environmental investigation agency

Climate

Pumping Up the Potential

Maximising the climate benefits of Europe's heat pump roll-out with natural refrigerants

March 2025

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ABOUT EIA

We investigate and campaign against environmental crime and abuse. Our undercover investigations expose transnational wildlife crime, with a focus on elephants, pangolins and tigers and forest crimes such as illegal logging and deforestation for cash crops such as palm oil. We work to safeguard global marine ecosystems by addressing the threats posed by plastic pollution, bycatch and commercial exploitation of whales, dolphins and porpoises. Finally, we work to avert climate catastrophe by strengthening and enforcing regional and international agreements that tackle short-lived climate super-pollutants, including ozone-depleting substances, hydrofluorocarbons and methane, and advocating corporate and policy measures to promote transition to a sustainable cooling sector and away from fossil fuels. We use our findings in hard-hitting reports to campaign for new legislation, improved governance and more effective enforcement. Our field experience is used to provide guidance to enforcement agencies and we form partnerships with local groups and activists and support their work through hands-on training.

OUR CLIMATE WORK

Our Climate programme seeks to keep global warming below 1.5°C and meet the climate challenge through rapid, sustained reductions of emissions of all the major greenhouse gases. This will be achieved by developing, implementing and enforcing ambitious national, regional, global and sectoral obligations to reduce emissions of ozone-depleting substances (ODS), fluorinated gases (F-gases), methane (CH_4), nitrous oxide (N_2O) and carbon dioxide (CO_2). These obligations should be reinforced by strong governance frameworks ensuring corporate accountability and sustainable financing for a just and fair transition for all.

EIA is the only NGO committed to combating HFC and ODS climate crime and has almost 30 years of experience investigating and exposing this criminal trade. Our groundbreaking investigations have helped change laws to better protect our planet. Our work also focuses on promoting rapid greenhouse gas mitigation opportunities through the uptake of climate-friendly HFC-free cooling solutions.

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Front cover: Heat pumps are a vital technology in the decarbonisation of heating

Above: A cylinder of refrigerant being used in the maintenance of a heat pump system

Executive summary

The transition to heat pumps is crucial for decarbonising buildings, with the EU and UK recognising their pivotal role in meeting climate targets and setting ambitious targets to roll them out across their respective housing stocks.

While heat pumps reduce emissions when compared to fossil fuel heating, their climate impact depends on the refrigerants used. To maximise emission reductions and prevent long-term reliance on climate-damaging refrigerants, a swift transition to natural refrigerant heat pumps is essential.

Natural refrigerants, such as propane, carbon dioxide (CO_2) and ammonia, have a significantly lower global warming potential (GWP) than the hydrofluorocarbons (HFCs) typically used and can also offer improved energy efficiency, further reducing the environmental impact of heat pumps.

This report highlights the benefits, barriers and future challenges associated with the uptake of heat pumps in general and explores how natural refrigerant heat pumps, with their associated benefits, can be promoted as part of the solution to some of these challenges. Key benefits include better performance and sustainability, while barriers such as overly restrictive safety standards and lack of installer awareness can hinder their adoption.

To support their broader uptake, policymakers in the EU and UK must proactively promote natural refrigerant heat pumps, ensuring workforce readiness through comprehensive training and certification. Additional recommendations include updating safety standards and building regulations, as well as the introduction of subsidies, grants and green public procurement guidelines tailored to the use of natural refrigerants.

By acting now, policymakers can maximise emissions reductions and support a sustainable heat pump rollout across Europe.

Above: A heat pump outside a home. Heat pumps commonly contain super-polluting HFCs

The role of natural refrigerant heat pumps in decarbonisation

Heat pumps are a key technology in the decarbonisation of buildings, potentially reducing emissions by up to 66-80 per cent compared to heating options reliant on fossil fuels.[1]

In 2022 the European Commission launched its REPowerEU Plan, setting out an ambitious goal of 10 million heat pump installations from 2022-27.[2] More recently, in order to meet its 2030 climate target, the EU has estimated it will need to roll out six million heat pumps a year from 2025 onwards.[3] In the UK, the Government has announced a target of 600,000 heat pump installations a year by 2028.[4] It is widely recognised that securing such an uptake of heat pumps will require Government interventions, for example in the form of consumer subsidies and support for the servicing and installation sector.

All heat pumps deliver emissions reductions compared to fossil fuel boilers; however, there are still climate impacts associated with the energy they use and the refrigerants they contain, which may leak out during production, during use and at end of life. As electricity grids decarbonise and advancements are made in heat pump energy efficiency, the proportion of a heat pumps emissions coming from the refrigerant will grow.

