

Plugging heat in: smart policy can help electrify household heating in Europe

Heat pumps can slash EU fossil fuel imports, protect consumers from price shocks and boost local industry, but wider use depends on making them cost competitive with fossil heating.

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About

This report highlights how the high lifetime costs of heat pumps slow their uptake among EU households. The report assesses how reducing different components of electricity costs lowers the price ratio of electricity and gas - an important measure to make heat pumps more affordable. The analysis highlights the importance of lowering electricity prices in electrifying European heat demand.

Redesigning electricity bills can boost heat pump adoption across Europe

Heat pumps allow the EU to electrify its heat demand, cutting expensive fossil imports, protecting consumers from price shocks and invigorating domestic industry. Their wider adoption will depend on heat pumps becoming more affordable across the EU.

There are several factors that influence consumer uptake of heat pumps, cost being an important one. Despite their vastly superior efficiencies, the lifetime costs of heat pumps remain generally higher than for gas boilers. A key reason is the practice of adding policy-related costs to electricity prices making it more expensive than gas. This needs to be addressed to unlock the electrification of heat.

- **Over 30% of EU household heating relies on imported gas.** The risks associated with fossil gas imports can be eliminated through greater deployment of heat pumps.
- **60–70% of heat pumps sold in Europe are made domestically,** giving the EU a strong base to grow this market. However, installation costs may vary. For example, it costs twice as much to install a heat pump in Germany compared to the UK – negatively impacting the affordability.
- Heat pump sales are also highly sensitive to running costs, with consumer electricity prices remaining less competitive than gas bills in most EU countries. The **electricity-gas/coal price ratio varies across Member States, ranging from 1.4 to 4.6.** The Netherlands, with the lowest ratio of 1.4,

achieved triple the heat pump sales per 1,000 households compared with countries such as Germany, Poland or Hungary, where the price ratio exceeds 3.

- **Non-energy costs can make up as much as three quarters of the consumer price of electricity in EU Member States**, driving down the competitiveness of heat pumps. Shifting policy costs from electricity prices to government budgets would lower the average electricity-to-gas price ratio from 2.85 to 2.51. Redirecting these costs from electricity to gas would reduce the ratio even further, giving an additional boost to heat pump sales.

Unlocking the full potential of heat pumps requires a strategic rethink of electricity pricing across all Member States. Removing outdated policy costs and ensuring that electricity prices are competitive with gas can help transform consumer choices, accelerate the shift away from costly fuel imports and invigorate Europe's domestic heat pump industry. This is a pivotal opportunity for forward-thinking policymakers to seize, driving progress toward REPowerEU's 2030 heat pump goals.

Tom Harrison

Electricity Transition Analyst, Ember

Heat pumps: an opportunity waiting to be seized

Widespread adoption of heat pumps could switch EU heating demand from imported fossil fuels to homegrown electricity, cutting import costs and protecting consumers from price shocks. But despite their vastly superior efficiency, the high costs of electricity compared to gas is holding heat pumps back.

1.1 Heat pumps cut the EU's import dependency

Heat pumps are powered with electricity that is increasingly produced from homegrown sources. Greater uptake of heat pumps would therefore cut fossil imports while boosting the EU's domestic heat pump manufacturing industry.

1.1.1 One third of EU household heating is from imported fossil gas

The EU remains heavily reliant on fossil fuel imports for domestic heating. In 2023, 35% of EU domestic heating was powered by gas. In total, domestic heating consumed [75 billion cubic metres \(bcm\)](#) of fossil gas in 2023, equivalent to 37% of all EU gas demand for that year. About 90% of EU gas came from imports, much of it from increasingly volatile LNG markets.

Such high import dependence carries significant economic cost and geopolitical risk, exposing European citizens to volatile fossil markets and leaving

the bloc vulnerable to political extortion. In the heating sector this is particularly concerning, as shown by [examples from Ukraine](#).

