



Deutsche Umwelthilfe

Public Consultation
Inception Impact Assessment

September 2020

Strengthening the F-Gas Regulation to Address Hydrofluorocarbons and Sulphur Hexafluoride

The F-Gas Regulation is a landmark piece of European Union (EU) climate legislation for transitioning away from fluorinated gases such as hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF₆). After five years in force, the legislation is now being reviewed for improvement. This paper identifies several areas where the F-Gas Regulation requires revision to improve implementation, increase climate ambition as set out in the European Green Deal (EGD), and contribute significantly to the EU climate neutrality target.

I. Measures to Promote Compliance with the F-Gas Regulation

Accelerate the HFC Phase-Down Schedule. Following the adoption of the Kigali Amendment, the HFC phase-down schedule will need to be adjusted to meet the last step. At the same time, the current phase-down schedule does not take account of the demand reduction brought about by the service ban under Article 13, paragraph 3, which, from 1 January 2020, prohibits the use of fluorinated greenhouse gases, with a global warming potential of 2500 or more to service or maintain refrigeration equipment with a charge size of 40 tonnes of CO₂ equivalent or more. While initially the service ban increased demand for HFCs as systems were refilled with lower-GWP refrigerants, demand should now swiftly decrease assuming all systems comply with the ban and overall a significant decrease is expected. According to EIA calculations, reducing the 2027 phase-down step from 24% to 10% and the 2030 phase-down step from 21% to 5% could avoid 681 Mt CO₂e of HFCs by 2050 while also aligning with recent mitigation scenarios toward climate neutrality from the Intergovernmental Panel on Climate Change (IPCC).¹ Moreover, accelerating further the EU HFC phase-down schedule beyond the Kigali Amendment would set the stage for a future adjustment of the global HFC phase-down. While the Kigali Amendment has committed governments to phase down HFCs, faster action to flatten the curve is urgently needed and both feasible and cost-effective. Even a modest adjustment of 10% to accelerate the Kigali Amendment could yield around 8 Gt CO₂e emission reductions by 2050, based on estimates from the European Commission of the total climate benefit of the Kigali Amendment.

Recommendation: Adjust the 2024 and 2027 reduction steps to take account of the service ban and advances in alternative technologies and reduce the penultimate step in 2027 to 10% and the final step in 2030 to 5%, in advance of the Kigali Amendment schedule.

Enact a Real-Time Per-Shipment ODS-style Licensing System. Rather than adopt a real-time per-shipment HFC licensing system like the one used for predecessor gases (ozone-depleting substances), the F-Gas Regulation instead creates an electronic registry that has proven entirely inadequate to ensure effective compliance and enforcement. For example, any comparison between HFC quota limits and actual HFC imports can only be performed several months after the calendar year has passed and all imports and exports are reported by companies – long after the HFC import took place. This means that authorities cannot restrict HFC imports that are clearly in excess of quota, since the importer can claim it intends to export HFCs later in the year. These shortcomings and others make it extremely difficult for customs authorities to enforce HFC quota limits, contributing to illegal trade which has been estimated to amount to more than 30% of the legal trade in recent years.²

Recommendation: Adopt a robust real-time HFC licensing system based on the ODS licensing system, which requires per shipment licenses for all HFCs, including exempted HFCs and HFCs in transit.

Eliminate the 100t CO₂e Loophole. The HFC phase-down exempts producers and importers of less than 100 CO₂e tonnes HFCs per year from having to secure HFC quotas.³ Some traders have taken to establishing multiple shell companies to import quantities under the 100t CO₂e threshold, complicating enforcement by customs authorities. In one example, authorities have shared that one Chinese financial consortium set up hundreds of shell companies in Europe that collectively imported significant HFC quantities into the EU through a practice known in the money laundering business as “smurfing.”

Recommendation: Delete the exemption for producers and importers that place less than 100 CO₂e tonnes per year on the market.

