Brussels, 31 March 2021

EPEE Position Paper on the REACH restriction proposal of all per- and polyfluoroalkyl substances (PFAS)

Introduction

EPEE, representing the refrigeration, air-conditioning and heat pump industry in Europe, has been following with interest the recent call for evidence by the Netherlands, Germany, Norway, Sweden and Denmark related to a possible REACH restriction proposal to limit the risks to the environment and human health from the manufacture and use of all per- and polyfluoroalkyl substances (PFASs). EPEE understands that the above-mentioned Member States Competent Authorities (MSCAs) are currently working on an analysis for PFASs in the context of a regulatory management option analysis (RMOA), with Norway having the lead on fluorinated gases (F-Gases).

As major downstream users of hydrofluorocarbons (HFCs), hydrofluoroolefins (HFOs) and hydrochlorofluoroolefins (HCFOs) in refrigeration, air-conditioning and heat pumps, EPEE members wish to share their views about a possible inclusion of F-Gases in a broad-PFAS restriction proposal, as this could lead to significant unintended consequences and seriously jeopardise the European and international climate and energy goals.

Executive Summary

In this paper, EPEE will substantiate the claim that it would be counter-productive to address F-Gases in the context of a REACH restriction proposal. EPEE strongly recommends addressing all F-Gases, including HFOs, solely under the F-Gas Regulation as the most suitable framework, taking into account safety, energy efficiency, environment and health.

In particular, EPEE considers that:

- Including F-Gases in a broad PFAS REACH restriction proposal could have unintended consequences as the term PFAS as such does not identify if a substance is harmful or not and represents an overgeneralisation which is problematic.
- Restricting F-Gases via REACH would lead to double regulation and jeopardise the F-Gas Regulation – one of the most successful climate regulations in the EU.
- Restricting F-Gases and more specifically HFCs and HFOs in Europe would create a climate of uncertainty and jeopardise the major climate benefits of the Kigali Amendment to the Montreal Protocol.
- Lower Global Warming Potential (GWP) HFCs and HFOs are essential to decarbonise the heating and cooling sector in a safe, reliable and cost-efficient way.

1. F-Gases are already successfully addressed by the F-Gas Regulation

The F-Gas Regulation provides a robust framework to address F-Gases. It is geared towards preventing emissions, reducing the consumption of F-Gases and restricting them in specific applications whenever possible from a technical, economic feasibilty and health and environmental perspective. Within this context, additional restrictions under REACH would be disproportionate, hamper competitiveness and innovation as compared to the goals already pursued by the F-Gas Regulation.

a. The application of the current legal framework:

The first 2006 F-Gas Regulation was successful in stabilising F-Gas emissions – which would otherwise have grown significantly – through emission control/leakage measures and limited use restrictions. Its 2014 revision went even further and introduced additional measures such as the HFC phase-down and several sectoral GWP limits.

The spirit of the F-Gas Regulation is to prevent the emissions of F-Gases – in other words, to contain them in the equipment and to ensure that they do not reach the atmosphere. All measures, including leak detection, the ban to vent F-Gases at the end of lifetime of equipment, recovery, recycling and reclamation of gases, prohibition of disposable containers, certification and training of installers, have been geared towards achieving that objective. In addition, the 2014 F-Gas Regulation introduced several bans and the HFC phase-down in order to further reduce potential F-Gas emissions.

For example, already in the first F-Gas Regulation, F-Gases (HFCs and PFCs) have been completely banned since 2006 in footwear, and from 2007 in windows and tyres, etc. The 2014 F-Gas Regulation further extended the list of bans and added a significant number of additional restrictions. In addition, since it was not considered possible to replace F-Gases or define GWP limits in all types of applications, the HFC phase-down was introduced, which gradually reduces the consumption of HFCs while leaving the required flexibility to the market to adapt.

b. A successful approach:

The results of this approach have been highly successful, and demonstrate that EU legislation on F-Gases is well in line with the European Green Deal's climate ambition. By 2030, it is expected that F-Gas emissions will be reduced by two-thirds compared to 2014 levels on a tonnes of CO_2 equivalent basis. The expected cumulative emission savings are 1.5 Gigatonnes of CO_2-equivalent by 2030 and 5 Gigatonnes by 2050.

