Öko-Recherche
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Final report

Fluorinated Gases under EU Regulation: Assessing the Role of the F-gas Regulation and the Proposed Universal PFAS Restriction

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Frankfurt/Main, 22 October 2026

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Abbreviations

AC/HP	Air Conditioning/Heat Pump
ChemSec	The International Chemical Secretariat
DUH	Deutsche Umwelthilfe
EEB	European Environmental Bureau
EiF	Entry into Force
EU	European Union
F-gases	Fluorinated greenhouse gases covered under the EU F-gas Regulation
Fluorinated gases	Fluorinated gases covered under the PFAS restriction proposal
FTOC	Flexible and Rigid Foams Technical Options Committee
HFC	Hydrofluorocarbon
HFO	Hydrofluoroolefin
HVACR	Heating, Ventilation, Air Conditioning and Refrigeration
MAC	Mobile Air Conditioning
NA	Not Available
PFAS	Per- and polyfluoroalkyl substances
PU	Polyurethane
RAC	Refrigeration and Air Conditioning
RACHP	Refrigeration, Air Conditioning and Heat Pumps
uPFAS	Universal PFAS restriction
XPS	Extruded polystyrene

1 Understanding of the context

1.1 Legislative framework addressing F-gases in the EU and internationally

Fluorinated greenhouse gases (F-gases) are man-made substances used in numerous industrial applications and include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6), nitrogen trifluoride (NF_3) as well as other fluorinated substances. Due to their high global warming potentials (GWP), F-gases contribute significantly to climate change.

Production and consumption of F-gases, specifically HFCs, have increased considerably because they are widely used as substitutes for ozone depleting substances (ODS), which are being phased-out globally under the Montreal Protocol. F-gas emissions are mainly released from refrigeration, air conditioning and heat pump (RACHP) equipment, foams, aerosols, solvents, and fire protection equipment. Other emission sources include halocarbon production, certain industrial processes in the semiconductor and non-ferrous metal industry as well as the use in switchgear equipment for transmission of electricity.

F-gas emissions have long been addressed by international conventions such as the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol. As a party to the Kyoto Protocol, the EU must report on the status of the reduction commitments made under the UNFCCC and in relation to EU legislation on greenhouse gas (GHG) emission reductions. Regulation (EU) No 525/2013 stipulates the overarching mechanism for monitoring and reporting greenhouse gas emissions ("Monitoring Mechanism Regulation", MMR).[1] In more detail, Commission Implementing Regulation (EU) No 749/2014 sets the requirements for national reporting under Regulation (EU) No 525/2013.[2]

Recognising the contribution of F-gases, specifically HFCs, to global climate change, the international community decided in 2016 in Kigali (Rwanda) on an Amendment to the Montreal Protocol. The so-called Kigali Amendment entered into force on 1 January 2019 and implements a global HFC phase-down by cutting down the HFC production and consumption by more than 80 % over the next 30 years. There are different baseline years and HFC reduction schedules for Article 5 and non-Article 5 countries, with developed countries starting first and developing countries taking on reduction commitments in the medium-term, in addition to the ODS phase-out also regulated under the Montreal Protocol. The phase-down of HFCs requires the development and uptake of suitable alternative refrigerants with low or zero GWP, which can substitute for HFCs. Beyond the specific reduction schedules, the Kigali amendment introduced import/export licensing and reporting requirements. By extending the scope of controlled substances to HFCs, the Montreal Protocol evolved from an environmental to a

[1] Regulation (EU) No 525/2013 accessible under https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32013R0525

[2] Regulation (EU) No 749/2014 accessible under http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2014.203.01.0023.01.ENG

climate change agreement and presents an important step towards the long-term goals set by the Paris Climate Agreement.

The EU was the first region in the world where a complete F-gas legislation had been established. The first F-gas Regulation (EC) No 842/2006 of the European Parliament and of the Council of 17 May 2006 on certain fluorinated greenhouse gases was supplemented with nine Commission Implementing Regulations and contained provisions related to certification of technicians and companies dealing with F-gases, reporting on F-gases, leakage checking and recovery requirements for F-gas containing equipment, placing on the market bans for products and equipment containing or relying on F-gases as well as prohibitions of the use of certain F-gases in specific applications.