1.1.2 Heat pumps replace imported gas with domestic electricity

Heat pumps are a well established technology that could electrify Europe's household heating demand. By using electricity generated from domestic renewables, heat pumps enable Europe to eliminate a substantial share of its fossil fuel demand, significantly reducing import costs while boosting the bloc's energy security. Combined with digitalisation and thermal storage, heat pumps can also help balance the electricity system.

1.1.3 Europe has a strong heat pump manufacturing industry

The European Commission recognises the strategic importance of heat pumps and, as part of the REPowerEU package in 2021, set the ambitious target of doubling the number of heat pumps in the EU every four years. Achieving this target would deliver an additional [60 million units by 2030](#).

Encouragingly, the EU is in a good position to capitalise on this emerging market as it has a strong heat pump manufacturing base. Between [60 and 70 percent of heat pumps](#) sold in Europe are domestically produced, while [15% of all heat pumps sold globally](#) are manufactured in Europe. This means that not only would increasing heat pump uptake allow more EU households to be heated with domestic energy, but it would also boost European industry and employment.

Yet despite these clear advantages, it is still a minority of EU households that have a heat pump installed.

1.2 High lifetime costs slow heat pump uptake

There are several factors that impact heat pump adoption. Among the most frequently cited are consumer awareness of the technology and availability of trained installers, but perhaps the single biggest barrier is cost. Consumers cannot be expected to switch to heat pumps en masse unless there is a clear economic benefit over existing fossil heating systems.

[The lifetime cost of a heat pump](#) is roughly split equally between upfront costs (installation and capex) and operational costs (fuel and maintenance), although availability of government grants for installations can change these proportions.

1.2.1 Heat pump upfront costs vary significantly by country, with Germany's installations costing more than double those in the UK

The upfront costs of a heat pump can vary significantly between countries. [A recent study from Aachen University and Octopus Energy](#) found that – before government grants or subsidies – a heat pump unit and its installation costs around €12,000 in the UK, while the equivalent heat pump system in Germany costs nearly €30,000. This divergence is driven by a range of factors such as labour costs and VAT rates.

For comparison, [a new fossil gas boiler currently costs around €3,000](#). This significant price difference between gas boilers and heat pumps is in large part due to the scarcity of qualified heat pump installers which drives up installation costs of heat pumps. Bringing down the upfront costs of heat pumps across all of the EU requires each Member State to develop its own policy package.

1.2.2 Heat pumps are 2–3 times more efficient than gas boilers, but outdated tariff rules consume the savings

While upfront costs are a significant barrier to uptake, running costs also have a major impact on heat pumps' lifetime total cost compared to gas boilers.

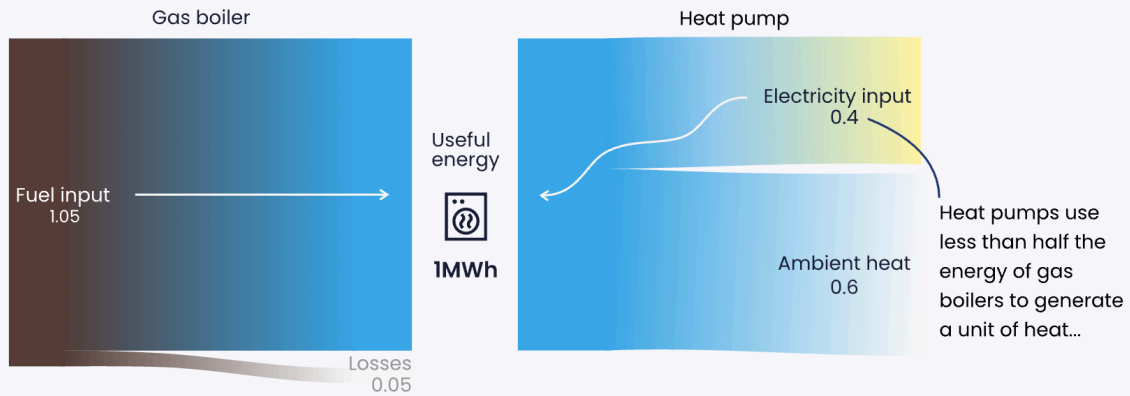
A heat pump is around 2-3 times more efficient than a gas boiler, meaning it requires up to three times less input energy than a gas boiler to output the same amount of heat. The efficiency gain compared to a gas boiler is so vast that even if all of the input electricity were produced by a gas power station, a heat pump would still deliver an overall gas saving.

