Carbon Economics

The State of Industrial Electrification in Europe 2026

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Contents

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SECTION

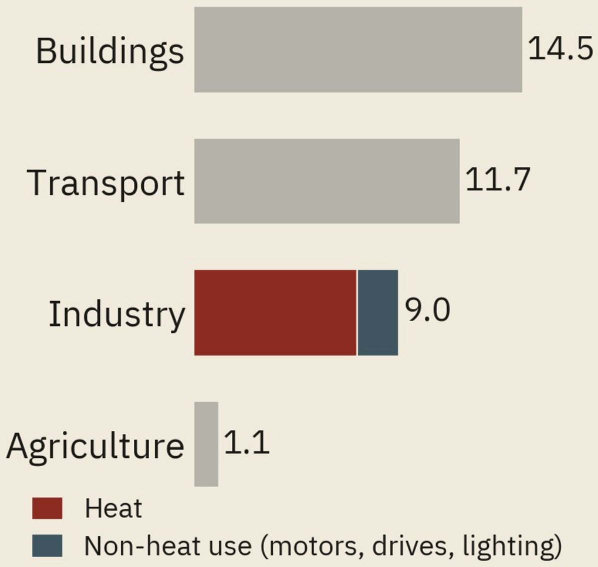
The Potential

The amount of fuel-based heat in European industry, and the technical potential to replace it with electricity.

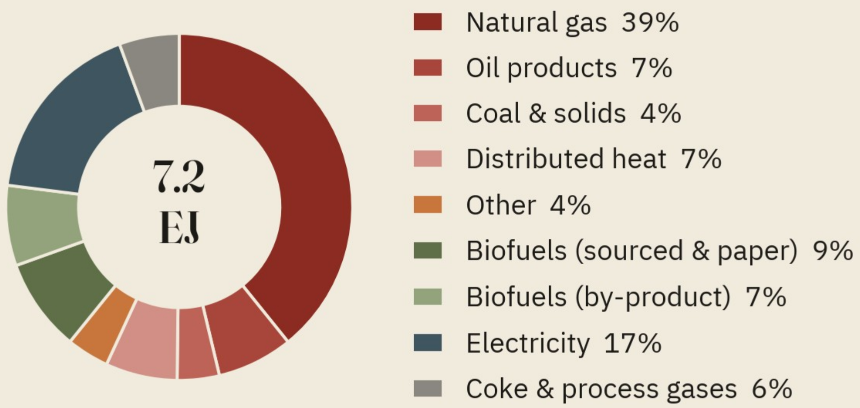
Industry uses a quarter of the EU's energy, mostly in the form of heat

Electrifying industry mostly means electrifying its heat.

EU final energy use by sector (EJ)



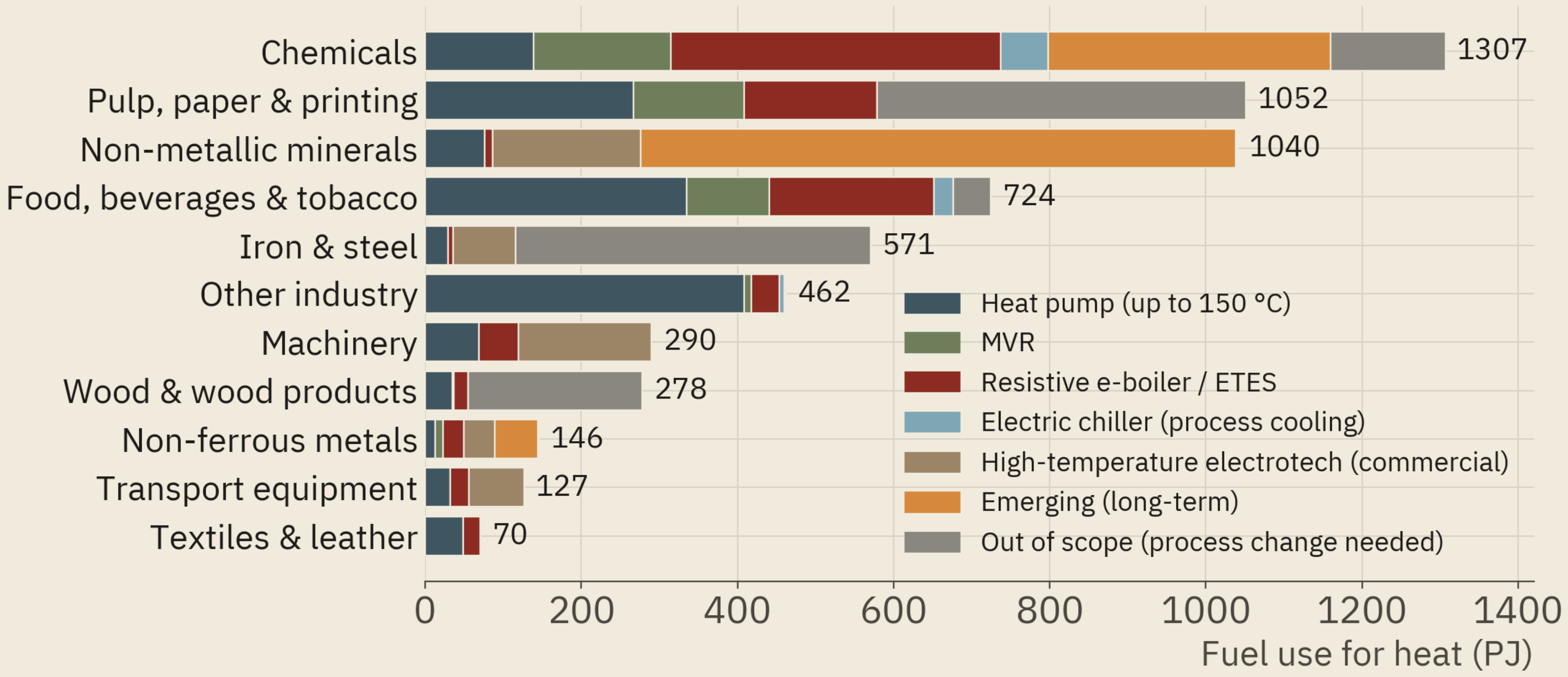
Industrial heat by energy source



Source: Eurostat Complete Energy Balances (nrg_bal_c), 2023; JRC-IDEES-2023.
Note: Final energy use by sector is from Eurostat (2023); industry is split into heat and non-heat use, while the other sectors are shown as totals. Non-heat use is electricity for motors, drives and lighting, together with a small amount of non-heat fuel. Industrial heat by energy source (JRC-IDEES-2023) is the fuel and electricity used to raise process and on-site heat; feedstock and non-energy use are excluded. Electricity appears as its own slice because that heat is already supplied electrically, separately from the electricity industry uses for everything else. Slices are coloured by fuel family. Shares are EU27; values may not sum to 100% due to rounding.