Eliminate Free Grandfathering and the New-Entrants Reserve. The HFC quota allocation method has proved controversial for several reasons. First, HFC quotas worth billions of euros, a public good, were being distributed to private companies for free, resulting in significant windfall profits. Second, according to anecdotal accounts, free grandfathering to producers and importers of bulk enabled those companies to force equipment manufacturers into using their gases in order to gain access to their EU quotas (and therefore EU market access for their equipment), to the detriment of non-fluorochemical technologies in their portfolios. Third, the new-entrants reserve, designed to allow new entrants to enter into the market, enabled thousands of companies to gain valuable quotas for free by simply submitting a declaration of their intention to place HFCs on the market, which could then be sold for profit. Overtime, these so-called new entrants have increased significantly; for example, between 2015 and 2017, Daikin listed 29 new entrants across Europe. In total, at an amount of €10 per CO₂e tonne, free grandfathering and the new-entrants reserve have already resulted in over €8 billion in lost revenue to the EU budget over the first six years of the HFC phase-down.⁴ It is time to move toward a fairer system, such as an auction or allocation fee, that would generate revenues to help shore up the EU budget with “own resources,” and support the F-Gas Regulation implementation.

Recommendation: Allocate HFC quotas at cost through an auction or allocation fee, using the revenue to support Member State implementation and enforcement and to facilitate the uptake of climate-friendly technologies.

Ensure Transparency of HFC Quota Allocation and Provide Full Access to the Registry to Customs Authorities and the Public. Although not mandated by the F-Gas Regulation, the Commission has consistently argued that revealing the names of the producers and importers along with their respective HFC quota allocations would violate the commercial interests of those companies. The result has been an opaque system that lacks legitimacy and undermines compliance and enforcement by competent authorities and customs, prevents good-faith actors (*e.g.* certified personnel and distributors) from

verifying the legality of the HFCs purchased and undermines public participation and oversight – all of which contribute to illegal trade. Despite stating that “competent authorities, including customs authorities, of the Member States shall have access, for information purposes, to the registry,” not all customs authorities have access to the registry. Linked to the lack of transparency on HFC quota allocation, the F-Gas Regulation should be revised to ensure such access is available to all interested persons, including customs authorities and the general public, which includes certified personnel and distributors. It is otherwise impossible to verify the legality of any given producer or importer placing HFCs on the market, which has already contributed to the current levels of illegal HFC trade occurring today.

Recommendation: Make information on HFC quota allocation publicly available and make information in the electronic registry publicly available.

Close Loophole in the Definition of “Non-Refillable Container” and Prohibit Their “Use.” The F-Gas Regulation defines a “non-refillable container” as “a container which cannot be refilled without being adapted for that purpose or is placed on the market without provision having been made for its return for refilling.”⁵ This definition has proven unworkable and unenforceable, mainly due to the final clause that creates an exception for otherwise non-refillable containers where “provision having been made for its return and refilling.”⁶ It is not clear what evidentiary requirements one must meet to show provision has been made for its return for refilling, and no guidance has been forthcoming from the Commission. Moreover, Annex III only bans placing-on-the-market of non-refillable containers, rather than the use of such containers. From a compliance and enforcement perspective, a use ban is far superior since it avoids the factual issue of whether or not the non-refillable container was placed on the market prior to the ban entering into force and where it was first placed on the market, thus reducing the burden on competent authorities to enforce. It should be noted that a large number of illegal HFC seizures in the EU have involved non-refillable containers, and the Montreal Protocol recommends banning or controlling the use of non-refillable containers on illegal-trade grounds. *Decision XIX/12: Preventing Illegal Trade in Ozone-Depleting Substances* states that Parties “wishing to improve implementation and enforcement of their licensing systems in order to combat illegal trade more effectively may wish to consider implementing domestically on a voluntary basis the following measures:... [b]anning or controlling the use of non-refillable containers.”⁷ This observation is equally applicable to non-refillable containers of HFCs.

Recommendation: Amend the definition of “non-refillable container” and prohibit the use of non-refillable containers throughout the EU.

