POSITION PAPER

Photo: Ecoforest

Financing heat pumps – barriers and solutions

This paper examines the financial barriers to the widespread adoption of heat pumps. It explores the overall costs, the electricity to gas price ratio, upfront investment, and considerations specific to industrial heat pumps. By shedding light on these barriers and suggesting potential solutions, we aim to provide valuable insights into the formulation of policies and financing strategies that promote a more sustainable and energy efficient future.

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General overview on the cost of heat pumps

Understanding the total cost of ownership

Heat pumps are an important substitute for standard fossil fuel-based boilers. Functionally equivalent, more efficient and renewable-based, they provide heating and sanitary hot water. Reversible units can also provide cooling, which improves efficiency and adds additional comfort for the user.

In a rational world, consumers would base their purchasing decision on a mix of cost and comfort criteria. Thus, they would calculate the total cost of ownership (TCO) over the expected useful life of each alternative and choose their heating system accordingly. In taking a TCO perspective, the higher initial investment in a system can be overcompensated by lower operating costs. The outcome of such a calculation depends on the difference in initial investment, on the difference in energy demand and on the difference in energy cost (prices at the time of decision and their expected development trajectories over the useful life). In reality, investors are more often guided by a short-term focus on investment cost only, ignoring the TCO perspective.

In the past, a TCO perspective showed a cost advantage for heat pumps due to much lower operating costs, but this advantage has decreased significantly in many markets due to a parallel decrease in fossil fuel prices and an increase in electricity costs (Figure 1). This results in a less favourable energy price ratio for heat pumps.

General approaches to reduce the costs

1. **Promoting awareness of total cost of ownership and side-benefits:** The sector and policy makers need to focus more on creating awareness of both the total cost of ownership concept and the side-benefits of heat pump systems that increase cost competitiveness over the useful life of the product: influencing factors are increased efficiency at current costs and cost reductions along the value chain that offer added value to the consumer, such as the integration of heat pumps into the building ventilation system, the use of electricity generated on site, the use of free waste heat from cooling processes for heating and sanitary hot water. The latter is particularly important in large commercial buildings.
2. **Development of a consistent long-term decarbonisation pathway:** The most cost-efficient impact on heat pump market development will be the development of a decarbonisation pathway for society in general and the heating/cooling sector in specific, with short-, mid- and long-term targets, including the number of installations, disconnection to gas grid, etc. If governments develop these plans, announce them, and set a timetable for their execution, industry can and will adjust R&D as well as production planning. At EU level, the publication of the Heat Pump Action Plan and the proper development and implementation of the National Energy and Climate Plans (NECPs) are important to providing clarity to the sector at large (investors, manufacturers, installers, citizens). At national level clear and consistent policies and measures are needed as well. If it is clear that regions will be disconnected from the gas grid, investors will stop choosing combustion technology today to avoid the disadvantage of system change in the future.

Since this change cannot be financed by government money alone, it is of paramount importance to align the individual's economic rationale with the goals of society. Governments must create a political framework that makes the most sustainable solutions the ones that are most interesting from an economic perspective of the investor/decision-maker. Only then will it become more interesting to buy low/no emission heating and cooling systems today.