Electrifying all of industrial heat takes half a dozen technology routes

EU27 industrial fuel use for heat, by sector and electrification technology mix.

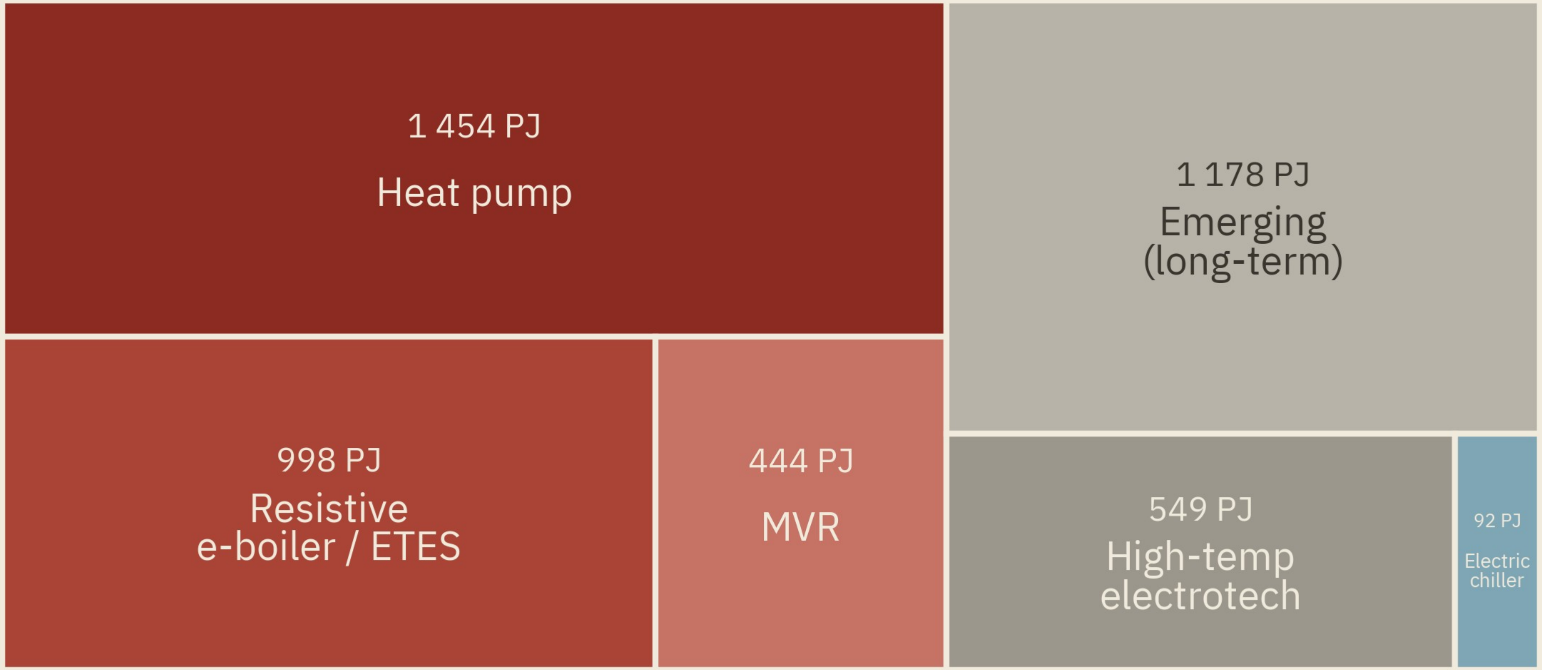


Source: JRC-IDEES-2023; technology allocation by Carbon Economics.
Note: Each sector's fuel use for heat is matched with an electric technology mix that can replace it. Heat pumps supply low-temperature duties up to 150 °C. Mechanical vapour recompression (MVR) provides evaporation and distillation loads where there is a vapour stream to recompress. Resistive electric boilers and thermal storage (ETES) carry the rest of the steam. Electric chillers replace fuel-driven process cooling. High-temperature electrotech that is already commercial (e.g. induction, electric arc and resistance furnaces, all-electric glass furnaces and electric kilns) serves applications where bespoke solutions are needed. Emerging routes include plasma and electric cement kilns, electric crackers and reformers. Blast furnaces are out of scope. Refinery gases in chemicals, and by-product biofuels (e.g. black liquor, wood residues) in pulpmaking, wood products and food and beverages, continue to be burned on site for heat.

About 60% of the potential can be reached with a mix of 3 technology routes

The full in-scope technical potential (4.7 EJ of fuel use) divided into electric routes.

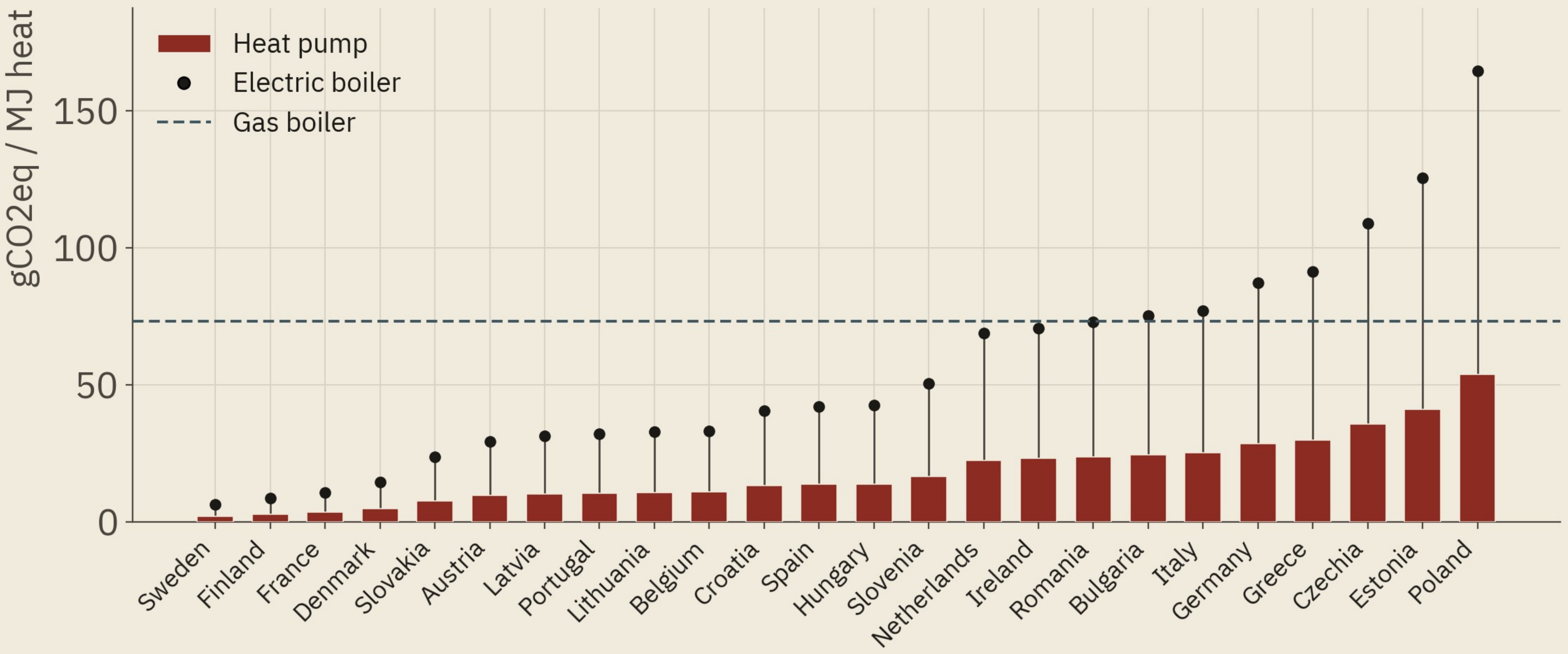
Heat pumps, MVR and resistive: about 60% of the potential