To achieve these significant savings, lower GWP HFCs and HFOs play an essential role. For safety and energy efficiency reasons (*see also Chapter 2*), non-fluorinated alternatives are not suitable for all uses and the HFC phase-down provides the required flexibility to the market to select the best suited refrigerants for a given application from a safety, technical feasibility, efficiency, environmental and cost perspective.

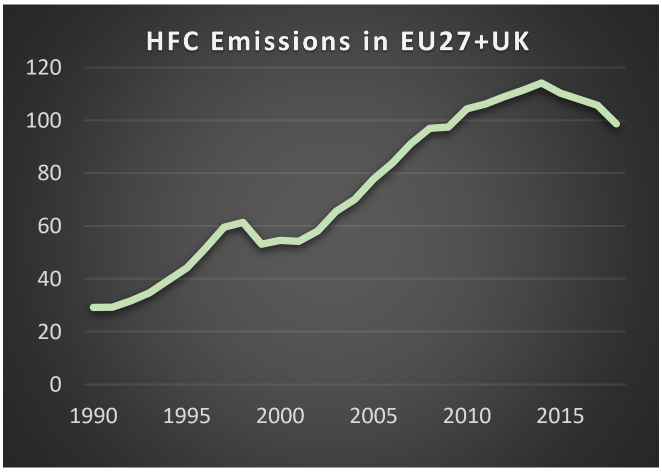

Figure 1: HFC Emissions in EU27 + UK; EEA Greenhouse Gas Data Viewer (in mT CO2-eq)

The 2006 and 2014 F-Gas Regulations have reversed the HFC emission trend in Europe. Since 2014, emissions have started to decrease significantly – despite growing demand for heating and cooling – which is a clear sign that the approach taken is bearing fruit.

c. Lower GWP HFCs and HFOs are essential to achieve the Kigali Amendment to the Montreal Protocol:

Restricting HFCs and HFOs in Europe would create a climate of uncertainty and jeopardise the major climate benefits of the Kigali Amendment to the Montreal Protocol.

In the context of the F-Gas Regulation, the EU was pioneering in helping to achieve the Kigali Amendment to the Montreal Protocol, which is expected to avoid up to 0.4°C of global warming by 2100. As developing countries are preparing their Kigali HFC phase-down management plans (KPMPs), lower GWP HFCs and HFOs will have a major role to play to achieve the phase-down objectives. Restricting F-Gases via REACH in the EU could therefore also jeopardise the achievement of the Kigali Amendment internationally and its significant benefits for the climate.

d. The risks of a double regulation under REACH:

The restriction under REACH is designed to manage risks that are not addressed by other REACH processes or by other Union legislation.

Therefore, restricting F-Gases via REACH would not only jeopardise the successful implementation of the F-Gas Regulation but also lead to overlapping regulatory frameworks, a double regulation. This could raise confusion among the market actors, thereby jeopardising the expected emission savings and creating a disproportionate burden for industry and users, in particular for SMEs who are already struggling with the transition towards lower GWP refrigerants.

Indeed, pursuant to the EU's principle of proportionality, the measures concerned should be appropriate for attaining the legitimate objectives pursued by the EU legislation, without going beyond what is necessary for attaining that same objective. A REACH restriction as the most extreme measure, if broadly applied to all PFAS including F-Gases, would risk being disproportionate, also in light of the fact that the F-Gas Regulation already addresses F-Gas restrictions. Indeed, the F-Gas Regulation is the most proportionate instrument to cover F-Gases, and its effective provisions should apply to all F-Gases, including HFOs.

2. F-Gases are essential for the safe operation of RACHP equipment

F-Gases were originally introduced due to their excellent safety features which made them more reliable and safe to use as refrigerants when compared to highly flammable, highly toxic or high-pressure alternatives. While the situation is continuously evolving, there are still safety limitations associated with the use of many non-fluorinated gases. This is also why F-Gases are essential for the safe and reliable operation of RACHP equipment.