Establish Minimum Civil Penalties for HFC Quota Violations by the Commission and Require Criminal Sanctions in Member States. Given the significant HFC price premium that producers, importers and illegal traders can extract from customers as a result of reduced supplies of HFCs on the EU market, a robust penalty regime is imperative for the smooth functioning of the HFC phase-down. However, the F-Gas Regulation only sets out penalties on lawful producers and importers—a 200% reduction of the amount exceeded the following year, levied by the Commission—and sets out no minimum civil penalties and criminal sanctions on illegal traders to be levied by the Commission or Member States.⁸ As a result, penalties and sanctions vary widely across the EU. Unless penalties and sanctions take into account of the significant potential profits made by offenders, they will fail to act as significant deterrents and illegal trade will continue to proliferate. Given the central role of the HFC phase-down, and the need to prevent weakest points of entry for illegal traders, the F-Gas Regulation should be amended to establish minimum civil penalties by the Commission and criminal sanctions by Member States for HFC quota violations. With respect to civil penalties by the Commission, the recently adopted *Regulation (EU) 2019/1242 setting CO₂ Emission Performance Standards for New Heavy-Duty Vehicles* provides useful precedent. There, in a regulatory framework not unlike the quota system under the EU HFC phase-down, the Commission shall impose an “excess CO₂ emissions premium” against manufacturers that exceed their CO₂ emission target, based on a legislatively prescribed formula.⁹ Here, the Commission should be similarly empowered to levy such minimum civil penalties (fines) as well as Member States to enact criminal sanctions.

Recommendation: Include minimum civil penalties in the revised F-Gas Regulation, based on a multiplier of the value of the HFC seizure, to be levied by the Commission and require criminal sanctions for specific violations in Member States.

Strengthen the Obligation on HFC-23 By-Product Destruction. The recent scientific article *Increase in Global Emissions of HFC-23 despite Near-Total Expected Reductions* reveals that HFC-23 emissions (GWP 14,200) are higher than at any point in history.¹⁰ These unexpected HFC-23 emissions very likely mean significant illegal HFC trade in violation of Article 7(2) of the F-Gas Regulation. Article 7(2) prohibits placing on the market any fluorinated greenhouse gas unless evidence has been provided that HFC-23 by-product has been destroyed or recovered in line with the best available techniques.¹¹ The purpose of Article 7(2) was to ensure a climate benefit under the HFC phase-down since the manufacturing process for many HFCs incentivized under the HFC phase-down—including HFC-32, HFC-125, HFC-1234yf and HFC blends thereof—can result in HFC-23 by-product emissions.¹² It now appears that importers are blatantly violating Article 7(2) with impunity, further exacerbating illegal HFC trade, and undermining the significant investments the EU has already made to abate HFC-23 by-product emissions under the Clean Development Mechanism (CDM). Indeed, by late-2012, over 261 million HFC-23 Certified Emission Reductions (CERs) under the CDM had already been used in the EU ETS.¹³ Assuming a reasonable average carbon price of €8 CO₂-eq/t, this meant that the EU had already contributed over €2 billion to fund HFC-23 by-product destruction technologies abroad whereas the average cost to destroy HFC-23 was only €0.17 CO₂-eq/t or less than €45 million. To address this perverse outcome, from 2013 onward, the EU banned the use HFC-23 CERs in the EU ETS. In light of this, despite the fact that the destruction technologies were already installed, some companies threatened to emit the HFC-23 into the atmosphere unless they continued to receive funds from the sales of CERs.¹⁴ Article 7(2) sought to address this problem by conditioning access to the European marketplace on evidence of HFC-23 by-product destruction or recovery. Since then, the Kigali Amendment was adopted, requiring HFC-23 by-product destruction or recovery from 2020 onward, but implementation of this provision is unclear. The EU has the ability—and obligation—to require HFC-23 by-product destruction or recovery by implementing Article 7(2) and, in the upcoming revision, should strengthen the regulatory framework through the adoption of a certification scheme.

Recommendation: Establish a certification scheme with full traceability and transparency for HFC-23 by-product destruction and require producers and importers to report on compliance with this provision in their annual reports. Moreover, the EU should only import HFCs from countries that have ratified and are in compliance with the provision on HFC-23 by-product destruction in the Kigali Amendment.¹⁵

Require Producer Responsibility Schemes Meeting Minimum Requirements. Several Member States have adopted producer responsibility schemes, including take-back schemes in Sweden, Germany and France and a deposit-refund scheme in Denmark.¹⁶ HFC extended producer responsibility (EPR) schemes serve to internalise the costs of HFC recovery and promote compliance. The Waste Framework Directive (WFD) was recently amended to set out minimum requirements for EPR schemes, and requires Member States to ensure EPR schemes are established as a common policy approach.¹⁷ Here, in addition to requiring Member States to ensure the establishment of EPR schemes, the EU should also include certain minimum requirements on collection, reclamation, recycling, disposal facilities, equipment provision to certified technicians, reporting and awareness raising – similar to the approach to EPR schemes in the Directive (EU) 2019/904 on the Reduction of the Impact of Certain Plastic Products on the Environment (also referred to as the Single-Use Plastics Directive”).