Operating costs

Exploring energy price disparities

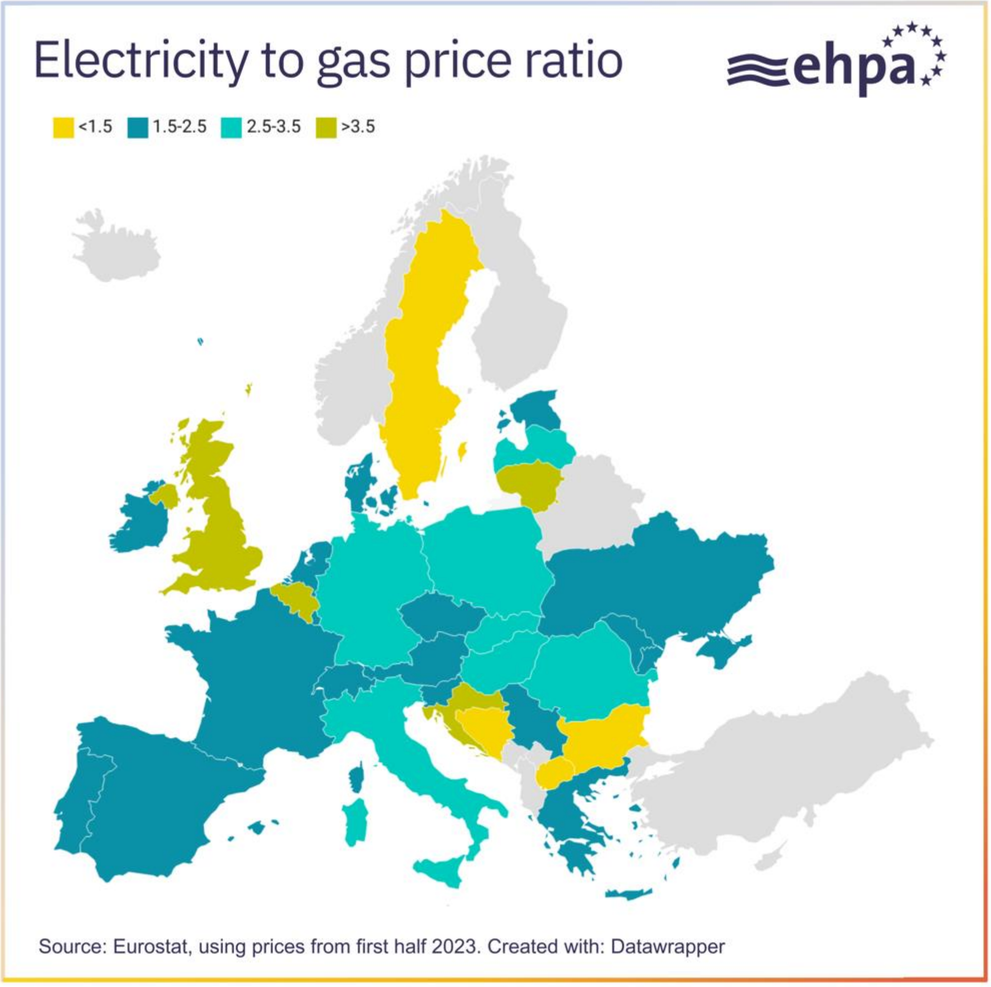

Figure 1: Map of electricity to gas price ratio in European countries

In some countries, the gap between the operating costs of heat pumps and fossil fuel boilers persists, despite the clear energy efficiency advantage of heat pumps. Europe's ambitious targets, as outlined in the RePowerEU plan, highlight the critical role of heat pumps in decarbonizing heating systems. However, the price ratio of electricity to gas - the main fossil fuel used for heating in Europe - often discourages households from switching to heat pumps, hindering progress towards sustainability goals (Figure 2).

The energy price ratio, which compares the cost of electricity (the auxiliary energy for most heat pumps) to the cost of providing 1 kWh of useful heat energy from alternative technologies, is a key metric to analyse this matter. It is based on the cost of energy use (excluding annual fees, meter readings, etc.) and includes efficiency losses of the fossil fuel boiler. A heat pump system has a comparative operating cost advantage over competing technologies when the Seasonal Performance Factor (SPF) at the site is higher than the energy price ratio. The greater the difference between the SPF and the energy price ratio, the greater the advantage.

To incentivise people to buy a heat pump, they need to see a rapid return on investment. To achieve this, electricity should be no more than double the price of gas. However, this is not the case in most countries. Many factors contribute to this issue, most notably the components of the electricity bill, including the energy price, network costs, and taxes and levies, each of which affects the overall cost structure.