Source: JRC-IDEES-2023; technology allocation by Carbon Economics.
Note: Heat pumps, resistive heating (both e-boilers and ETES) and mechanical vapour recompression (red) cover about 60% of the in-scope technical potential. High-temperature electrotech and the still-emerging routes make up the rest (grey). Electric chillers (replacing fuel-based process cooling) are shown separately.

Heat pumps reduce emissions across the EU, e-boilers depend on the grid

Lifecycle carbon intensity of delivered heat by country, against a natural gas boiler.



Source: Ember Yearly Electricity Data 2025, adjusted; gas emission factor Edwards et al. (JEC well-to-tank); analysis by Carbon Economics.
Note: Lifecycle carbon intensity of delivered heat, gCO2eq per MJ. Gas boiler emissions are 73.2 gCO2eq/MJ (56.2 combustion, 9.7 upstream, 90% boiler efficiency). Bars are for heat pumps operating at COP 3.0. Dots are for electric boilers operating at 98% efficiency. Two adjustments to the published Ember series: biomass combustion CO2 set to zero, Estonian oil shale set to 1 110 gCO2/kWh (IEA) instead of generic 658 for other fossil fuels.

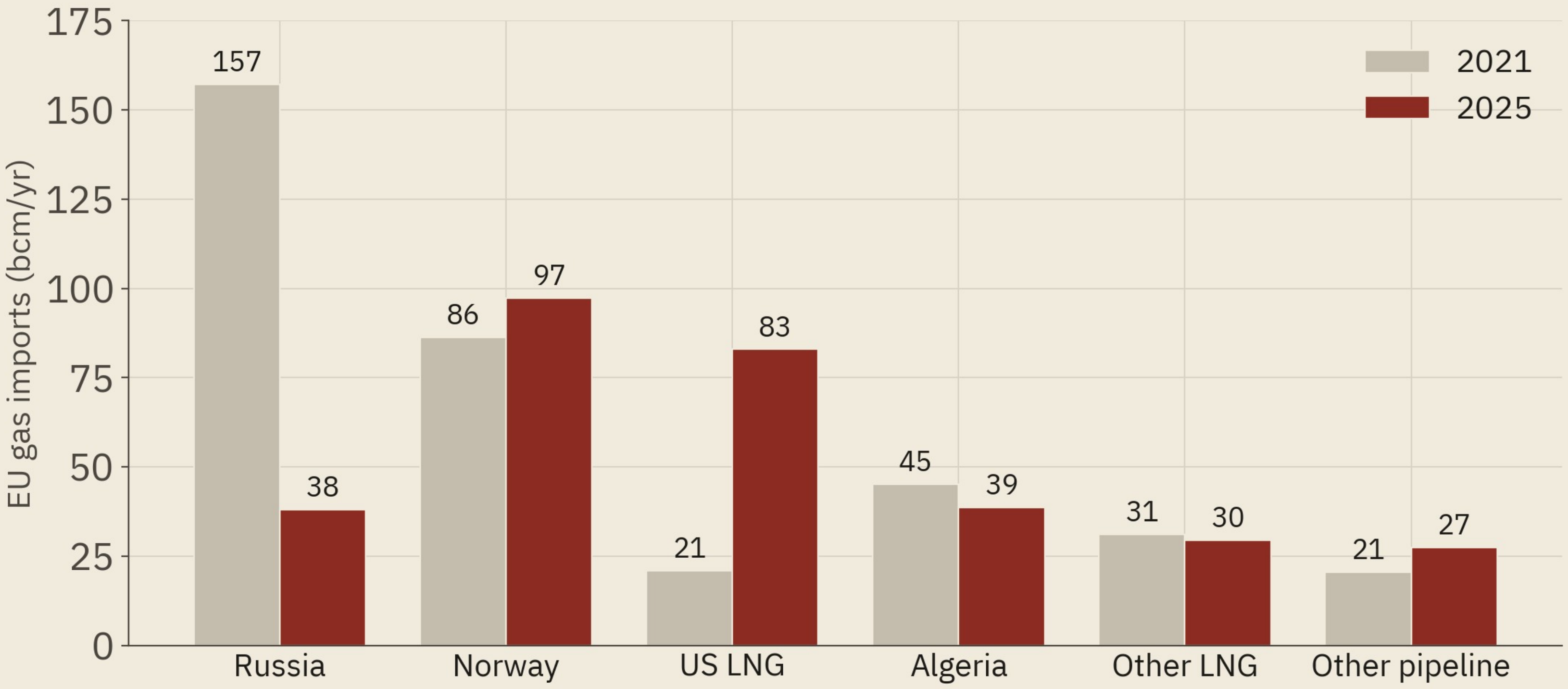
SECTION

02 The Economics

The cost of electric heat across Europe, country by country, on 2025 hourly prices, taxes, levies and network fees.

