Heat Pump Monitor 2026

Trends and market opportunities

International Energy Agency

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Introduction

Heating and cooling account for a significant share of global energy demand and CO_2 emissions. As countries work to meet rising demand for secure, resilient, affordable and sustainable energy solutions, heat pumps can play a central role in heating and cooling systems. Despite strong growth in recent years, heat pumps meet less than 15% of heating demand in buildings worldwide and remain niche in industry and district heating applications. This highlights both the scale of the challenge and the significant opportunities for market expansion. Looking forward, deployment is expected to keep increasing across most major economies, driven by the increasing cost-competitiveness of heat pumps, stricter building standards, rising cooling demand, increased electrification and growing interest in low-emissions district heating solutions. However, growth patterns vary widely across regions and sectors, reflecting differences in policy frameworks, energy prices, characteristics of the existing stock and user preferences.

Energy, climate, industrial and trade policies are increasingly interconnected, and measures affecting energy pricing, building regulations, manufacturing strategies, innovation support and trade all influence the deployment and competitiveness of heat pumps. Market conditions are also changing quickly, shaped by geopolitical developments and industrial and technological progress. In this rapidly evolving context, policy makers require timely, evidence-based and comparable information to guide decision-making.

For many years, the IEA has tracked energy technology markets and related policies. Heat pumps have been a core element of this work, and as their strategic importance has grown, so too has the need for more comprehensive, granular, consistent and regularly updated monitoring. Governments increasingly seek comparable indicators across countries, better visibility on manufacturing capacity and supply chain resilience, and clearer evidence on the effectiveness of policy instruments in different contexts.

The IEA's Heat Pump Monitor responds to these needs by providing a comprehensive, data-driven assessment of global and regional heat pump markets, their enabling conditions and their future prospects. It centralises IEA analysis in one place, and consolidates national and international data within a consistent analytical framework aiming to support governments, researchers, and industry stakeholders in identifying priority actions to scale up deployment, reinforce domestic manufacturing and maximise socio-economic benefits in line with broader objectives.

The analysis focuses on the buildings sector, where most heat pump deployment currently occurs, and also incorporates insights on industrial and district heating applications. It assesses the current status and outlook of global and regional markets, examines deployment trends and market penetration, and analyses manufacturing capacity, trade flows and supply chain dynamics. It also evaluates cost-competitiveness, affordability, innovation performance and employment impacts. Heat pumps are defined in line with the IEA's Heat Pump Taxonomy[1] to ensure consistency across regions and over time. The outlook presented in the Monitor is examined through scenario analysis, using the IEA's Current Policies Scenario (CPS), Stated Policies Scenario (STEPS) and Net Zero Emissions by 2050 Scenario (NZE Scenario), consistent with the World Energy Outlook 2025 (see below).

The IEA Heat Pump Monitor consists of a dedicated online tool that integrates analytical insights with data visualisation. Its central output consists of an analytical summary highlighting the main messages and quantitative insights, complemented by a compendium of 20 visual dashboards that enable users to explore trends across a wide range of indicators in greater depth and to conduct cross-country comparisons.

The dashboards are organised around four main pillars: a) global deployment trends by sector of application; b) in-depth analysis of buildings sector applications including aspects related to affordability, energy security, industrial competitiveness, innovation and technology; c) regional perspectives; and d) policies. Graphic visualisations are accompanied by analytical insights to support interpretation and application in a broader economic and regulatory context.

While the Monitor provides a global overview, it places particular emphasis on major heat pump markets that illustrate different development pathways and policy approaches. These are Europe, the People's Republic of China (hereafter, "China"), Japan and the United States, which reflect diverse regulatory environments, market structures and consumer preferences. Together, they offer valuable lessons for broader policy-learning internationally.

The analysis builds on the IEA's established market tracking systems, modelling tools and expert networks, including the IEA's Global Energy and Climate Model and Manufacturing and Trade Model. It draws on national and international statistical sources and benefits from stakeholder consultations and peer review.

[1]The IEA definition of heat pumps includes heat pumps that are used as primary heating equipment, intended as the main equipment providing heat. The boundary includes reversible units (such as reversible air conditioners) when they serve as the main heating equipment. However, it excludes such units when used solely for cooling, or as a complement to other heating equipment, such as a boiler.

Scenarios used in IEA's Heat Pump Monitor 2026

The projections for technology deployment, employment, manufacturing and trade presented in the Monitor are based on scenario analysis. The scenarios differ primarily in their assumptions about government policies. Three scenarios are used in this report:

- The **Current Policies Scenario (CPS)** sets out a pathway for the future of the energy system in which no change in energy-related policies is assumed beyond what is already in place. The CPS therefore builds on a narrow reading of today's policy settings, only considering those that are adopted in legislation and regulation, and assuming no changes will be made, even where governments have indicated their intention to do so. Where existing policies target a range of outcomes, it is assumed that the lower end of the range is achieved. In the CPS, policies that are time-bound or that target specific years are not strengthened after they expire. Alongside this view of the policy landscape, the CPS also offers a generally cautious perspective on the speed at which new energy technologies are deployed and integrated into the energy system. It tends to project slower adoption of new technologies in the energy system than seen in recent years, or than projected in the STEPS.
- The **Stated Policies Scenario (STEPS)** is designed to reflect the direction of travel of the global energy sector based on current energy-related policies, including those that have already been adopted, announced, or are in the advanced planning stage – even if they are not yet enshrined in law or regulations. Examples of the latter include energy efficiency targets such as minimum energy performance standards for heat pumps. Policy targets are not assumed to be automatically met: in each case, their prospects are assessed taking account of market, infrastructure readiness and financial constraints. The STEPS assumes that time-bound policies continue beyond the currently-stated durations and retain a similar pace of change. However, it does not assume that aspirational goals, such as those included in the Paris Agreement, are achieved.
- The **Net Zero Emissions by 2050 (NZE) Scenario** is a normative scenario that maps out a global pathway for the energy sector to achieve net zero carbon dioxide (CO_2) emissions by 2050, alongside achieving goals on universal energy access and large reductions in air pollution. In contrast with previous editions, the NZE Scenario is no longer a low-overshoot scenario: it assumes that warming exceeds 1.5°C for several decades before returning below 1.5°C by 2100. This adjustment reflects persistently high emissions in recent years and the slow deployment of some key technologies.

Pillar A. Cross-sectoral deployment

Heat pump deployment differs markedly across buildings, district heating and industry, as a reflection of the different stakeholders involved, as well as variations in policy support, energy prices, infrastructure and technical suitability by application. Uptake is closely linked to regulatory stability, competitiveness, system integration, access to finance and technology maturity. Systematic tracking of these developments helps governments design effective measures, strengthen industrial competitiveness and align heating strategies with energy security and wider policy objectives, at the same time as identifying emerging market opportunities and anticipating barriers to investment.

Pillar A of the Heat Pump Monitor focuses on the current trends and future outlook for heat pump deployment across a range of application sectors. It analyses the underlying drivers shaping future market developments, including regulatory frameworks, cost-competitiveness and infrastructure.

Deployment in buildings

Current status

Heat pump adoption is growing in a vast market.

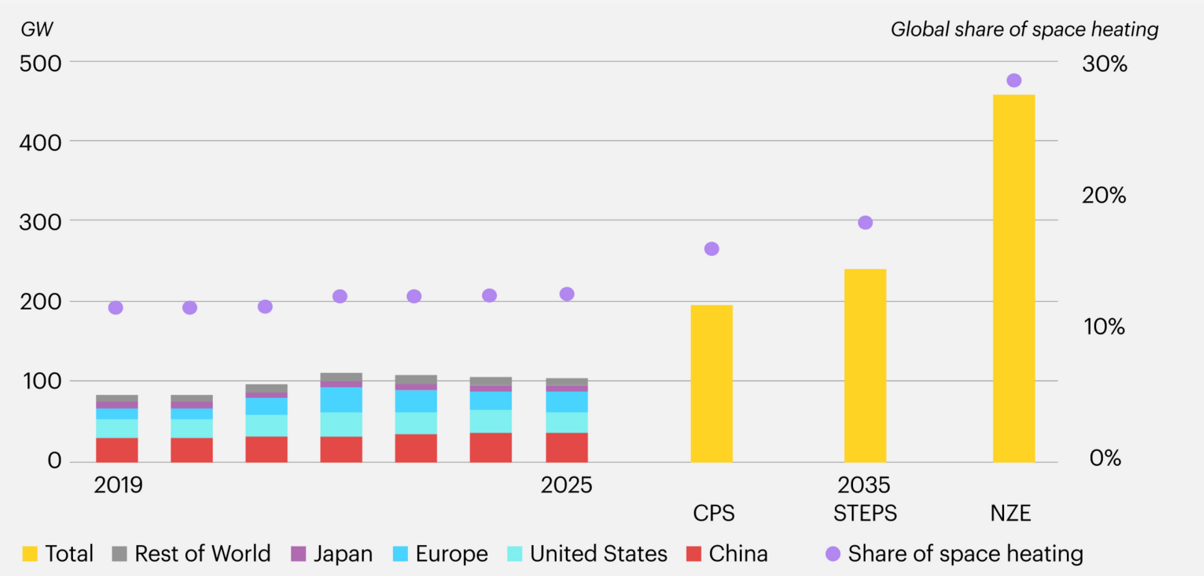
Deployment has fluctuated in recent years, as steady growth prior to 2020 and record expansion in 2021 and 2022 – particularly in Europe – was followed by a slowdown in 2023. Since then, global sales have remained mostly stable, but with great regional variations. In some countries, sales of heat pumps have outpaced gas boilers and furnaces. The United States remains the largest market in terms of installed stock, followed by China, Europe and Japan, but China leads sales. Uptake is highest in areas with mild climates and is expanding in regions with rising demand for cooling, where heat pumps provide both heating and cooling, when backed by long-term policy frameworks and favourable electricity-to-gas price ratios.

What's next?

Policy will be decisive for accelerating deployment.

The efficiency of heat pumps is widely recognised, but there are persistent barriers to deployment, notably high upfront costs, high electricity prices in some regions, and a shortage of skilled installers. A rebound in sales is expected in all IEA scenarios, as measures such as building codes, subsidies, heating plans and targets take effect in different countries. Deployment is also expanding in emerging markets, driven by dual-use heat pumps that provide cooling, and rising adoption of heat pump water heaters. In the CPS, sales are expected to increase by over 80% by 2035. In the STEPS, sales more than double, supplying around 20% of global heating demand. In the NZE Scenario, stronger policies mean global sales grow twice as fast as in the past decade.

Global heat pump sales by region and share of space heating needs covered by heat pumps by scenario, 2019-2035



Notes: CPS = Current Policies Scenario; STEPS = Stated Policies Scenario; NZE = Net Zero Emissions by 2050 Scenario.

Sustained policies will be critical to unlock potential for heat pump deployment.