The most common refrigerants used in heat pumps are HFCs, a group of fluorinated greenhouse gases (F-gases) with GWPs commonly hundreds or thousands of times greater than CO_2. Their continued use in new heat pumps, which typically have a lifetime of 20-25 years, will see the emissions of these climate super pollutants locked in until about 2050, seriously jeopardising 2050 net zero targets and EU legislation which is phasing out these gases.[5]

Fortunately, climate-friendly natural refrigerants are available as alternatives to HFCs in heat pumps and their use is increasing. These include CO_2 (R-744), propane (R-290) and ammonia (R-717), all with GWPs of one or less over a 100-year period.[6] Increasingly, performance data demonstrates that natural refrigerant systems are equally or more energy efficient than their HFC counterparts and can therefore reduce energy-associated emissions as well as long-term running costs.[7]

The International Energy Agency (IEA) estimates that installing HFC-free heat pumps, thereby eliminating HFC refrigerant leakage emissions, could deliver an additional 10 per cent emissions reduction compared to a fossil fuel boiler.[8] On top of this, additional halocarbon emissions from the production of HFCs – which involves chemical feedstock and byproduct emissions, which impact both the climate and the ozone layer – can be avoided by switching to natural refrigerant technologies.[9]

Above: At Chillventa 2024, a majority of heat pump manufacturers were showcasing natural refrigerant models

The current landscape: opportunities and barriers

HFCs are being phased out in the EU under the 2024 EU F-gas Regulation and phased down globally under the Kigali Amendment to the Montreal Protocol.[10] In the UK, HFCs are controlled under the 2014 F-gas Regulation, which is being reviewed with an aim to consult on proposed changes in 2025.[11]

The EU F-gas Regulation is the most ambitious F-gas legislation in the world and is central to driving green innovation across the cooling and heat pump sectors. The HFC reduction schedule, which requires a complete phase-out by 2050, is facilitated by new equipment bans which prohibit the use of HFCs according to the GWP and equipment type, thus reducing demand for these gases (*see Table 1 on p.7*).

From January 2027, the use of HFCs with a GWP of 150 or more in monobloc air-to-water heat pumps will be prohibited. This clear and ambitious policy has shaped the direction of travel in this sector, with many major domestic EU heat pump manufacturers now transitioning away from HFC use in monobloc air-to-water heat pumps and offering natural refrigerant models.[12]

Following the removal of some significant subsidies and a decrease in fossil gas prices, previously strong growth in the domestic heat pump market in the EU slowed in 2023 and 2024,[13,14] while growth in the UK's nascent market has recently been observed.[15]

The uptake of heat pumps is influenced by various factors, such as supply chain issues, changes in national subsidies, workforce availability, consumer confidence and variations in electricity/gas price ratios. Holistic efforts which tackle these challenges in a sustainable way should explicitly support the uptake of natural refrigerant heat pumps.

Prioritising the deployment of natural refrigerant heat pump systems has a range of co-benefits that could be reaped by society. These include a broader heat pump roll-out to older, less thermally efficient buildings previously thought unsuitable for heat pump installations; greater energy efficiencies, particularly at high flow temperatures; and a reduction in the demand for and risk of illegal trade in HFC refrigerants.

However, EIA's analysis also identifies several barriers to the uptake of heat pumps which particularly undermine the uptake of natural refrigerant systems. These include a lack of skilled engineers trained to handle natural refrigerants, changes in national heat pump subsidies and a lack of knowledge of consumers on the benefits of natural refrigerant models.

Although the manufacturer roll-out of natural refrigerant based air-to-water systems appears to be flourishing, the same cannot be said for air-to-air split systems. Under the EU F-gas Regulation, the use of HFCs with a GWP of 150 or more in new air-to-air small split equipment (up to 12kW) will be prohibited from January 2029.[16] Despite the use of natural refrigerants in this equipment being proven for some time, manufacturers remain reluctant to release these systems onto EU markets at scale.

Discussions with manufacturers and standards experts indicate this is partially due to delays in the introduction of European Norm (EN) standards, which allow larger charge sizes of flammable refrigerants, including propane, in this subsector. It is also clear that the shortage of installation and service technicians trained to handle flammable refrigerants is a hinderance. However, from September 2025 all EU Member States need to have training and certification systems in place for alternatives to F-gases, so it is hoped that these barriers will be overcome.