Potential solutions

1. **Shift taxes and levies away from electricity bills:** moving taxes and levies away from electricity bills and add them for example to general budgets can alleviate the burden of disproportionately high taxes and levies on electricity, making cleaner heating options more economically viable for consumers.
    a. The taxes and levies not related to energy should be removed, for example in Italy the feel for the national broadcaster is paid via the electricity bill.
    b. Levies and taxes related to policy support should be removed. For example, subsidies for renewable energy or to help vulnerable households in the energy transition.
    c. Excise duties should be reworked so that they make sense also from an environmental point of view, for example, switching from volume to energy content-based taxation.
2. **Put a price on the use of carbon:** introducing a price on carbon emissions can provide a direct incentive for reducing carbon-intensive practices and encourage investment in low-carbon technologies like heat pumps. The EU's expansion of the European emission trading system (ETS2) will extend the "polluter pays" principle to fuels used in buildings other than electricity (already covered in the main ETS) and transport. However, it will only kick in from 2027 and has its limitations (e.g. a price cap). In this context, national carbon pricing can also be beneficial. A carbon tax has been introduced in January 2021 in Germany, and it has been in place in Sweden since 1991 and in Finland since 1990.
3. **Offer dynamic electricity tariffs:** offering lower or variable electricity tariffs for consumers adopting flexible heat pumps can incentivize their adoption and utilization. This strategy not only promotes energy efficiency but also encourages the integration of renewable energy sources into the grid, contributing to overall decarbonization efforts. It is expected that the reformed Electricity Market Design will impact this, as it focuses on higher grid investments, non-fossil flexibility support options for Member States, and increased assessments of EU flexibility needs.
4. **Finalise the revision of the Energy Taxation Directive:** a complete Energy Taxation Directive, aligned with the new EU climate and energy goals, could allow electricity to be taxed less than fossil fuels.

Upfront costs for heat pumps

Unpacking initial barriers to adoption

The overall cost competitiveness of heat pumps compared to other heating technologies depends on a variety of factors, including initial purchase price, operating and maintenance costs (including electricity costs), durability, and financial incentives such as grants or tax credits. In most markets, despite financial incentives, **heat pumps generally have higher upfront costs than conventional fossil fuel heating systems such as oil or gas boilers but benefit from lower running costs over their lifetime due to their superior energy efficiency.**

Reducing the upfront costs of purchasing and installing heat pumps is critical to making them more attractive to consumers. Technology type, rated capacity, manufacturing quality, functionality, and geographic location are some of the factors that affect the final cost of the equipment. The maturity of the market also influences costs by affecting installation and additional costs such as electrical and piping work or storage tanks. Labour costs also contribute to differences in upfront costs between countries.

Switching to a heat pump in an existing house may involve additional costs, especially regarding installation. For instance, older homes may need to upgrade their electrical systems to accommodate higher electrical loads based on the heat pump's capacity. In addition, existing radiators may need to be replaced with larger radiators or alternative heating systems, such as radiant floor heating or forced air systems, to optimize heat pump efficiency. These upgrade costs can account for a significant portion of the total installation cost.

Efforts to reduce upfront costs are critical to increasing consumer interest in heat pumps. Government support and private sector financing have an important role to play in helping consumers manage these costs and take advantage of the energy savings offered by heat pumps. In particular, **there is an urgent need to help low-income households access cleaner and more cost-effective heating solutions** such as heat pumps.

Potential solutions

1. **Industrialisation of production processes and standardisation of solutions:** Both cost and efficiency improvements can be expected from dedicated developments at the component level. Also, the manufacturing of prefabricated sub-units (refrigerant cycles, complete outdoor units) that are then integrated into the casing and connected to the hydronic system help to reduce manufacturing time and cost. Economies of scale, verticalization of certain manufacturing processes and higher automation levels can all help to reduce the upfront costs of the product.
2. **Avoiding often changing product requirement legislation**: Legislation such as the F-gas Regulation and Ecodesign put specific requirements on heat pumps. Every time product requirements are changed or added, this leads to a re-design re-testing and re-certification of the heat pump which adds costs.
3. **Public finance incentives:** There is a wide range of public financial incentive schemes in different countries, including grant and subsidies (which are often different for lower and higher income households, and which should be redirected from subsidies for fossil fuel heating systems to heat pumps), reduced VAT rates for heat pumps, tax exemptions, among others. In Spain, France and Italy for example, a white certificate system is being implemented, through which the country obliges certain companies in the energy sector (generally energy suppliers and distributors) to demonstrate that they have been able to implement energy savings. In Spain for example, some electricity companies promote heat pumps with special contracts and upfront discounts to meet these savings.
4. **New business models (private financing):** The right regulatory environment can encourage the emergence of new business and financing models (Figure 2) that reduce the financial burden on consumers, including the following:
    - Energy as a Service (EaaS) and Heat as a Service (HaaS) models: EaaS / HaaS providers offer heat pump installations as a service, allowing building owners to pay for heating and cooling services rather than the equipment itself. In these models, the service provider takes on all the costs of financing, installing and operating the heat pump and charges the customer for this service in addition to the actual energy costs, e.g. a 10-year payback period. These models should be facilitated by enabling heat pump manufacturers or installers to provide loans and/or take financial risks to enable them to pre-pay the heat pump for their consumers. This approach eliminates the need for significant initial capital investment and spreads costs over time.
    - Energy Service Agreements: Third parties install and maintain heat pumps on homeowners' properties in exchange for a share of energy savings, similar to power purchase agreements (PPAs) for solar panels. In other words, the provider takes on all the costs of financing, installing and operating the heat pump, and instead of charging the end user for the service, takes a share of the energy cost savings over time.