In 2015, Regulation (EC) 842/2006 was replaced by Regulation (EU) No 517/2014.[3] The scope of the revised F-gas Regulation was significantly extended, inter alia, to include an HFC phase-down schedule and HFC quota allocation system, additional certification and reporting requirements and an additional set of placing on the market and use bans.

Building on the success of Regulation (EU) No 517/2014, Regulation (EU) 2024/573[4] (hereinafter “F-gas Regulation”) was designed to phase out the use of high-GWP F-gases, in line with international commitments under the Montreal Protocol and the Paris Agreement. It was adopted on 7 February 2024 and entered into force on 11 March 2024. This revised Regulation significantly strengthens the HFC phase-down when compared with Regulation (EU) No 517/2014 and includes a total HFC phase-out by 2050. To complement the HFC phase-out, Regulation 2024/573 actively promotes the use of alternatives with lower global warming potentials. The regulation outlines specific GWP limits for new equipment to be placed on the market, effectively prohibiting the use of high-GWP F-gases in certain applications where suitable alternatives are available. This shift towards low-GWP alternatives is particularly critical in sectors such as commercial refrigeration, air conditioning, and heat pumps. In sum, the new F-gas Regulation further accelerates the transition to environment-friendly alternative technologies.

However, the substances proposed to replace HFCs include so-called (unsaturated) hydrofluoroolefins (HFOs) and blends of HFOs and HFCs (having lower GWP than most saturated HFCs). These contribute to another important environmental problem since several of the HFOs and HFCs can in part or completely be converted in the atmosphere into trifluoroacetic acid (TFA)[5]. TFA is a persistent and mobile substance and the final breakdown product of many per- and polyfluoroalkyl substances (PFAS) and qualifies as a PFAS itself. In June 2026, the European Chemicals Agency’s Committee for Risk Assessment (RAC)

[3] In this proposal, for the sake of clarity and consistency Regulation (EU) No 2024/573 is referred to as “F-gas Regulation”. In cases, in which the first or second F-gas Regulation is meant, the reference “Regulation (EC) No 842/2006” or “Regulation (EU) No 517/2014” is used.

[4] https://eur-lex.europa.eu/eli/reg/2024/573/oj

[5] Behringer, David, Felix Heydel, Barbara Gschrey, Steffi Osterheld, Winfried Schwarz, Kristina Warncke, Finnian Freeling, u. a. „Persistent Degradation Products of Halogenated Refrigerants and Blowing Agents in the Environment: Type, Environmental Concentrations, and Fate with Particular Regard to New Halogenated Substitutes with Low Global Warming Potential“, 2021, 259.

recommended the additional harmonised classification of TFA as toxic to reproduction (Categories 1B), PMT and vPvM.[6]

1.2 Fluorinated gases as part of EU regulatory action on PFAS chemicals

REACH (Registration, Evaluation, Authorisation, and Restriction of Chemicals) is one of the key legislations in the EU for chemical regulation, aiming to “ensure a high level of protection of human health and the environment”. The European Chemicals Agency (ECHA) is the Agency responsible for technical, scientific, and administrative tasks related to the implementation of REACH.

PFAS (per- and polyfluoroalkyl substances), often called "forever chemicals," are a group of man-made chemicals that are used in various industries, including refrigeration and air-conditioning, firefighting foams, textiles, and electronics. Their persistence in the environment and the hazards to human health and the environment posed by substances in this group have led to growing concern and regulatory action, particularly in the EU. The EU has been considering stricter controls on PFAS for several years due to concerns about their environmental impact and health risks, including cancer, reproductive issues, and developmental problems.[7] Five European countries, namely Germany, the Netherlands, Denmark, Sweden and Norway have been working to develop a universal PFAS restriction (hereinafter referred to as “uPFAS”) proposal under REACH[8], with the aim to restrict their use across multiple sectors. In January 2023, a uPFAS proposal was published that aims to limit the use of all PFAS in the EU, with derogations and prolonged transition periods where alternatives are not yet available. The proposed restriction is seen as a landmark in chemicals regulation, as it would drastically limit the presence of these chemicals in industrial, consumer, and commercial products.