The EU General Product Safety Directive, Low Voltage Directive, Machinery Directive and Pressure Equipment Directive require equipment manufacturers and importers to place safe products on the EU market. This applies not only to the use phase but to the whole life cycle of the equipment (including manufacturing, installation, servicing, decommissioning, and end of life treatment).

a. Absence of mandatory certification scheme for the use of refrigerants:

There is no mandatory certification scheme in the EU for the installation, servicing, decommissioning and end of life treatment of non-fluorinated refrigerants many of which are highly flammable. A recent study by AREA, the European association of refrigeration, air conditioning and heat pump (RACHP) contractors, shows that out of all EU F-Gas certified installers, only between 3.5% and 7% are trained to use alternatives to F-Gases, which demonstrates that the market is far from being ready to use these as default solution.

b. Safety during installation, servicing, decommissioning and end of life treatment

Safety during installation, servicing, decommissioning and end of life treatment falls under the ATEX "Workplace" Directive 1999/92/EG. This means an installation, servicing or waste treatment company has the duty to protect the safety of its employees, even if the company is self-employed. Since it is a Directive, the implementation at national level may not be the same in all countries. Despite precautions, it will be impossible to reduce the risks to zero when flammable products are used due to possible human errors. Recent accidents have demonstrated that even well qualified people can make mistakes. In the case of highly flammable refrigerants such as hydrocarbons, such accidents have serious consequences. F-Gases have been used for decades and due to their characteristics pose a lower risk when compared to hydrocarbon alternatives.

3. Heating and Cooling are essential to achieve carbon neutrality by 2050

Lower GWP HFCs and HFOs are essential to decarbonise the heating and cooling sector in a safe, reliable, and cost-efficient way.

More than three quarters of all greenhouse gas emissions in Europe are related to CO_2 from energy production and consumption. Heating and cooling represent 50% of the final energy consumption in Europe, and 80% of the energy consumed in buildings is for heating, cooling and hot water. Therefore, there is no doubt that addressing heating and cooling is essential to achieve carbon neutrality by 2050. The European Commission's recent impact assessment lays out several pathways in that sense, where the "Energy Efficiency First" principle (EE1), electrification of the heating sector and increasing the share of renewables in heating and cooling are explicitly mentioned as key avenues. Heat pumps, whether residential or industrial, in buildings or powering district heating and cooling systems, will have a major role to play, as will thermal storage, waste heat recovery and demand side flexibility.

a. F-Gases remain crucial to tap into the full abatement potential of heat pumps:

It is foreseen that by 2050, up to 15% of the entire EU heating demand will need to be delivered by large heat pumps connected to district heating systems. Large heat pumps represent a pivotal element as they facilitate the transition to renewable energies and hence decarbonisation, by providing flexibility in terms of electricity consumption, heat storage at appropriate time slots depending on supply and demand of energy. Such large heat pumps, particularly when situated close to residential areas, are not suited to run on non-fluorinated refrigerants due to safety concerns and constraints in terms of energy efficiency. Recent heat pump technology developments have shown a clear preference for HFO refrigerants due to their good energy efficiency and ultra-low GWP

Lower global warming potential (GWP) fluorinated refrigerants including HFCs and HFOs are essential to operate heat pumps and other vapour compression-based technologies in a safe, cost-effective, technically feasible, energy-efficient, and reliable way. Restricting them via REACH would be counter-productive and jeopardises the achievement of European and international energy and climate goals.

b. EPEE early modelling results underpin 2014 F-Gas Regulation

In 2012, EPEE commissioned a study to SKM Enviros. In this study, the refrigeration, air-conditioning and heat pump (RACHP) market was modelled using 7 main sectors and 43 sub-sectors. This large number of sub-sectors ensured that the varying conditions of the RAC market were fully considered. For each sub-sector, a “standard current system” was defined. Key characteristics were identified including current market size, rates of market growth, refrigerant charge and leakage rates, energy efficiency and capital cost. Alternative refrigerants that could be used in each sub-sector were evaluated. The impact of each alternative was assessed in terms of energy efficiency, capital and operating costs and any potential barriers to use (e.g. safety legislation and the relevant norms and standards). Fourteen different refrigerants were considered as alternatives to the relevant HFCs in current use.