It is anticipated that the entry into force of the EU's Emissions Trading Scheme II will play a role in the balancing of electricity/gas price ratios while incentivising the transition to clean heating.

Additionally, Europe's Social Climate Fund, which will distribute €65 billion across Member States in order to support vulnerable households most at risk from rises in fuel prices, offers a significant source of funding available to support the broader heat pump roll-out.[17]

Table 1: *Common domestic heat pump technologies and their refrigerant considerations*

PRODUCT TYPES			
Type	**Description**	**Level of natural refrigerant penetration**	**Equipment ban dates under the EU F-gas Regulation**[18]
Air-to-water 	Most commonly installed as self-contained or 'monobloc' systems, they take thermal energy from the air outside and use it to heat water that is then passed through radiators or underfloor heating. They can also be used for domestic hot water production and are the most popular retrofit option in homes that already have hydronic (water-based) heating systems.	Many manufacturers already have natural refrigerant air-to-water systems on the market for the domestic setting. While solid data on proportion of installed heat pumps with certain refrigerants is hard to come by, anecdotal evidence gathered at Chillventa 2024 showed that almost all monobloc manufacturers already sold natural refrigerant systems or would be releasing one in the very near future.	**12 kW or less:** Refrigerant with GWP≥150 – January 2027 Using any F-gas – January 2032 **Between 12-50kW:** Using refrigerant with GWP≥150 – January 2027
Air-to-air 	Air-to-air heat pumps distribute heat via the air. They most commonly work as a split system with one or more indoor units connected to a unit on the building's exterior, with refrigerant piped between the indoor and outdoor units.	The use of flammable refrigerants such as R-290 in these systems is currently limited. The use of R-290 in single split cold air air-conditioning systems is well proven and in 2022 Haier announced plans to launch a single split R-290 heat pump onto the EU market.[19] However, despite the technical viability of this technology, manufacturers have shown reluctance to launch these products onto EU markets.	**12kW or less:** Using refrigerant with GWP≥150 – January 2029 Using any F-gas – January 2035 **Over 12kW:** Using refrigerant with GWP≥750 – January 2029 Using refrigerant with GWP≥150 – January 2033
Ground and water source 	Ground and water source heat pumps typically extract heat from the ground or a water body by circulating brine through underground/ underwater pipes. They typically have much larger installation costs and are therefore more commonly installed in larger buildings, district heating and commercial and industrial uses.	Ground and water source heat pumps represent a relatively small proportion of currently installed heat pumps.[20] As with other heat pumps, the market is currently dominated by F-gas systems but some R-290 systems have already been brought to market.[21]	**12 kW or less:** Refrigerant with GWP≥150 – January 2027 Using any F-gas – January 2032 **Between 12-50kW:** Using refrigerant with GWP≥150 – January 2027

Supporting demand growth

The uptake of heat pumps varies across Europe with some countries clearly leading adoption while others are being left behind. However, sluggish uptake in the UK and across the EU leaves a significant challenge if stated heat pump targets are to be met.

At the end of 2024, the total number of heat pumps installed in Europe stood at 24 million, with two million units installed in 2024.[22] This poses a significant challenge if the EU is to meet its target of six million installations a year from 2025 onwards.[23] In the UK, annual installations reached more than 98,000 in 2024.[24] The UK Government's target is 600,000 installations a year by 2028.[25]

Given that the transition to natural refrigerants in heat pump systems is ongoing and could deliver significant climate benefits, as well as the low level of consumer awareness of refrigerant considerations, there is a particular need to support demand for natural refrigerant systems.

Subsidy and grant schemes

One of the primary drivers of heat pump uptake appears to be national subsidies, as evidenced by Italy's Superbonus scheme which covered 110 per cent of the cost of a heat pump, in effect paying homeowners to switch.

Italy now has one of the highest heat pump penetrations rates in Europe at 158 heat pumps for every 1,000 homes.[26] However, the removal of this scheme in 2023 led to a sharp drop in Italian sales and has been identified as a key driver affecting the broader slump in EU sales.[27]

Other learnings from subsidy schemes include the need to make them easily accessible to homeowners by offering upfront grants rather than rebates. Rebates require a homeowner to be able to provide the initial funds for installation and then apply for reimbursement. This can block access to low-income households. Incentives which are tied to certification schemes also support much needed skills training and standardisation.

The use of F-gas-free heat pumps in particular could be promoted via the introduction of subsidies for natural refrigerant heat pump installations, as has been done in Germany (see case study on pg. 9). Subsidies which target highly energy efficient and high temperature heat pumps should also be promoted. Not only do efficient, high temperature heat pumps reduce electricity demand, cut running costs and lower installation costs, but they are also often associated with natural refrigerant models.