Fluorinated gases have been identified as significant contributors to climate change due to their high GWP and are a subset of PFAS used in refrigeration, air conditioning, and other industrial applications. According to the OECD[9], PFAS are defined as any chemical with at least a perfluorinated methyl (–CF_3) or methylene group (–CF_2–), without any H/Cl/Br/I atom attached to it, which also includes many fluorinated gases. However, due to their chemical structure, some F-gases such as HFC-23, HFC-32, HFC-134, HFC-152a are not PFAS according to the mentioned definition.

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[6] Link to RAC 77 minutes, Consensus on TFA opinion on the harmonized Classification for TFA p.5-6 https://echa.europa.eu/documents/d/guest/rac77_final_minutes_en

[7] European Environment Agency. „Emerging chemical risks in Europe — ‘PFAS’“, Dezember 2019. https://www.eea.europa.eu/en/analysis/publications/emerging-chemical-risks-in-europe.

[8] BAuA RIVM, NEA and Danish EPA, Annex XV restriction report - Proposal for a restriction of Per- and poly fluoroalkyl substances (PFAS).

[9] OECD (2021), *Reconciling Terminology of the Universe of Per- and Polyfluoroalkyl Substances: Recommendations and Practical Guidance*, OECD Publishing, Paris, https://doi.org/10.1787/e458e796-en.

Terms used in this study

To differentiate the partly overlapping scope of substances covered under the (i) EU-F-gas Regulation and (ii) the PFAS restriction proposal, the terms used in the context of this study should be clarified upfront. In the following, the term '**F-gas**' is used for substances regulated under the EU F-Gas Regulation. Fluorinated gases covered under the PFAS restriction proposal are referred to as '**Fluorinated gases**'.

The PFAS restriction proposal includes fluorinated gases. These chemicals are themselves or break down to substances that are part of the broad group of persistent substances with additional environmental and health concerns. The restriction proposal is currently in the process of being reviewed by ECHA's scientific committees, RAC and SEAC. The final opinions of the committees will be sent to the EU Commission, which will develop a final proposal which will be put to vote among the member states. There are differing views on the justification of the PFAS restriction including on how narrow or wide the derogations to the proposed restriction shall be, especially when balancing public health with industrial needs.

1.3 Scope of the study

This study assesses the overlap between the EU F-gas Regulation and the proposed universal PFAS restriction, with particular attention to the quantities of fluorinated gases affected by both frameworks.

Following discussions between the commissioning organizations Deutsche Umwelthilfe e.V. (DUH), European Environmental Bureau (EEB), International Chemical Secretariat (ChemSec), and the contractor (Öko-Recherche), and acknowledging existing studies[10] on alternatives to PFAS, it was agreed that the study shall assess the extent of the interplay of the EU F-gas Regulation and the latest PFAS restriction proposal, including concerned volumes and evidence to further substantiate the argumentation for enhanced restriction of Fluorinated gases.

[10] Glüge, Juliane, Katharina Breuer, Armin Hafner, Christian Vering, Dirk Müller, Ian T. Cousins, Rainer Lohmann, Gretta Goldenman, und Martin Scheringer. „Finding Non-Fluorinated Alternatives to Fluorinated Gases Used as Refrigerants". *Environmental Science: Processes & Impacts* 26, Nr. 11 (2024): 1955–74. https://doi.org/10.1039/D4EM00444B.

2 Methodology

Assumptions on future (in the year 2030) refrigerant mix for sales of new stationary and mobile RACHP equipment have been made based on diverse assessments conducted under relevant activities, most prominently the compilation of the Evaluation[11] and Impact Assessment[12] for the EU Commission's preparation of Regulation (EU) 2024/573. The F-gas demand (including quantities used for manufacturing of equipment ("first fill") + quantities used to service & maintain existing equipment) of substances in the relevant sectors shown in the results section and Annex 5.1 were derived from results contained in the before-mentioned Evaluation and Impact assessment studies and RACHP sector demand studies based on a data cut-off of February 2025[13].

Figures and quantities on the demand of F-gases shown throughout this section reflect the volumes that would be on the market without the uPFAS restriction and as such this can be seen as a baseline situation. The quantities shown take into account previous assessment work conducted in the context of the review of Regulation (EU) 517/2014 and the preparation of the Impact Assessment that supported the preparation of Regulation (EU) 2024/573, thereby largely reflecting assumptions and impacts of the new EU F-gas Regulation. However, the final F-gas Regulation includes certain additional placing-on-the-market prohibitions and a revised HFC phase-out schedule that were not fully reflected in the Impact Assessment. Consequently, the projected demand may be higher or lower for certain applications than under the final regulatory framework.