The EU now buys nearly half its gas on the global LNG market

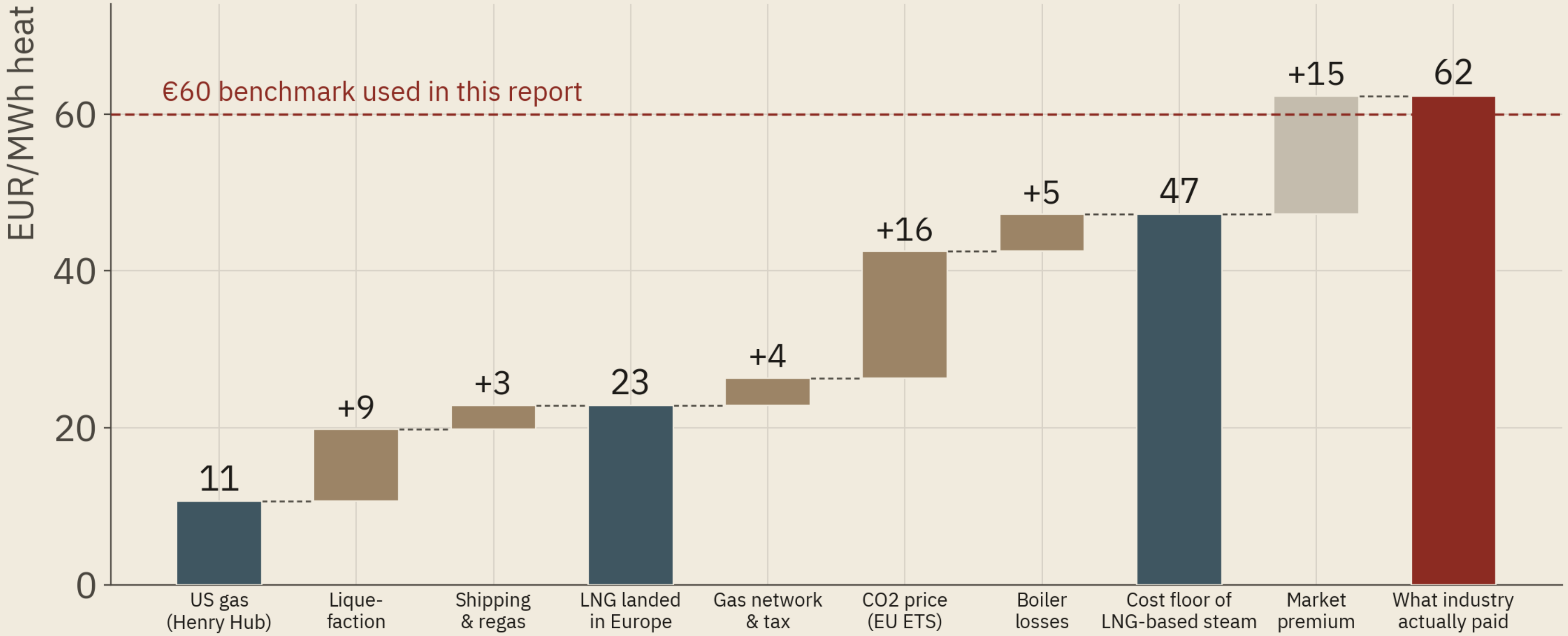
EU gas imports by source, bcm per year, 2021 and 2025.



Source: Bruegel, European natural gas imports; analysis by Carbon Economics.
Note: EU gas imports by source in 2021 and 2025, on Bruegel's gross-arrival basis. LNG supplies 46% of imports, up from 20% in 2021. Russia and Norway include their LNG.

What US gas costs by the time it makes heat in Europe

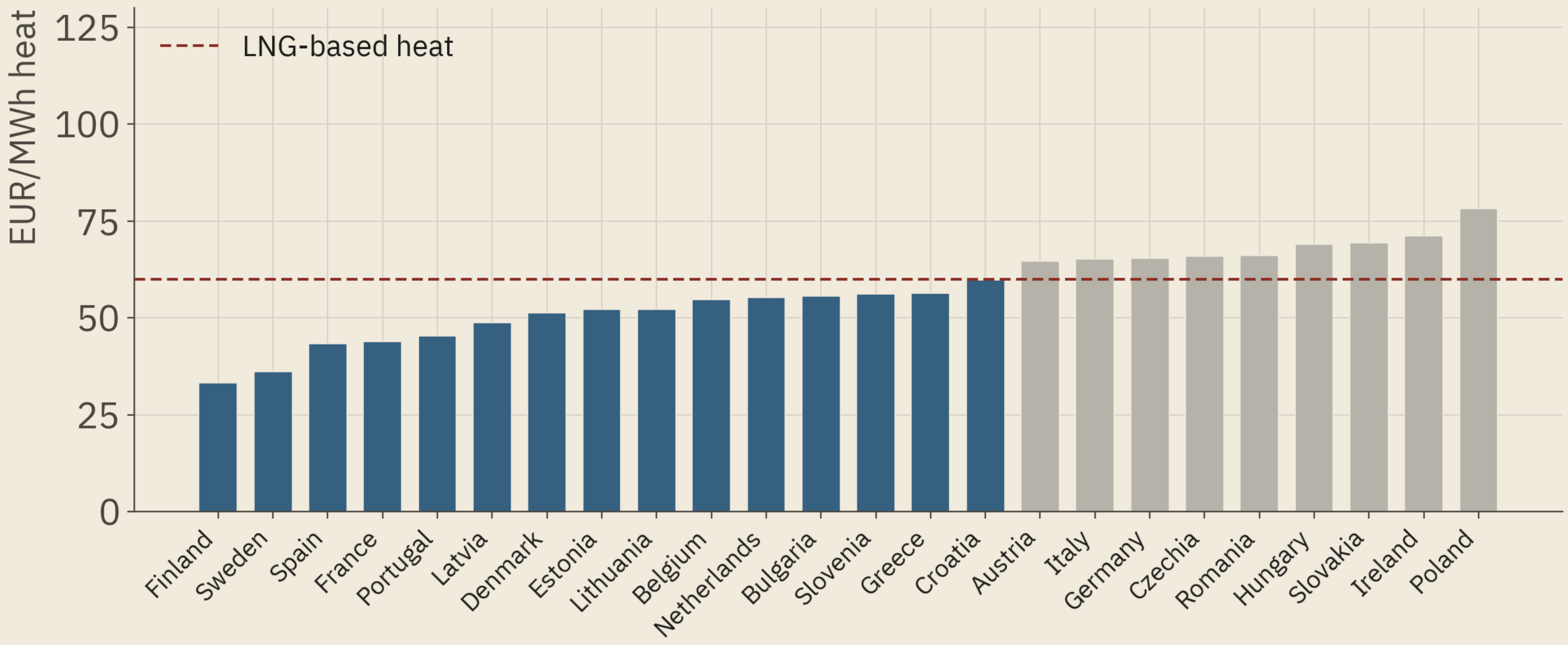
The build-up from Henry Hub to steam supply in Europe in 2025.



Source: Henry Hub spot price 2025 (EIA); LNG chain costs after Rystad, CSIS, Timera and EECC; TTF gas price 2025 (ICE Endex); EU ETS.
Note: The delivered cost of gas-fired steam, built up from cheap US gas. Henry Hub averaged $3.52/MMBtu in 2025. Landing LNG in Europe costs about €23/MWh. Network charges, gas excise, CO2 at €80/t and a 90% boiler add another €24, taking it to €47/MWh of heat. This is the floor price for heat from LNG. In reality the price is higher due to competition with Asia for LNG.