However, due to the way that energy bills are structured, electricity typically costs 2-4 times as much as gas from the consumer perspective. This difference in input prices is enough to offset the efficiency benefit of a heat pump, meaning that under current regulatory regimes, heat pump running costs are comparable or even higher than for a fossil fuel boiler.

Rebalancing energy costs in the EU is key to unlocking heat pump running-cost savings

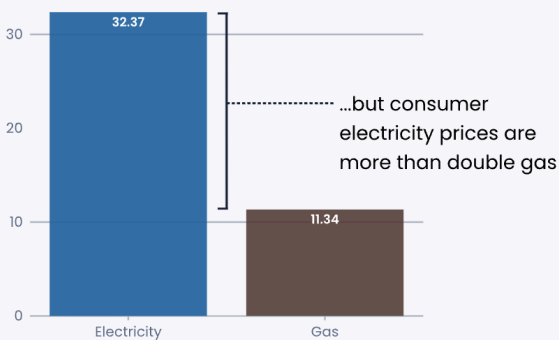
Heat pumps are far more energy efficient than gas boilers...

Illustration of energy needed to generate 1 MWh of useful heat with a gas boiler or heat pump in the EU

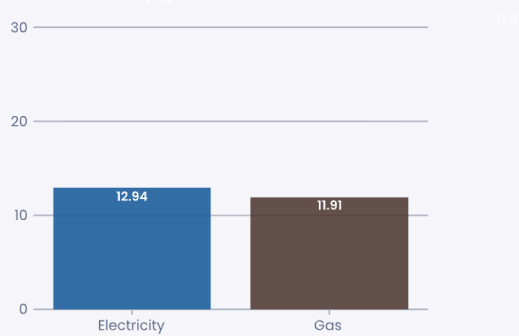


...but unbalanced energy prices can mean they are more expensive to run

Cost per MWh of input energy (€, EU27 average 2024)



Cost for 1 MWh heat (€)



Source: European Commission, Ember analysis • Assumed gas boiler efficiency of ~95% and heat pump COP of 2.5



1.2.3 Slashing down the gap between gas and electricity prices is key to boosting heat pump competitiveness

The price of electricity in comparison to the price of fossil fuels is a key factor determining whether or not the running costs of a heat pump are lower than those of a gas boiler. This is very important in deciding if a heat pump is cost competitive with a fossil boiler.

Because of the variation in installation costs, there is no specific price ratio at which point heat pumps become more affordable than fossil boilers across all Member States. However, the European Heat Pump Association (EHPA) [calls for the price ratio to be no higher than 2](#) in order for heat pumps to be competitive. This means that a kilowatt hour of electricity should cost no more than double a kilowatt hour of gas. To boost heat pump sales in the EU, the price ratio must come down from the 2024 EU average of 2.85, especially in countries like Latvia or Hungary, where it can be as high as 4.

Removing levies from electricity prices can boost heat pump affordability

The taxes and levies included in electricity bills can be reduced or removed to cut costs and lower the price ratio of electricity to gas. In turn, this can increase heat pump affordability across the EU.

2.1 Taxes, policy costs and network fees offer short-term ways to cut electricity bills

The consumer price of electricity has several components. Reducing some components, such as the cost of generating electricity, requires structural change over the mid- to long-term. Other components, however, such as taxes, levies and network charges, can be adjusted in the short-term.

