams, incl. pre-blended polyols	14 286	15 284	11 709	11 503	9 234	8 526	8 202	12 960	9 564	10 152	11 521	10 162	10 693
Aerosols	9 090	11 131	8 425	9 547	7 808	10 950	9 690	8 875	8 949	8 405	9 929	8 973	8 832
Fire protection	649	491	531	1 677	2 508	1 451	1 385	1 858	808	584	502	324	130
Electrical equipment	1 197	1 422	969	1 290	1 344	1 362	1 419	604	739	811	949	621	525
Semiconductor, photovoltaics and other electronics manufacture	127	301	184	265	243	169	71	1 057	715	755	924	897	769
Other or unknown applications	1 861	2 219	2 185	1 501	1 437	1 684	1 132	6 402	1 485	997	1 266	1 450	1 249
Total bulk supply	**88 586**	**89 569**	**82 681**	**91 749**	**83 620**	**82 715**	**80 898**	**121 739**	**89 475**	**89 419**	**93 653**	**81 177**	**67 487**

Notes: 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. The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. Data available for Croatia for the period 2009-2012 are limited to HFCs and do not cover PFCs and SF_6. Imports of pre-blended polyols are excluded since 2018. 2018 supply given here is significantly above the amounts given in the previous report (EEA, 2019) due to erroneous data identified during quality control. Feedstock use does not appear in this table as it is excluded from the scope of bulk supply.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Table A5.24 Intended applications of EU bulk supply of F-gases

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Intended applications of bulk supply	**Million tonnes of CO_2e**												
Refrigeration, air conditioning and heating and other heat transfer fluids	138.5	136.5	139.6	161.6	143.7	140.3	140.4	205.4	142.4	137.8	125.2	85.0	64.4
Foams, incl. pre-blended polyols	13.4	12.9	9.8	10.4	6.5	6.1	5.9	11.6	7.2	8.8	8.4	5.1	3.7
Aerosols	12.2	14.5	11.2	12.5	9.9	14.1	12.7	11.6	12.4	11.2	13.9	11.5	11.1
Fire protection	4.0	3.0	3.2	7.5	9.7	5.8	2.6	6.6	3.0	2.2	1.8	1.1	0.5
Electrical equipment	27.3	32.4	22.1	29.4	30.7	31.0	32.4	13.8	16.9	18.5	21.6	14.2	12.0
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	12.4	10.9
Other or unknown applications	16.7	15.4	14.7	6.7	4.9	4.9	5.3	15.8	6.1	5.5	7.9	6.0	5.7
Total bulk supply	**213.5**	**218.0**	**202.6**	**231.3**	**208.2**	**204.3**	**200.1**	**274.1**	**197.8**	**194.6**	**192.2**	**135.3**	**108.2**

Notes: 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. The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. Data available for Croatia for the period 2009-2012 are limited to HFCs and do not cover PFCs and SF_6. Imports of pre-blended polyols are excluded since 2018. 2018 supply given here is significantly above the amounts given in the previous report (EEA, 2019) due to erroneous data identified during quality control. Feedstock use does not appear in this table as it is excluded from the scope of bulk supply.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Table A5.25 HFCs placed on the market and quota compliance

			2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
	POM category		**Million tonnes of CO_2e**												
(1)	POM of 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									279.4	162.4	158.1	166.7	102.1	83.8
	thereof:														
(3)	*for exempted uses Art.15(2)a-f:*									C	C	C	18.8	21.1	21.6
(4)	*thereof: for exempted uses Art.15(2)a-e:*									*7.0*	*7.6*	*14.1*	*9.2*	*11.1*	*11.2*
(5)	*thereof: exemption Art. 15(2)f: Pharmaceutical MDIs*									*C*	*C*	*C*	*9.6*	*10.0*	*10.3*
(6)	Quota-relevant bulk HFC POM 2015 onwards	*= (2) – (4); since 2018: = (2) – (3)*									154.7	144.0	157.5	81.0	62.2
(7)	POM of HFCs in equipment 2014 onwards:	*= (8) + (10)*								11.2	13.6	19.7	17.5	15.4	12.1
	thereof:														
(8)	*HFC POM in RACHP equipment*									*11.1*	*12.8*	*19.2*	*17.0*	*15.3*	*12.0*
(9)	*thereof: without quota authorisation coverage, 2017 onwards*												*0.4*	*0.7*	*0.2*

Table A5.25 HFCs placed on the market and quota compliance (cont.)