Heat pumps beat LNG across nearly two-thirds of the EU

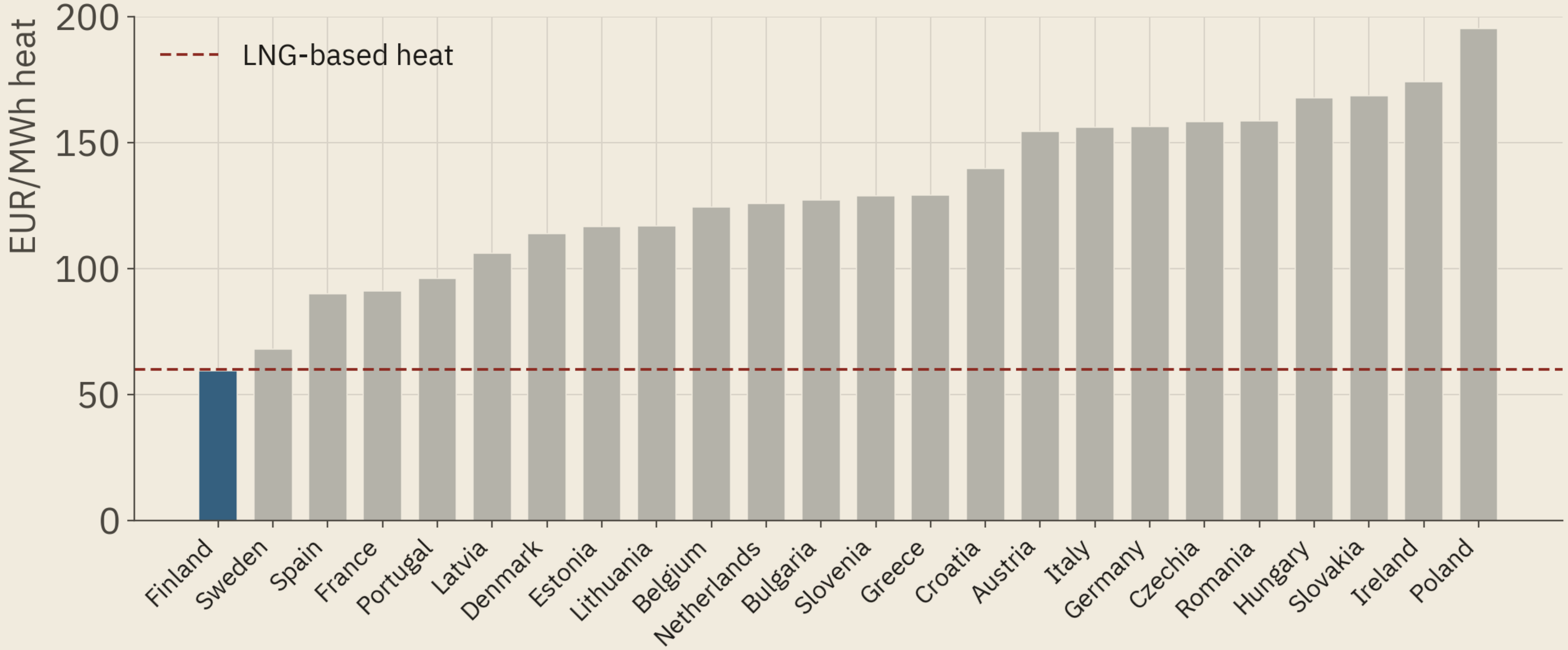
Heat pump levelised cost of heat across the EU on 2025 hourly prices, taxes, levies and network fees.



Source: Carbon Economics EHeat model; ENTSO-E hourly day-ahead prices 2025; Eurostat band IE electricity taxes, levies and network fees, 2025.
Note: 5% discount rate over 20 years, COP 3.0. Cyprus and Malta are excluded (no day-ahead market) and Luxembourg sits inside the German bidding zone.

Electric boilers struggle to compete at current prices

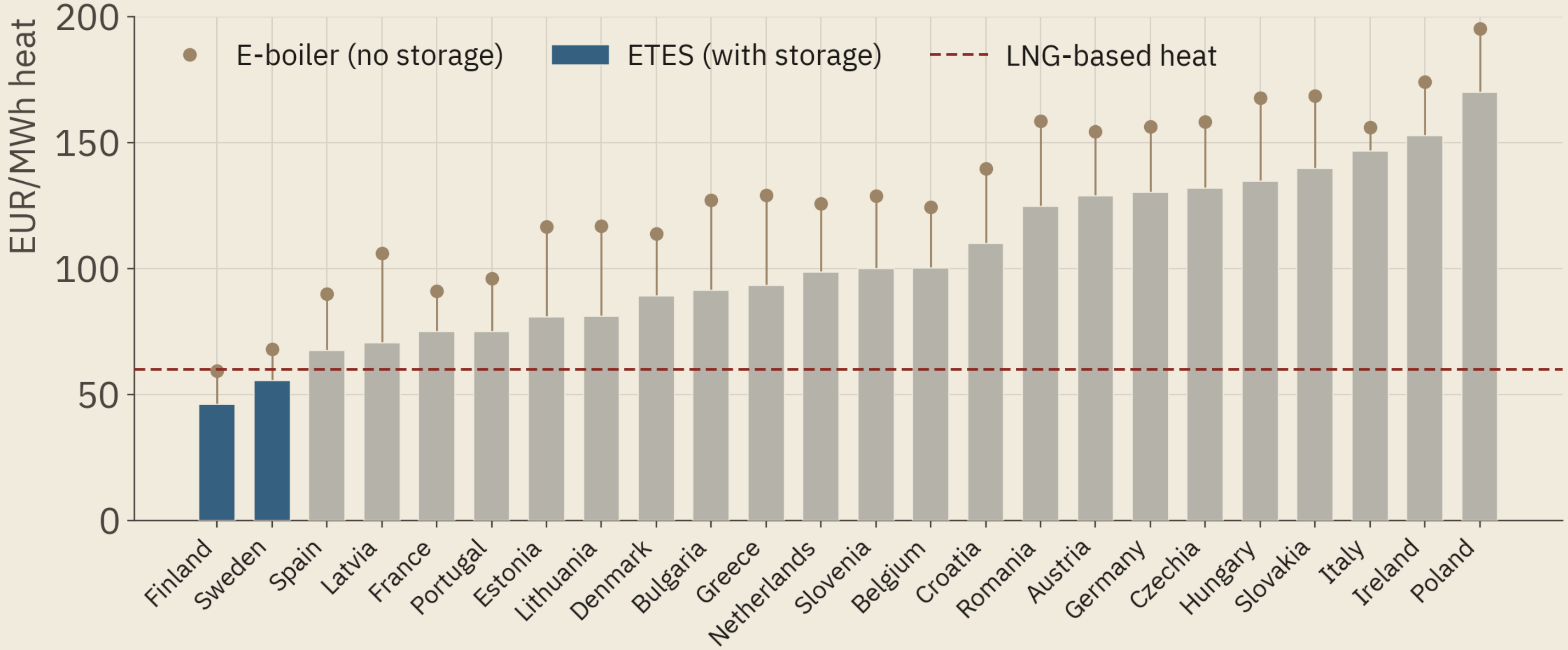
Electric boiler levelised cost of heat across the EU on 2025 hourly prices, taxes, levies and network fees.