Recommendation: Require Member States to ensure the establishment of EPR schemes for HFCs that meet certain minimum requirements, to be detailed in the legislation with further rules adopted via implementing or delegated acts.

Inspection and Enforcement. As in other EU legislation, Member States should carry out regular inspections on relevant market actors based on an EU risk-based targeting mechanism.¹⁸ Moreover, the F-Gas Regulation suffers from a problem of insufficient market surveillance, raising the need for an EU-wide

coordination policy in order to standardise procedures, rationalise costs and resources and promote timely enforcement, among other purposes.

Recommendation: Establish minimum inspection requirements and an EU risk-based targeting mechanism to assist Member States with carrying out inspections, in addition to adopting an EU-wide market surveillance and coordination policy for the F-Gas Regulation.

Establish Fund for Seized HFC Shipments. Customs authorities are presented with a dilemma when illegal HFC shipments are seized. On one hand, confiscation comes at a cost to the customs authorities for storage and destruction, which for some Member States is not a viable long-term solution. On the other hand, sending them back raises the prospect that the HFC shipments are simply re-routed to another entry point into the EU. In one instance a Member State tried auctioning the confiscated illegal HFC shipment but that was unsuccessful, likely due to the unknown purity and origins of the illegal HFC shipment.¹⁹ The EU should therefore establish a fund to assist Member States following seizures.

Recommendation: Establish a fund that may be accessed by customs authorities to dispose of seized HFC shipments in an environmentally sound manner.

II. Measures to Strengthen Ambition and Facilitate Adoption of HFC-Free Alternatives

Mandatory Competence on Alternative Refrigerants and Technologies in Certification Programmes. Certification programmes established under Article 10 do not include mandatory training on natural refrigerants and technologies. In addition to being irresponsible—some alternatives to HFCs are toxic or flammable or operate at higher pressures, putting the safety of untrained certified personnel at risk—the lack of mandatory training on natural refrigerants also disproportionately impacts small- and medium-sized enterprises (SMEs) that do not have the capacity to set up their own training schemes and places the onus to secure training on the certified personnel themselves.²⁰ Additional barriers also contribute to the lack of trained technicians and engineers, both among contractors that install and maintain equipment and professional engineers that specify and design equipment.²¹ First, although training materials are generally available, such as informational documents and software, there is a lack of translation into all relevant languages.²² Translation would encourage wider use across the EU, and would be required if such training were a part of certification programmes. Second, although some Member States plan to open (or have opened) additional practical training facilities for hands-on training on relevant equipment, there is a considerable shortage in many regions.²³ Third, the training modules for flammable A2L and A3 refrigerants are significantly similar, if not identical, and it would only make sense to equip technicians with the tools to ensure safe handling of all refrigerants with which they are likely to come into contact.

Recommendation: Require certification programmes established by Member States to include mandatory competence on natural refrigerants and technologies, including practical training facilities allowing for hands-on training on relevant equipment.

Update Antiquated Standards. In November 2017, the Commission formally adopted its long-awaited *Commission Implementing Decision on a Standardisation Request as Regards Use of Flammable Refrigerants in Refrigeration, Air-Conditioning and Heat Pump Equipment (M/555)* under Regulation (EU) No 1025/2012 on European Standardisation. In it, the Commission requests the European Committee for Standardisation (CEN) and the European Committee for Electrotechnical Standardisation (CENELEC) “to draft a European standardisation deliverable with technical specifications for the use of flammable refrigerants, in particular those classified as A3, in refrigeration, air conditioning and heat pump equipment.”²⁴ The legal wording of the final version of the Standardisation Request undermined its strength significantly. First, the main difference between a European standardisation deliverable (ESD) and a European standard is that national transposition of the technical specifications in an ESD is not required. Besides, technical specifications in an ESD cannot contradict existing European standards, which made it difficult for the Standardisation Request M/555 to fulfil its own mandate to update existing antiquated standards. This situation risks undermining the smooth functioning of the internal market and setting back