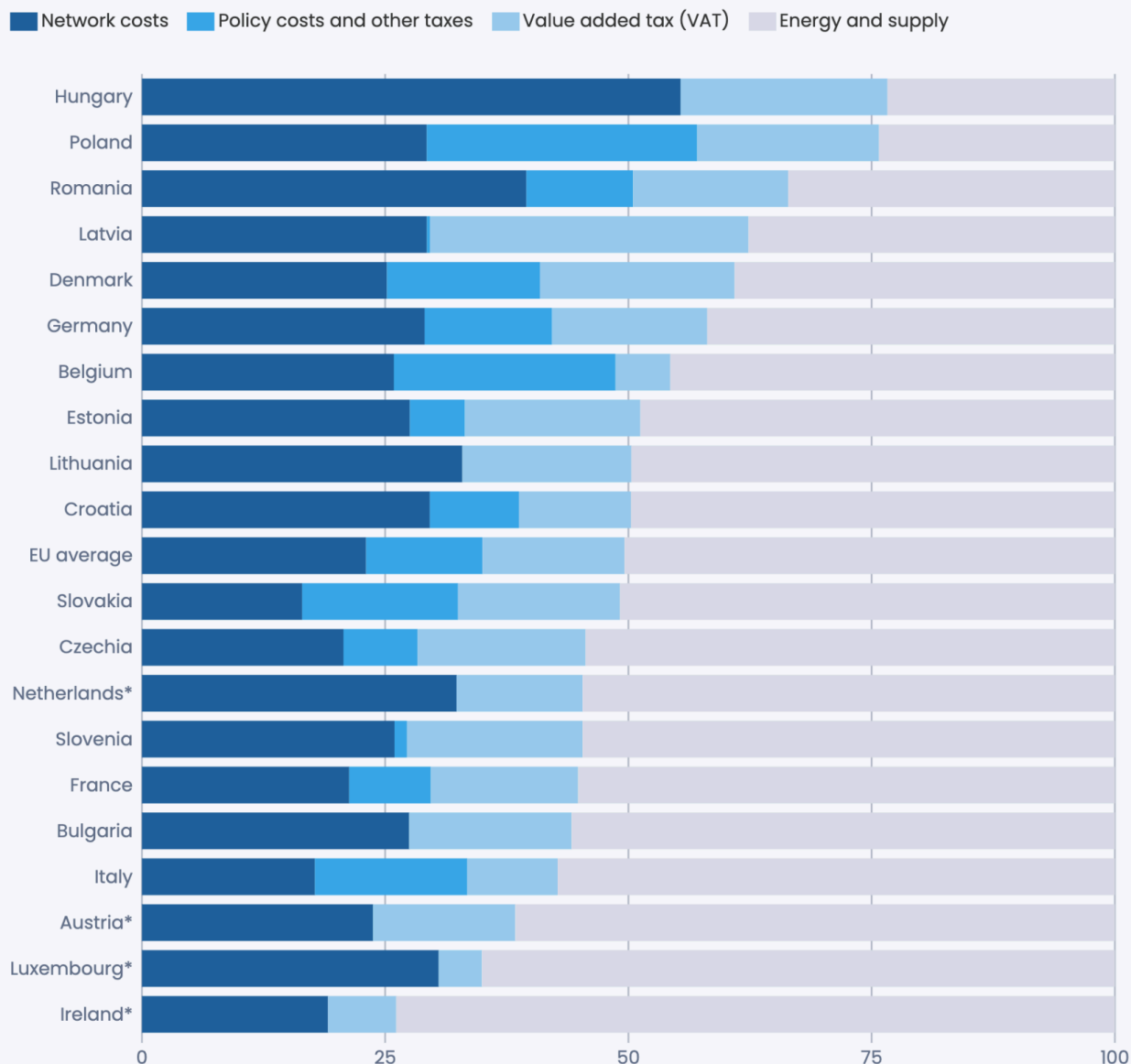
Household gas and electricity prices consist of four main components: energy and supply costs, network costs, policy costs (or levies) and taxes (VAT and other taxes).

- **Energy and supply costs** include the costs associated with generating, aggregating and balancing the electricity or gas. These costs are determined by international fuel prices as well as European and national energy markets.