			2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
	POM category		**Million tonnes of CO_2e**												
(10)	*HFC POM in other equipment*									*0.1*	*0.7*	*0.5*	*0.5*	*0.2*	*0.2*
(11)	Total physical POM of HFC 2014 onwards (bulk + equipment)	*= (2) + (7)*								290.6	175.9	177.7	184.2	117.5	95.9
(12)	Quota authorisations issued 2015 onwards										17.1	19.9	11.6	18.8	35.8
(13)	Quota-relevant POM 2015 onwards	*= (6) + (9) + (12)*									171.8	163.9	169.4	100.4	98.2
(14)	Maximum quantity of HFC phase-down										183.1	170.3	170.3	101.2	100.3
	Quota compliance 2015 onwards:														
(15)	Unused quota (company level)										12.0	7.1	3.2	2.0	3.0
(16)	Quota exceedance (company level)										0.7	0.6	2.4	1.0	1.0
(17)	*thereof: production/ bulk import of HFCs*	*= (16) – (9)*									*0.7*	*0.6*	*2.0*	*0.3*	*0.8*
(18)	EU-wide margin to maximum quantity	*= (14) – (13)*									11.2	6.3	0.8	0.7	2.0

Notes: The geographical scope of presented POM data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019.
C, confidential; POM, placing on the market; RACHP, refrigeration, air conditioning and heat pumps.

Sources: EC (2011, 2014, 2020); EEA (2019, 2020b).

Table A5.26 Consumption of HFCs covered under the Montreal Protocol

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
	Million tonnes of CO_2e												
EU consumption of HFCs covered under the Montreal Protocol	177.5	169.3	156.4	194.0	173.2	159.4	163.2	267.0	146.9	141.4	145.1	94.8	74.4

Note: The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019.

Sources: EC (2011, 2014); EEA (2019, 2020b).

Table A5.27 Companies reporting on 2019, by Member State and reported activities

Country	Total	Thereof:						
		Producers	Importers	Exporters	Equipment importers	Feedstock users	Destruction companies	Quota authorisers
Austria	28	—	16	—	13	—	—	2
Belgium	59	1	25	8	31	—	—	7
Bulgaria	104	—	60	1	34	—	—	44
Croatia	38	—	15	2	22	—	—	4
Cyprus	33	—	15	—	20	—	—	5
Czechia	61	—	26	1	31	—	1	3
Denmark	36	—	12	3	21	—	—	2
Estonia	27	—	16	—	9	—	1	5
Finland	29	—	7	1	19	—	2	4
France	165	3	58	11	107	1	1	23
Germany	187	3	63	19	115	1	7	18
Greece	72	—	29	4	38	—	—	3
Hungary	46	—	19	—	27	—	—	—
Ireland	13	—	5	—	9	—	—	1
Italy	340	—	212	14	104	—	—	39
Latvia	14	—	9	—	4	—	—	3
Lithuania	39	—	30	1	7	—	—	5
Luxembourg	—	—	—	—	—	—	—	—
Malta	18	—	6	1	13	—	—	—
Netherlands	89	1	38	6	51	—	1	12
Poland	861	—	689	5	57	—	1	366
Portugal	39	—	12	4	23	—	—	2
Romania	65	—	23	—	39	—	—	3
Slovakia	18	—	7	—	7	—	1	3
Slovenia	33	—	11	—	23	—	—	—
Spain	123	—	43	15	74	—	—	8
Sweden	151	—	117	4	35	—	1	9
United Kingdom	148	1	68	10	63	—	2	23
EU-28	**2 836**	**9**	**1 631**	**110**	**996**	**2**	**18**	**594**
Non-EU-28 total	**310**	**n.a.**	**63**	**2**	**16**	**n.a.**	**n.a.**	**248**

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 (2020b).