the introduction of safe and energy-efficient HFC-free technologies.²⁵ To prevent continued abuse of the standardisation process, the revised F-Gas Regulation should require European standards be updated to require specific charge sizes be allowed by a certain date in specific sectors so that the market prohibitions and HFC phase-down can be achieved.

Recommendation: Demand an update to antiquated standards to allow for the introduction of safe and energy-efficient climate-friendly technologies, in particular those relying on A3 refrigerants; European standards should support minimum technical requirements for all potential charge sizes and should be explicitly set out in the revised F-Gas Regulation.

Promote Incentive Schemes and Public Procurement for HFC-Free Alternatives. European public-sector expenditure is over €2 trillion annually which accounts for around one-fifth of the EU's GDP, representing a significant opportunity to use public-sector purchasing power to influence the market and guide what products are bought.²⁶ The recently adopted recovery fund will further add to public-sector expenditure, and serves as a singular opportunity to ensure responsible climate spending to leapfrog obsolete technologies in support of the objectives of the European Green Deal.²⁷ In 2015, the Commission funded a study to review the extent to which green public procurement (GPP) in Member States advances the objectives of the F-Gas Regulation.²⁸ The conclusions were underwhelming, noting that “there does not seem to be, across the board, significant use of GPP to address the topic of F-gases and promote the use of alternative low-GWP refrigerants within the EU today.”²⁹ Moreover, where GPP criteria were adopted in Member States, its application was often uneven given its voluntary nature and the lack of monitoring.³⁰ GPP has the potential to serve as a market pull for certain product groups in key subsectors. A principal value of GPP is that it can expand markets for environmentally innovative products going beyond minimum mandatory requirements. Although some product groups may not need a market pull, other product groups would be greatly assisted with benefits to the governmental bottom line and economy at large.

Recommendation: Require Member States to promote incentive schemes and to review and revise GPP policies to promote the introduction of alternative technologies.

Strengthen the Placing on the Market Prohibitions in Annex III. Placing on the market (POM) prohibitions, also called bans, have proven to be the most effective measure in the F-Gas Regulation, providing clear market signals with little administrative burden and costs. Following a comprehensive review of each subsector, the Commission-funded *Preparatory Study* (2011) and the Commission-published *Impact Assessment* (2012) concluded that the transition to safe and energy-efficient alternatives relying on natural and low-GWP technologies available at the time was both cost-effective and feasible in most subsectors by 2020.³¹ Yet the F-Gas Regulation as proposed (2012) and adopted (2014) contained very few bans in Annex III. It is now 2020 and subsectors that should have already transitioned have not; nearly a decade has been lost. The Commission must make up for this lost decade by proposing significant revisions to Annex III. To illustrate what could have been, the following table outlines when bans could—and should—have been adopted for various subsectors based on the *Preparatory Study* and *Impact Assessment*, underscoring the missed opportunities in refrigeration, air-conditioning and heat pumps sectors, in particular:

