F-Gas Regulation Briefing Note – Transport Refrigeration

Transport refrigeration can be HFC-free

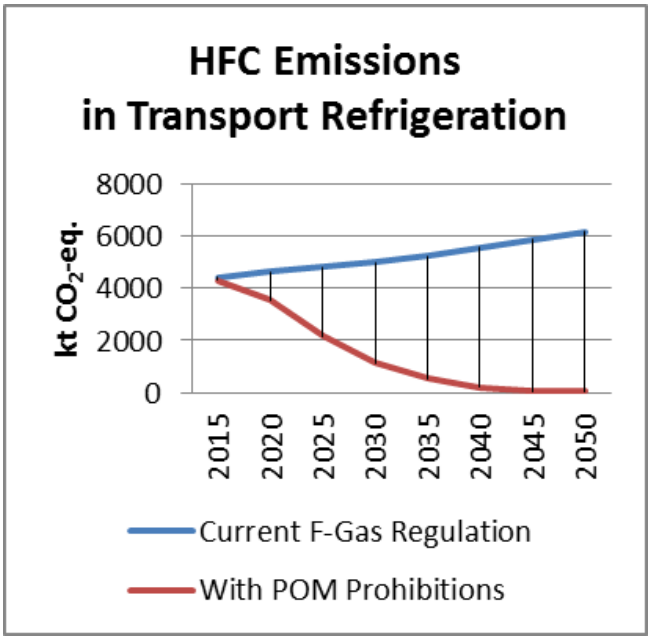
This fact sheet provides information about phasing out hydrofluorocarbons (HFCs) in transport refrigeration in the European Union. It is intended to inform revisions to the F-Gas Regulation, which are currently under consideration. The term "transport refrigeration" covers several applications including refrigerated vans, refrigerated trucks and trailers, and fishing vessels.

The briefing notes in this series cover:

1. Domestic Refrigeration
2. Commercial Refrigeration
3. Industrial Refrigeration
4. Transport Refrigeration
5. Stationary Air Conditioning
6. Foams and Aerosols

Emission trends and alternatives

HFC emissions from transport refrigeration will continue to undermine climate objectives unless action is taken soon. Assuming full implementation of the F-Gas Regulation, HFC emissions from this sector will rise steadily without additional measures.[1] With an average lifetime of between 10 and 30 years, there is a need to prevent new HFC-based equipment from being placed on the market to achieve climate targets in 2030 and beyond.



Several recent studies have identified technically feasible and safe alternatives already in use in the European Union. The alternatives vary for each subsector, but mostly rely on natural refrigerants such as propane, carbon dioxide and ammonia.[2] A recent European Commission-funded study analyzed the market penetration of alternatives and found that, with only small derogations for discrete applications, HFC-based equipment can be banned by 2020 in refrigerated vans and fishing vessels and sometime before 2030 in refrigerated trucks.[3] These additional measures would prevent over 135 Mt/CO_2-eq. emissions through 2050,[4] resulting in significant reductions of HFC emissions on a timescale responsive to climate science.

Energy efficiency

HFC-free alternatives can be up to 7.5% more energy efficient than HFC-based equipment.[5] This is particularly relevant in light of the EU Energy Efficiency Plan, which sets out a 2020 target of 20% reduction in energy consumption compared to projections.[6] Increased energy efficiency decreases reliance on fossil fuels and reduces running costs for consumers.

Cost effectiveness

On a CO_2-equivalent basis, alternatives are very cost-effective. Banning the use of HFCs in this sector with placing on the market (POM) prohibitions would achieve significant GHG reductions at much lower costs than containment and recovery measures, as demonstrated in Table 1.[7]

* The Environmental Investigation Agency (EIA) is an independent campaigning organisation committed to bringing about change that protects the natural world from environmental crime and abuse. For more information, contact ukinfo@eia-international.org.

The Stern Review suggests that the social cost of carbon today is approximately €64.5/t CO_2-eq., a figure that is well above the abatement costs in this sector.[8] Switching to HFC-free alternatives is sound public policy.

