



Heat Pumps and Refrigerant Gases

EIA, EEB and ECOS

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Introduction

- Heat pumps are necessary for the decarbonisation of buildings
- Heat pumps are a key tool in reducing emissions and limiting warming to below 1.5°C
- The roll out of heat pumps must be prioritised and accelerated

However,

- Heat pumps often contain highly climate damaging refrigerant gases
- Locking in high GWP refrigerants during the roll out of heat pumps would be counterproductive for the climate
- HFC-free heat pumps exist on the market and must be mainstreamed

What are HFCs?

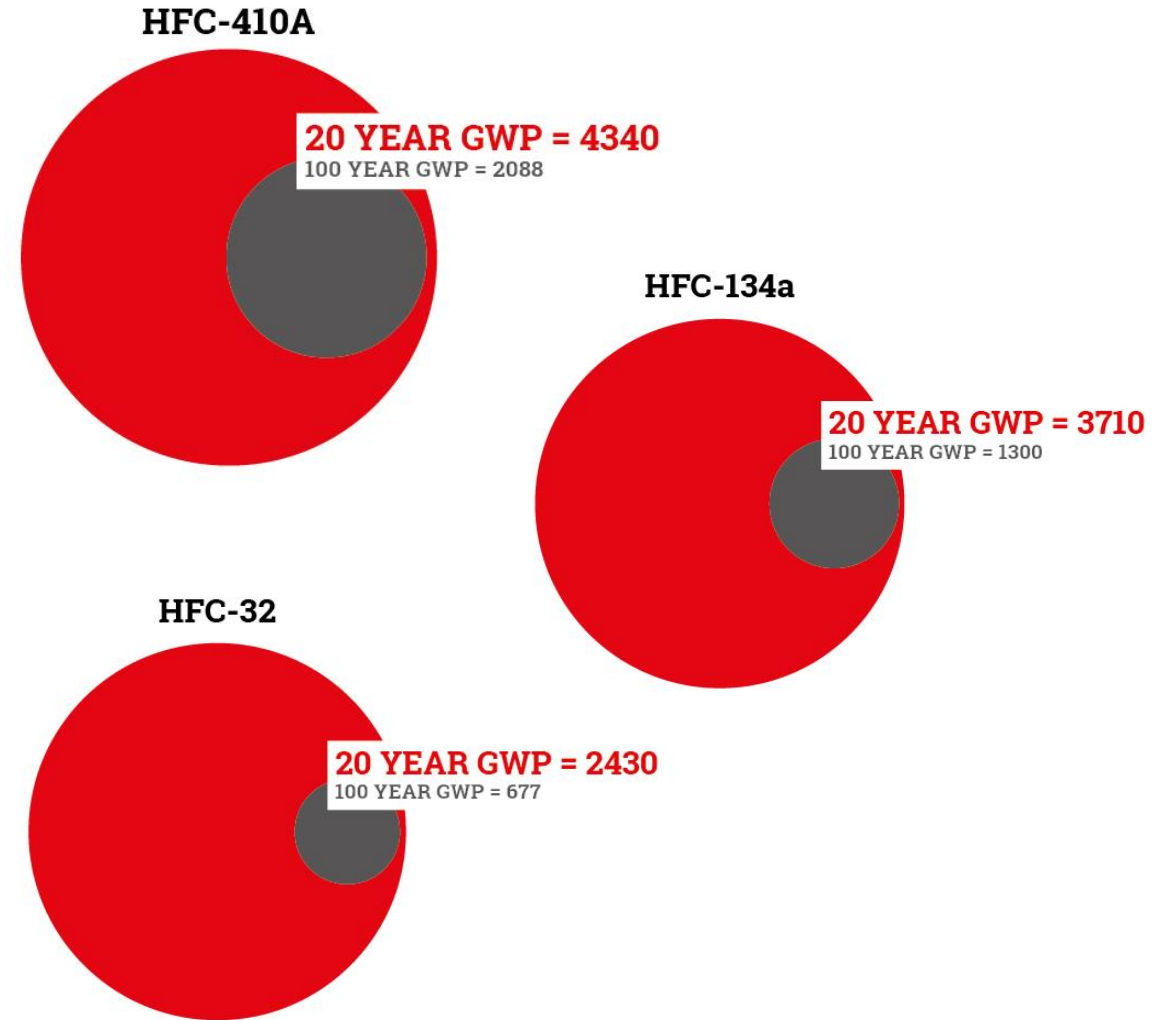
Hydrofluorocarbons (HFCs) are super greenhouse gases used predominantly as refrigerants in air-conditioning, refrigeration and heat pumps

HFCs have Global Warming Potentials (GWP) many **thousands of times higher than carbon dioxide** (CO₂) on a 100-year scale and even higher on a 20-year scale

Most residential heat pumps in Europe use R-410A (GWP 2,088) or R-407C (GWP 1,774), while the use of R-134a (GWP 1,430) and R-32 (GWP 675) is growing

HFCs are released into the atmosphere during the lifetime of the equipment through leakage and during disposal at the end of life of equipment

These are short lived climate pollutants – their warming effect is fast but curbing these emissions would have fast acting impact on flattening the climate curve



HFC Policy Landscape

EU (UK) F-Gas Regulation – up for review

- EU agreement to phase down HFCs by 79% by 2030
- HFCs used in heat pumps fall under F-gas quota so availability of these refrigerants for heat pumps will reduce while costs increase as a result of the phasedown.
- A prerequisite for the desired heat pump market growth is availability of refrigerant gases. To allow sectors that cannot move as easily to HFC alternatives longer timescales to do so, the heat pump sector must be transitioned to low GWP refrigerants immediately.