The results clearly show that it is impossible to completely phase-out F-Gases, and that next to non-fluorinated gases also F-Gases with lower GWP and HFOs would be needed to achieve the phase-down targets. However, they also show that certain gases can be more easily addressed than others. For example, the study indicated that phasing down consumption of high GWP R-404A can deliver early and deep cuts since there were already alternatives available for this high GWP refrigerant in virtually all types of new equipment. Reality has confirmed the assumptions of the study and the 2014 F-Gas Regulation includes indeed restrictions in that sense under Annex III. Again, the 2014 F-Gas Regulation reflects that finding (for more information, please consult the study).

c. EPEE is currently updating its modelling with Gluckman Consulting

EPEE has extended its modelling work with Gluckman Consulting to include emissions related to energy use when operating heating and cooling systems. The results have not been finalised yet and are therefore not available at this point in time. However, EPEE would like to share a graph derived from the ongoing modelling work, which gives an indication of the trend as well as of the importance of reducing energy related emissions and the key role of heat pump technologies to achieve carbon neutrality by 2050.

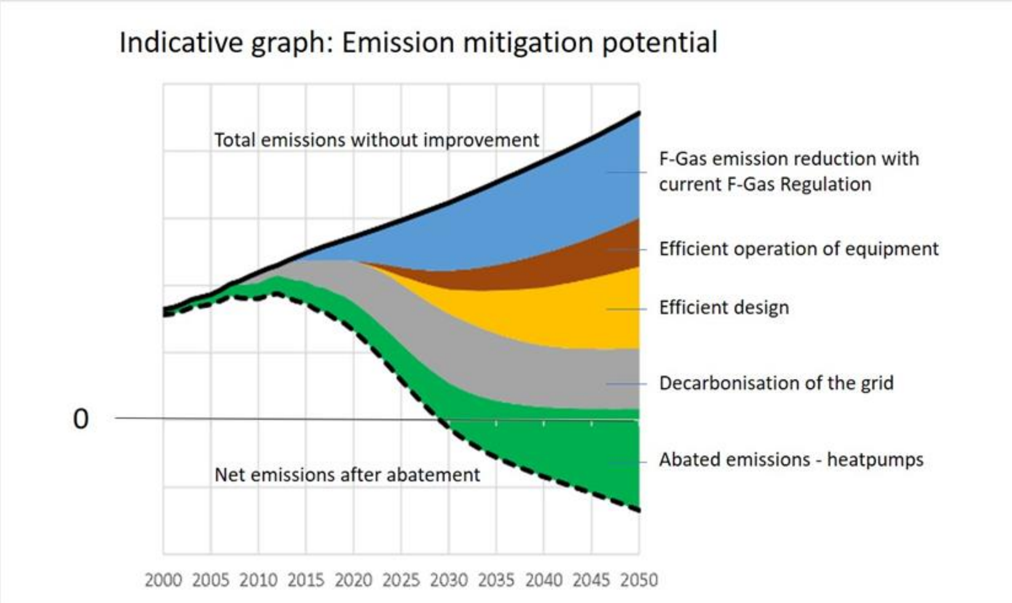

Figure 2: Emission mitigation potential in relation to different areas.

The wedges of the graph indicate the relative emission mitigation potential by abatement measure, including direct emissions related to refrigerants and indirect emissions related to energy production and consumption. The solid upper line indicates how total emissions would have evolved with a business-as-usual scenario, whilst the dotted lower line shows the total abatement potential. The negative emission offset (green wedge) is generated by heat pumps as they facilitate the move away from fossil fuel-based technologies.

Key messages:

- Carbon neutrality can only be achieved with a combination of measures, including the reduction of direct F-Gas emissions via the F-Gas Regulation, improved operation, control and maintenance, improved efficiency of new equipment, reduced cooling demand and decarbonisation of the grid.
- Heating is currently still mainly based on fossil fuels. Heat pumps play a crucial role in decarbonising heating, potentially creating a large "negative emission offset".
- To ensure the broad deployment of heat pumps, all types of refrigerants will be needed, including lower GWP HFCs and HFOs to provide safe, reliable, and cost-efficient solutions adapted to application and local circumstances.

