

# A Hidden Challenge for Decarbonisation of the Building Sector: Implications from Heat Pump Boom in Europe

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## SYNOPSIS

Every government is making efforts to decarbonise the economy to achieve its climate change mitigation targets. However, the focus and support have been concentrated on the industries and the production side. However, some sectors, including the building sector, require not only industrial innovation but also a significant change in consumer behaviour. The recent boom and slowdown of heat pumps in Europe show the importance of consumers in decarbonising the building sector. Based on reviewing this case, this policy brief discusses the factors that may impact consumer choice and how the government could foster public engagement.

## KEY POINTS

- Heat pumps have emerged as a sustainable heating solution with low carbon emissions and cost-saving potential.
- Heat pump sales in Europe hit record highs in 2022, growing by 39% from the 2021 level and 100% from the 2019 level. However, they appear to be in a slump recently.
- The government's financial incentives and natural gas prices have driven ups and downs of heat pump deployment.
- To help decarbonise the building sector, the government needs to induce behaviour change among consumers through various policies, including imposing regulations, providing economic incentives, and raising public awareness.

## INTRODUCTION

Climate change has been increasingly capturing global attention, prompting governments around the world to embark on energy transition paths with commitments to meeting net-zero emissions by the middle of this century. Also, more and more corporations have pushed for this transition by setting their carbon emissions reduction goals. Although efforts of governments and corporations to decarbonise the economy and business operations are growing, they have focused on the production/supply side, i.e. expanding generation from renewables and developing and supplying low-carbon technologies and products. However, some sectors, such as buildings and road transport, require not only industrial innovation but also a significant change in consumer behaviour.

[Building operations contribute 30% of global final energy consumption and 26% of global greenhouse gas emissions by consuming energy for heating, cooling, lighting, and using appliances and equipment.](#) Thanks to various policies to promote energy-efficient buildings and appliances, many low-carbon technologies and products are already available. However, the fast deployment and utilisation of these technologies will depend on the consumer's choice. Even though technologies are commercialised and mature, they will be all spin and no substance if consumers do not purchase them. With this background, this policy brief discusses the role and importance of consumers in decarbonising the building sector and how the government could foster

public engagement by examining the recent boom and slump of heat pumps in Europe.

## ANALYSIS

### *Emergence of Heat Pumps as a Low-Carbon Heating Option*

[Space and water heating accounts for almost half of global energy use in buildings](#), and the market has been dominated by fossil fuel-based heating systems, such as gas boilers and furnaces. Therefore, low-carbon alternatives need to be deployed rapidly to help decarbonise heating and the building sector. Among a variety of heating options, heat pumps have emerged as a promising technology for sustainable heating solutions. Heat pumps extract heat from a lower-temperature area, lift the temperature through compression, and transfer the heat to a higher-temperature area. For example, in cold weather, heat pumps move heat from a building's cool outside to inside to warm the building. In addition to the indoor or outdoor air, heat pumps can tap thermal energy from the groundwater and the earth. Furthermore, heat pumps can offer both cooling and heating functions since they can reverse the direction of refrigerant flow.

As heat pumps transfer heat instead of generating it, they show 3-5 times higher efficiency than traditional and condensing gas boilers, and such a higher efficiency results in lower carbon emissions and heating cost savings. When producing one megawatt-hour (MWh) of thermal energy, heat pumps emit 0.146 tonnes of carbon dioxide equivalent (tCO<sub>2e</sub>), while gas boilers and condensing boilers produce 0.245 tCO<sub>2e</sub> and 0.221 tCO<sub>2e</sub>, respectively. Experts predict that CO<sub>2</sub> emissions from heat pumps will decrease to 0.078 tCO<sub>2e</sub> by 2030. Heat pumps also can reduce electricity consumption by about 50% compared to other electric heaters. Regarding the heating costs, it was estimated that [switching to heat pumps could save USD 105-1,287 annually for American households](#) and [CAD 700-3,500 \(USD 516-2,579\) annually for Canadian households](#), depending on the current heating equipment.