Sector	Subsector	2012 Impact Assessment Feasibility of Ban		Ban Included in Annex III in 2014 Revision?
		2020	2030	
Domestic Refrigeration	Refrigerators/Freezers ³²	Yes	Yes	Yes, for 2015
	Stand-Alone Systems ³³	Yes	Yes	Yes, for 2022
Commercial Refrigeration	Condensing Units ³⁴	Yes	Yes	No
	Centralized Systems ³⁵	Yes	Yes	Partial, for 2022
Industrial Refrigeration	Small < 100 kW ³⁶	No	95% feasible	No
	Large > 100 kW ³⁷	Yes	Yes	No
Transport Refrigeration	Refrigerated Vans ³⁸	Yes	Yes	No
	Refrigerated Trucks ³⁹	No	Yes	No
	Fishing Vessels ⁴⁰	No	95% feasible	No
Mobile Air Conditioning	Cargo Ship AC ⁴¹	Yes	Yes	No
	Rail Vehicle AC ⁴²	No	60% feasible	No
	Passenger Ship AC ⁴³	No	90% feasible	No
Stationary Air Conditioning	Moveable Systems ⁴⁴	Yes	Yes	Yes, for 2020
	Split Systems ⁴⁵	Yes	Yes	No
	Multi-Split/VRF System ⁴⁶	No	Yes	No
	Rooftop Systems ⁴⁷	Yes	Yes	No
	Chillers (Displacement) ⁴⁸	Yes	Yes	No
	Centrifugal Chillers ⁴⁹	No	Yes	No
Fire Protection	Heat Pumps ⁵⁰	Yes	Yes	No
	Fire Prot. HFC-23 ⁵¹	Yes	Yes	Yes, for 2016
	Fire Prot. HFC-227ea ⁵²	No	90% feasible	No
Aerosol	Technical Aerosols ⁵³	No	95% feasible	Yes, with an exception
Foams	XPS ⁵⁴	Yes	Yes	Yes, for 2020
	PU Spray Foam ⁵⁵	Yes	Yes	Yes, for 2023
	Other PU ⁵⁶	Yes	Yes	Yes, for 2023

An unintended consequence of this lost decade is the significant illegal HFC trade witnessed today as subsectors that should have already transitioned to natural-refrigerant and low-GWP alternatives have not, inflating demand under the HFC phase-down and creating a lucrative black market. Moreover, it represents a significant lost opportunity. For instance, the best available solution for the room air-conditioners (RAC) is propane, a hydrocarbon refrigerant that exhibits very good energy efficiency, importantly also in hot ambient temperatures. A ban on single-split AC of GWP >15 would compel the full conversion in the EU in this sector, which if starting in 2025, for example, would reduce HFC demand by 62 Mt CO₂e by 2050.⁵⁷ [Note: the EU already has a ban in 2025 of GWP >750 so the calculations reflect the difference between propane and HFC-32 (GWP 675), not propane and HFC-410A (GWP 2088).

Recommendation: Include immediate bans for subsectors that could have already converted to HFC-free alternatives based on natural-refrigerant technologies available a decade ago, as identified in the *Impact Assessment*, and adopt prospective bans for 2025 and 2030 for the remaining subsectors

(including new ones) based on a more recent analysis of natural-refrigerant and low-GWP technologies available today. This should include, at a minimum, strengthening existing bans in single-split stationary air-conditioning systems and multipack centralized systems to prohibit GWP >15, in addition to the introduction of new bans in condensing units in commercial refrigeration and heat pumps, discussed separately below.

Introduce Bans for High-GWP Hydronic Heat Pumps. The residential heat pump market is expected to grow rapidly (doubling by 2024) to meet EU Green Deal’s ambition to decarbonise the heating sector and improve the energy performance of buildings.⁵⁸ The current absence of bans, lack of trained engineers and outdated standards and building codes will lead to a large bank of HFC heat pumps being installed despite HFC-free alternatives being currently viable and available in Europe both in terms of production and sales. Without intervention, heat pumps will use a growing proportion of the HFC quota required by those sectors that cannot move to alternatives as quickly, putting pressure on supply and possibly fuelling additional illegal HFC trade. Domestic, commercial and industrial heat pumps have largely been ignored by the F-Gas Regulation thus far but the projected growth in this sector merits their close scrutiny and attention in this review.

Recommendation: Adopt near-term bans for subsectors that could have already converted to HFC-free alternatives, as identified in the *Impact Assessment*, including domestic ground-source heat pumps (GSHP), water-source heat pumps (WSHP), exhaust air heat pumps and monobloc air-source heat pumps (ASHP).