Table 1: Effectiveness of Placing HFC-Based Equipment and Alternatives on the Market

Subsector	Containment and Recovery		POM Prohibition	
	GHG Emissions Abated	Abatement Cost (t/CO_2-eq.)	GHG Emissions Abated	Abatement Cost (t/CO_2-eq.)
Fishing Vessels	39.8%	€ 0.52	99.5%	€ 3.3
Trucks & Trailers	39.1%	€ 45.8	99.9%	€ 2.6
Vans	2.9%	€ 291	99.7%	€ 45

From an end-user perspective, most consumers can expect to save money over the lifetime of alternatives, as demonstrated in Table 2.[9] Because HFC-based equipment has achieved significant economies of scale, upfront investment costs are lower. But HFC-based equipment generally has higher annual running costs due to lower energy efficiency and costs of refills. For these reasons, most HFC-free alternatives more than make up the higher upfront investment costs during their lifetime through lower annual running costs, resulting in end-user cost savings. For those that do not pay back, the incremental costs are very low. Nevertheless, to overcome any barriers to adoption resulting from higher upfront investment costs, especially for small-and medium-sized enterprises (SMEs), Member States can design support schemes to minimize upfront costs and promote taxes on HFC use.

Table 2: Costs to End Users of HFC-Based Equipment and HFC-Free Alternatives

	Refrigerant	Upfront Costs	Annual Costs	Lifetime Costs	Cost Differential
Fishing Vessels	**HFC-404a / CO_2**	**€ 2,015,000**	**€ 190,230**	**€ 7,721,900**	---
	Ammonia / CO_2	€ 2,301,500	€ 178,700	€ 7,662,500	- €59,400
Trucks & Trailers	**HFC-404a**	**€ 20,098**	**€ 6,525**	**€ 85,344**	---
	Propane	€ 22,016	€ 6,147	€ 83,489	- € 1,856
	CO_2	€ 22,626	€ 6,326	€ 85,894	+ € 550
Vans	**HFC-134a**	**€ 3,015**	**€ 6,945**	**€ 9,960**	---
	CO_2	€ 3,375	€ 6,420	€ 9,795	- € 165

Policy recommendations

Policymakers should revise Annex II of the F-Gas Regulation to include POM prohibitions on HFCs in transport refrigeration starting in 2020 for refrigerated vans and fishing vessels and starting in 2025 for refrigerated trucks:[10]

Fluorinated Greenhouse Gases	Products and Equipment	Date of Prohibition
Fluorinated GHG gases GWP >15	Refrigerated Vans	1 January 2020
Fluorinated GHG gases	Fishing Vessels	1 January 2020
Fluorinated GHG gases	Refrigerated Trucks	1 January 2025

In addition, in the years before the POM prohibition takes effect, the European Union should consider a gradual phase-down of HFC-based equipment through quantitative limits on new units that may be placed on the market. This will promote the progressive uptake of alternatives in advance of the POM prohibition, providing certainty of investment and preventing market disruptions.

Environmental Investigation Agency
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[1] 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 "Öko-Recherche Study"], Annex VI, pp. 297-306 (chart produced from data provided by Öko-Recherche).
[2] Öko-Recherche, Study, Annex VI, pp. 297-306.
[3] Öko-Recherche, Study, pp. 262-264 and Annex V, pp. 250-252 (market penetration of alternatives is close to or at 100%).
[4] *See generally* Öko-Recherche Study, Annex V, pp. 250-252 and Annex VI, pp. 297-306 (figure produced from data provided by Öko-Recherche).
[5] Öko-Recherche, Study, Annex V, pp. 250-252 (charts produced from Öko-Recherche data).
[6] European Commission, *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Energy Efficiency Plan 2011* (8 March 2011), SEC (2011) 280 final, p. 2.
[7] Öko-Recherche, Study, Annex V, pp. 250-252 abatement cost of containment and recovery determined by dividing the additional annual cost of containment and recovery measures by the GHG reductions achieved from those measures; cost of POM prohibitions already outlined for each subsector).
[8] Stern, N. *et al.*, *The Economics of Climate Change: The Stern Review*, Cambridge University Press (2007).
[9] Öko-Recherche, Study, Annex V, pp. 250-252 (chart produced from Öko-Recherche data; upfront costs represent the initial cost of the hardware plus cost of first fill).
[10] Some refrigerated vans may need to rely on unsaturated HFCs—also referred to as hydrofluoro-olefins (HFOs) with a GWP less than 15—to meet a 2020 POM prohibition date. The European Commission should periodically review whether a full POM prohibition on all HFCs is appropriate for refrigerated vans given the uncertainties in lifecycle HFC emissions associated with HFO production and the persistent toxicity of their breakdown chemicals in the environment.