Regional patterns in heat pump deployment in buildings

Current status

Heat pump use differs markedly across different regions

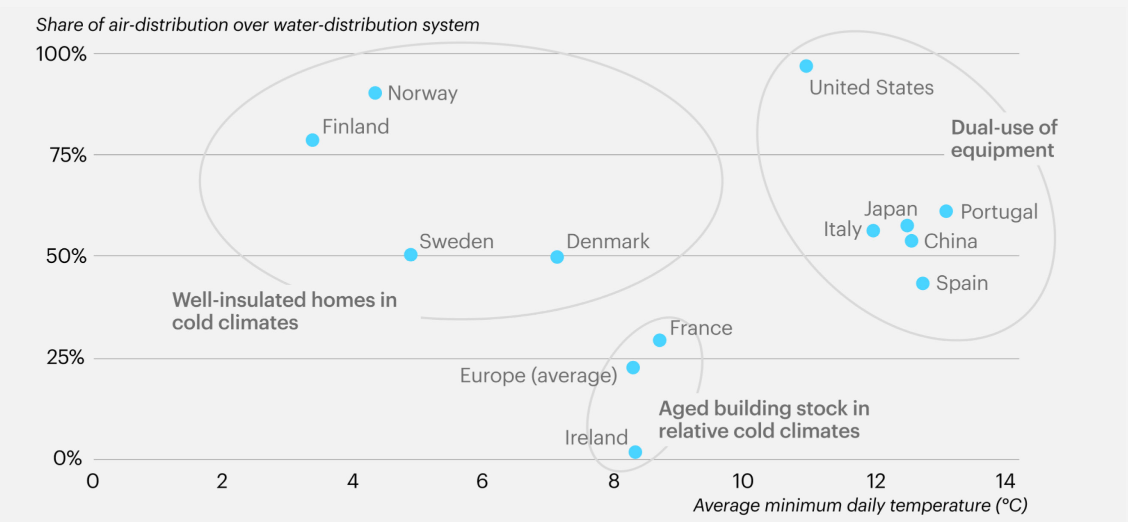
Heat pump types and use patterns are shaped by differences in climate conditions, building design, heating systems, comfort preferences, standards and available financial support. Worldwide, the vast majority of heat pumps sold for buildings are air-source units. Of these, air-to-air systems are most common in China, the United States, the Nordic countries and Japan. In China, they are often used part-time or to heat only part of the space; in the United States, they are mostly centralised within ducted heating, ventilation and air-conditioning (HVAC) systems; in the Nordics, they operate in well-insulated homes; and in Japan, they provide primary space heating alongside growing use of heat-pump water heaters. By contrast, Germany, the United Kingdom and northern Italy mainly rely on air-to-water (hydronic) systems with radiators or underfloor heating. Technology choice impacts unit size, which tends to be larger in the United States and Europe and smaller in China and Japan.

What's next?

While regional differences are expected to persist, harmonised market data across regions could inform better policies

Technology variety and differing consumer preferences are not expected to change in future years. However, these conditions have led to differences in reporting standards and classifications, which hinder like-for-like market comparison and tracking, as well as potential policy learnings across markets. A particular limitation concerns the need to distinguish heat pumps used primarily for heating from those serving the broader cooling market. To address this, the IEA has proposed a taxonomy to support collaboration towards harmonised global heat pump data monitoring. Harmonised data could provide policy makers with robust evidence to design, develop and monitor energy and industrial policies, while giving industry stakeholders a clearer understanding of market dynamics and investment opportunities across regions.

Share of heat pump sales using air-distribution systems over water-distribution ones with respect to climate conditions for selected countries, 2024



Notes: Shares are in capacity terms based on 2024 sales. Water-distribution refers to hydronic systems, and air-distribution to ducted and unducted reversible air conditioners.

Air-to-air units that can provide both heating and cooling have high market shares in certain regions

Deployment in district heating

Current status

Heat pumps make up a small share of district heating

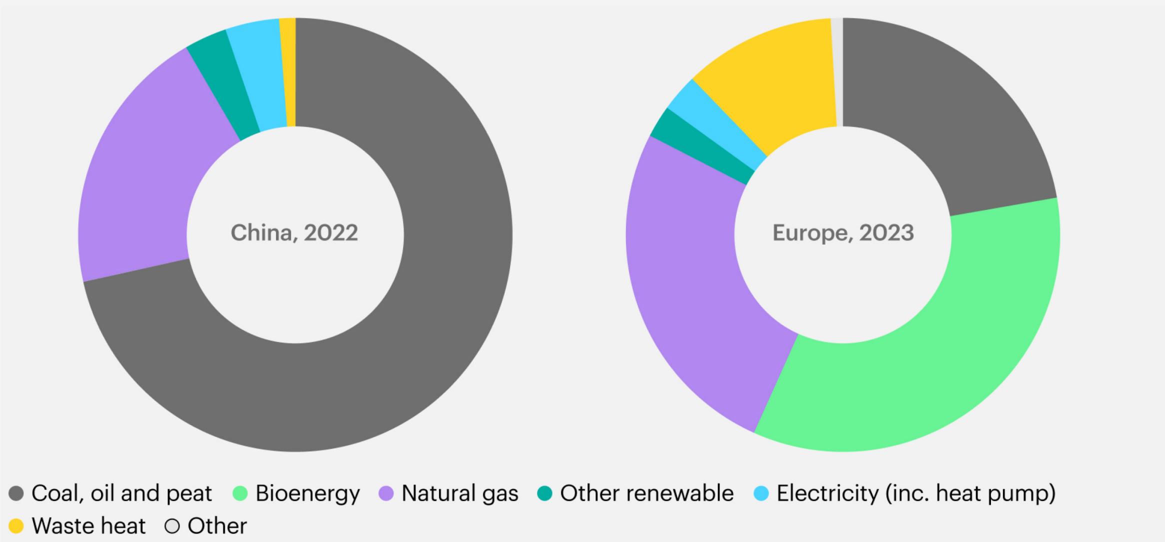
District heating supplies around 10% of global heat demand in buildings, mainly concentrated in Northern and Eastern Europe, Russia and China. It remains less widespread in North America, where systems are typically smaller in scale than those in China or Europe. While district heating is a resource-efficient method of heating, it still relies on fossil fuels for 90% of its supply globally, but a large and growing number of modern networks can integrate renewable and other low-emissions sources. Data on global heat pump deployment in district heating is scarce, but in Europe, large heat pumps and electric boilers supplied about 3% of district heating in 2023, and had the highest growth rate of all heat sources.

What's next?

Heat pumps will be part of rapidly expanding district heating systems

Policy interest in district heating is increasing, and heat pump deployment is expected to expand. In China, the floorspace covered by district heating tripled between 2002 and 2022, and there are policies in place to further develop and decarbonise those networks. In North America, the amount of floorspace connected to district energy networks increased by an average of 6% per year over the same period, indicating increasing momentum. In Europe, the European Union's Energy Efficiency Directive sets clear thresholds for district heating to rely less on fossil sources and to become more efficient. Heat pumps are expected to play an important role in meeting this growing heat demand and replacing fossil heat sources. For example, Germany alone has around 900 MW of district heating heat pump capacity under construction or in planning, positioning it among the leaders in this sector.

District heating supply by source in China and Europe, 2022 and 2023



Sources: Danish Energy Agency (2024), Prospects for Clean and Renewable Heating in China – Insights from Denmark; China District Heating Association (2022); Euroheat & Power (2025), DHC Market Outlook 2025.

Heat pumps have played only a marginal role in district heating supply to date.

Opportunities for heat pumps in district heating

Current status

Heat pumps offer a compelling opportunity for district heating

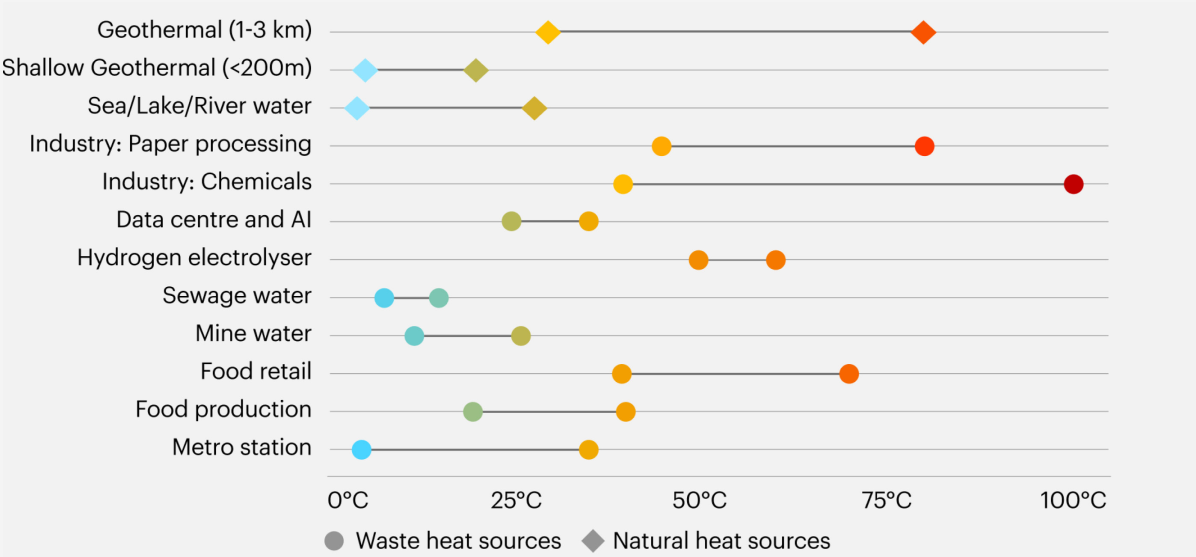
Compared with other options for district heating supply, heat pumps provide distinct possibilities. They deliver significantly higher efficiency than other electrical heating options and can utilise a wide range of low-temperature heat sources including waste heat from industrial processes, sewage treatment plants and data centres, and natural sources such as lakes, rivers and geothermal. Through flexible operation, heat pumps can provide grid-supporting services, and absorb intermittent excess electricity supply from solar and wind to produce heat that is stored with thermal storage and dispatched later, for example when energy prices and demand are higher.

What's next?

The possibilities of heat pumps in district heating are already being seen in deployments across all regions

A growing number of case studies showcase the future possibilities for heat pumps in district heating. One of the single largest deployments of heat pumps in district heating globally is in Stockholm, where a combined capacity of 500 MW of heat pumps supplies about 10-20% of heat demand to the network. In China, with its vast industrial base, a 200 MW absorption heat pump in the city of Qianxi utilises waste heat from a nearby steel mill. In the United States, another example comes from the fast-growing data centre industry: Amazon's headquarters in Seattle has been heated by waste heat from a nearby data centre since 2017, enabled by heat pumps and district heating.

Temperature ranges of heat sources suitable for heat pumps in district heating



Note: Geothermal temperatures are for average geological conditions without any increased geothermal activity.
Sources: Figure adapted from IEA (2025), Opportunities for district heating in the changing energy landscape, with additional analysis based on ThinkGeoEnergy and Marina, A. et al. (2021), An estimation of the European industrial heat pump market potential.