Introduce Bans and Containment Measures for SF₆-based Switchgear. SF₆ is one of the most potent greenhouse gases yet its growth and use continues virtually unabated. Indeed, the number of medium-voltage (MV) switchgear units, which currently rely on SF₆, is expected to increase up to 90% by 2050.⁵⁹ If low-GWP alternatives are not deployed urgently, emissions will soar and be locked in for millennia, jeopardising the EU Green Deal’s ambition and undermining efforts to decarbonise the energy and transport sectors through renewable electrification. There are no technical barriers to using SF₆-free MV switchgear in new installations. It is also currently technically feasible to install SF₆-free high-voltage (HV) switchgear up to 145kV. SF₆-free equipment over 145kW is being developed and is expected to be a viable option in the next five years; this process would be accelerated by clear signals to industry of an anticipated ban. Manufacturing of “related equipment” (gas insulated lines, bushings and instrument transformers) are also responsible for a significant proportion of annual SF₆ emissions; this review should bring attention to potential emissions reductions in these processes as well.⁶⁰

Recommendation: Ensure all SF₆ usage is reported to enable accurate emission profiling, and adopt immediate bans for new switchgear containing SF₆ up to 145kV and a prospective ban on SF₆-based switchgear over 145kV by 2025 with mandatory leakage checks for non-hermetically sealed systems and any systems larger than 5kg. End of life emissions from the installed base of existing SF₆-based switchgear should be addressed, potentially through producer responsibility schemes.

III. Overarching Measures

Articulate Near-Term Warming Impact of Ambitious Action. It is widely recognized that meeting the climate emergency requires urgent action to avoid climate forcing in the coming years and decades. Although the GWP metric is at the bedrock of climate policy and underpins the HFC phase-down, the commonly used 100-year time horizon (GWP₁₀₀) understates the climate impact of HFCs on the climate system in the near-term. The GWP of widely used HFC-134a is almost trebled to 3,700 when measured over a 20-year period compared to the 100-year period.⁶¹ Using GWP₂₀ raises serious questions about the recent uptake of so-called mid-GWP HFCs, such as HFC-32, which has a GWP₂₀ of 2,430, almost four times higher than its GWP₁₀₀ value and hundreds of times higher than its low-GWP replacement in air-conditioning, propane.⁶² This timeframe for understanding the near-term warming impact of HFCs also aligns with EU climate ambitions, particularly as it relates to 2030, 2040 and 2050.

Recommendation: Align the F-Gas Regulation with the Paris Agreement and evaluate the climate impact of an accelerated EU HFC phase-down and market prohibitions in terms of GWP₂₀ in parallel to the current GWP₁₀₀ to provide policymakers and the public with an accurate snapshot of the near-term climate benefit of fast action on HFCs. For consistency reasons, the revised F-Gas Regulation text may remain based on GWP₁₀₀.