Kigali Amendment to the Montreal Protocol

- Global agreement to phase down HFCs by over 85% by 2050 and avoid 0.5°C of warming by 2100. HFCs for use in heat pumps will continue to become more scarce and expensive globally.

PFAS under REACH

- Current proposal to ban many HFOs and HFCs in the EU as they are ‘forever chemicals’ that can be harmful to the environment and human health. If successful, this would eliminate the use of HFOs and HFC-32 in domestic heat pumps.

HFCs in Heat Pumps

Research in the UK showed fluorocarbons in heat pumps add another 20% to the carbon footprint due to leakage of gas, although this is dependent on the GWP of the F-gas used and the leakage rate

Emissions associated with refrigerant use will be increasingly important as deployment of heat pumps grows.

Given heat pumps have an average life span of 20+ years, locking in HFCs when lower GWP alternatives are available runs counter to the EU's decarbonisation and climate goals, the EU F-Gas Regulation and EU commitments under the Kigali Amendment to the Montreal Protocol.

With current HFC refrigerants and the integration of renewables in the electricity mix, heat pumps can reduce carbon emissions by 35-65% when replacing gas boilers. A full transition to HFC-free heat pumps run entirely from renewable energy could effectively reduce carbon emissions 100% compared to gas boilers.

HFC Alternatives

Technically feasible and cost-effective natural refrigerant alternatives are available on the market and gaining popularity, these include:

- Propane (GWP <1)
- Carbon dioxide (GWP 1)
- Ammonia (GWP 0) for large scale heat pumps.

As well as reducing direct emissions from the refrigerant, the use of propane can contribute to improving energy efficiency due to its excellent thermodynamic properties with many models achieving EU energy label of A/A+++.

A few of the energy efficient HFC-free heat pumps on the market are featured in EIA's Pathway to Net-Zero Cooling Product List at www.cooltechnologies.org

EU manufacturers are leading the way for natural refrigerant heat pumps

HFC Alternatives

'Low' GWP HFCs and HFOs (hydrofluoroolefins) are also available and being pushed by the F-gas industry

However, there are numerous environmental concerns related to their widespread adoption:

- TFA (trifluoroacetic acid) is a breakdown product of HFO-1234yf and HFC-134a and could have serious impacts of ecosystems and human health if levels continue to rise
- HFC-23 emissions are at record highs and scientists are pointing at HFO breakdown and/or HFC-32 production as possible sources
- Emissions from manufacturing these gases is far higher than for manufacturing their natural refrigerant alternatives, not reflected in GWP values

Barriers to overcome

Standards

Updating antiquated European standards and building codes to allow higher charge sizes for flammable (A3) refrigerants, such as propane

- The IEC standard to increase the allowable charge size for flammable refrigerants in AC units and heat pumps is currently being revised and is expected at the beginning of 2022 – problems remain with late transposition at European levels
- European and international standards setting safety and environmental criteria for refrigerants are also under revision
- National building codes in the EU often prohibit the use of flammable refrigerants in high-rise or public buildings, but changes in standards can drive changes at national level

Barriers to overcome

Training

- There are not enough trained heat pump installers. Developing the installer base is essential to decarbonising heating.
- Updated, improved and more accessible training is needed for both the existing heating installer workforce and entrants to fill the new green jobs this sector will provide. Natural refrigerant training must be a mandatory component in these courses and certifications.
- Awareness of natural refrigerant heat pumps in the installer base is paramount.
- This will have the added benefit of creating new green jobs.

Barriers to overcome

Clear market signals are needed to facilitate the uptake of low-GWP heat pumps

In 2011 and 2012, the European Commission and its consultants found that heat pumps relying on natural refrigerants could provide for 80% of all new equipment by 2020 with the right market signals. However, those market signals were not introduced.

In the upcoming EU F-Gas Regulation Review we are advocating for the European Commission to **adopt a ban on residential heat pumps with GWP > 10 in F Gas Regulation Annex III**. Residential heat pumps continue to use high GWP HFCs despite the availability of climate-friendly technologies and the ability of this sector to have fully converted to low-GWP alternatives.

Public Procurement policies at EU, national and local levels must include a GWP limit to their criteria for heating and cooling products including heat pumps. National financial incentive schemes and subsidy policies must also include consideration of refrigerant choice and set GWP thresholds for equipment to be deemed applicable for funding. All heat pumps should meet high energy efficiency requirements and use natural refrigerants where possible.

Towards a United Vision

How do we ensure the necessary and urgent roll out of heat pumps does not jeopardise climate goals by locking in high GWP HFC emissions for the lifetime of the equipment?

How do we raise the issue of HFCs in heat pumps without undermining the overall aim of accelerating the heat pump roll out?

How do we ensure that early movers installing heat pumps in their homes are not stung by HFC supply restrictions and prices hikes in the next ten years?

How do we support and incentivise the adoption of natural refrigerant heat pumps?

Any Questions?