Table A5.28 Non-EU companies reporting on 2019, by location of only representative

EU-28 country of only representative	Total represented non-EU-28 companies	Thereof from: United Arab Emirates	Canada	Switzerland	China	Egypt	Gibraltar	Hong Kong	India	Japan	South Korea	Monaco	Marshall Islands	Mexico	Malaysia	Norway	Saudi Arabia	Singapore	Thailand	Turkey	Taiwan, Province of China	United States	British Virgin Islands	Vietnam
Belgium	6	2	—	—	—	1	—	—	—	1	—	—	—	—	—	—	1	—	—	1	—	—	—	—
Bulgaria	3	—	—	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Cyprus	46	—	—	—	46	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Czechia	2	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	1	—	—
Finland	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—
France	16	—	1	—	—	—	—	—	1	—	—	1	—	2	—	1	—	—	—	—	—	10	—	—
Germany	37	—	—	—	15	—	—	4	—	2	4	—	—	—	1	—	—	1	1	—	1	7	—	1
Ireland	171	—	—	—	167	—	—	1	1	—	—	—	1	—	—	—	—	—	—	—	—	—	1	—
Italy	6	—	—	1	3	—	—	—	—	1	—	—	—	—	—	1	—	—	—	—	—	—	—	—
Netherlands	8	—	—	3	—	—	—	1	—	1	—	—	—	—	—	3	—	—	—	—	—	—	—	—
Sweden	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—
United Kingdom	12	—	—	1	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	10	—	—
EU-28 total	**310**	**2**	**1**	**5**	**234**	**1**	**1**	**6**	**2**	**5**	**5**	**1**	**1**	**2**	**1**	**7**	**1**	**1**	**1**	**1**	**1**	**29**	**1**	**1**

Note: '—', no data reported.

Source: EEA (2020b).

Table A5.29 Activities reported 2007-2019

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Reports received	**77**	**86**	**94**	**110**	**125**	**133**	**153**	**468**	**780**	**1 284**	**1 728**	**2 137**	**3 146**
Of which mention:													
Production of F-gases	6	12	8	7	9	10	9	10	9	9	8	8	9
thereof: HFC production	*4*	*9*	*6*	*5*	*7*	*8*	*7*	*6*	*6*	*6*	*5*	*5*	*7*
Bulk import of F-gases	55	53	58	70	77	91	112	187	293	379	577	895	1 694
thereof: bulk HFC import	*48*	*47*	*53*	*66*	*73*	*86*	*107*	*173*	*282*	*366*	*563*	*877*	*1 675*
Bulk export of F-gases	44	47	64	75	74	81	82	92	99	111	119	115	112
thereof: bulk HFC export	*37*	*39*	*55*	*67*	*64*	*70*	*72*	*81*	*89*	*98*	*104*	*100*	*94*
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	840	1 039	1 079	1 012
thereof: RACHP equipment charged with HFCs	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*n.a.*	*220*	*409*	*826*	*1 028*	*1 067*	*1 002*
Destruction	6	8	7	8	10	11	10	10	15	13	13	16	18
Feedstock use	2	2	2	2	1	1	1	3	3	3	3	5	2
Supply of quota authorisation	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	20	34	94	335	842
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*	*6*	*22*	*52*	*357*

Notes: The reporting obligation for equipment importers applied in 2014 for the first time. Reporting on quotas authorised to other companies has applied since 2015. The geographical scope of presented data is the EU-28 except Croatia for the period 2007-2008 and the EU-28 for the period 2009-2019. Companies may report on more than one activity.
n.a., not applicable; RACHP, refrigeration, air conditioning and heat pumps.