A wide range of heat sources can be integrated with heat pumps in district heating.

Deployment in industry

Current status

Heat pumps are starting to be adopted in industry

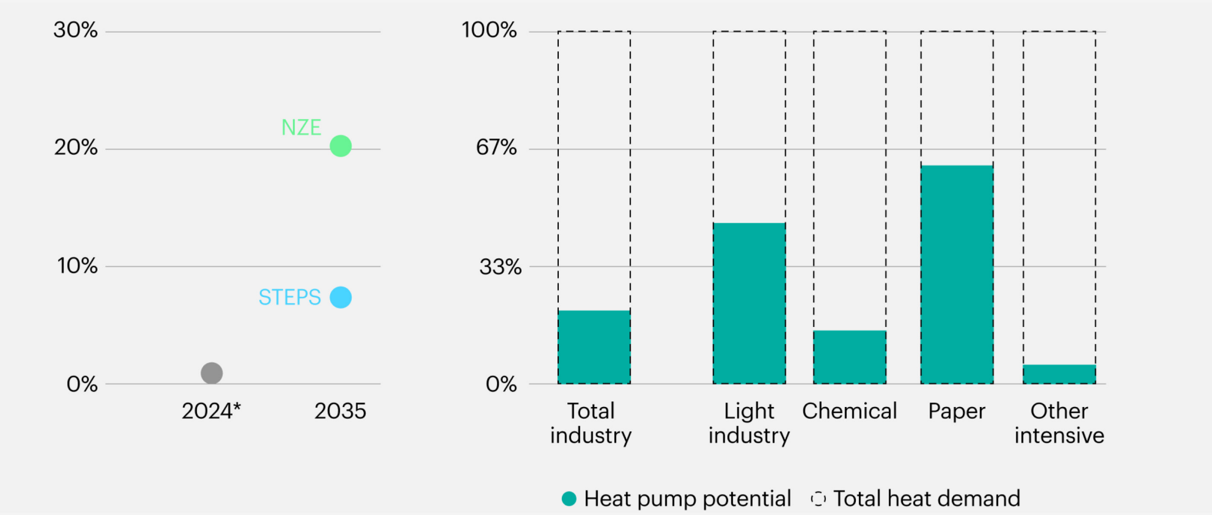
Use of heat pumps in industrial environments is not new but remained very low until a recent acceleration in deployment. High capital cost, technological complexity, grid connection delays and limited awareness have all constrained uptake. Today, however, companies are looking for ways to improve energy efficiency, recover waste heat and diversify their energy mixes. In this context, heat pumps are becoming an increasingly attractive option. Deployment statistics are scarce, but more and more examples are now emerging, driven by policy support. In Japan, industrial heat pump capacity reached almost 650 MW in 2024 according to the JEHC, up from 290 MW a decade prior. Heat pumps are most well-suited to applications like drying, pasteurisation or supplying steam. Light industry (which includes food and drink, textiles and machine manufacturing), and the paper and chemical sectors have the highest deployment potential, as a large portion of their processes are at suitable temperatures.

What's next?

Technological innovation opens the door to new industrial applications

Industrial heat pump deployment accelerates in all IEA scenarios, thanks to greater awareness, policy support and resilience benefits. Additionally, technological innovation keeps increasing the potential for heat pumps at higher temperatures. Industrial heat pumps able to reach 120°C were first demonstrated around 2022, and commercial roll-out of machines reaching over 160°C is expected by 2027. In the STEPS, heat pumps supply 8% of heat demand in light industry in 2035. In the NZE Scenario, a stronger policy push results in faster deployment to supply 20% of demand in 2035.

Estimated share of heat pumps in heat supply to light industry by scenario (left), 2024-2035, and deployment potential as a share of heat demand per sector (right), 2024



Notes: STEPS = Stated Policies Scenario; NZE = Net Zero Emissions by 2050 Scenario. * 2024 values are estimates.

Industrial heat pumps have the potential to supply up to 20% of industrial heat, mainly in light industry and the paper and chemical sectors.

Cost-competitiveness of industrial heat pumps

Current status

Industrial heat pumps can compete with alternatives on cost

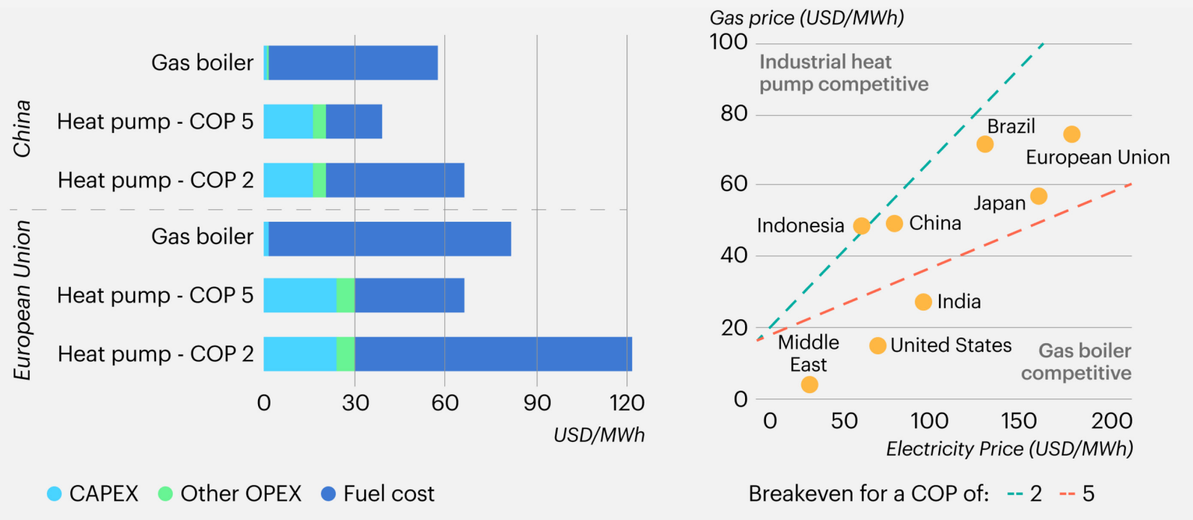
Industrial heat pumps are costly, with a capital cost about ten times greater than a gas boiler and three times that of a coal boiler. In addition, electricity prices are generally higher than for fossil fuels. However, heat pumps can compete with these alternatives over their lifecycle thanks to their efficiency, and the greater their Coefficient of Performance (COP), the lower their operating cost. For instance, in China, a heat pump with a COP under 2 would not be competitive against a gas boiler considering current prices, but if the COP is above 3, the balance would shift in favour of the heat pump.

What's next?

The COP of an industrial heat pump is mainly affected by one factor: the temperature lift

The temperature lift is the delta between the temperature of the heat source and the heat sink. A greater lift generally results in a lower COP, meaning that heat pumps using ambient air or water as a heat source have a limited temperature range in which they can be cost-competitive. The use of higher-temperature heat sources, such as industrial waste heat, provides a stepping-stone to reach much higher output temperatures while remaining competitive. The other main factor impacting competitiveness is the electricity-to-gas price ratio. In regions like the Middle East or the United States, where gas is relatively cheap compared to electricity, industrial heat pumps are less likely to compete with gas boilers on cost.

Levelised cost of industrial heat pumps and gas boilers in China and the European Union (left) and industrial electricity and gas price in selected countries (right), 2025



Note: CAPEX = capital expenditure; OPEX = operating expenditure; COP = Coefficient of Performance.

The cost-competitiveness of industrial heat pumps depends on two key factors: their Coefficient of Performance and the electricity-to-gas price ratio.

Pillar B. Deep dive on heat pumps in buildings

The most immediate opportunity for scaling up heat pump deployment is in the buildings sector, as technology is mature and widely applicable. Uptake in buildings is shaped by multiple factors, including climate, consumer preferences and cost-competitiveness, which vary across countries. Monitoring these factors is critical to identify opportunities, as well as any barriers, and to guide policy interventions.

Pillar B of the Heat Pump Monitor examines current trends and future opportunities for heat pump deployment in buildings. It is structured around four sub-pillars – affordability, industrial competitiveness, energy security, and innovation and technology – to provide a comprehensive, policy-relevant overview of the market and its enabling conditions.

Affordability

Affordability is widely recognised as a key challenge to heat pump deployment. While the lifetime costs of heat pumps are mostly favourable, especially in climates with both heating and cooling needs, upfront costs are typically higher than for conventional technologies, creating a potential burden for consumers. The ratio of electricity to natural gas prices is a critical factor in determining whether the additional upfront investment can be recovered over the system's lifetime.

The affordability sub-pillar of the Heat Pump Monitor explores regional variations in upfront, operational and lifetime costs, highlighting the opportunities that exist to enhance the cost-competitiveness of deploying heat pumps across different markets.

Upfront costs

Current status

Heat pump prices vary widely and are generally higher than alternatives

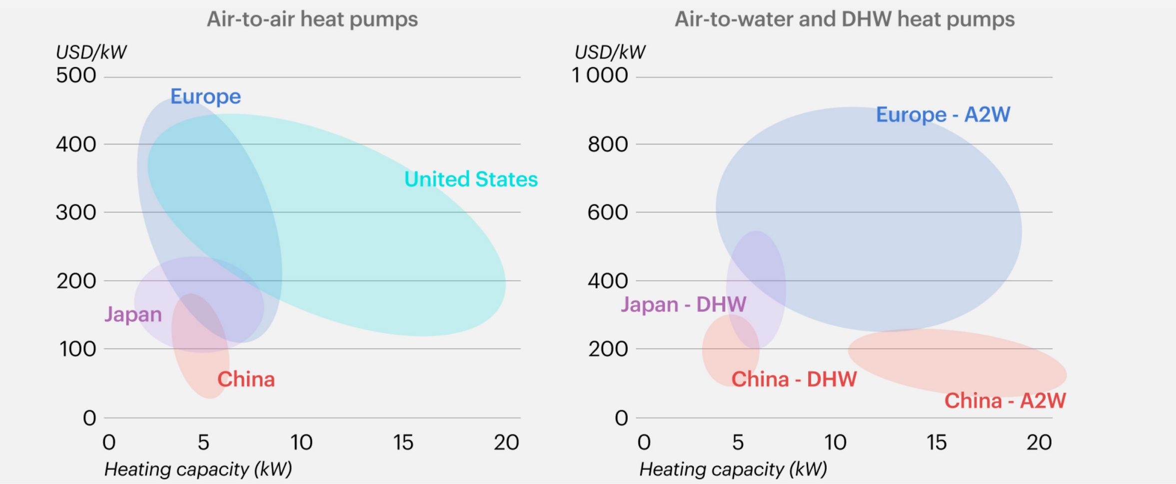
Retail prices of equipment differ within and across regions, depending on factors including heat pump type, building design and the existing heating infrastructure. China stands out as the most cost-competitive region across all product categories, thanks to its large manufacturing base with strong government support. However, even within comparable regions and product segments, heat pump prices differ as much as 60% between lower- and higher-cost products. Despite this, heat pumps remain more expensive on average than competing heating technologies, which continues to be a major barrier to deployment. In addition, in Europe and the United States, installation costs are often high, sometimes even higher than equipment costs, further increasing the overall investment required. As a result, many markets still rely on public subsidies to make heat pumps attainable for most consumers.