Due to such advantages, many countries have paid attention to heat pumps as their future heating option. The European Union (EU) stands at the forefront of promoting heat

pumps. In May 2022, the EU published the REPowerEU plan, aiming to reduce the EU's dependency on Russian fossil fuels and accelerate the green transition by increasing the share of renewables in the EU energy mix to 45%. It proposes doubling the current deployment rate of heat pumps in buildings and installing at least 10 million additional heat pumps by 2027. [The European Heat Pump Association \(EHPA\) interprets this objective as around 20 million heat pump installations by 2026 and nearly 60 million installations by 2030](#). Additionally, the EU's Energy Performance of Buildings Directive mandates the cessation of subsidies for oil and gas boilers by 2025 and the phase-out of fossil fuel boilers by 2040. Also, the EU recommends that member countries introduce a ban on gas boilers from 2028 in new buildings.

National-level policies further support this directive. The Netherlands ruled in 2018 that all new construction must be built without a connection to the gas grid, and Norway prohibited the use of oil for heating for all new and existing buildings in 2020. Austria and Germany have announced bans on new fossil fuel boilers starting in 2023 and 2024, respectively. Similarly, Denmark, the United Kingdom (UK) and France are expected to gradually ban fossil fuel boilers in new buildings from 2025 (Denmark and the UK) and 2026 (France). Along with these bans, the UK and Denmark respectively planned to install 600,000 new heat pumps by 2028 and replace 400,000 gas boilers with heat pumps and district heating by 2029.

### *Heat Pump Boom and Recent Slowdown*

The EU has experienced a remarkable increase in heat pump sales since the late 2010s. In the EU, the skyrocketing of heat pump sales was largely attributed to the spike in gas prices following the conflict between Russia and Ukraine, coupled with aggressive decarbonisation strategies targeting the building sector. According to the [EHPA's European Heat Pump Market and Statistics Report 2023](#), heat pump sales in Europe hit record highs (3 million units) in 2022, growing by 39% from the 2021 level and by 100% from the 2019 level. It led to 19.8 million units of accumulated heat pump installations in Europe. In 2022, France was the biggest heat pump market in Europe with 621,776 units

sold (16% increase from the 2021 level), followed by Italy (513,535 units, +35%), Germany (275,697 units, +59%), Sweden (215,373 units, +61.3%), and Poland (207,992 units, +112%). Some countries like Germany, Poland, Italy, and France reported more than a 30% increase in heat pump sales in terms of the share in total heating system sales. Notably, in France, heat pump installations (56%) have even surpassed fossil fuel systems (44%).

However, such an upswing in heat pump sales seems slightly enervated recently. In 2023, the sales of heat pumps in the EU fell for the first time in 15 years. Total sales in the 14 European countries decreased by 5% due to falling natural gas prices and rising interest rates. Particularly, heat pump sales were reduced by 36% in Italy, 42% in Finland, and 46% in Poland in 2023. In Germany, annual sales in 2023 (more than 350,000 units) increased by 50% from the 2022 level, but monthly sales have decreased since June 2023 and fell 40% in December 2023. Thus, it looks very challenging for the country to meet the target of installing 500,000 units of heat pumps per year by 2024.

### ***Behind the Scenes: What Drove These Ups and Downs?***

Although the government set ambitious targets for the deployment of heat pumps and developed strategies to support heat pump production, they will be hollow commitments that cannot guarantee the achievement of policy objectives if consumers do not purchase heat pumps. Thus, the key is securing public engagement in the heat pump deployment.

According to the [UK Office of Gas and Electricity Markets \(Ofgem\)'s consumer survey conducted in November 2019](#), consumers did not feel ultimately responsible for reaching net zero, although some recognised that they would need to play some part. In this sense, decarbonisation was not a high priority for consumers in changing their behaviour. Furthermore, many consumers said they would not change their current energy supply or systems without support or guidance since their biggest concern was the financial burden. [Deloitte's latest consumer survey in 2023](#) also confirms that economic benefit is the most important determinant of consumer behaviour. Consumers answered

that a more fundamental reason why they adopted a sustainable lifestyle was to save money rather than to protect the environment. Only 26% and 11% of the respondents were willing to pay more for sustainable products and make a purchase decision based on carbon footprint, respectively.