Sources: EEA (2020b).

Annex 6 Quality control

Three-tier concept

The quality control (QC) concept was designed to catch many typical reporting errors, misunderstandings and inconsistencies automatically as users fill in the reporting form. Any implausible values are either rejected outright, or users are required to provide explanations for them. Such values, along with those that have frequently caused inconsistencies in the past, are flagged for manual checking to the European Topic Centre staff. The QC process formally consists of three tiers:

- QC0: live automatic checks as data are entered into the web form;
- QC1: quality issues pertaining to a single report, automatic and manual;
- QC2: quality issues across reports (e.g. matching figures for mutual trading), manual.

When problems are found or confirmed during the manual stage, the report is put on hold and the company is contacted for clarification. Reports can pass the QC process only after all problematic items have been cleared.

Automatic quality control in the Business Data Repository

Automated tests fall into four categories:

Completeness. All the data necessary for a particular company's activities must be present. For example, companies that have specified that they are producers must fill out all fields that are relevant to F-gas production.

Plausibility. One particularly large part of plausibility tests is the inclusion of 'white lists' of gases that are commonly used for certain applications and equipment categories, and typical amounts of F-gas in equipment. Gases not on the white lists are treated as unusual, and reporters are warned about a possible mistake in the gas selection or a slip in the column.

Consistency. Across the report, corresponding numbers must match. For example, the total amount of gas accounted for in the 'Intended applications' section must match the amount determined as placed on the market in the production/import/export section.

Correctness. Company data for trade partners that are specified by reporting companies are validated in the automatic stage. A fuzzy algorithm compares the location and company names provided with the data associated with the VAT (value added tax) number in the Directorate-General for Climate Action's (DG CLIMA's) F-gas portal.

If a rule is violated, reporters are either prompted (immediately or at submission) to correct or amend their values or to provide comments to explain inconsistencies and unusual choices. Violation of critical rules prevents the submission of the report completely, while transgression against other rules results in a warning only. In the latter cases, submission of the report is possible, and problematic values are flagged for a manual follow-up by the F-gas team.

Manual quality control by the F-gas team

In the second level of QC, the F-gas support team follows up on reports that were flagged by the automated system. Reporters are contacted if reported values remain questionable during this stage. If reporting mistakes are confirmed, reporters are asked to resubmit a corrected report via the Business Data Repository (BDR), ensuring the transparency of the reporting process. Only in exceptional cases are the data manually adjusted, and these adjustments are documented in feedback files added to the respective BDR envelope containing the company's submission.

Common quality control issues in the 2019 reporting season

As in the previous year, the system proved very workable and was able to catch the majority of problems before they were submitted to the EEA (albeit with significant support to companies needed in some cases). The majority of issues left for manual investigation thus amounted to housekeeping, checking comments, verifying numbers that may have been counted twice and so on, and only a relatively small number of actual mistakes had to be corrected by the reporting companies.

However, with the number of companies increasing further, workload due to issues raised by the automated QC routines is still high. As resources were limited, manual follow-up was restricted to key error categories either relevant to the order of magnitude of reported amounts or significantly affecting potential company non-compliance under the HFC phase-down.

Most failures related to:

- mistakes in the order of magnitude (reporting in kilograms instead of tonnes);
- mistakes in the unit of reported amounts (tonnes of CO_2e instead of physical tonnes);
- confusion between bulk imports and imports of equipment;
- reporting of RACHP equipment in non-RACHP categories;
- confusion between HFC-134a and HFC-134;
- erroneous reporting of feedstock use.

The obligation for equipment importers to upload additional verification documents in the BDR was an additional challenge for many companies, creating a huge amount of enquiries.

European Environment Agency

Fluorinated greenhouse gases 2020
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2020 — 79 pp. — 21 x 29.7 cm

ISBN 978-92-9480-294-1
doi: 10.2800/08599

TH-AL-20-024-EN-N
doi:10.2800/08599

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of the European Union

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