What's next?

Reducing costs requires sustained industrial investment, policy support and workforce development

As heat pumps have become more efficient, and gained additional features, their prices have remained largely stable over time. Following this trend, no drastic price drops are expected in the short term. However, China's experience has demonstrated that lowering equipment costs is possible, and other regions could further reduce upfront costs through sustained investment in manufacturing and supply chains. Structural changes like this would take time, meaning that targeted financial incentives for consumers, such as subsidies on investment, would remain necessary to sustain market growth in the interim. In parallel, in regions with high installation costs, expanding skills training, improving market and price transparency and standardising installations will be critical to lowering overall installation costs.

Equipment cost distributions of bestselling heat pumps by product category and region, 2025



Note: A2W = air-to-water (monoblock); DHW = Domestic Hot Water heater including water tank.
Sources: IEA analysis based on data from JD.com, Kakaku, Klimatime, Climamarket, Klimango, Klima-sklep, Airecomfort, HVACDirect

Heat pump prices and capacities vary widely across regions and products, although China has the lowest-cost options in all categories.

Operational costs

Current status

Affordable electricity is key to heat pump cost-competitiveness

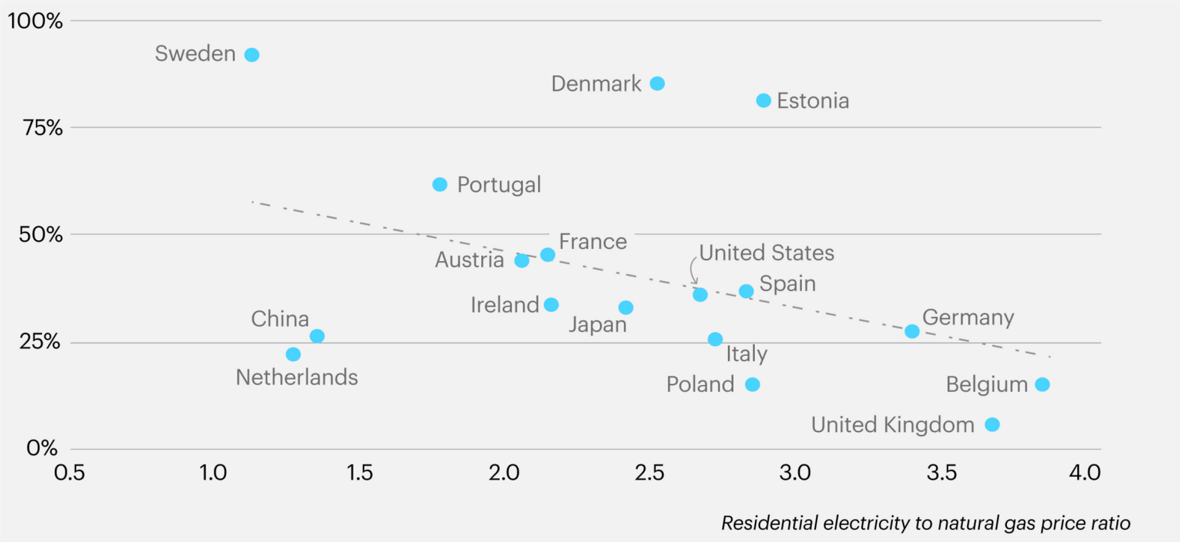
Heat pumps are 3-5 times more efficient than natural gas boiler alternatives but usually have higher upfront costs. For heat pumps to be cost-competitive, the ratio of electricity price to natural gas price must be sufficiently low for the additional upfront investment to be recovered over the equipment lifetime. Data show that the countries with the lowest price ratios also tend to have the highest market shares of heat pumps. In addition, several countries with favourable price ratios have also historically had long-term policy support for heat pump uptake. There are also some exceptions to the price ratio trend, most notably China and the Netherlands, where the heat pump markets have started to grow more recently.

What's next?

Price ratios are unlikely to change without targeted efforts

The annual average electricity to natural gas price ratio has remained relatively stable over time in most regions, and any big changes have been largely due to sudden price shocks, such as the 2022 energy crisis. However, energy markets remain dynamic and rapidly evolving, which is likely to affect electricity-to-gas price ratios over time. Governments do have tools at their disposal to alter this trend, for example by adjusting energy taxes and levies as well as electricity tariffs. One option could be to reduce tax on electricity used for heating, as has previously been done in [Denmark](#) and [Finland](#), for example. Heat pumps with intelligent operation are also becoming more common and when combined with hot water storage tanks and time-of-use electricity pricing, can reduce operational costs by using electricity when it is cheapest.

Heat pump market shares with respect to gas boilers and relative to the electricity to natural gas price ratio (annual averages) in selected countries, 2024



Notes: Market share is based on unit sales of heat pumps and gas boilers. The electricity price for Denmark includes the reduced tax. Energy prices for EU member states as per [Eurostat](#), others by the [IEA Energy Prices Database](#).
Sources: IEA analysis based on data from [EHPA](#), [METI](#), [JRAIA](#), [AHRI](#), [ChinaIOL](#) (2025).

Electricity to natural gas price ratio is the most influential factor in determining heat pump cost-competitiveness compared to natural gas boilers.

Lifetime cost

Current status

Heat pumps are often cost-competitive over their lifetime, but costs vary widely

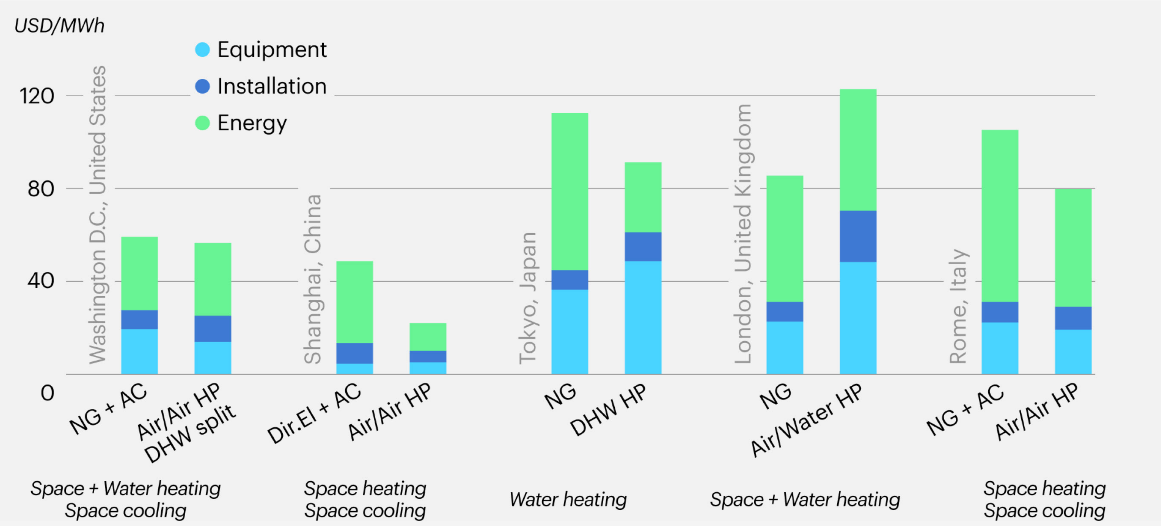
In many cases, heat pumps are already cost-competitive with conventional alternatives over their lifetime. The lifetime cost of owning (also known as Total Cost of Ownership) a heat pump (based on the levelised cost of heating and cooling) depends on multiple factors, including equipment cost, installation cost, equipment lifetime and energy price. This means that the lifetime cost can vary widely between households, even within the same region and with identical use. Typically, while heat pumps have a higher upfront cost than conventional alternatives, they have lower operational costs thanks to their higher efficiency, despite high electricity-to-gas price ratios in some countries.

What's next?

There are several policy options available to address the lifetime cost of heat pumps

Depending on the region and use case, upfront investment costs and operational costs contribute differently towards the lifetime cost. Electricity cost is among the most important factors to address to reduce lifetime cost, especially in countries with a high electricity-to-gas price ratio. An example of a policy measure suitable for these cases is to adjust energy taxes and levies as well as electricity tariffs (e.g. time-of-use pricing) and support flexible demand. Upfront costs – such as for equipment and installation – also affect consumer decisions. Direct subsidies towards the equipment cost are a common approach used to drive uptake, but other options such as low-interest loans, "Heating as a Service" or leasing business models can also be used.

Levelised cost of heating and cooling for selected cities and use cases (unsubsidised), 2024



Notes: AC = Air conditioner; HP = Heat pump; DHW = Domestic Hot Water; NG = Natural gas condensing boiler; Dir.El = Direct electric heating. In regions with both heating and cooling needs, reversible air/air heat pumps are assumed to be used for both purposes. Assumes a 3% discount rate and 15-year lifetime for ACs, gas and air/air HPs, and an 18-year lifetime for air/water HPs.

Heat pumps are used in a variety of ways based on heating and cooling needs; in many cases they are cost-competitive over their lifetime, but costs vary widely.

Energy security

Heat pumps can play a strategic role in enhancing energy security by reducing reliance on fossil fuels, especially natural gas for building heating, helping countries manage imports and diversify energy sources. However, this shift increases reliance on the electricity grid for security of heating and increases total and peak electricity demand during cold periods. At the same time, switching to heat pumps also creates opportunities to provide flexibility and support grid management.

The energy security sub-pillar of the Heat Pump Monitor examines how heat pumps both reduce natural gas demand and influence peak electricity loads, offering insights to inform system planning and policy design.

Peak electricity demand and flexibility

Current status

Increased heat pump adoption in buildings is raising electricity demand, but heat pumps remain a manageable share of total peak electricity load

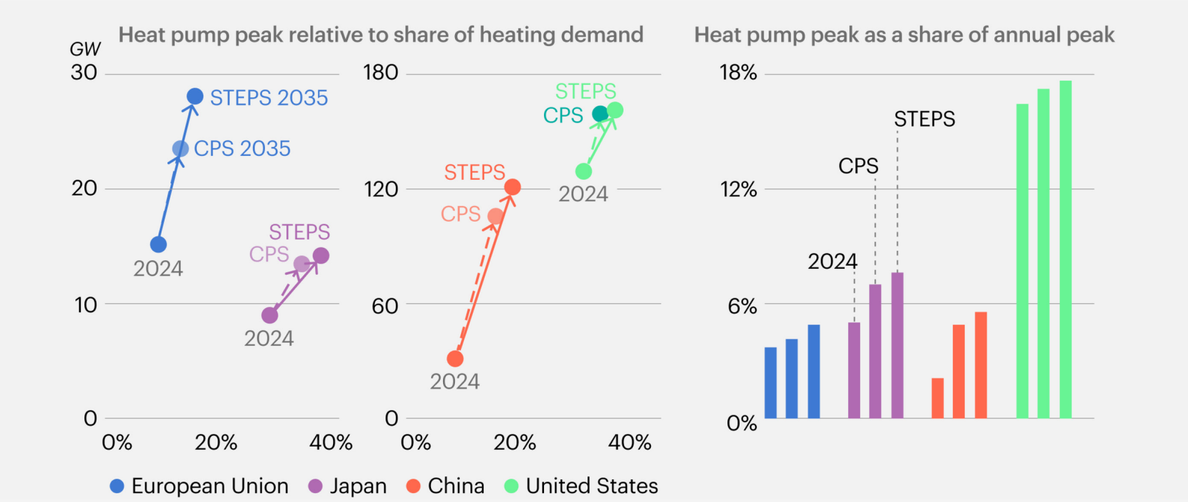
Electrifying heating through heat pumps adds a new thermosensitive load to power systems, increasing electricity demand during cold periods. This requires consideration of electricity security and resource adequacy, particularly during extreme weather events such as cold spells. Today, peak heat pump electricity demand ranges from around 2% to 16% of the overall peak – and sometimes higher shares locally – amounting to about 10 GW in Japan and 130 GW in the United States. The pace of heat pump electricity demand growth will be further shaped by income growth (which affects living standards and floorspace per household), building insulation levels and improvements in heat pump efficiency.