- **Network fees** account for the costs of building, operating and maintaining electricity and gas transmission and distribution networks such as power lines and gas pipes. These costs are heavily regulated.
- **Policy costs**, also referred to as **levies**, are included to fund government policies aimed at changing or improving the electricity supply, for example renewable support schemes or capacity mechanisms. In some cases, non-energy related policies are also funded through electricity bills.
- **Taxes** can be split into two sub-categories: excise duty and value added tax (VAT). Excise duties are commonly used to dissuade undesirable types of consumption, such as alcohol and cigarettes, that lead to social harm. The logic of applying these to electricity only held when its production was carbon intensive, but now over 70% of EU electricity production is fossil-free. VAT is simply a sales tax applied as a percentage of all other costs.

Non-energy costs can make up as much as three quarters of the price of electricity in EU Member States

Household electricity price component share of total cost (%) for selected EU Member States 2024



Source: European Commission, Ember analysis • 'Policy costs and other taxes' includes excise duty

*Austria, Ireland, Luxembourg and the Netherlands all have 'negative' policy costs reflecting national measures to lower consumer electricity bills, these are not included here

In most EU Member States energy and supply costs are the largest component of household electricity prices, generally making up around 50% of the total cost. Of the remaining components, policy costs and other taxes (including excise duty) can make up over 25% of total costs in Member States such as Poland.

Both policy costs and taxes are determined by national governments, although all Member States must comply with the taxation price floors set out in the EU [Energy Taxation Directive](#) and [VAT Directive](#). These cost components can therefore be reduced. Network costs too can be shuffled off electricity bills and funded in other ways.

2.2 Cutting policy costs and taxes can help unlock heat pump deployment

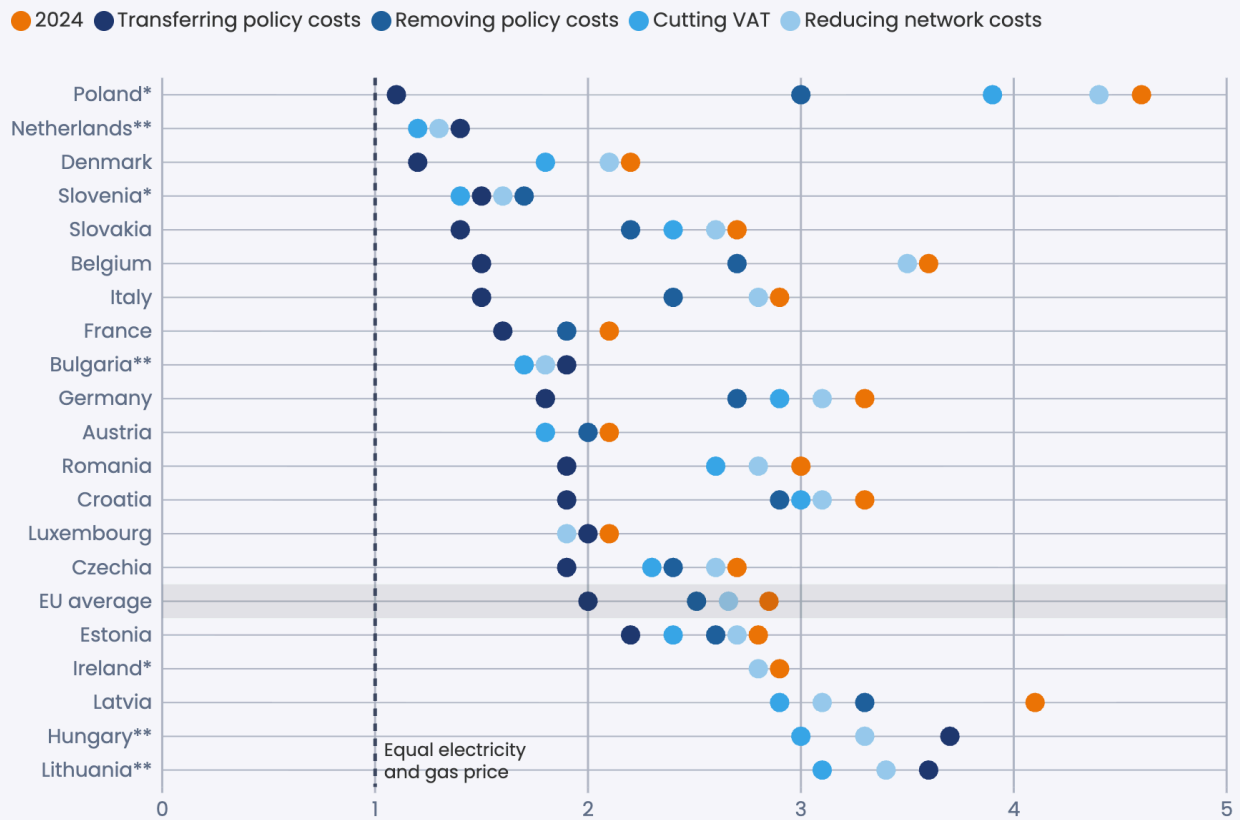
There are several options for reducing policy costs and taxes and levies from electricity bills. Here, four possibilities are examined:

1. **Removing policy costs and other taxes** from electricity to general taxation
2. **Transferring policy costs and other taxes** from electricity to gas
3. **Cutting VAT** to the reduced rate of 5%
4. **Reducing network costs** on consumer bills using government funds

Cutting policy costs, taxes or network charges makes electricity more competitive with gas across the EU

Ratio of household electricity to gas price

Countries ordered from lowest potential ratio



Source: European Commission, Ember analysis • 'Policy costs' includes other taxes such as excise duty

*Ireland and Slovenia compare electricity to heating oil prices, Poland compares with coal.

**The Netherlands, Bulgaria, Hungary and Lithuania have the same value for 2024, removing policy costs and transferring policy costs



Removing policy costs from electricity prices in 2024 would have lowered the EU average electricity to gas price ratio from 2.85 to 2.51. The price ratio would have fallen in almost all Member States, lowering the running costs of heat pumps and making them a more affordable option for consumers.

Transferring policy costs from electricity to gas has the greatest impact on the average price ratio across the EU in 2024, reducing it to 1.98 and reaching just below the EHPA's benchmark price ratio. This is not surprising, as this is the only option considered that also increases the price of gas.

The average rate of VAT on electricity in the EU is 18%. This means cutting VAT to the reduced rate of 5% (as is provisioned for in the VAT directive) in all Member States has a significant impact on the average price ratio, lowering it to 2.51.

Reducing network costs – in line with Germany's effective 15% reduction (see Methodology) – has the smallest impact on the 2024 price ratio, reducing it to 2.66. This suggests that in order to significantly influence heat pump uptake, this measure would either need to go further, or be combined with other measures.

There is no one-size-fits all method of reducing electricity prices and lowering the electricity to gas ratio. However, removing policy costs is perhaps the most frequently proposed method as it doesn't increase costs for any consumers and is quick to implement. In fact, by applying a price cap on electricity and absorbing the resulting cost into the national budget, the Netherlands has in effect followed this option.

In doing so the Netherlands achieved the lowest price ratio of any Member State in 2024 – 1.4, and became one of the top heat pump markets in Europe – selling 15 heat pumps per 1000 households in 2024. This stands in stark contrast to Poland, Hungary or Germany, where the electricity-gas/coal price ratio is well above 3 and heat pump sales are below 5 per 1000 households.

2.3 Innovative tariffs can further boost heat pump competitiveness

By offering lower rates for electricity, either at certain times of day, or for consumption specifically by heat pumps, innovative tariffs can significantly improve heat pump competitiveness.

In Germany, the dedicated heat pump tariff ([Wärmepumpen-Stromtarif](#)) offers a discount equivalent to 60% of network fees for the electricity consumed by a heat pump. In exchange, the distribution operator is empowered to interrupt electricity supply for a limited period at times of system stress. This measure alone would have reduced the electricity-to-gas price ratio in Germany to approximately 2.57 from 3.25 in 2024. Separate metering is required to implement such a system.