Leveraging the Social Climate Fund

The EU is preparing to launch Emissions Trading Scheme II (ETS II), which aims to use carbon pricing to reduce emissions from buildings, transport and other sectors not covered by the existing ETS. While there are provisions that ensure these costs are levied on the upstream suppliers of fossil fuels or energy, there is an expectation that a significant proportion will be passed on to consumers.

In order to tackle the concern about rising consumer energy prices, the EU has also set up a Social Climate Fund (SCF) designed to provide financial assistance to those most at risk from rises in energy and fuel prices. It is expected the SCF will provide funds for, among other things, transitioning away from fossil fuel-based home heating technologies and towards renewable alternatives, such as heat pumps.

Funded through the sale of carbon allowances, up to €65 billion will be provided to Member States for use between 2026-32.[32] Additionally, mandatory Member State co-financing of their individual plans at a rate of 25 per cent means the fund is expected to mobilise €86.7 billion.[33]

With the support of advisory documents from the European Commission, each Member State will have to submit its own Social Climate Plan, which lays out how the state intends to use the funds provided, by 30 June 30 2025. This must specifically lay out plans to 'decarbonise heating and cooling', among other aims.[34] The plans must be fully operational by 2026, outlining a socially just decarbonisation strategy, before the ETS II comes into force in 2027.[35]

Given the performance benefits (see section *Improving communications*), natural refrigerant heat pumps could reduce heat pump running costs, lower the costs of retrofitting houses to be heat pump ready and maximise the number of buildings that could be fitted with a heat pump.

During the summer of 2024, the EU held a public consultation on the application of the 'Do No Significant Harm' (DNSH) principle to the SCF. The DNSH is defined as 'not supporting or carrying out economic activities that do significant harm to any environmental objective'[36] The EU could use this principle to ensure that F-gas-based refrigerant systems are either entirely invalid for funding under the SCF or that natural refrigerant systems are given priority.

Under the delegated acts to the EU Taxonomy regulation, the Commission has already set a refrigerant threshold of GWP 675 on heat pumps for their installation to be considered a 'sustainable activity'.[37] While this could

be transferred into Social Climate Plans, given the acceleration that has taken place towards natural refrigerant heat pumps in Europe since the Taxonomy regulation was passed in 2020, the Commission should advise Member States to implement significantly lower GWP thresholds for refrigerants or prioritise the installation of natural refrigerant heat pumps.

Green public procurement

Public procurement rules can help local and national governments meet their own climate targets while also creating a base load demand for manufacturers and installers.

If green public procurement (GPP) rules specified that public buildings must install only the most climate-friendly heat pumps, thereby mandating natural refrigerant systems, this could help boost demand and investment in these technologies and prove that their efficiency in a range of buildings and locations.

In Italy, there exist Minimum Environmental Criteria (CAMs) for "building energy services", which include refrigeration and heating services. The CAM states that equipment for domestic hot water and air cooling and heating "must also be equipped, where available on the market, with natural refrigerants".[38] Italy is the only country in the EU to have made the minimum environmental criteria mandatory in GPP.

If this was emulated across the EU and UK, it could help stimulate uptake of natural refrigerant technology, both within public buildings and outside of this sector through increased technological development.[39]

Above: The Social Climate Fund provides an opportunity to support natural refrigerant heat pump installation in the EU.

Above, inset: German subsidies already prefer natural refrigerants.

German case study

Under the Federal Funding for Efficient Buildings (BEG) scheme, German residents can receive a basic subsidy of 30 per cent of the cost of a domestic heat pump installation. A series of additional bonuses are also available; specifically, a five per cent "efficiency bonus" is added if the heat source is ground or wastewater, or if the system utilises a natural refrigera.[28]

Since the subsidy amounts and bonuses were updated in January 2024, there has been an increase in the percentage of heat pump installations claiming the efficiency bonus. In March 2024, 65 per cent of installations were eligible for a bonus but by December 2024 the proportion was 76 per cent.[29] While these figures aren't broken down any further to specifically refer to the refrigerant used, it can be assumed using past data that the majority of installations claiming the efficiency bonus are natural refrigerant systems.

The other type of installation eligible for the bonus — ground and water source heat pumps — accounted for just seven per cent of all heat pump installations in Germany in 2023.[30] Therefore, we can conservatively estimate that by the end of 2024, at least a majority of domestic heat pump installations in Germany featured natural refrigerant systems.