What's next?

Heat pump peak demand grows rapidly to 2035 and offers opportunities for power systems flexibility

In absolute terms, peak heat pump demand rises rapidly to 2035 in all scenarios. However, their contribution to system-level peak demand remains limited, as overall peak growth is also driven by other rising loads, notably electric vehicles and air conditioning. In Japan, China and the United States, summer peaks continue to exceed winter peaks, meaning system sizing is more influenced by cooling demand, including from reversible heat pumps. In addition, heat pumps are set to become an important source of system flexibility. By leveraging buildings' thermal inertia, water storage, coupling with other heating equipment and recent manufacturer advances in controllability, heat pumps can shift electricity consumption in response to grid or price signals, thereby lowering pressure on electricity grids and enabling renewables integration.

Heat pump peak electricity demand and share of heating demand covered by heat pumps in the Current Policies Scenario and Stated Policies Scenario, 2024-2035



Note: CPS = Current Policies Scenario; STEPS = Stated Policies Scenario.

Higher heat pump deployment adds new loads to electricity systems, but their high efficiency mitigates peak demand impacts.

Natural gas security

Current status

Heat pumps contribute to reducing demand for natural gas

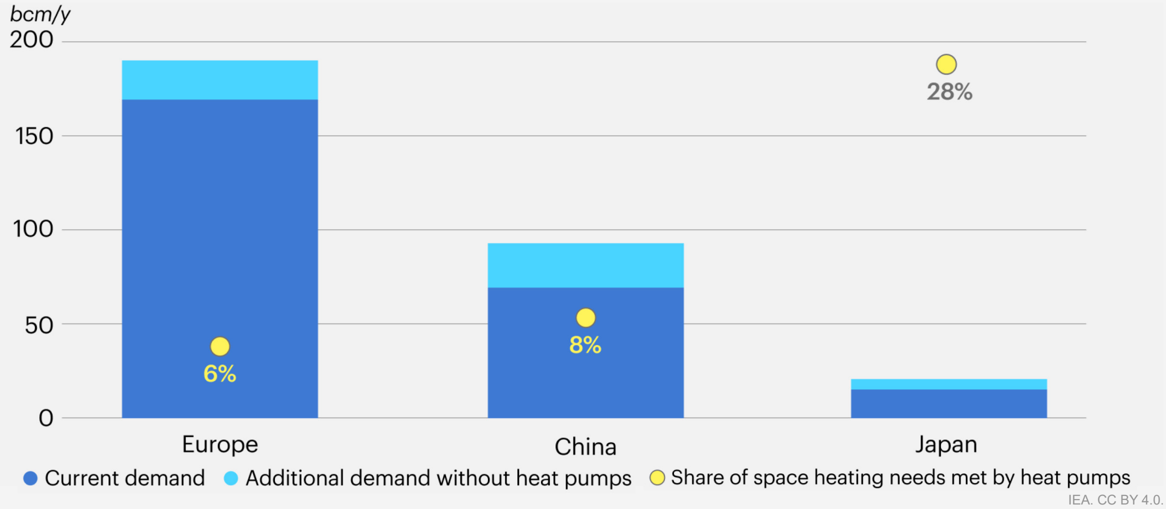
In Europe and Japan, heating in buildings represents around 50% of total natural gas demand. In China, this share is around 20%, as use in industry plays a larger role. Without heat pumps, reliance on natural gas would likely be even higher: In 2024, if all already-installed heat pumps had instead been replaced with natural gas boilers, annual natural gas demand for heating buildings in Europe would have been an estimated 12% higher (20 billion cubic meters (bcm)). In Japan and China, it would have been around 35% higher (6 bcm and 25 bcm, respectively). Data for 2025 shows that gas savings from heat pumps has continued to increase, reaching a combined 53 bcm for the three regions.

What's next?

Heat pumps will remain important to reducing reliance on energy imports

As countries seek to enhance energy security and resilience at the national level, many are now aiming to reduce and diversify energy imports. For example, Japan aims to increase the share of oil and gas demand that is domestically controlled to 50% by 2030, and the European Union aims to phase out Russian gas imports by the end of 2027. In 2024, Europe relied on net imports to cover about half of its total natural gas demand. In China, around 40% of demand was met by imports, and in Japan, almost 100%. Further deployment of heat pumps has significant potential to reduce natural gas demand and reliance on imports, contributing to policy objectives on energy security. In 2024, there were a total of over 200 million natural gas boilers used for space heating in the latter three markets, with heat pumps still only covering a small share of heating needs.

Natural gas demand for heating in buildings, additional demand potentially avoided by heat pumps, and share of space heating met by heat pumps, 2024



Notes: Accounts for natural gas demand used for electricity generation for heat pumps. The 2024 natural gas intensity for heating and electricity generation is assumed to be the same as the 2020-24 average. Share of space heating needs is by equipment stock.

Heat pumps are already curbing natural gas demand in Europe, China and Japan, with room to further support energy security and reduce reliance on imports as uptake grows.

Industrial competitiveness

Manufacturing and trade are central to the competitiveness and availability of heat pumps. Production is geographically diverse, with most major markets sourcing the majority of heat pumps domestically, although the production of components such as compressors remains concentrated in a few regions. Growing global demand presents opportunities to expand manufacturing, but scale-up can be constrained by short-term shifts in policy signals, supply chain bottlenecks, and shortages of skilled workers.

The industrial competitiveness sub-pillar of the Heat Pump Monitor examines manufacturing and trade patterns, regional variations in production costs, and workforce and skills gaps that can affect capacity to meet growing heat pump demand.

Employment

Current status

The global heat pump workforce has grown 50% since 2015, but mass roll-out places strains on supply of workers

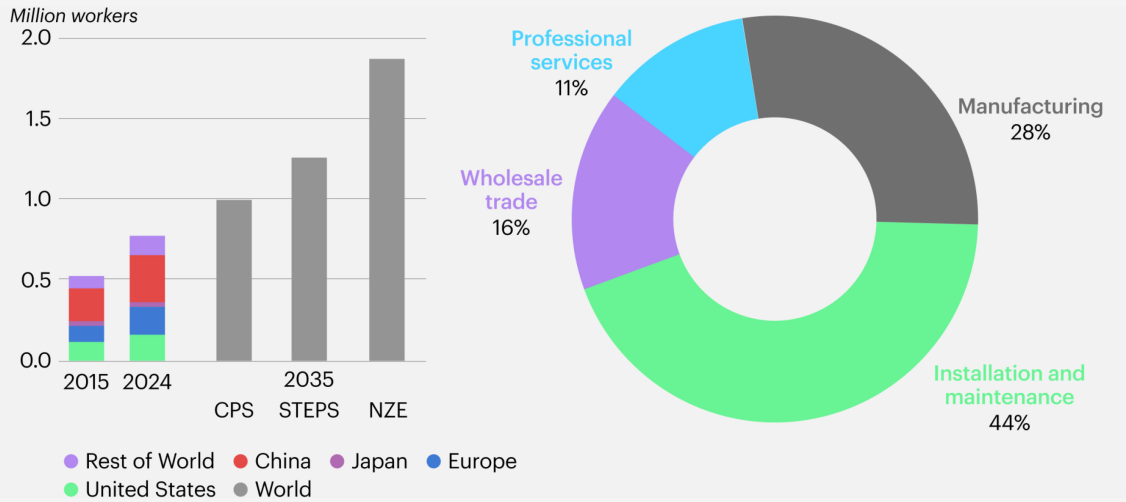
Nearly 800 000 workers globally currently work principally on heat pumps, or 1% of the total energy workforce. Manufacturing, installation and repair together account for nearly three-quarters of jobs, which are concentrated in three major regions – China, Europe and the United States. As with many other parts of the energy sector, the mass roll-out of heat pumps faces bottlenecks due to shortages of vocationally trained workers, namely HVAC installers and plumbers. In addition, inadequate training and experience have sometimes resulted in poor-quality installations and negative public perceptions. The skills gap is especially pronounced in Europe, where water-based heating systems are more common, meaning existing boiler installers must supplement their plumbing training with courses on the mechanics of heat pumps, electrical installation, safety standards and handling of F-gases.

What's next?

Heat pump jobs are projected to grow by 2035 in all scenarios

Demand for heat pump workers is expected to continue to grow over the next decade in all scenarios, though at varying rates. In the CPS, in which heat pump sales remain lower than in other scenarios, the pace of employment growth slows relative to recent years, with a 30% increase by 2035. This rises to 60% in the STEPS, on par with recent trends, and up to 140% in the NZE Scenario. Meeting future demand for labour to deliver on heat pump installations would require an immediate ramping-up of vocational education, given existing shortages and the time required for training and gaining practical experience.

Heat pump employment by region, scenario and economic activity, 2015-2035



Notes: CPS = Current Policies Scenario; STEPS = Stated Policies Scenario; NZE = Net Zero Emissions by 2050 Scenario. The number of jobs per economic activity corresponds to the number of workers in each activity who work principally on heat pumps, and is based on data from 2024.

Demand for heat pump workers is set to continue growing rapidly over the coming decade, adding to existing strains on the supply of skilled workers.