Conclusions

There is no doubt that the transition towards refrigerants with a lower GWP is making excellent progress in all types of applications. The main driver for this transition is the HFC phase-down as stipulated by the 2014 F-Gas Regulation. Given that the transition is happening and that the introduction of lower GWP F-Gases has already been making a significant contribution to achieving the phase-down steps, EPEE strongly recommends to focus on adapting building and fire safety codes, safety standards and training and certification measures to facilitate the increased use of non-fluorinated refrigerants which are often highly flammable rather than introducing artificial and additional bans through REACH, which risk to create disproportionate measures, undermine the aim of existing legislation which already regulates F-Gases in a comprehensive way and would, therefore, very likely lead to confusion in the market, entailing a high risk of unintended consequences.

EPEE would therefore like to reiterate its strong support for the F-Gas Regulation and its current provisions, emphasising that HFC emissions have been decreasing since 2014 and that the phase-down has driven the transition to lower and low GWP refrigerants. **EPEE therefore strongly recommends addressing all F-Gases, including HFOs already in scope, solely under the F-Gas Regulation since this is the most suitable framework, taking into account essentiality in the form of safety, energy efficiency, environment and health. Additional restrictions via REACH are counter-productive.**

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About EPEE

The European Partnership for Energy and the Environment (EPEE) represents the refrigeration, airconditioning and heat pump industry in Europe. Founded in the year 2000, EPEE's membership is composed of over 50 member companies as well as national and international associations from three continents (Europe, North America, Asia). With manufacturing sites and research and development facilities across the EU, which innovate for the global market, EPEE member companies realize a turnover of over 30 billion Euros, employ more than 200,000 people in Europe and also create indirect employment through a vast network of small and medium-sized enterprises such as contractors who install, service and maintain equipment. Please visit our website www.epeeglobal.org and www.countoncooling.eu for information about our sustainable cooling campaign.

ANNEX I
Simplified description of the RACHP sector

1. The refrigeration, air-conditioning and heat pump market (RACHP)

As demonstrated in the 2012 SKM Enviros study, the RACHP market is a very fragmented market: it can be split into at least 43 sub-sectors, where each of these sub-sectors has different characteristics including the type of technology used, the market size, rates of market growth, expected life-time, refrigerant type, charge and leakage rates, energy efficiency, capital cost, etc. (*please refer to Annex II of this paper for a detailed overview of the RACHP market).*

Technology	Typical applications	Factory built / on site	Installed base of systems by 2030 System capacity range Typical lifetime
Integral Systems *Small chilled or frozen retail display cabinets, bottle coolers, in-line drink coolers, vending machines, ice-makers, commercial storage…*	Food retail, restaurants, pubs, hotels, canteens,…	Factory built	Estimate: 16m 0,5 – 3 kW 15 years
Condensing Units *Small split refrigeration system to cool one or more retail display cases or cold rooms containing chilled or frozen products. Compressor and air-cooled condenser located remotely from evaporator that cools display cases or cold rooms*	Supermarkets, convenience stores, bakeries, butchers, flower shops, pharmacies, beer and wine cellars …	On site, often customised	Estimate:> 5m 1 – 20 kW 15 years
Central systems *Large multipack centralised systems, with 4 to 6 compressors in a factory built "pack" located in a plant room, connected to external air cooled condensers and to a number of retail display cabinets and sometimes storage*	Supermarkets, hypermarkets	Factory built / On site	Estimate: 0.5m 20 – 200 kW 15 years

Table 1: Overview commercial refrigeration

The example of **Commercial Refrigeration** demonstrates the vast variety of applications, even within one segment. For example, a hypermarket operator will have different requirements from a flower shop owner, the technologies used are different and the type of contractor working on the installation will differ as well. In the case of a flower shop, the condensing unit will not get much attention (it will probably run until there is a failure), and it will be installed by a small or very small installer company (often family owned). In case of the hypermarket, the central system will be at the heart of the market's operation and installation will be taken care of by in-house specialised personnel or by a bigger installer company structure.

Other sub-sectors have similar challenges. For example, chillers are used to service critical infrastructure such as data centres and hospitals. In these applications, technologies require the ability to service different operating conditions, system sizes and other site-related criteria such as safety. For these systems, different refrigerant fluids must be used and have different properties. The nature and size of these systems often require on-site maintenance personnel, or higher levels of maintenance that help to prevent emissions.