In the medium term, the natural refrigerant bonus is designed to increase the availability of these technologies on the German market. As a signal of its intent to transition to all natural refrigerant heat pumps, the German Government announced that the BEG will fund only natural refrigerant heat pump systems from 2028.[31]

Removing roadblocks to adoption

Addressing skills shortage

To meet the EU's ambitious heat pump roll-out targets, the European Heat Pump Association (EHPA) estimates that the number of employees in the European heat pump industry will need to grow by more than 300 per cent to about 500,000 (up from 117,000 currently) by 2030.[40]

In addition to training on heat pumps, technicians handling F-gases are required to be certified. The updated EU F-gas Regulation now requires technicians to be trained in handling alternatives to F-gases, i.e. natural refrigerants. In September 2024, the European Commission set out the minimum requirements for these certification schemes via a delegated act. Member States now have until September 2025 to adopt these requirements and set up the schemes.[41]

While the UK's F-gas Regulation does not set out requirements for engineers to be trained on F-gas alternatives, it faces a similar challenge in the lack of qualified heat pump installers. The UK is likely be impacted heavily by the transition to natural refrigerants in the EU as over half of the UK's heat pumps are imported from the block.[42]

The lack of skilled installation and service technicians is broadly accepted as a key barrier to the heat pump roll out.[43] While increasing attention is being paid to the need to train technicians in this sector, low levels of awareness of the EU F-gas Regulation mean that upcoming bans on the use of HFCs in heat pumps risk being undermined by a lack of workforce skilled in handling natural refrigerants.

Member States must fulfil their duty to set up national certification schemes for natural refrigerant handling as soon as possible to avoid equipment bans coming into force without the necessary workforce available to handle the alternatives. There is an urgent need to increase the pace of F-gas-free heat pump training. Ireland's scheme, which gives installers €500 to offset costs of registered training, could be replicated to boost uptake of certification.[44]

Ensuring that heating technicians are aware of the various heat pump options available, are trained in how to install them and understand their differing energy efficiencies, and therefore running costs, is a key component of successful heat pump roll out.

According to the European Heating Industry, close to 80 per cent of consumers buying new heating systems receive advice from an installer and about 96 per cent of them follow that advice either completely or to a great extent.[45]

Above: A rapid increase in installer training is needed for the heat pump roll-out

Actions to address skills shortage

In March 2023, renewable energy trade associations and representatives of installers of clean technologies, with the support of the European Commission, set up a large-scale skills partnership for the renewable energy industrial ecosystem.[46] The aim is to provide an operational response to the skills gap in the EU and promote the development of an expert workforce in the sector.

EHPA have developed a detailed plan for boosting heat pump deployment.[47] Key actions identified to address the skills shortage include:

- financial incentives aimed at enabling more installers to receive training
- ensuring heat pump installers have a minimum level of skills
- marketing and job opportunity awareness raising campaigns aimed at encouraging school leavers and existing heating system installers
- ensuring training courses for architects and home designers include heat pumps
- reducing red tape to support the installer profession
- supporting staff in local public bodies to enable them to carry out local heat planning as required in the energy efficiency directive.[48]

Best practice examples

HP4ALL is an EU-funded project aimed at increasing the number of heat pump installers and designing a heat pump competency framework. In 2021, it produced a report of best practice initiatives designed to increase the skills in the energy sector.[49] Key learnings identified by the report include:

- the potential for national heat pump-related industry associations to feed into National Energy and Climate Plans (NECP), noting that this was successfully done in Italy enabling the NECP to support heat pump roll out[50]
- supporting training via focused marketing to reach the right people and delivery of high quality, up-to-date heat pump training
- establishment of high-quality certification schemes, which also ensures customers can be assured of the level of service
- embedding training into wider policies, such as requiring installations to be undertaken by certified personnel in order to receive subsidies. Examples include MaPrimeRenov in France and the Green Homes and Mortgages initiative in Romania
- creation of energy advice one-stop shops and networks of experts in energy efficiency.

Above, left: An installer discusses heat pumps with a homeowner. Advice from installers can help drive natural refrigerant heat pump adoption.

Above: Financial incentives for installers can help encourage training uptake

While there has been a significant amount of attention paid to supporting the development of skills in the heat pump sector, many initiatives fail to recognise the need to educate around refrigerants and the upcoming impacts of the EU F-gas Regulation.