3 Comparing the scope of the EU F-gas Regulation and the PFAS restriction proposal

3.1 PFAS covered under the EU F-gas regulation

Annex IV of the current EU F-gas Regulation (listing 'placing on the market prohibitions') includes some provisions that extend the scope from the use of HFCs (indicating GWP thresholds for certain applications) to "other F-gases" covered in Annex II[14] and III[15] compared to the scope of Regulation (EU) 517/2014. For the use of fluorinated gases, this has a direct effect for four specific applications, where the use of any F-gases (including HFOs but also non-PFAS gases such as R32) is prohibited for the placing on the market of new cooling equipment. Years in which these provisions generally apply to F-gases are indicated with "F-gas ban" (grey cells). In the following Figure 1, the placing on the market bans are summarised.

[11] Birchby et al. Evaluation Final Report, March 2022, URL: https://climate.ec.europa.eu/document/download/10d7525b-37e1-4a74-92fc-a7d9666217e5_en?filename=f-gas_evaluation_report_annexes_en.pdf

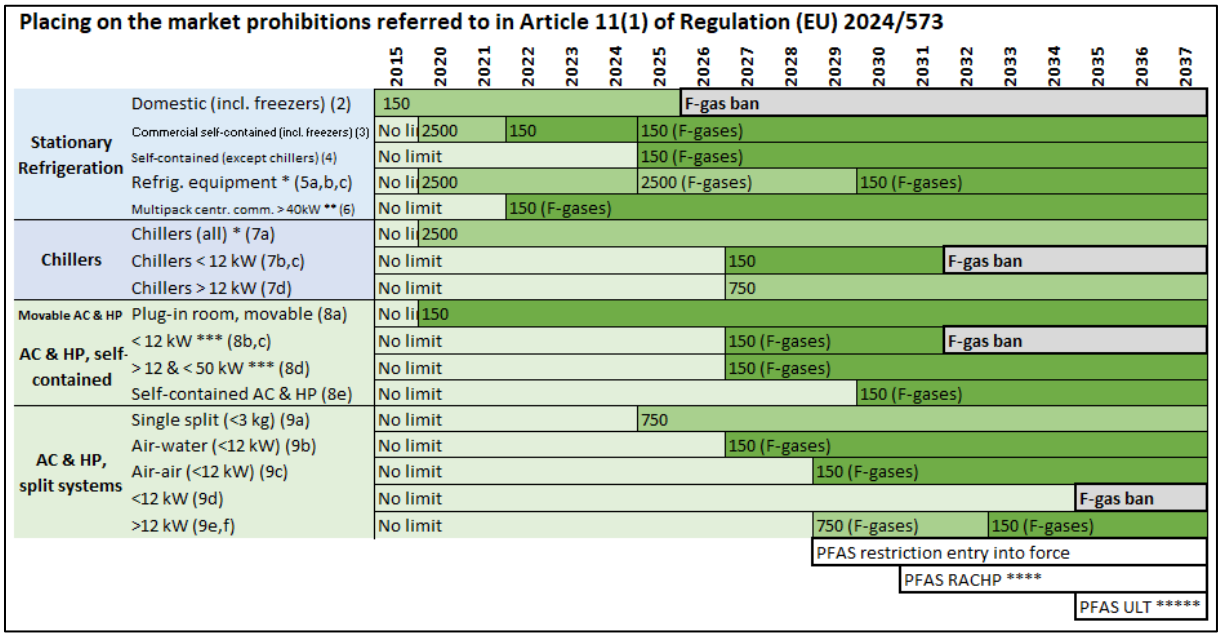
[12] Gschrey et al. Impact Assessment Final Report, March 2022, URL: https://climate.ec.europa.eu/document/download/a1e51d06-28be-4415-bb33-270d9932fa51_en?filename=f-gases_external_preparatory_study_en.pdf

[13] Including comprehensive market assessments compiled by Japan Refrigeration and Air Conditioning Industry Association (JRAIA) and Building Services Research and Information Association (BSRIA).