2. The value chain

Given the complexity of the RACHP market, the value chain is fragmented as well, with different actors, depending on the application segment. **The following, simplified drawing illustrates three key messages:**

1. A refrigerant manufacturer / blender has little overview on the end-user to whom the refrigerant is eventually sold.
2. The value chain is dominated by a vast number of key actors, many of them being SMEs (installers).
3. OEMs, component manufacturers and installers are the main specifier of what gases will be used in which application.

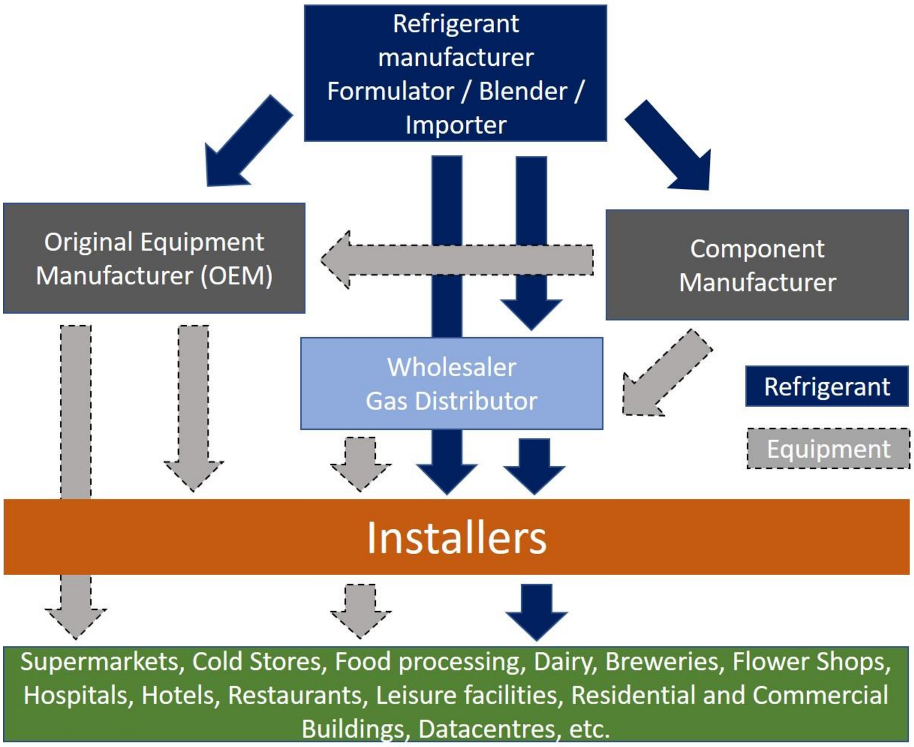

Figure 3: Simplified overview of the RACHP value chain

3. The waste stream

The F-Gas Regulation prohibits the intentional release of F-Gases and stipulates mandatory recovery at end of life and when RACHP equipment is serviced or converted to another refrigerant (retrofit). With the HFC phase-down in place, and HFCs – consequently – getting more and more expensive, recovery, recycling and reclaim[1] of used F-Gases is increasingly important and contributes significantly to reducing emissions. Adequate waste management is therefore an important and well-established element of the RACHP sector.

Installers, together with the gas distributors play a key role in refrigerant waste stream management. Furthermore, for the end of life of equipment containing refrigerants (e.g. domestic refrigerators) a dedicated waste stream management is required under the WEEE Directive and the ELV Directive (e.g. for air-conditioning systems in cars).

[1] EU 517/2014, Art.2: 'recovery' means the collection and storage of fluorinated greenhouse gases from products, including containers, and equipment during maintenance or servicing or prior to the disposal of the products or equipment; 'recycling' means the reuse of a recovered fluorinated greenhouse gas following a basic cleaning process; 'reclamation' means 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.