Engagement at the national and EU-wide level with installer associations should be prioritised and include information on upcoming F-gas equipment bans, certification schemes for natural refrigerant handling and the performance benefits of natural refrigerant heat pumps.

Safety standards and building safety regulations

While there has been an increase of natural refrigerant air-to-water heat pumps arriving on the market, there has been significantly less progress in the roll-out of natural refrigerant air-to-air split systems.

These heat pumps are particularly important for uptake in southern European countries and those with a low proportion of existing hydronic heating systems. In conversations with EIA, heat pump manufacturers identified restrictive safety standards and national building safety regulations as key blockers to their production of these units. While some single split units (with just one indoor air distributor) are now available with R-290, limits on the amount of flammable refrigerant placed in them is holding back the uptake of multi split units in Europe.

Due to the fact that, unlike a monobloc air-to-water heat pump, the refrigerant in an air-to-air system is commonly present in pipework on the inside of a building, more stringent requirements are generally applied for flammable refrigerants, such as R-290.

The two primary safety standards relevant to air-to-air heat pumps are EN 378 and EN 60335-2-40. The UK remains subject to and involved in the review of these EN standards.

When progress is made in these standards, it often takes a number of years for these to be harmonised across Europe. For example, a revision of IEC 60335-2-40 passed in 2022 that allowed for an increased flammable refrigerant charge size was only published as EN 60335-

2-40 in November 2024 and is still awaiting its final harmonisation to be completed.

Currently, a review of EN 378, ongoing since 2016, is proposing to allow marginally higher charge limits for flammable refrigerants as well as introducing design rules that would allow for more flexible flammable refrigerant charge allowances provided appropriate safety measures are applied.

National authorities should support the updating of these standards to allow the safe increase of flammable refrigerant charge sizes. These standards should also be made more inclusive of different design measures used to offset the potential increased flammability risk from larger flammable refrigerant charge sizes. When such changes are adopted, the harmonisation of these standards across Europe should be prioritised.

In 2020, a report from the European Commission identified building safety regulations as a significant blocker to the installation of air-to-air split systems containing flammable refrigerants in certain nations.[51]

For example, France, Spain, Italy and Austria have restrictions on flammable refrigerants, particularly in apartment buildings. In Italy these safety regulations are enforced at a town level, requiring authorisation from the local fire department.[52] These varying requirements cause manufacturers of the systems to design products for the most stringent markets, even where less strict safety regulations exist elsewhere in order to avoid complicating their production processes.

National authorities should work to harmonise building safety regulations across Europe to enable greater clarity and stability for manufacturers. Future building safety regulations should rely on the established international framework for ensuring the safety of these systems, namely the standards discussed above.

Above, left: Installers reviewing a safety standard.

Above: A collection of refrigerant cylinders.

Improving communications

The heat pump industry has been the subject of numerous attacks from the boiler and fossil fuel industries and their lobbyists.[53]

Claims about the inability of heat pumps to keep homes warm, their price in comparison to new boilers and other aspects such as noise levels have been used to deter consumers from investing in new installations.[54] These campaigns have been particularly vociferous in the UK, where heat pump installations remain low and individual gas boilers still dominate.[55]

In several ways, natural refrigerant heat pumps are better placed, compared to F-gas systems, to counteract these claims due to their performance and climate credentials.

Performance benefits

Data published by the German Government on the air-to-water heat pumps eligible for its national subsidy scheme reveals that R-290 products are on average rated to be six to seven per cent more efficient than F-gas products[56]

Installer reported data on the real-world performance of their heat pumps in the UK shows a similar uplift in performance with R-290.[57] Higher efficiencies also mean greater energy savings for customers and so can be used to counteract the relatively high upfront cost of installation when compared to a fossil gas boiler. These benefits were also confirmed by several manufacturers at Chillventa 2024.[58]

Data collected by EIA suggests that R-290 monobloc heat pumps typically operate more quietly and have a wider possible operating temperature range than those using high GWP HFCs..[59]

All these features could be at the forefront of the promotion of R-290 heat pumps to counteract misinformation from the pro-gas boiler lobby towards heat pumps more generally.

Retrofit capabilities

The higher energy efficiency at higher maximum flow temperatures of R-290 systems could broaden the market for heat pumps generally, as they can be installed with less need for radiator upgrading and other works.