Source: Carbon Economics EHeat model; ENTSO-E hourly day-ahead prices 2025; Eurostat band IE electricity taxes, levies and network fees, 2025.
Note: 5% discount rate over 20 years, boiler efficiency 98%. Cyprus and Malta are excluded (no day-ahead market) and Luxembourg sits inside the German bidding zone.

Thermal storage brings the cost down, but not decisively yet

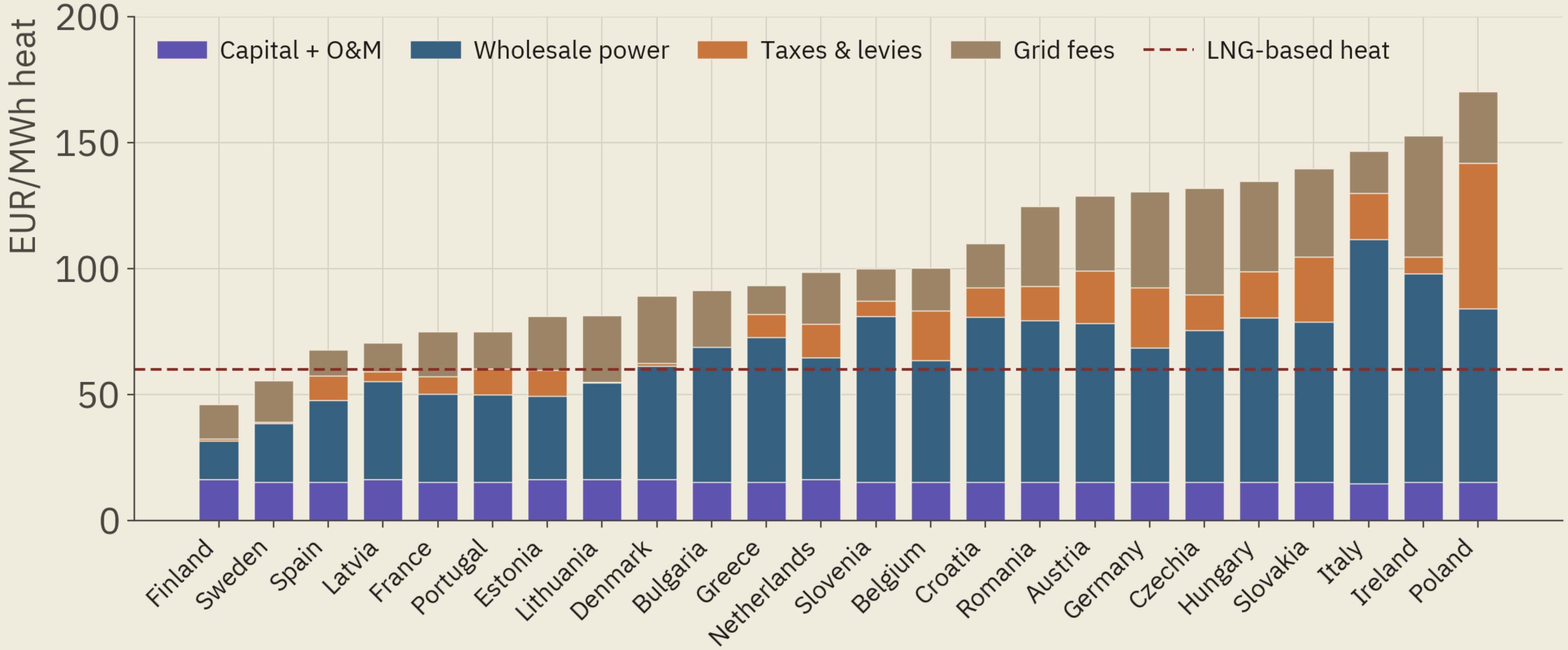
ETES (electro-thermal energy storage) levelised cost of heat across the EU on 2025 hourly prices, taxes, levies and network fees.



Source: Carbon Economics EHeat model; ENTSO-E hourly day-ahead prices 2025; Eurostat band IE electricity taxes, levies and network fees, 2025.
Note: Steam generation from electrically heated thermal storage (ETES) is dispatched to charge in the cheapest hours. Bars represent ETES cost, the marker above is the e-boiler, so the gap is the value of storage. Storage duration cost-optimised (mostly 16 h), no gas backup. Simulated with the Carbon Economics EHeat model.

Tax and grid-fee reform is key for electric steam

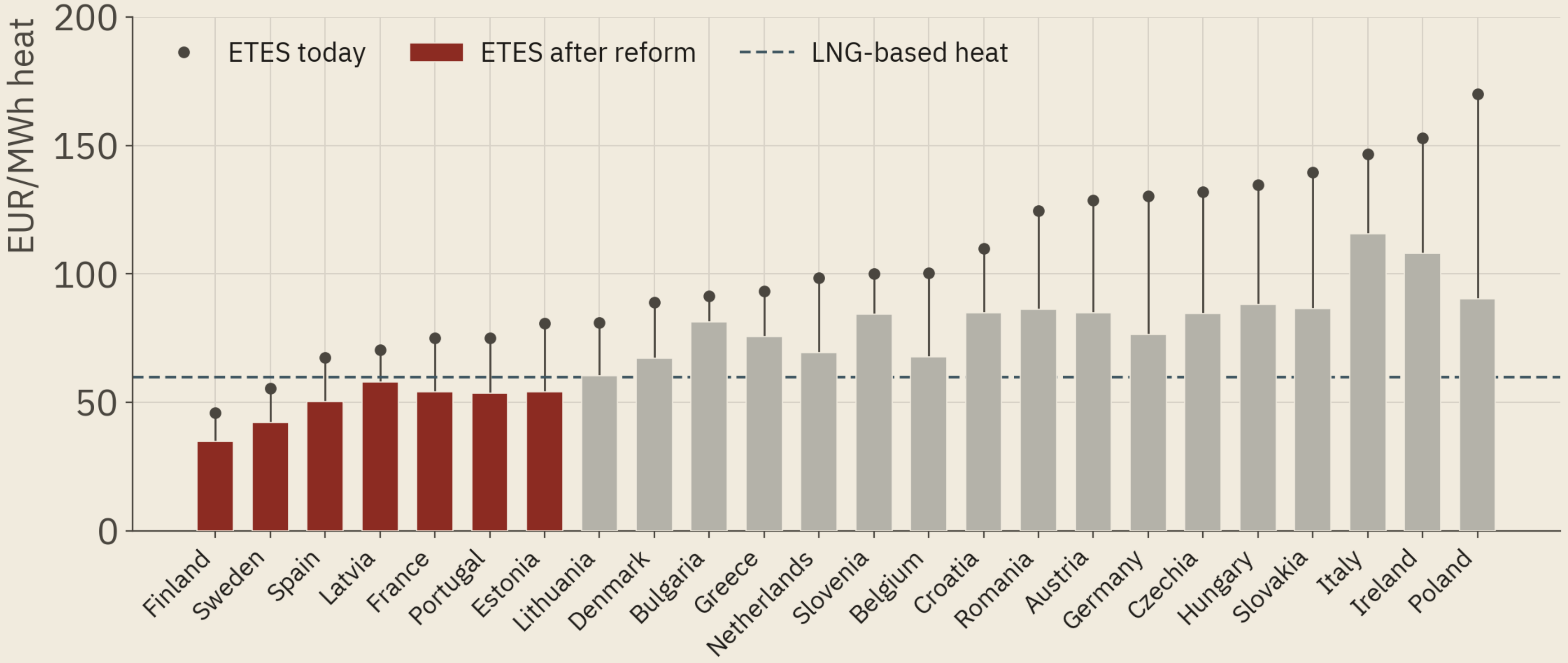
ETES levelised cost of heat across the EU in 2025, split into its cost components.