- ESCO Partnerships: Energy service companies (ESCOs) collaborate with utilities to include heat pump installations in comprehensive energy efficiency projects, financed through energy performance contracts (EPCs), where the ESCO guarantees energy savings to cover the costs. ESCOs could offer, for example, HaaS/EaaS or ESA.
- Heat Pump Subscription Models and rent a heat pump: Companies offer subscription services where homeowners pay a monthly fee covering the cost of the heat pump, as well as the installation and maintenance.
- On-Bill Financing (OBF): Homeowners can repay the cost of a heat pump through gradual payments on their utility bills, with the utility company providing upfront financing.
- Valorising flexibility: End users use their heat pumps flexibly and this flexibility is valorised by the utility either individually or via an aggregator offering services to balance the grid.

5. **Partnerships between technology providers, energy distributors, utilities and service companies:** These partnerships are key to promoting sustainable and efficient energy solutions. These collaborations can lead to comprehensive offerings, many of those listed above under point 3, that integrate energy-efficient technologies, such as heat pumps, with distribution networks and services.

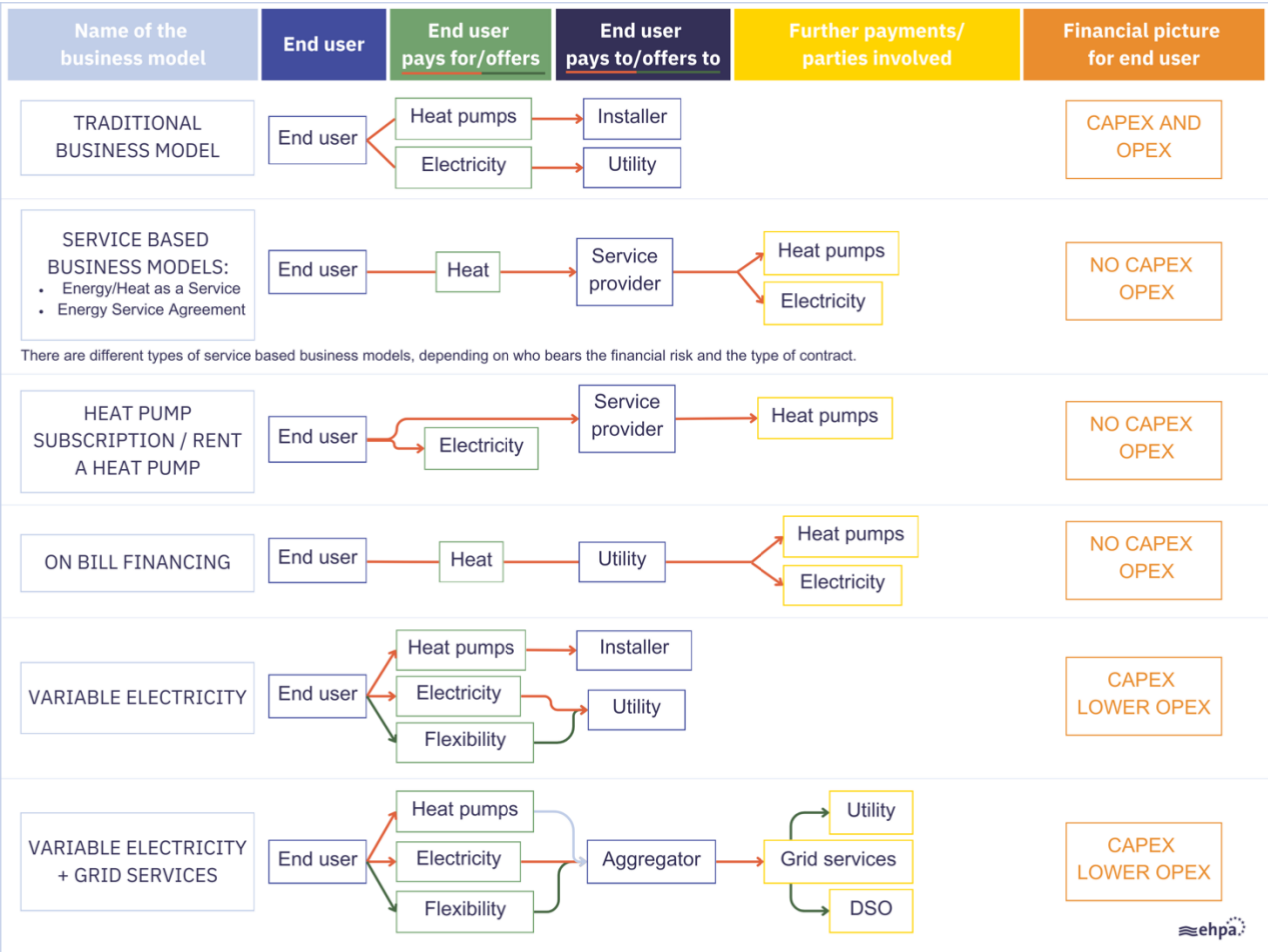

Figure 2: Partnerships between technology providers, energy distributors, utilities and service companies

6. **Other forms of private and/or public financing:**
   - Incentivizing Lenders: Governments can encourage banks and lending institutions to provide attractive loan terms for heat pump installations, like lower interest rates, longer repayment periods, or reduced down payment requirements.

- <u>Green Bonds and Climate Finance</u>: Governments and financial institutions can issue green bonds dedicated to residential heat pump installations, attracting environmentally conscious investors and offering favourable terms for homeowners.
- <u>Community Financing</u>: Communities can establish financing schemes where homeowners collectively invest in heat pumps and benefit from bulk discounts, shared maintenance costs, and more favourable financing terms. This model can also leverage local resources and support.