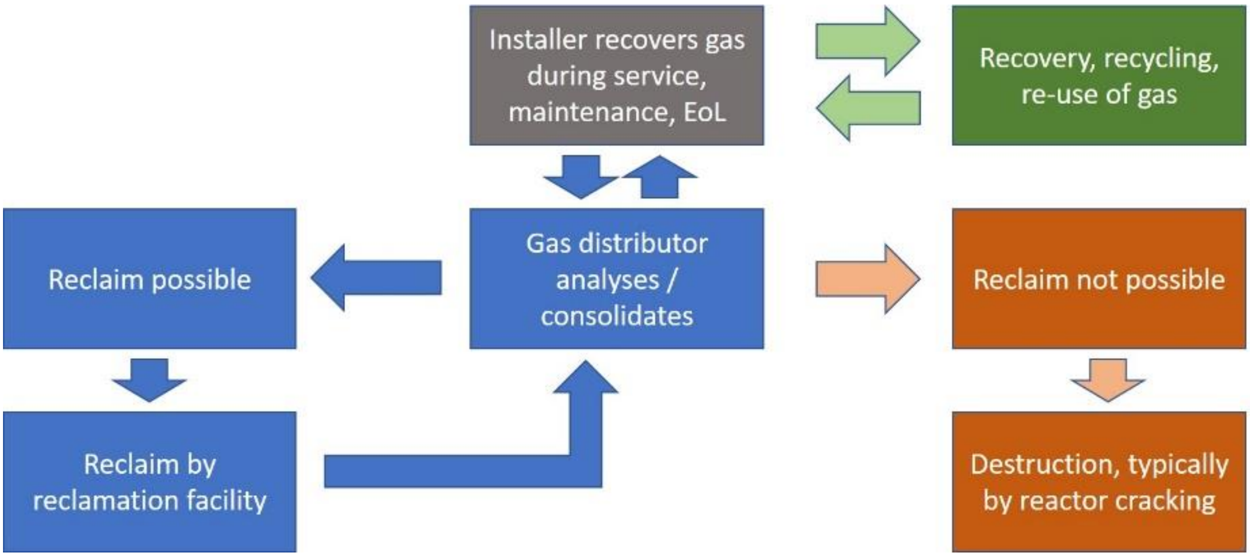

Figure 4: Simplified overview of the refrigerant waste stream

4. Refrigerants

In line with the complexity of the RACHP market and value chain, refrigerant choice depends on many different factors and what is true for one segment cannot be considered by default as true for another segment.

As a rule of thumb, market segments with technologies with small refrigerant charges that are pre-assembled, pre-charged with refrigerants and where the human intervention on-site is kept to a minimum typically move faster to non-fluorinated alternatives than those segments and technologies with higher refrigerant charges which are characterised by a high degree of customisation and installation work. This is due to the fact that non-fluorinated alternatives are typically either highly flammable, or highly toxic. Product standards such as IEC(EN) 60335-2-40 and IEC(EN) 60335-2-89 are intended to facilitate the use of flammable refrigerants but, since they are voluntary and not mandatory, they will not solve liability issues. Additionally, these standards limit the use of highly flammable refrigerants, e.g. propane to a max of just kg. or respectively 0.5kg. charge with risk mitigation measures.

Furthermore, according to a recent study by the European contractors' association AREA, only between 3.5% and 7% of installers are trained to use such gases. It is therefore not surprising that fluorinated refrigerants continue to dominate in many markets and that OEMs are cautious in terms of switching to alternatives.

The example of commercial refrigeration illustrates that refrigerant choice varies depending on technology and application. It also shows that the market moves towards alternatives whenever this is possible from a safety, energy efficiency and affordability perspective. For more detailed information on refrigerant types and market segments please refer to the 2012 SKM Enviros Study. Even if the market has evolved since then, it still indicates valid trends and characteristics of the segments and sub-segments.

	Integral Systems	Condensing Units	Central Systems
Flammable versus non-flammable refrigerants: A3 = high flammability A2L = lower flammability A1 = non flammable	A3 A2L A1	A3 A2L A1	 A2L A1
Fluorinated versus non-fluorinated	Both Hydrocarbons play an important role	Mainly fluorinated Small share of CO2	Both CO2 plays an important role
Explanation	Integral systems are small, hermetically sealed and are supplied pre-charged. They require little intervention by the installer on site.	Condensing units are small/medium split-type systems which are often assembled on site. The installers play an important role, in terms of design and installation on site.	Central systems are very large split type systems, assembled on site, but in an "industrial" way, designed and installed by specialised companies.