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- ² See e.g. Stop Illegal Cooling (website), available at <https://stopillegalcooling.eu/data/>.
- ³ Regulation (EU) No 517/2014, Article 15(2).
- ⁴ Öko-Recherche and CITEPA, *Briefing Paper: HFC Availability on the EU Market* (March 2020), pp. 1-2.
- ⁵ Regulation (EU) No 517/2014, Article 2(13).
- ⁶ Regulation (EU) No 517/2014, Article 2(13).
- ⁷ Decision XIX/12: Preventing Illegal Trade in Ozone-Depleting Substances, ¶ (3)(e).
- ⁸ See Regulation (EU) No 517/2014, Article 25.
- ⁹ See Regulation (EU) 2019/1242 Setting CO₂ Emission Performance Standards for New Heavy-Duty Vehicles, Article 8.
- ¹⁰ K.M. Stanley et al, *Increase in Global Emissions of HFC-23 despite Near-Total Expected Reductions* (Nature Communications, Article 397 – 21 January 2020), available at <https://www.nature.com/articles/s41467-019-13899-4>.
- ¹¹ Regulation (EU) No 517/2014, Article 7(2).
- ¹² European Commission, *F-Gas Regulation (Regulation (EU) No 517/2014): Technical Advice to Member States on Implementing Article 7(2) – Discussion Paper* (October 2015), p. 4, available at https://ec.europa.eu/clima/sites/clima/files/f-gas/docs/151023_hfc23_byproduction_en.pdf.
- ¹³ See Sandbag, *Help or Hindrance? Offsetting in the EU ETS* (November 2012, available at https://sandbag.org.uk/site_media/pdfs/reports/Help_or_Hindrance_Offsetting_2012_3.pdf).
- ¹⁴ Environmental Investigation Agency, *Two Billion Tonne Climate Bomb: How to Defuse the HFC-23 Problem* (June 2013), available at http://www.eia-international.org/wp-content/uploads/EIA_HFC-23_report_0613_Final.pdf.
- ¹⁵ Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer (Kigali, 15 October 2016), Articles 2J(6) and 5, available at https://treaties2023.un.org/doc/Treaties/2016/10/20161015%2003-23%20PM/Ch_XXVII-2.f.pdf.
- ¹⁶ Öko-Recherche et al., *Preparatory Study for a Review of Regulation (EC) No 842/2006 on Certain Fluorinated Greenhouse Gases, Final Report* (September 2011) (hereinafter “Preparatory Study”), pp. 50, and 52-53.
- ¹⁷ Directive 2008/98/EC, as amended, Article 8(a); see also Directive (EU) 2019/904 on the Reduction of the Impact of Certain Plastic Products on the Environment, Article 8; Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE) (recast), Article 5, 7 and 12-13.
- ¹⁸ See e.g. Directive (EU) 2019/883 on Port Reception Facilities for the Delivery of Waste from Ships, Article 11.
- ¹⁹ See Cooling Post, *Bulgarian Customs to Auction Illegal Refrigerant* (21 June 2019), available at: <https://www.coolingpost.com/world-news/bulgarian-customs-to-auction-illegal-refrigerant/>; Cooling Post, *Auction of Seized Refrigerant Set To Go Ahead* (23 June 2019), available at: <https://www.coolingpost.com/world-news/auction-of-seized-refrigerant-set-to-go-ahead/>.
- ²⁰ Regulation (EU) No 517/2014, Recital 6.
- ²¹ European Commission. *Report from the Commission on Availability of Training for Service Personnel Regarding the Safe Handling of Climate-Friendly Technologies Replacing or Reducing the Use of Fluorinated Greenhouse Gases* (Brussels, November 2016) COM(2016) 748 final, p. 9.
- ²² European Commission. *Report from the Commission on Availability of Training for Service Personnel Regarding the Safe Handling of Climate-Friendly Technologies Replacing or Reducing the Use of Fluorinated Greenhouse Gases* (Brussels, November 2016) COM(2016) 748 final, p. 8; see also Real Alternatives, *Blended Learning for Alternative Refrigerants* (website), available at <http://www.realalternatives.eu/home>.
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- ²⁶ Ricardo AEA Gluckman Consulting – Topic C Briefing Paper Green Public Procurement – 2015.
- ²⁷ European Council, *Council Conclusions (21 July 2020)*, available at <https://www.consilium.europa.eu//media/45109/210720-euco-final-conclusions-en.pdf>
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- ³¹ See *Preparatory Study*; European Commission, *Impact Assessment: Review of Regulation (EC) No 842/2006 on certain fluorinated greenhouse gases* (Commission Staff Working Paper), SWD(2012)0364 (hereinafter “Impact Assessment”), available at https://ec.europa.eu/clima/sites/clima/files/f-gas/legislation/docs/swd_2012_364_en.pdf; see also Umweltbundesamt, *Avoiding Fluorinated Greenhouse Gases: Prospects for Phasing Out* (June 2011, English Version); SKM Enviro, *Phase Down of HFC Consumption in the EU – Assessment of Implications for the RAC Sector* (Final Report, Version 11, September 2012).
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- ³⁴ *Preparatory Study*, Annex V, p. 246; *Impact Assessment*, pp. 73, 115 and 241-254.
- ³⁵ *Preparatory Study*, Annex V, p. 247; *Impact Assessment*, pp. 73, 115 and 241-254.
- ³⁶ *Preparatory Study*, Annex V, p. 248; *Impact Assessment*, pp. 73, 116 and 241-254.
- ³⁷ *Preparatory Study*, Annex V, p. 249; *Impact Assessment*, pp. 116, 173 and 241-254, citing Umweltbundesamt, *Avoiding Fluorinated Greenhouse Gases: Prospects for Phasing Out* (June 2011, English Version).
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- ⁴¹ *Preparatory Study*, Annex V, p. 260; *Impact Assessment*, pp. 119, 173 and 241-254.
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