[14] Including: Section 1: Unsaturated hydro(chloro)fluorocarbons, Section 2: fluorinated substances used as inhalation anaesthetics and Section 3: other fluorinated substances.

[15] Including Section 1: Fluorinated ethers, ketones and alcohols, and Section 2: Other fluorinated compounds.

Figure 1: Overlap between EU F-gas regulation and PFAS proposal concerning stationary RACHP applications covered. Threshold figures listed for certain years indicate the entry into force of placing on the market prohibitions for stationary RACHP equipment pursuant to the Regulation (EU) 2024/573. The figure indicates periods without GWP-based placing-on-the-market prohibitions ("No limit"), GWP thresholds of 150, 750 and 2,500, and subsequent bans covering all F-gases irrespective of GWP. PFAS restriction entry into force in 2028 is an assumption.



Note: except ultra-low temperature equipment (below – 50 °C)*
*** Except cascade systems: GWP 1500*
**** If safety requirements do not allow, GWP: 750*
***** PFAS ban in stationary RACHP (except ultra-low temp)*
****** PFAS ban in stationary ultra-low temp RACHP*

3.2 Quantitative assessment of fluorinated gases affected by the PFAS restriction proposal

3.2.1 Total F-gas Demand and PFAS Share

The demand projections presented in this section are based on the methodology described in Section 2 and largely reflect the assumptions and expected impacts of Regulation (EU) 2024/573. Due to some extent of divergence of underlying assumptions made under the preparatory Evaluation and Impact Assessment documents compared to the final legal document of the F-gas Regulation (specifically some additional placing on the market bans and a different HFC phase down schedule), demand shown in this report could be higher or lower for certain applications.

Demand in CO_2 Equivalents

Figure 2 illustrates the projected demand for fluorinated gases within the scope of the proposed PFAS restriction ("In Scope") and F-gases outside its scope ("Not in Scope"), such as HFC-32 and HFC-152a, taking into account the current EU F-gas Regulation (see Section 2). The graph on the left-hand side (a) shows the evolution of total F-gas demand expressed in Mt CO_2 eq, indicating a reduction of more than 90% between 2025 and 2050. This substantial decline reflects the expected impact of the HFC phase-out and relevant placing-on-the-market

prohibitions under the EU F-gas Regulation. However, a reduction in CO_2-equivalent demand does not necessarily imply a corresponding reduction in the quantities of fluorinated gases used, particularly where high-GWP substances are replaced by lower-GWP alternatives that remain within the scope of the proposed PFAS restriction.