Manufacturing and trade

Current status

Differing local preferences and standards mean that heat pump manufacturing is geographically diverse, and trade is limited

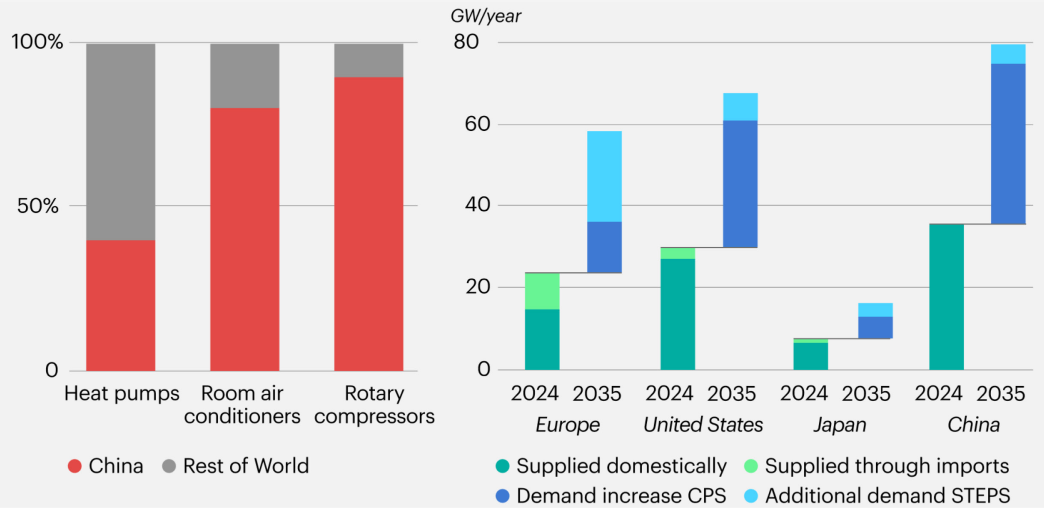
Unlike other key clean energy technologies, the supply chain for heat pumps is relatively diverse, although upstream steps such as rotary compressor manufacturing are more regionally concentrated, notably in China. In 2024, only around 15% of heat pumps installed in buildings worldwide (by capacity) were traded across borders, with most demand met by domestic production. In all major markets – China, the United States, Europe and Japan – over 70% of heat pumps sales in 2024 were sourced locally. Global manufacturing capacity in 2024 stood at around 145 GW/yr, led by China (35%), followed by the United States (25%) and the European Union (20%).

What's next?

Growing demand opens up new avenues for manufacturing and trade globally

Both current policies and stated policy intentions point towards a global increase in demand to 2035, and, therefore, to manufacturing capacity, although the role of trade is less certain. Heat pump manufacturing is relatively localised and can scale quickly in response to predictable demand (the typical lead time for a new factory is 1-3 years), but this does not always happen smoothly. Short-term policy signals, sudden demand surges, or shortages of skilled labour and components can all delay capacity expansion. As a result, domestic production may lag behind demand growth, increasing reliance on imports. Countries with strong air-conditioner manufacturing industries, especially China, are well positioned to quickly expand heat pump and component production by repurposing existing production lines for air conditioners, and would require only limited investments to adapt to requirements in other regions.

Global heat pump manufacturing and demand by region in the Current Policies Scenario and Stated Policies Scenario, 2024-2035



Notes: CPS = Current Policies Scenario; STEPS = Stated Policies Scenario. The left-hand side figure is based on data for 2024.

China's dominance in air-conditioner manufacturing positions it to rapidly scale up exports in response to growing heating and cooling demand globally.

Levelised cost of production

Current status

Economies of scale have made China the lowest-cost heat pump producer

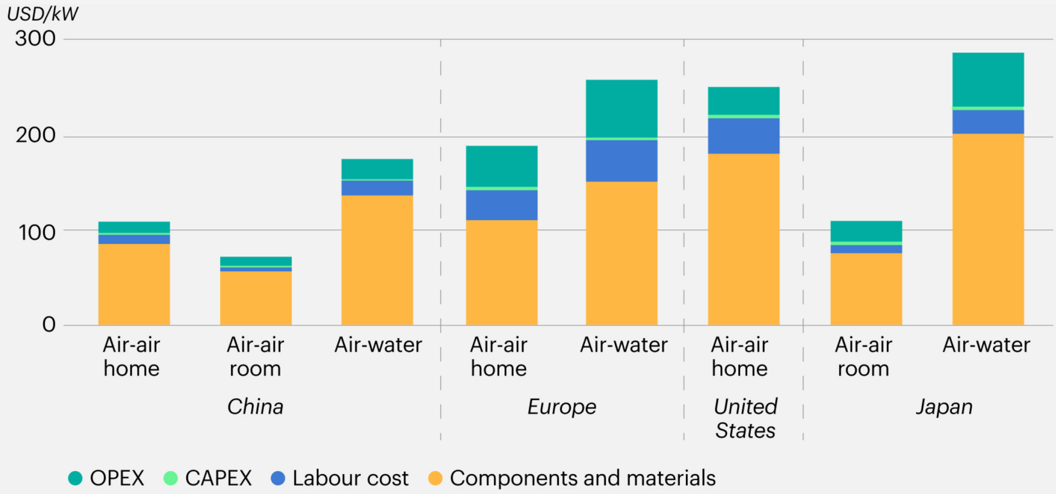
Heat pump production costs vary widely by region, shaped by manufacturing conditions (skills, infrastructure, energy and labour) and market factors such as product type, size, compressor choice and standards. Given that final assembly is not an energy-intensive process, components and materials dominate production costs (60-85%), favouring countries with competitive and well-integrated heat pump component manufacturing and access to materials. China has a major advantage, especially for air-to-air units, which share supply chains and manufacturing processes with air conditioners. Air-to-air heat pumps cost about 40% less to produce in China than in Japan, while air-to-water units remain around 60% more expensive to produce in Europe than in China. Most of the production cost gap is due to economies of scale, vertical integration and lower labour cost.

What's next?

Competitiveness requires stable demand at scale – not just lower production costs

Several levers could help narrow the production cost gap with China, including automation, industrial clustering and deeper collaboration through joint ventures and technology partnerships. However, closing the cost gap will be challenging. In addition, production cost has a limited effect on final retail prices, particularly for air-to-water heat pumps. Stable, predictable demand is critical to ensuring economies of scale that can support the competitiveness of local manufacturing. Demand is highly sensitive to electricity-to-gas price ratios, as well as to the final end-user costs, for which installation and distribution costs also play an important role, especially in Europe.

Levelised cost of production by main cost components, 2024



Notes: OPEX = operational expenditure; CAPEX = capital expenditure. Retail cost includes only the outdoor unit for the United States, and only the equipment cost for all other regions.

The competitiveness of heat pump manufacturing depends on supply chain integration and scale, which ultimately hinges on market design, demand stability and energy price signals.

Innovation and technology

Technological development remains key to enhancing the performance, sustainability and cost of heat pumps and, as a result, their adoption in the market. Although heat pump technology is already mature, continuing innovation enables new applications across different climates and building types, lowers operating costs, improves integration with buildings and power systems, and supports higher-temperature or industrial uses. Innovation is also crucial in the context of refrigerant transitions, which present both opportunities and challenges for manufacturers.

The innovation and technology sub-pillar of the Heat Pump Monitor highlights emerging technological developments, examines trends in heat pump patents, and explores the opportunities and implications arising from shifts in refrigerants.

Technology development

Current status

Heat pumps are a mature technology

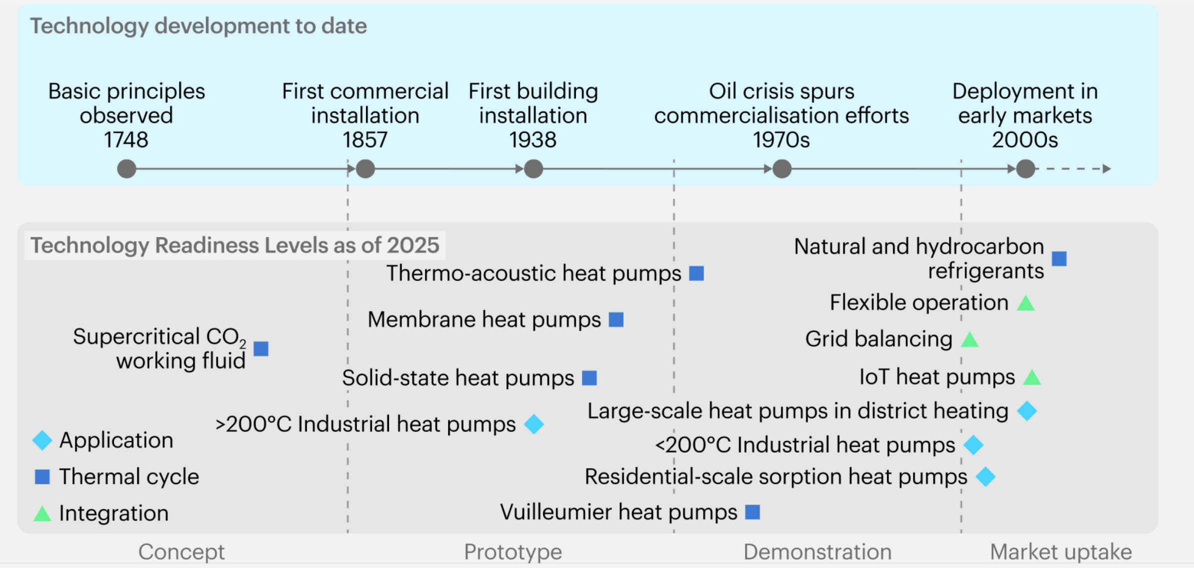
The global market for heat pumps in buildings is mature and experiencing strong growth, as the technology has now been in commercial use for more than 100 years. Virtually all heat pumps commonly found in buildings use the vapour-compression cycle, mostly operating with hydrofluorocarbon refrigerants. Deployment of alternative heat pump designs to date (such as absorption and adsorption) is limited to niche markets, while some new designs (such as thermo-acoustic and membrane heat pumps) are still under development and have not yet reached commercialisation. R&D in heat pump technology is being undertaken worldwide, led by multinational companies such as Daikin, Midea, Nibe and Carrier, as well as by international collaborations such as the IEA Technology Collaboration Programme on Heat Pumping Technologies.

What's next?

Innovations are expanding in the heat pump market

Much of the ongoing innovation in heat pump technology concentrates on expanding use cases and improving the efficiency, connectivity and flexibility of vapour compressor units. Another area of innovation relates to the thermodynamic cycle – either the application of new types of refrigerants or use of other novel thermal cycles that do not require any refrigerants at all. In the short term, heat pumps with innovations such as natural and hydrocarbon refrigerants and flexible operation will become more common on the market. In the longer term, novel technologies such as thermo-acoustic and solid-state heat pumps might start to appear on commercial markets.

Heat pump technology development milestones and current state, 1748-2026



Note: IoT = Internet of Things, heat pumps with network connectivity for data exchange with other devices.
Sources: IEA analysis and Zogg, M. (2008), History of heat pumps: Swiss contributions and international milestones.

Innovation can increase the added value and efficiency of heat pumps in all applications.