Source: Carbon Economics EHeat model; ENTSO-E hourly day-ahead prices 2025; Eurostat band IE electricity taxes, levies and network fees, 2025.
Note: The ETES levelised cost split into capital and O&M, wholesale power, taxes and levies, and network fees. Storage duration cost-optimised (mostly 16 h). Simulated with the Carbon Economics EHeat model.

Action Plan-aligned reform takes seven countries below gas

Lowering industry electricity tax to the EU minimum (€0.5/MWh) and an 80% discount on grid fees for flexible loads; the two levers the EU Electrification Action Plan proposes.



Source: Carbon Economics EHeat model; ENTSO-E hourly day-ahead prices 2025; Eurostat band IE electricity taxes, levies and network fees, 2025.
Note: A policy-reform sensitivity with two levers, both aligned with the EU Electrification Action Plan (COM(2026) 595, July 2026); the EU Heating and Cooling Strategy, still awaited, is expected to carry the same levers into industrial heat. Taxes and levies on electricity are set to the EU minimum of €0.5/MWh. Volumetric network charges are cut by 80% for flexible off-peak load, following a German example (§19 StromNEV, which allows the individual network charge to fall as low as 20% of the published tariff for sites that avoid the grid's peak windows) and the Action Plan's proposals to rebalance electricity taxes and levies and reform network charges to reward flexible, storage-friendly use of the grid. Dispatch is unchanged because both levers are flat per-MWh. Simulated with the Carbon Economics EHeat model.

03

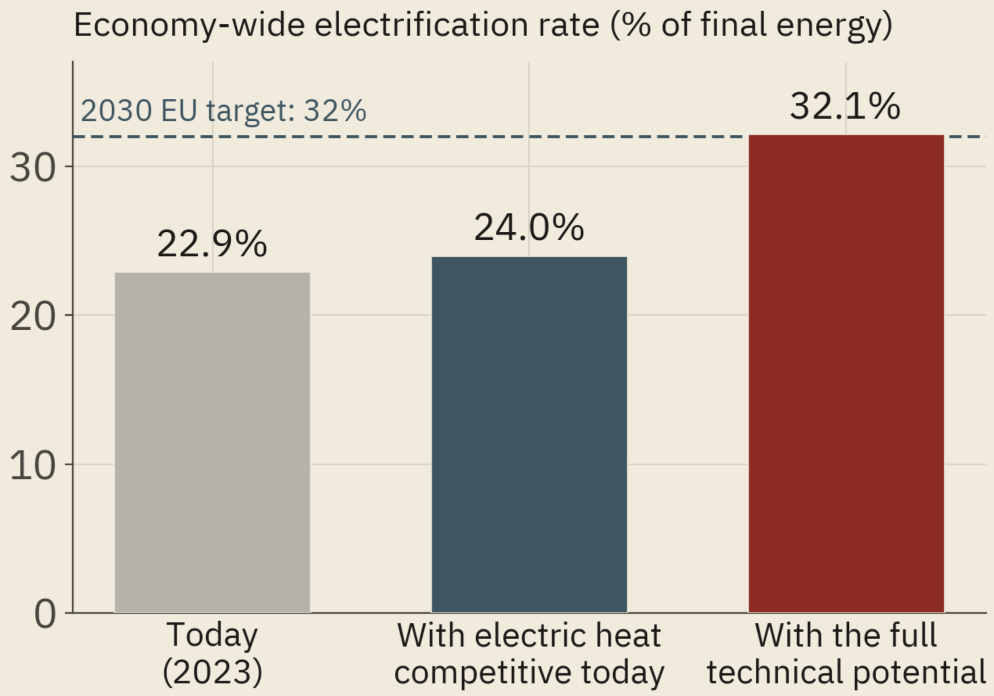
SECTION

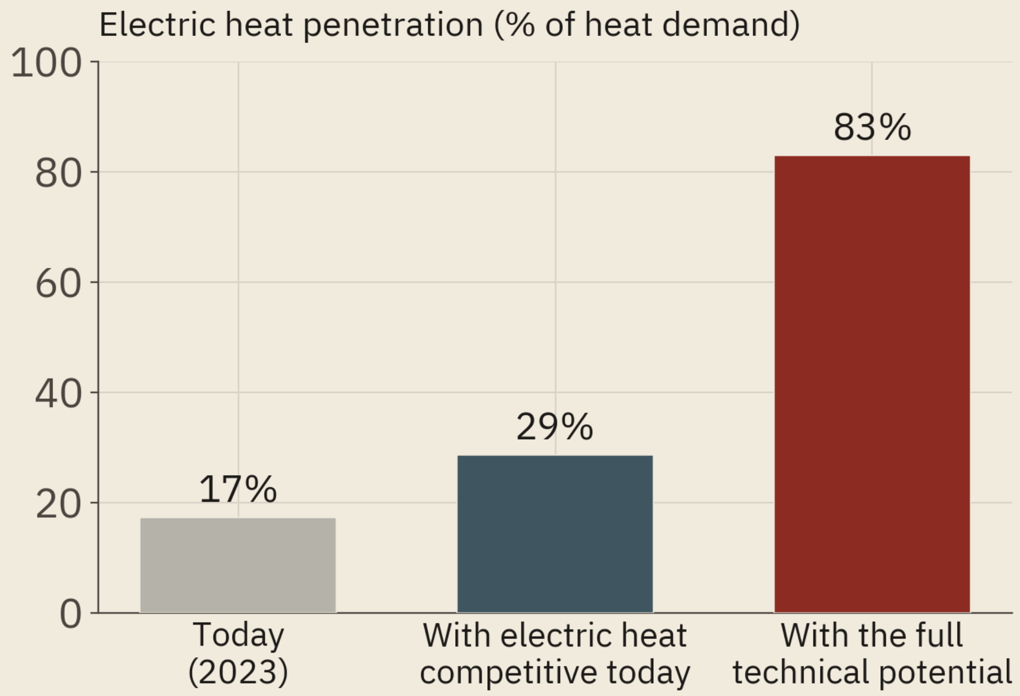
The Impact

Its role in delivering the EU's electrification targets, strengthening energy security, and driving new renewables.