Table 2: overview refrigerant types in commercial refrigeration

5. Socio-economic aspects

There are hundreds of thousands of companies in Europe that are involved in the RACHP sector. They range from major OEMs, gas distributors and wholesalers through to tens of thousands of SMEs.
For example, in a country like France, there are roughly 34,000 installation companies certified according to the F-Gas Regulation, over 600 gas importers and distributors and over 100 manufacturers of pre-charged equipment. It can be assumed that the same sort of market structure is true for the rest of the EU-27, with SMEs broadly dominating the company landscape.

Indeed, according to Eurostat[2], SMEs represent 98.7% (a total of 23.5 million) of the overall enterprises in the EU-27. They employ about half of the workforce in Europe and contribute 44% of total value added to the economy. Roughly the same ratio can be expected in the overall RACHP sector with small companies (below 10 employees) dominating the installer base, which are a critical part at the bottom of the supply chain.

A REACH restriction on top of the F-Gas Regulation's restrictions and phase down would be disproportionate and simply eliminate a large number of these companies from the market, leading to major unemployment, less options for end users when it comes to installations and higher overall prices for products and installations, thus severely eroding the competitiveness of already vulnerable European companies. In addition, as mentioned already under point 4, only very few installers are currently trained for the use of non-fluorinated refrigerants which would further exacerbate this effect, increasing the risk of accidents.

[2] https://ec.europa.eu/eurostat/web/products-eurostat-news/-/WDN-20180627-1

Furthermore, the end users of RACHP equipment would be severely impacted, and again it would be predominantly SMEs. With a REACH restriction on F-Gases, they would no longer be able to repair equipment or to convert it to a lower GWP refrigerant (retrofit) in case of failure. Rather, they would need to scrap the old equipment and replace it by a new one since it is not possible to use flammable or high pressure or toxic refrigerants in systems which have not been designed for those hazardous properties. Not only would this come with a much higher cost, but it would also be against the principles of the circular economy, in relation to the generation of waste. As an example, there are 20,000 butchers and 45,000 bakery shops in Germany alone. These are sectors which are already struggling for survival in many cases due to competition from larger operations and in the context of the COVID-19 pandemic. The obligation to buy new equipment simply because the old one cannot be repaired any more could be the final straw.

Finally, the secondary effects of a failing RACHP system could lead to dramatic consequences. Coming back to the example of butchers and bakeries, it would lead to food waste and further increase the financial loss for the butcher. Lastly, an additional example concerns the low temperature applications to store products at temperatures below -50°C, which are required to store material for medical or biochemical use. For such applications there is still no viable alternative to replace F-Gases and the consequences would be dramatic. The list is of course much longer, and the total impact is certainly still dramatically underestimated.

ANNEX II
Simplified overview of the RACHP sector

Main markets	Residential refrigeration	• Food retail • Food service • Retail displays • Cool storage • Supermarkets • Hypermarkets	Transport of chilled and frozen food	• Food processing • Breweries • Warehouses • Milk cooling • Other industrial processes	Heating and Cooling for residential and commercial buildings	Heating and Cooling for residential and commercial buildings	Cooling for mobile applications
Technology based sub-segments	Refrigerators and freezers	• Integral systems chill • Integral systems frozen • Condensing Units chill • Condensing Units frozen • Central systems chill • Central systems forzen	• Vans, light trucks • Large trucks, ISO containers • Marine; merchant, fisihing	Direct Expansion Systems • Small, chill • Small, frozen • Mid-size, chill • Mid-size, frozen • Large, chill • Mid-size, frozen Industrial Chillers • Mid-size • Large Flooded Systems • Large, chill • Large,frozen	Integral Systems Split Systems • Small • Mid-size • Large • Ducted Roof-top Units • Small • Large VRF Systems • Small • Large	Chillers • Small • Mid-size • Large • Very large Hydronic Heat Pumps • Very small • Small • Mid-size • Large	• Cars, vans, cabs • Buses, trains • Cruise ships, ferries • Other surface ships, submarines
Main use Segments	Residential refrigeration	Commercial refrigeration	Transport refrigeration	Industrial refrigeration	Heat pumps using air as sink	Heat pumps Using water as sink	Mobile A/C

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