Indeed, the financial advantage to consumers looks like the leading facilitator for the rapid spread of heat pumps in the European heat pump markets. Given its high upfront cost, a heat pump may not be an attractive option for consumers. However, the government's financial incentives, including subsidies, tax deductions, and rebates, relieved consumers' cost burden. European countries have offered various subsidies and tax benefits to cover the costs of heat pump purchase and installation. Observations in the UK and Germany provide anecdotal evidence about the effects of subsidies on consumer behaviour. In the UK, the weekly number of applications for installation rose by more than 60% after the government increased the Boiler Upgrade Scheme grant for residential heat pump installation from GBP 5,000 (EUR 5,837) to GBP 7,500 (EUR 8,755) in October 2023. On the other hand, the number of applications for heat pump subsidies in Germany peaked in August 2022, just before the government lowered the upper limit of subsidy from EUR 24,000 to EUR 21,000. The applications between January and June 2023 dropped by 49.8% compared to the first half of 2022.

High gas prices also motivated consumers to switch their heating systems. A sharp rise in gas prices resulting from the Russia-Ukraine war made heat pumps secure price competitiveness in Europe. Between the first half of 2021 and the first half of 2023, while the average household electricity price in the EU increased by about 30% from EUR 220/MWh to EUR 289/MWh, the average household natural gas price increased by more than 85% from EUR 64/MWh to EUR 119/MWh. Given that heat pumps have cost-effectiveness when the electricity price is higher up to 2.5 times than the gas price, the soaring gas prices caused consumers' concern over heating costs, which served as a favourable condition for the heat pump industry. However, the demand for heat pumps was dampened as natural gas prices returned to pre-war levels in 2024.

### **Securing Public Engagement in Decarbonisation of the Building Sector**

[The International Energy Agency \(IEA\) explains that heat pumps still account for only around 10% of the global heating market in spite of a significant increase in sales, and global heat pump sales should expand by over 15% annually by 2030 to meet net-zero targets.](#)

The heat pump boom in Europe suggests public engagement, along with the government's strong policies, is essential to accelerate heat pump deployment and, by extension, decarbonise the building sector. Consumers can contribute to reducing greenhouse gas emissions from buildings by installing not only heat pumps but also using other energy-efficient appliances.

The government could induce behaviour change of consumers through various policies. First, regulations, such as restrictions on fossil fuel-based heating systems and appliances with poor energy efficiency, could be used to urge prompt action of consumers by imposing penalties for non-compliance. Second, financial support and incentives can be effective to encourage consumer participation by lifting a financial barrier to specific technologies or products. However, these policies have limitations. People may resist the strict command-and-control policies, and financial support may aggravate the government's fiscal burden. For example, Italy abolished a tax credit scheme to support installing insulation systems, heat pumps, and solar panels in February 2024 because of an increasing fiscal expenditure. Also, if the initial costs of appliances are incredibly high, they may remain unaffordable despite the government's subsidies. Therefore, it is necessary to raise public awareness of decarbonisation and net zero as a more fundamental way to ensure public engagement. If consumers recognise their roles in achieving a sustainable future and the urgency of their actions and have a higher willingness to pay for low-carbon goods and services, the energy transition will be realised more actively and smoothly.

In addition, regarding the heat pump installation, the combination of variable electricity pricing and thermal storage can make heat pumps more attractive to consumers by enhancing their cost-

effectiveness. By consuming electricity when prices are lower, typically during off-peak hours, consumers can further optimise their heat pump operation costs. Integrating thermal storage systems with heat pumps allows consumers to store thermal energy when electricity prices are low and utilise the stored energy later when prices are higher or when heating is needed.

### **CONCLUSION**

Decarbonisation efforts transcend government and industry, and individuals also should take part. The process of engaging the public in the energy transition often receives insufficient attention from the government. Convincing the public to embrace sustainable purchasing decisions is crucial for the success of any transition strategy. Effective communication, incentives, and policies are essential to facilitate this shift, emphasising the role of individual choices in achieving broader environmental goals.

### **WHAT TO LOOK OUT FOR**

- Governments' subsidies and other policies for heat pumps and their effects on sales of heat pumps
- Global oil and natural gas prices
- Initiatives to promote public engagement in decarbonisation

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