Improving running costs remains a priority, possibly through electricity tax reductions or specific heat pump tariffs, to further increase their attractiveness and uptake.

Industrial heat pumps

<u>Assessing the role of industrial heat pumps</u>

Figure 4: Photo of industrial heat pump in pasta company[1]

Heat comprises over 60% of energy consumption within industries. Utilizing renewable energy sources like air, water, sewage, ground, exhaust air from buildings (e.g., hospitals, hotels, offices), or waste heat from various processes and infrastructure, industrial heat pumps offer a viable avenue for decarbonizing low-temperature heat provision within industry. These heat pumps play a crucial role in advancing Europe's energy and climate objectives. Nearly half of overall heat demand is created by processes with temperatures below 200°C, which satisfies most heat requirements of sectors like food and beverage, plastics, textiles, wood products, and appliance and machinery manufacturing. Within the EU industry, the chemical and food sectors are emerging as the largest consumers of natural gas, accounting for 52% of consumption. To reduce this dependence, heat pumps appear as a key alternative solution.

<u>Key challenges and potential solutions</u>

Heat pumps, particularly those capable of operating at higher temperatures, entail high upfront costs, partially attributable to their **limited market penetration and standardization**. On average,

[1] Pasta company reduces costs by 68% with heat pumps, EHPA. Available at https://www.ehpa.org/heat-pump-stories/pasta-company-reduces-costs-by-68-with-heat-pumps-2/

low-temperature heat pumps are three times more expensive than gas boilers, while high-temperature variants can be up to eight times pricier.

Despite the upfront costs, heat pumps offer compelling long-term benefits. **Their superior energy performance results in approximately four times less primary energy consumption compared to boilers for the same output**, translating into lower and more resilient operational expenses. Consequently, for low-temperature requirements, replacing gas boilers with heat pumps becomes financially advantageous within a few years, even if the boilers have not reached the end of their useful lifespan.