Many retailers across Europe now offer either static or dynamic time-of-use (ToU) tariffs, offering cheaper electricity at certain (fixed or variable) times of day. The discounts during these periods typically vary between 10–25%. In the UK, [Octopus Energy offers a ToU tariff](#) specifically for electrically heated homes, whereby three times a day electricity is discounted "roughly 50% below the new rate on a standard variable tariff (SVT)". For a consumer on this tariff, operating a heat pump exclusively during the discounted periods, the effective electricity to gas price ratio would be 2.14 instead of the average 4.28 in 2024.

Recommendations

Reducing the energy and supply costs of electricity is crucial to lowering consumer costs and unlocking not only heat pumps, but all types of electrification across Europe.

In the near term, rebalancing energy costs through policy choices could be seen as low-hanging fruit in the push to electrify Europe. By cutting the costs of electricity and lowering the price ratio with gas, heat pumps can become more affordable compared with fossil heating.

The European Commission has already set out actions and recommendations to address the imbalance in energy prices, most notably in the Action Plan for Affordable Energy. The European Commission's forthcoming [Electrification Action Plan](#) offers an opportunity to build on these measures and explore options for Member States to lighten electricity levies, unlocking greater potential for switching away from fossil fuels. There is also an urgent need to complete the Energy Taxation Directive revision and deliver on its measures to ensure that electricity is the least taxed energy source in Europe.

Enabling smart electricity consumption is another key way to lower energy costs for consumers and promote electrification. Smart electric technologies, such as heat pumps, can adjust their consumption in response to real-time electricity prices, opening access to cheap electricity, and, in some cases, feeding power back to the grid. By managing demand peaks, they help lower overall system costs. The Electrification Action Plan is therefore a crucial opportunity to ensure that citizens and businesses are empowered and incentivised to unlock the untapped potential of demand-side flexibility across the EU.

Supporting information

About Ember

Ember is an independent energy think tank that aims to accelerate the clean energy transition with data and policy. Its vision is a clean, electrified energy system for all. It gathers, curates and analyses data on the global energy system, publishing this openly and accessibly. It uses data-driven insights to shift the conversation towards high impact policies and empower other advocates to do the same. Founded in 2008 as Sandbag, it formerly focused on analysing and reforming the EU carbon market, before rebranding as Ember in 2020. Its diverse team brings together energy analysts, data scientists, communicators and team-builders based around the world in over 20 countries, including Australia, Brazil, Colombia, Germany, India, Indonesia, Poland, South Africa, Türkiye, the UK and US.

Methodology

Member States within scope

The analysis in this report excludes those Member States with low heating demand or no fossil fuel consumption in domestic heating. Therefore this analysis excludes Cyprus, Finland, Greece, Malta, Portugal, Spain and Sweden.

Data sources

Electricity and gas price data is taken from Eurostat ([nrg_pc_204_c](#) and [nrg_pc_202_c](#)).

This analysis compares the price of electricity with the most common fossil fuel used for domestic heating in the EU – gas. However, in Ireland, Poland and Slovenia, fossil gas is not the most common source of fossil fuel for heating. In Ireland and Slovenia it is heating oil and in Poland it is coal. Price data for domestic heating oil in Ireland is taken from [OilPrices.ie](#). Price data for domestic heating oil in Slovenia is taken from [CEIC Data](#). Price data for domestic coal in Poland is taken from [Statistics Poland](#).

Data on heat pump sales is taken from the [EHPA Market Intelligence platform](#).

Reduction in network charges

This analysis investigates the impact on the price ratio of lowering network charges. The German federal government [plans to subsidise network costs for consumers across the country in 2026](#). The effective rate of subsidy varies between states but in some cases could reach higher than 25% of network costs. To reflect the fact the size of Germany's economy and its greater ability to absorb the cost of subsidies into public debt compared with other Member States, this analysis uses the more conservative discount on network costs of 15%.

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