Industrial heat is big enough to close the EU's 2030 electrification gap

The economy-wide electrification rate against the 2030 target, and the electric share of industrial heat, both at today's competitive potential and at the full technical potential.

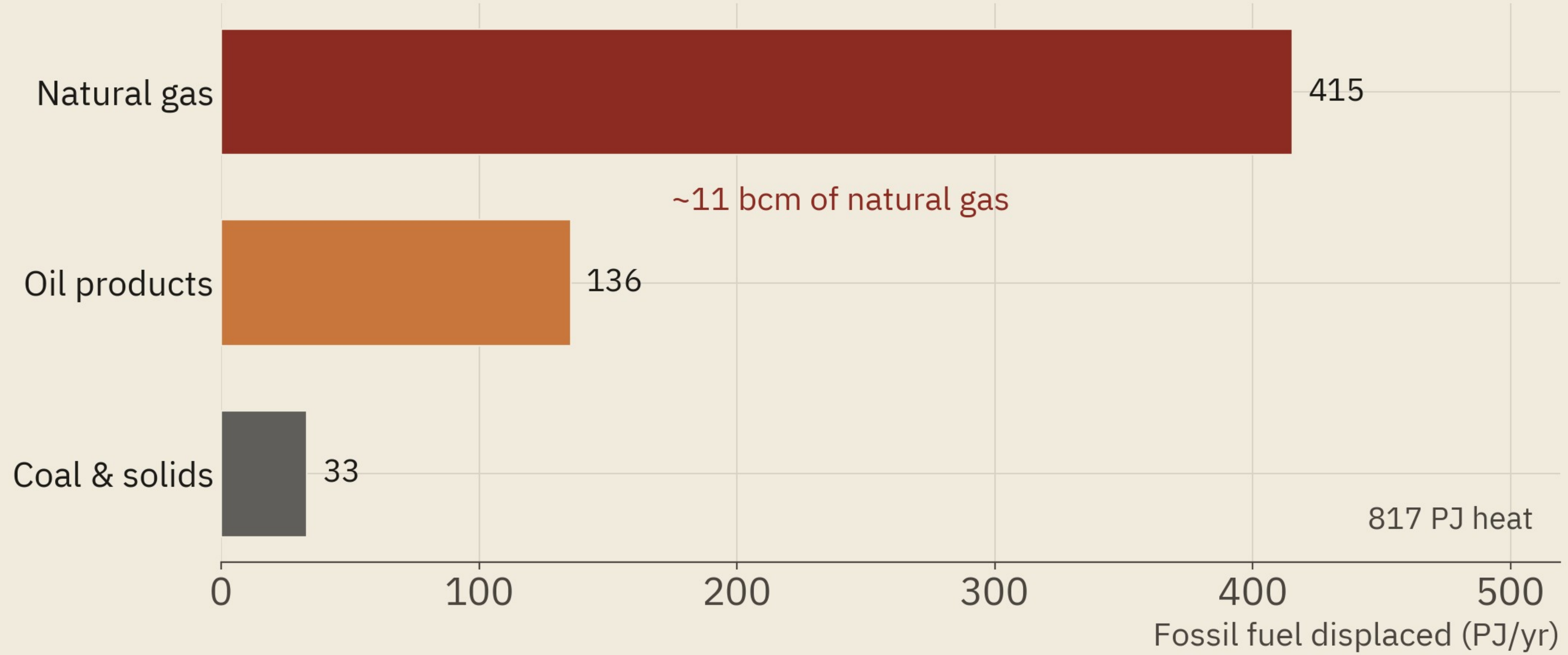




Source: Eurostat Complete Energy Balances (nrg_bal_c), 2023; JRC-IDEES-2023; EU Electrification Action Plan (2030 electrification KPI); Carbon Economics EHeat model.
Note: The economy-wide electrification rate is electricity as a share of final energy consumption. Each step adds the electricity needed for electrification and removes the fuel it displaces. As electric heat is more efficient, the denominator falls as the numerator rises. Competitive today is measured against the €60/MWh gas benchmark. The 32% line is the plan's 2030 KPI (COM(2026) 595). Electric heat penetration is the share of industrial heat demand met by electricity, arguably a better metric than electrification rate.

Electric heat could cut the gas import bill by €4.2 bn/yr already today

Electrification potential competitive today split by the fossil fuel it displaces.



Source: JRC-IDEES-2023; TTF gas price 2025 (ICE Endex); analysis by Carbon Economics.
Note: Valued at the 2025 TTF average (€36.4/MWh), the displaced gas is about €4.2 bn/yr of avoided imports. Beyond the fossil fuels shown, electrification displaces a further 129 PJ of purchased district heat and 104 PJ of biofuels and biogas, completing the 817 PJ total.

The market in four numbers

Using 2025 prices, the market potential is 817 PJ, about 17% of the technical potential.

72 TWh

New power demand

About 70% of the output of the solar and wind the EU added in 2025 (IEA).

9 GW

New grid connections needed

Concentrated in France, Spain, the Netherlands and Belgium.

43 Mt

CO2 avoided per year

Concentrated in France and Spain.

€29 bn

Equipment market

Heat pumps represent 90% due to their competitive LCOH and relatively high capex.

Source: JRC-IDEES-2023; IEA Global Energy Review 2026 (EU 2025 renewable additions); Carbon Economics EHeat model.

Sources

Prices, costs and energy data

Industrial energy demand: JRC-IDEES-2023; Eurostat energy balances (nrg_bal_c).

Electricity: Eurostat nrg_pc_205 band IE (taxes, levies, network fees); ENTSO-E hourly day-ahead prices 2025 (Italy via energy-charts.info); cross-check DG TAXUD Excise Duty Tables, Taxes in Europe Database v3.

Gas prices: TTF 2025 (ICE Endex); Henry Hub spot 2025 (EIA); LNG chain costs after Rystad, CSIS, Timera and EECC.

Gas imports: Bruegel, European natural gas imports (Gas Tracker).

Carbon: EU ETS allowance price; grid carbon intensity from Ember Yearly Electricity Data 2025 (adjusted); gas emission factor Edwards et al. (JEC well-to-tank).

Equipment capex: heat pump energy.nl HTHP factsheet / IEA HPT TCP Annex 58 + Danish Energy Agency; MVR energy.nl / TNO; e-boiler Danish Energy Agency / PyPSA.

Policy and context: EU Electrification Action Plan (COM(2026) 595); §19 StromNEV; IEA Global Energy Review 2026.

Technology assumptions (Carbon Economics)

Process-to-route allocation and temperature-band assignments allocated based on the process-heat literature.

MVR and heat pump addressability and per-sector route shares based on a literature review.

Route efficiencies (COP, boiler) and technology-maturity (TRL) ratings based on a literature review.

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 Methods are described in the notes beneath each figure; assumptions frozen year over year.

CONTACT

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