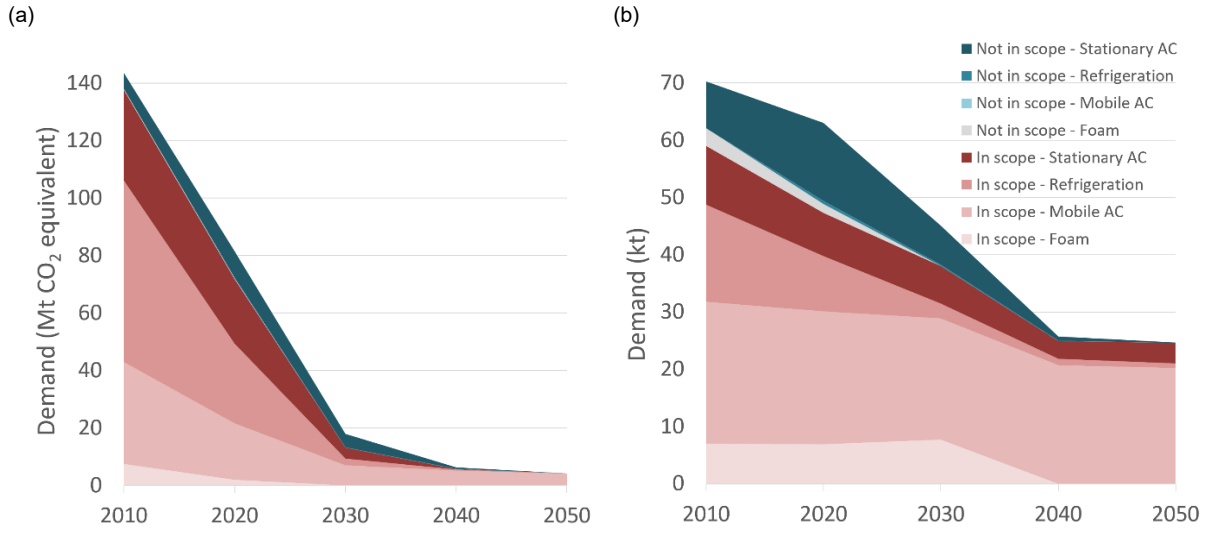
Remaining Demand in Kilotonnes

In the graph shown on the right-hand side (b), demand is expressed in kilotonnes (kt), without taking into account the GWP of individual substances. Although the absolute demand for fluorinated gases within the scope of the proposed PFAS restriction is projected to decline from approximately 41 kt in 2025 to 25 kt in 2050, substantial quantities are expected to remain in use under the EU F-gas Regulation. At the same time, their share of total F-gas demand increases from 75.1% in 2020 to 99.8% in 2050. This increase can largely be attributed to the declining demand for non-PFAS HFCs with intermediate GWP, particularly R-32 (GWP 675), as a result of the HFC phase-out and relevant placing-on-the-market prohibitions under the EU F-gas Regulation.

The distribution of demand across applications is also projected to shift substantially. In 2020, mobile air-conditioning accounted for 49.1% of total F-gas demand, followed by refrigeration (28.7%) and stationary air-conditioning (16.0%). By 2050, mobile air-conditioning is projected to account for 82.0% of total F-gas demand, followed by stationary air-conditioning (14.5%) and refrigeration (3.5%), highlighting the increasing dominance of mobile air-conditioning in the remaining F-gas market.

Despite declining overall demand, PFAS fluorinated gases are projected to dominate the remaining EU F-gas market by 2050.

Figure 2: Projected demand for fluorinated gases within and outside the scope of the proposed universal PFAS restriction in the EU27, 2010–2050, accounting for the EU F-gas Regulation but excluding the proposed PFAS restriction. (a) Demand expressed in Mt CO_2 equivalent; (b) demand expressed in kt.



3.2.2 Implications of the EU F-gas Regulation for PFAS Fluorinated Gases

To better understand the remaining demand for PFAS fluorinated gases, the following section examines the four applications in which the current EU F-gas Regulation prohibits the use of all F-gases, including both HFCs and HFOs, subject to the conditions and exemptions outlined in Annex IV:

1. **Domestic refrigerators** (including freezers, ban of F-gases from 2026 onwards), the conversion to natural refrigerants in the EU has been performed in the 1990s. No noticeable effect of the new F-gas ban.
2. **Chillers** (primarily cooling a heat transfer fluid i.a. for refrigeration & AC)[16] with a capacity below 12 kW (ban of all F-gases from 2032 onwards). Chillers < 12kW that shall be installed inside buildings, are currently using the halogen-free 'natural refrigerant' propane (R290) (if safety requirements allow), HFO-1234ze (if increase in size of installation can be tolerated) or R513A (GWP 629 containing HFO-1234yf/HFC-134a - 56/44% by mass). Here, the F-gas ban will have an effect on future use of fluorinated gases.
3. **Self-contained AC[17] & HP[18]** equipment with a capacity below 12 kW (ban of all F-gases from 2032 onwards). Self-contained equipment is factory-made and no gas-containing parts are connected on site (e.g. monoblock HPs currently widely installed in domestic buildings in the EU or movable 'plug-in' AC units). Systems for example include self-contained (monoblock) heat pumps for the use in domestic buildings where transition to natural refrigerants, specifically propane (R290), is well underway and likely to be completed in the short-term.
4. **Split AC & HP systems** with a capacity below 12 kW (ban of all F-gases from 2035 onwards). Split equipment refers to a system that consists of a number of refrigerant piped units that form a separate but interconnected unit, requiring the installation and connection of refrigerant circuit components at the point of use. Most prominently this includes smaller single air-to-air AC equipment where the use of F-gases with a GWP >150 will be prohibited from 2027 onwards. Noting that technology suppliers appear to consider the use of R290 (propane) over low GWP blends <150, an additional emission reduction from this application appears unlikely.

Taken together, the technological transition towards non-halogenated refrigerants has already largely taken place or is well underway in the four applications where the use of all F-gases will be prohibited. Therefore, the additional F-gas bans contained in the F-gas Regulation are expected to have only a limited effect on further reducing the use and emissions of F-gases in these applications, with the exception of chillers with a capacity below 12 kW[19].