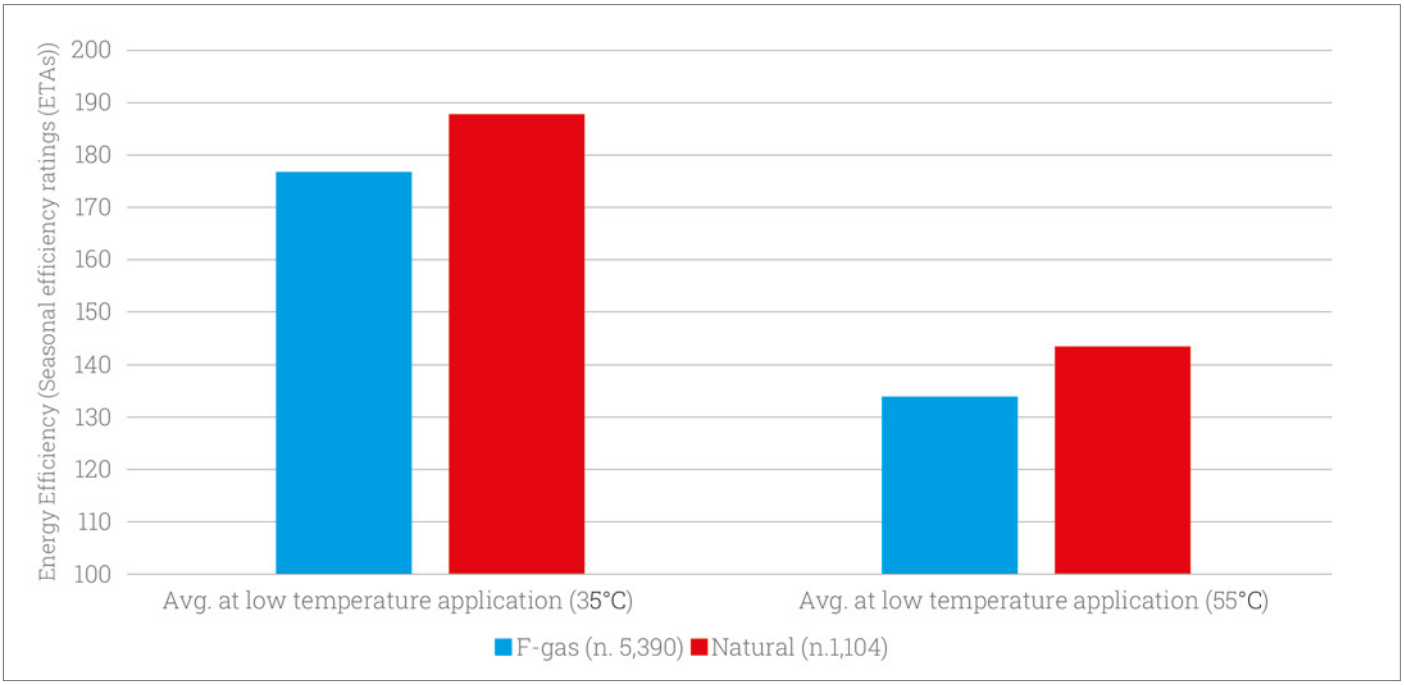
For homes and buildings that cannot significantly improve their insulation (due, for example, to historical status) or homeowners who cannot afford to do so in order to make their buildings suitable for a standard low temperature heat pump, an R-290 system with higher flow temperatures could meet their needs, allowing for wider heat pump roll out.

Given the EU and UK ambitious heat pump installation targets, messaging that includes the positive impact R-290 systems can have on the number of buildings that are eligible for retrofitting could improve their profile with policymakers and the wider heat pump industry.

Refrigerant labelling

Several common F-gas refrigerants are still being marketed as climate-friendly options for heat pumps, despite GWPs hundreds to thousands of times greater than natural refrigerant options.[60]

Figure 1: *Comparison of the energy efficiency ratings of air-to-water heat pumps eligible under the German BEG scheme split by refrigerant type.*



These F-gases do indeed have lower GWPs than previous options, but the lack of differentiation between these and natural refrigerants in terms of climate impacts dilutes the case for naturals.

Standardising and protecting the brand for natural refrigerants and more clearly stating their climate benefits as opposed to F-gases would help define their role in the market. Given that one of the primary attractors to all heat pumps is their climate benefits, further promoting natural refrigerant systems as the gold standard of climate-friendly technology could support their adoption.