In light of the above, several measures can be considered to address the cost challenges for industrial heat pumps and encourage their uptake:

1. **Financial mechanisms and subsidies:** To help companies make this transition, a number of mechanisms and subsidies are available at both EU and national levels to encourage investment in heat pump technology. At the European lavel, in 2022, the support schemes available included The European Fund for Strategic Investments (EFSI), Programme for competitiveness of Enterprises and Small and Medium-sized Enterprises (COSME), Recovery and Resilience Facility, Horizon 2020, H2020: INEA Grants for energy and transport, Connecting Europe Facility (CEF) Energy, Innovation Fund, and Just Transition Fund (Figure 3). EHPA is currently working on an overview of the available subsidy schemes at national level in the different European countries.

Investment support schemes

What are the potential investment support schemes to help industries make the switch?

Name	Focus	Description	Instrument	Budget + TRL
The European Fund for Strategic Investments (EFSI)	Cross-cutting research to maximize the energy efficiency of cross-sector industrial components in a cost-efficient manner	EFSI's goal is to help overcome the current investment gap in the EU and ensure that money reaches the local economy.	Equity finance, guarantees and debt financing	- 26 billion € - TRL 6-8
Programme for Competitiveness of Enterprises and Small and Medium-sized Enterprises (COSME)	Electricity efficiency; Heat efficiency and recovery; Carbon capture and storage; Sustainable infrastructure; Renewable energy	Provides venture capital and mezzanine finance to expansion and growth stage SMEs.	Equity finance	- 2,3 billion € - TRL 1-9
		Facilitates access to debt finance for SMEs.	Guarantees	
Recovery and Resilience Facility		Supports reforms and investments undertaken by Member States.	Debt financing, Grant/Subsidies	672,5 billion €
Horizon 2020	Cross-cutting R&I: improving system integration, optimal design, intelligent and flexible operation, including industrial symbiosis to increase energy and resource efficiency	2021-2027 EU Research Framework Programme.	Grant/Subsidies	- 100 billion € - TRL 1-9
H2020: INEA Grants for energy and transport		Helps innovative projects in the field of transport and energy.		- 5,3 billion € - TRL 6-8
Connecting Europe Facility (CEF) Energy		Makes direct investment into European transport, energy and digital infrastructures to address identified missing links and bottlenecks.	Grant/Subsidies, Guarantees, Debt financing	- 5,3 billion € - TRL 9
Innovation Fund	Sector-specific R&I: increasing the cost effectiveness of not yet economically viable technologies	Supports low-carbon innovative demonstration projects in energy intensive industries, innovative renewables, energy storage, CCUS	Grant/Subsidies	- 10 billion € - TRL 7-9
Just Transition Fund	Reduce emerging regional disparities caused by the transition towards a climate neutral economy (investments in SMEs, R&I, Deployment of technology and infrastructure, etc.)	Reskilling people, providing cleaner transport and energy efficient homes in sectors requiring major transformation, such as the steel, cement, chemicals and car manufacturing sectors	Various	7,5 billion €

Source: Opportunities to get EU industry off natural gas quickly: Cost analysis of alternatives to natural gas in food, chemical and glass industries, October 2022, CLIMACT.

Figure 3: Investment support schemes for industrial heat pumps at EU level.

2. **Scaling up investment in high-temperature heat pumps:** Even in a scenario characterized by consistently high energy prices throughout the decade, the comparative attractiveness of heat pumps increases due to their lower primary energy consumption. Under such circumstances, high-temperature heat pumps can even compete favorably with gas boilers. Numerous pilot projects focusing on low-temperature heat pumps have already demonstrated their economic viability, paving the way for wider deployment. However, scaling up investment in high-temperature heat pump projects remains crucial.

Some industry leaders are spearheading efforts in this direction, indicating a growing recognition of the potential of heat pump technology to facilitate the transition away from natural gas dependency in the EU industrial landscape.