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[16] As defined in Article 3 of the EU F-gas Regulation, 'chiller' means a single system whose primary function is to cool a heat transfer fluid (such as water, glycol, brine or CO2) for refrigeration, process, preservation or comfort purposes.

[17] As defined in Article 3 of the EU F-gas Regulation, systems treating air to meet the requirements of a conditioned space by controlling its temperature, humidity, cleanliness or distribution.

[18] As defined in Article 3 of the EU F-gas Regulation, means a piece of equipment capable of using ambient heat or waste heat from air, water or ground sources to provide heat or cooling

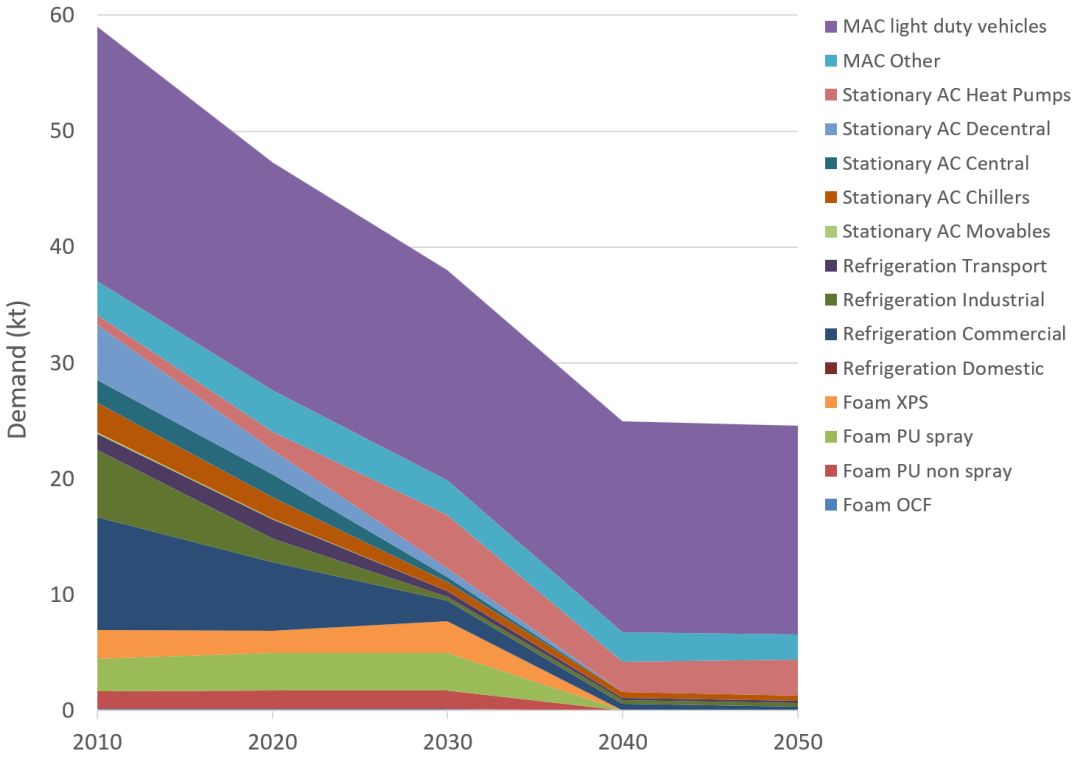
[19] Quantification of this portion of the F-gas demand for chillers <12kW is hardly possible due to the specific architecture of the sectors as considered under the Evaluation and Impact Assessment work conducted in the context of the preparation of Regulation (EU) 2024/573.

3.2.3 Projected Demand for PFAS Fluorinated Gases by Application

Application-specific projections of the demand of fluorinated gases (subject to the PFAS restriction proposal) are shown in Figure 3, which shows continued demand of PFAS under the EU F-gas Regulation (see also Table 1 in the Annex). As shown above, the projected **demand of "In scope" fluorinated gases** remains considerable under the regime of the EU F-gas Regulation. In more detail, the demand for fluorinated gases (largely HFO-1234yf and some HFC-134a) in mobile air-conditioning in passenger cars (referred to as "category M" under Directive 2006/40/EC) and light-duty vehicles (category "N1") accounts for the lion's share of total demand for fluorinated gases within the scope of the proposed PFAS restriction in 2030, at approximately 48%. The second-largest contributor is heat pumps, accounting for approximately 12% of this demand in 2030.