Under the EU F-gas Regulation, products containing F-gases must include their F-gas designation, GWP value of the F-gas, weight and CO_2e clearly on the labelling and instruction manuals.[61] Any equipment containing F-gases with GWP 150 or more must include this information in advertising descriptions.[62]

Reduction of import dependency

As the EU attempts to reduce dependency on non-EU products, it is worth noting that most F-gases used in the EU are imported (from China). In 2022, just 17 per cent of the EU's total F-gas supply was produced or reclaimed within the EU.[63]

Additionally, a primary material needed for the F-gas production process, fluorspar, was produced only in two EU countries and the UK in 2021.[64] According to the EU's Raw Materials Information System, just 2.4 per cent of global fluorspar production comes from the EU and the EU's import reliance was calculated at 60 per cent. Taking this into account, just seven per cent of the EU's total F-gas supply could be produced in the EU without the import of one of the primary ingredients. While other industries use fluorspar, more than a quarter of EU supply is used in the production of fluorochemicals (including refrigerants).[65]

According to the EHPA, when compared to other climate-friendly technologies such as solar panels or wind turbines, the heat pump supply and production chain has a higher proportion of EU made components and production facilities.[66] Retaining or increasing this proportion is politically desirable. The primary source of R-290 is fossil gas and while the EU has high import reliance on gas as a whole, the demand for use in heat pumps, even under the most ambitious uptake scenarios, would be more than fulfilled by domestic production.[67]

Bio-propane, created without the need for fossil fuels, is also already being produced in the EU.

Avoiding future refrigerant price hikes and connections to illegal trade

As the HFC phase-down progresses, the cost of HFCs used to refill heat pumps during servicing and maintenance will increase, potentially leading to higher costs for heat pump owners.

The scarcity of HFCs is also driving an ongoing illegal trade in these gases, as documented by EIA.[68] When having their heat pumps serviced, customers could inadvertently be fuelling illegal trade in HFCs and filling their heat pumps with unknown substances reducing efficiencies and even risking safety. By avoiding the use of HFCs, heat pump users can avoid costly refrigerant price hikes and the risk that their refrigerants are associated with illegal trade.

Above: A smart meter. Homeowners could save energy and money with an efficient natural refrigerant heat pump.

Conclusion and recommendations

The roll-out of heat pumps is a primary lever for the decarbonisation of buildings.

As this major shift in home heating occurs, policymakers should ensure that the emissions reductions delivered are as high as possible. With today's heat pumps expected to still be in operation around the 2050 net zero deadline, ensuring we do not lock in highly climate-damaging refrigerant emissions to this vital green technology is paramount and it is incumbent on the heat pump industry and manufacturers of F-gas-free systems to promote the benefits of natural refrigerant heat pumps.

The EU and UK administrations should direct the relevant authorities to promote the use of natural refrigerant heat pumps across the board, as well as ensuring their workforces are ready for the roll-out of these systems. The EU should use the opportunity ahead of it in the form of the Social Climate Fund to advise Member States on these measures.

Authorities must also prioritise removing any potential roadblocks in the roll-out of natural refrigerant heat pumps. It is vital that authorities ensure the adequate training and certification of installers in handling natural refrigerants. The certification schemes set up should also inform installers on the relevant aspects of the F-gas Regulation as well as the performance benefits and societal co-benefits delivered by natural refrigerant heat pumps.

National authorities should use their influence to support the updating of European and international safety standards to make way for more flexible limits for flammable natural refrigerants. They should also remove unnecessarily strict constraints within national building regulations that restrict the installation of air-to-air heat pumps containing flammable natural refrigerants.

Policy recommendations for the EU, UK and national European administrations:

- **Implement preferential bonuses** for natural refrigerant systems in heat pump subsidy schemes
- **Set a date** beyond which national heat pump subsidy schemes will only support the installation of natural refrigerant systems
- **EU Member States should use the upcoming Social Climate Plans** to specifically boost the adoption of natural refrigerant heat pumps
- **Restrict subsidies** to installations conducted by engineers with the relevant refrigerant handling certifications for the system they are installing
- **As soon as possible, set up heat pump training schemes** that take into account natural refrigerant handling considerations, or add these elements into existing training schemes
- **Ensure training schemes also provide the workforce with information on the restrictions under the F-gas Regulation** and the benefits of natural refrigerant systems
- **Where relevant, national authorities should support the updating of safety standards** to allow for more flexible flammable refrigerant charge limits
- **Update national building safety regulations** to ensure they do not impose restrictions on the use of flammable refrigerants beyond those specified in the internationally accepted safety standards
- **Use National Green Public Procurement schemes** to require the use of natural refrigerant heat pumps in the public building estate.

Above and opposite page: The European Parliament and UK Houses of Parliament. European governments can maximise the benefits of the heat pump roll-out by promoting natural refrigerant systems.

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