3. **Addressing the electricity to gas price ratio:** In addition to increasing investment in high-temperature heat pumps, addressing the electricity to gas price ratio is also critical to the widespread adoption of industrial heat pumps. The favourable price of gas often makes it a more economically attractive option for heat generation, particularly for high-temperature processes. Bridging this price gap and creating incentives or mechanisms to balance the cost equation between electricity and gas prices could prove instrumental in facilitating greater adoption of heat pumps in industrial settings.
4. **Implementation of business models and innovative financing tools for the scale up of large heat pumps:**
    - Energy as a Service (EaaS) and Heat as a Service (HaaS) models: EaaS / HaaS providers offer heat pump installations as a service, allowing building owners to pay for heating and cooling services rather than the equipment itself. These should be facilitated by enabling heat pump manufacturers or installers to provide loans and/or take financial risks to enable them to pre-pay the heat pump for their consumers. This approach eliminates the need for significant initial capital investment and spreads costs over time.
    - Heat Pump Performance Contracts: The company or organisation installing the heat pump guarantees a given level of performance and energy savings through performance-based contracts. This can encourage private investors to finance the project in return for a share of the savings generated by the heat pump.
    - Green Bonds: Green bonds dedicated to financing heat pump projects can be issued by governments and organisations. These bonds are targeted at environmentally conscious investors and can offer tax incentives or lower interest rates to borrowers. At the EU level, the European Gren Bond Standard regulation, was recently adopted, which sets out the requirements that "environmentally sustainable bonds" should meet, starting from the EU Taxonomy.
    - Heat Pump Crowdfunding: Crowdfunding platforms or investment opportunities targeted specifically at heat pump projects can enable individuals to collectively invest smaller amounts in large-scale heat pump installations.
    - Public-Private Partnerships (PPPs): Promote partnerships between public and private sectors to fund and execute heat pump projects. By combining public funds or incentives with private investment, both parties can alleviate financial burden.
    - Heat Pump Aggregation: Aggregate several heat pump projects into a portfolio, enhancing their appeal to institutional investors and financial institutions. This strategy diversifies risk and boosts the scalability of heat pump financing.

Conclusion

The transition to heat pump technology offers a promising path to a more sustainable and resilient energy future. However, several barriers need to be addressed to facilitate widespread adoption:

- **Overall heat pump costs:** While the total cost of ownership (TCO) analysis suggests long-term cost advantages, short-term investment focus often prevails.
  - ⇒ To reduce costs and encourage adoption, strategies include raising awareness of TCO and side-benefits, l, offering subsidy programs and financial incentives, and aligning economic incentives with decarbonisation goals.

- **Operating costs:** Despite the energy efficiency advantages of heat pumps, disparities in energy prices, especially the electricity to gas price ratio, is one of the primary barriers.
  - ⇒ To encourage adoption, it's critical to close this gap through measures such as shifting taxes and levies away from electricity bills, introducing dynamic electricity tariffs, and carbon pricing mechanisms.

- **Upfront costs:** One of the main challenges is the higher initial investment required for heat pumps compared to traditional fossil fuel alternatives. Factors including technology type, market maturity, and additional installation costs add to these costs.
  - ⇒ Strategies such as industrialisation of production processes and standardisation of solutions, financial incentives (including grants and subsidies, reduced VAT rates for heat pumps, and tax exemptions) and innovative business models such as Heat-as-a-Service (HaaS) can be potential ways to mitigate these barriers.

- **Industrial heat pump deployment:** Industrial sectors, which account for a significant share of energy consumption, face high upfront costs and market standardisation challenges.
  - ⇒ Targeted financial mechanisms, increasing investment in high-temperature heat pumps, implementing new business models and addressing the electricity to gas price ratio are ways to unlock their potential.

While heat pumps offer compelling long-term benefits in terms of energy efficiency and reduced emissions, challenges remain. However, with concerted efforts from policy makers, industry stakeholders and financial institutions, these barriers can be overcome. By implementing supportive policies, financing mechanisms and incentive programs, consumers and businesses can be encouraged to switch to heat pump technology, contributing to climate goals.

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The European Heat Pump Association (EHPA) represents the European heat pump sector. Our over 170 members include heat pump and component manufacturers, research institutes, universities, testing labs and energy agencies.

EHPA advocates, communicates and provides policy, technical and economic expertise to European, national and local authorities, and to our members.

We organise high level events and manage or partner in multiple projects.

We work to shape EU policy that allows the heat pump sector to flourish, and to become the number one heating and cooling choice by 2030. Heat pumps will be a central part of a renewable, sustainable and smart energy system in a future decarbonised Europe.