By 2050, mobile air-conditioning in passenger cars and light-duty vehicles is projected to account for an even larger share of total demand for PFAS fluorinated gases, reaching approximately 73% (18.05 kt). This demand is predominantly driven by HFO-1234yf, which remains the main refrigerant used in these applications. Heat pumps represent the second-largest individual application, accounting for around 13% (3.15 kt). Together, these two applications account for approximately 86% of total projected demand in 2050 (24.60 kt).

Figure 3: Projected demand for fluorinated gases within the scope of the proposed universal PFAS restriction in the EU27 from 2010 to 2050, broken down by application. The projections take into account the EU F-gas Regulation but exclude the proposed PFAS restriction. MAC (other) includes buses, trucks (N2 and N3), metro, rail, trams, and cargo and passenger ships. XPS = extruded polystyrene; PU = polyurethane; OCF = one-component foam. Demand is expressed in kilotonnes (kt).



4 Conclusion

The assessment demonstrates that the EU F-gas Regulation, while substantially reducing the climate impact of fluorinated greenhouse gases, does not comprehensively address the continued use of fluorinated gases covered by the proposed universal PFAS restriction.

Under the modelled baseline scenario, which accounts for the EU F-gas Regulation but excludes the proposed PFAS restriction, annual demand for fluorinated gases within the scope of the PFAS restriction is projected to decline from approximately 41 kt in 2025 to 25 kt in 2050, a reduction of around 40%. Substantial quantities would therefore continue to be used over the coming decades, particularly in mobile air-conditioning and heat pump applications.

These findings highlight the complementary objectives of the two regulatory frameworks. While the F-gas Regulation primarily addresses climate impacts, the proposed PFAS restriction seeks to address risks associated with the persistence of PFAS and their degradation products, including trifluoroacetic acid (TFA).

Consequently, the F-gas Regulation alone cannot be expected to achieve a comprehensive reduction in the use of PFAS fluorinated gases. Their inclusion in the universal PFAS restriction is therefore important to address environmental concerns not adequately covered by existing climate legislation.

5 Annex

5.1 Future demand of fluorinated gases

Table 1. Projected demand for fluorinated gases within the scope of the proposed universal PFAS restriction in the EU27, 2020–2050, broken down by application. The projections take into account the EU F-gas Regulation but exclude the proposed PFAS restriction. Demand is expressed in kilotonnes (kt). The methodology is described in Section 2.

Application of fluorinated gases	**2020**	**2025**	**2030**	**2040**	**2050**
Mobile AC	**23.22**	**21.86**	**21.15**	**20.72**	**20.18**
Passenger cars & light duty	19.70	18.65	18.18	18.21	18.05
Other	3.51	3.20	2.97	2.51	2.13
Stationary AC	**7.57**	**6.10**	**6.55**	**3.13**	**3.56**
Heat Pumps	1.59	2.48	4.56	2.62	3.15
Decentral	2.11	1.11	0.82	0.00	0.00
Chillers	1.84	0.92	0.74	0.50	0.41
Central	2.00	1.58	0.42	0.01	0.00
Movables	0.03	0.01	0.00	0.00	0.00
Refrigeration	**9.63**	**6.07**	**2.63**	**1.08**	**0.85**
Commercial	5.90	3.42	1.81	0.60	0.33
Industrial	2.07	1.40	0.29	0.30	0.33
Transport	1.65	1.25	0.53	0.18	0.20
Domestic	-	-	-	-	-
Foam	**6.89**	**7.30**	**7.71**	**-**	**-**
PU spray	3.28	3.28	3.28	-	-
XPS	1.91	2.32	2.73	-	-
PU non spray	1.56	1.56	1.56	-	-
OCF	0.14	0.14	0.14	-	-
Total	**47.31**	**41.32**	**38.03**	**24.94**	**24.60**

Note: The projected demand for fluorinated gases in foam applications is assumed to cease from 2033 onwards, reflecting the placing-on-the-market prohibition under Annex IV, point 17(c), of Regulation (EU) 2024/573, subject to exemptions for safety requirements.