Patents

Current status

Heat pump patenting has surged since 2010

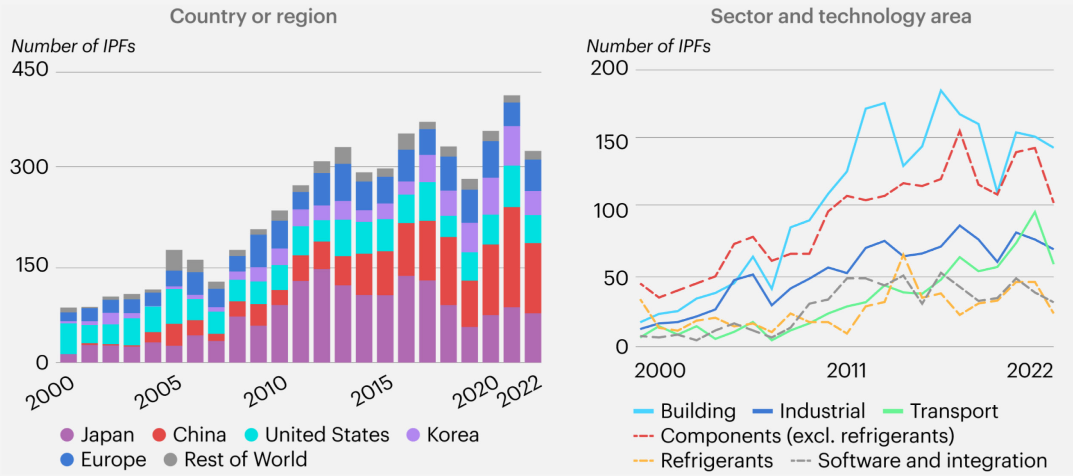
Heat pump patenting activity around the world has increased nearly fivefold since the 2000s – twice the average increase seen in other technologies – as R&D and innovation in heat pumps have expanded. Japan saw a sharp increase in patents in the late 2000s, encouraged by government-backed innovation programmes. In addition, Japan and Korea host the headquarters of many leading air-conditioning manufacturers, making them hubs for patent filings and intellectual property (IP) ownership. Patenting in China has grown steadily since 2000, positioning the country as an industry leader, with about one-third of all heat pump patents in 2022. Patenting efforts in Europe and the United States have also continued, although growth has been slower. The increase in patenting activity in the late 2000s was largely driven by applications for the buildings sector, but patents for industrial applications have also risen steadily over the past two decades.

What's next?

Patenting activity is expected to remain high, driven by innovations in electrification, system integration and refrigerants

China has recorded the highest patenting activity in nearly all categories in the past few years and is expected to retain this lead in the years to come. Since the 2010s, patenting in the transport sector has accelerated as electric vehicle sales have grown. This trend responds to the absence of combustion-engine waste heat in electric vehicles, which instead incentivises integrated thermal-management solutions using heat pumps. Korea and China have led patenting efforts in this sector in recent years. While most heat pump innovations are likely to remain at the component level (e.g. compressors, heat exchangers), advances in software, system integration and low-global warming potential (GWP) refrigerants are also expanding.

Heat pump patenting activity, 2000-2022



Notes: Shows a count of International Patent Families (IPFs), each of which represents a unique invention and includes patent applications filed in at least two countries. Country contributions on the left are exclusive; patents may appear in multiple categories on the right.

Source: IEA analysis based on European Patent Office PATSTAT patents database accessed through the OECD Micro-data Lab.

Patenting in heat pump technologies has risen sharply and is expected to remain high, driven both by continued innovation in long-established firms and China emerging as a new player.

Refrigerants

Current status

A refrigerant shift is underway

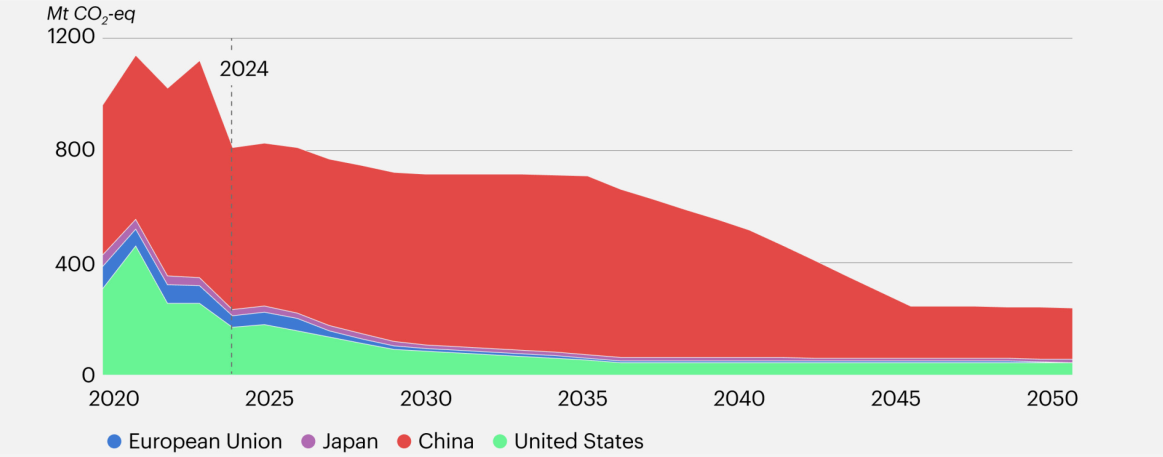
Historically, most heat pumps have relied on hydrofluorocarbons (HFCs) as refrigerants, many of which have very high global warming potentials (GWPs), more than 2 000 times that of CO_2 (e.g. R-410A). Emissions can occur through leakage during heat pump operation, servicing and improper handling at end of life. Today, heat pumps in buildings use a broad range of refrigerants. R32, with a GWP of 675 (significantly lower than old HFC), is widely deployed as a mid-transition option, alongside emerging lower-GWP alternatives such as Hydrofluoroolefin (HFO)/HFC blends (e.g. R-454B in the United States) and natural refrigerants, notably CO_2 in Japan and propane in Europe. In China, R32 is the predominant refrigerant and the share of R410A is declining.

What's next?

International action paves the way for a major cut in HFC emissions

The Kigali Amendment to the Montreal Protocol, in force since 2019 and ratified by 172 countries as of June 2026, aims to cut HFC use by over 80% globally by 2050 through country-specific phase-down schedules. In parallel, the European Union has adopted a stricter F-gas Regulation. Heat pumps account for as much as 15% of HFC use in countries with higher uptake, such as the United States or parts of Northern Europe. To meet these targets, it is expected that refrigerants used in heat pumps will shift to low-GWP refrigerants (GWP <150) in Europe and Japan by the end of the 2020s, and in China and the United States by the early 2030s. This is forcing manufacturers to redesign equipment and address safety challenges linked to low-GWP refrigerants (such as high pressures or flammability), while maintaining high efficiency and similar unit sizes, and adapting to regional regulations.

Hydrofluorocarbon consumption phase-down under the Kigali Amendment in key heat pump markets, 2020-2050



Notes: Values to 2024 are actual; later values are projected under full Kigali and F-gas compliance. While heat pumps can transition to low-GWP or natural refrigerants, other applications, such as aerosols and foams, still require HFCs, so overall limits do not reach zero.

Sources: IEA analysis based on UNEP, EEA, US EPA, and JRAIA.

The ongoing shift to low-GWP refrigerant alternatives is creating regulatory pressure for manufacturers but opens new opportunities for innovation.

Pillar C. Regional insights

Heat pump markets vary widely across regions, and their differing characteristics influence both rates of heat pump adoption and the policy measures that are most effective.

Pillar C of the Heat Pump Monitor examines key markets, including China, Europe, Japan and the United States, assessing market trends, policy frameworks, cost structures and technical potential from each region. This analysis highlights lessons learned, transferable practices and opportunities for tailored interventions to support wider deployment.

China

Current status

China has become the world's largest heat pump market, shaped by distinct regional heating practices

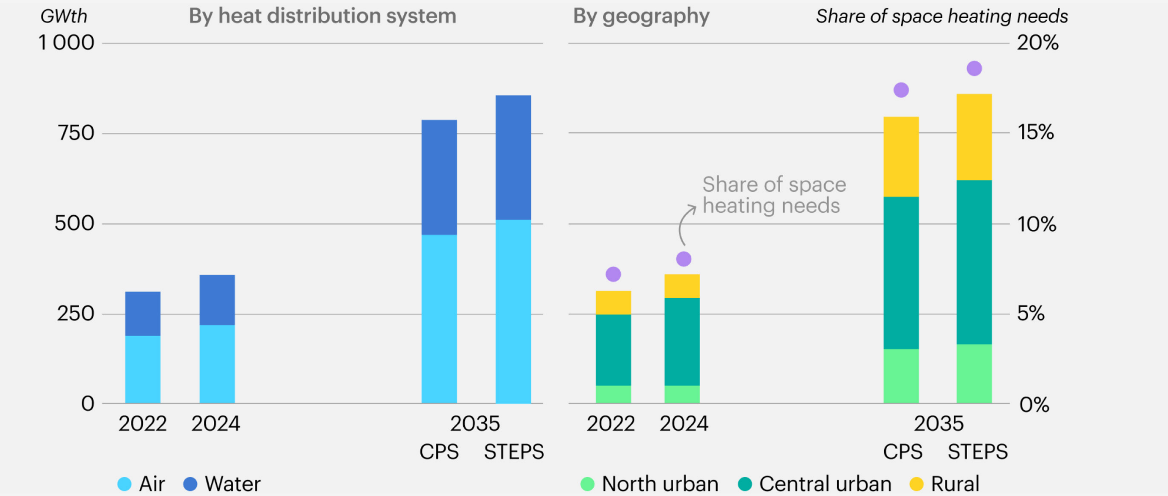
Deployment has grown at the buildings level and in centralised district heating, including with geothermal systems. Growth in distributed units has been driven by air pollution control and economic incentives such as the coal-to-electricity and "trade-in" programmes, stricter building energy codes and uptake in regions with heating and cooling demand. In northern urban China, district heating dominates, but distributed systems are emerging, including heat pumps. In the urban hot summer and cold winter zone, central heating is largely absent, and rising incomes have led to rapid growth in residential distributed solutions, such as heat pumps that provide flexible, part-time heating and cooling. These are already common in the services sector. In rural areas, space heating has historically relied on coal and traditional biomass stoves, but targeted policies are accelerating a shift towards heat pumps and other electric technologies. Hot water production is typically separate from space heating; heat pump water heaters are gaining ground, but conventional technologies remain dominant.

What's next?

Rapid growth in deployment is expected

Air-to-air heat pumps are often the most cost-competitive decentralised solution in China, but air-to-water systems compete with electric and gas heating in colder climates, and ground-source heat pumps can be cost-effective for large buildings, despite higher upfront costs. These favourable economics – and policy support – are expected to drive a strong increase in installed capacity in buildings by 2035, especially in rural areas across the whole country, cities in central parts of China, and new urban developments in northern China.

Decentralised heat pump stock in Chinese buildings in the Current Policies Scenario and Stated Policies Scenario, 2022-2035



Note: CPS = Current Policies Scenario; STEPS = Stated Policies Scenario.
Source: Updated from IEA (2024), The Future of Heat Pumps in China.

Heat pump deployment in China is set to accelerate through 2035, with growth expected both in air- and water-distribution systems.

What is China's role in the heat pump supply chain?

Current status

China is a world-leader on heat pump production, with a domestic supply chain that is often vertically integrated

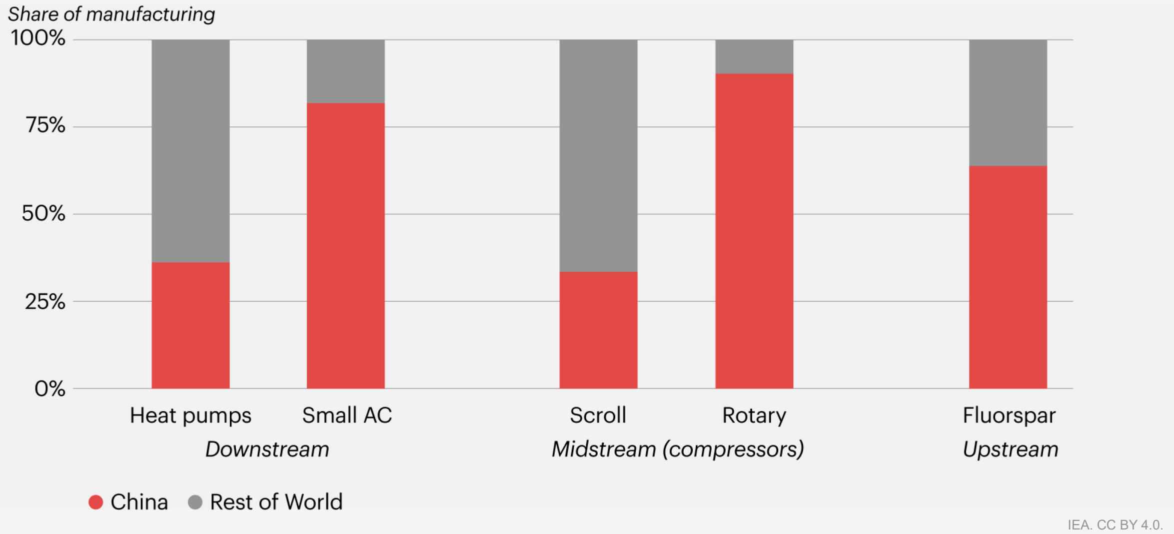
China's role in the global supply chain is concentrated in specific segments; for assembly of heat pumps, manufacturing outside China is sufficient to meet demand in most heating regions. However, manufacturing capacity for small air conditioners – which share components with heat pumps – is heavily concentrated in China. Notably, about 90% of rotary compressor manufacturing capacity is located in China, which creates an acute vulnerability in the supply chain. By contrast, scroll compressor manufacturing and refrigerant feedstock (fluorspar) production are more geographically diversified, reducing exposure to disruptions.

What's next?

Rising heat pump demand globally might increase reliance on Chinese manufacturing, but policy stability can increase supply chain diversity

Increasing electrification of heating – mostly driven by stricter building energy codes, heating policies and efficiency incentives – is expected to accelerate heat pump adoption. China has shown it can rapidly increase exports, and by doing so could meet strong demand growth in countries where local manufacturers typically need more stable demand signals to scale production. Diversifying the supply chains for rotary compressors and small air conditioners is expected to remain challenging, but domestic heat pump assembly can help reduce deployment delays and limit price volatility – if stable policies are implemented in key markets. Further opportunities to diversify the supply chain arise from differing efficiency standards and shifts to low-GWP refrigerants.

Share of manufacturing capacity for heat pumps, air conditioners and principal components in China and the rest of the world, 2024



Note: AC = Air conditioners.
Source: IEA (2026), Energy Technology Perspectives 2026.

China dominates manufacturing of small air conditioners and rotary compressors, but heat pump assembly, scroll compressors and fluorspar have more diverse supply chains.

Europe

Current status

Europe's market has strong structural drivers, but recent sales volatility highlights continued dependence on stable policy support

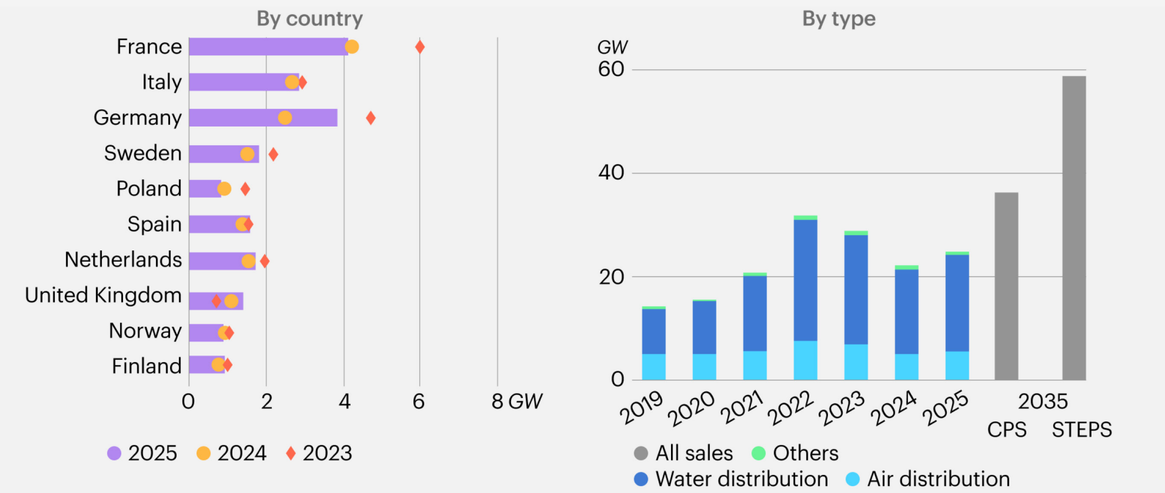
Europe accounts for more than 20% of global sales by capacity. Within the European buildings sector, air-to-water (hydronic) systems account for the largest share of sales, but some countries such as the Nordics tend to prefer air-to-air units. In 2025, France, Italy and Germany led in terms of total units sold, while Norway, Finland and Sweden had the highest share of installations by household, reflecting early adoption. After double-digit growth in 2022, driven by energy security concerns and the announcement of more than USD 2 billion in manufacturing investment, market conditions weakened in 2023, and total sales declined in 2024, apart from in the United Kingdom and Ireland, where sales continued to grow. Europe also has a strong presence within the industrial and district heating heat pumping sectors, showcasing a wide array of demonstration cases within the two sectors.

What's next?

2025 data show Europe's heat pump market recovering, and further growth is supported by the region's industrial base and policy frameworks

Data for 2025 shows a return to growth for the European heat pump market, with particularly strong annual growth for some countries, including Germany and Sweden. Europe benefits from a strong industrial base, technological leadership and an evolving policy framework. In the European Union, REPowerEU, the revised Energy Efficiency, Energy Performance of Buildings and Renewable Energy Directives, together with the Net-Zero Industry Act and Clean Industrial Deal, can support deployment across all sectors. Electrification remains central: the European Commission's Electrification Action Plan aims to electrify 32% of final energy use by 2030, and then increasing to 46% by 2040. By 2035, heat pump stock is projected to nearly double in the CPS and to reach two-and-a-half times today's level in the STEPS.

Heat pump sales in Europe's ten largest sales markets and sales in Europe by type in the Current Policies Scenario and Stated Policies Scenario, 2019-2035



Note: CPS = Current Policies Scenario; STEPS = Stated Policies Scenario.

Heat pump sales in Europe have fluctuated, with diverging trends indicating solid markets in some countries while others remain reliant on policy support.

How much natural gas could an accelerated heat pump roll-out save?

Current status

Current policies are supporting heat pump scale-up

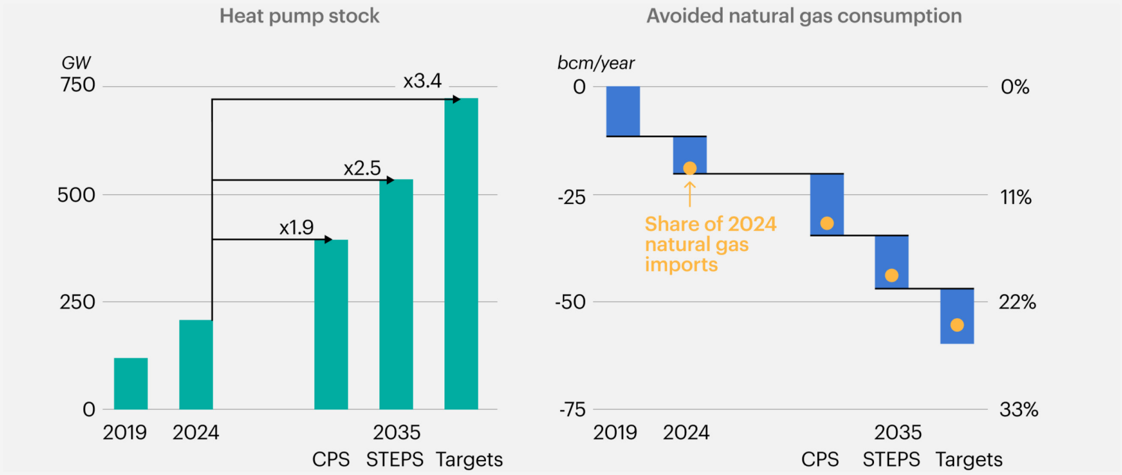
Europe remains highly dependent on imported natural gas; about half of total natural gas supply was imported in 2024. However, diversification and demand reduction have become central aims of European policy since the energy crisis of 2022. From 2019-24, gas demand in buildings fell by 12%, driven by the combined effect of efficiency gains, milder temperatures and the energy crisis. In the absence of heat pumps, this decline would have been only 3%, leading to 20 bcm/year of additional gas

What's next?

Heat pumps can drive immediate reductions in natural gas demand

Several policies could further amplify a fall in natural gas consumption. In particular, REPowerEU prioritises cutting fossil fuel imports and calls for rapid heat pump deployment, backed by targets for national deployment and manufacturing in Germany and France. Europe's heat pump stock is projected to continue growing over the coming decade in the CPS and STEPS, avoiding an additional 14 and 27 bcm/year of gas use by 2035, respectively. By contrast, full alignment with European heat pump targets – including REPowerEU and the UK target – could drive a more than threefold expansion, and raise gas savings up to 39 bcm/year – about 16% of today's net imports. While heating in buildings is the largest end-use of natural gas in Europe (accounting for around 50%), further savings could be made by expanding heat pump deployment in industry and district heating.

Heat pump stock in Europe's buildings and avoided natural gas consumption in the Current Policies Scenario, Stated Policies Scenario and in an accelerated deployment case, 2019-2035



Notes: CPS = Current Policies Scenario; STEPS = Stated Policies Scenario. "Targets" is based on the assumption that the targets of the RePowerEU and the UK target to 2030 are achieved and that these trends continue to 2035. Natural gas consumption includes all buildings end uses. Accounts for natural gas demand used for electricity generation for heat pumps.

Scaling up heat pump deployment could cut European natural gas consumption by 14-39 bcm/year by 2035, reducing dependency on imports.

Japan

Current status

Japan is experiencing a structural shift in heat pump manufacturing, technology, and market competition

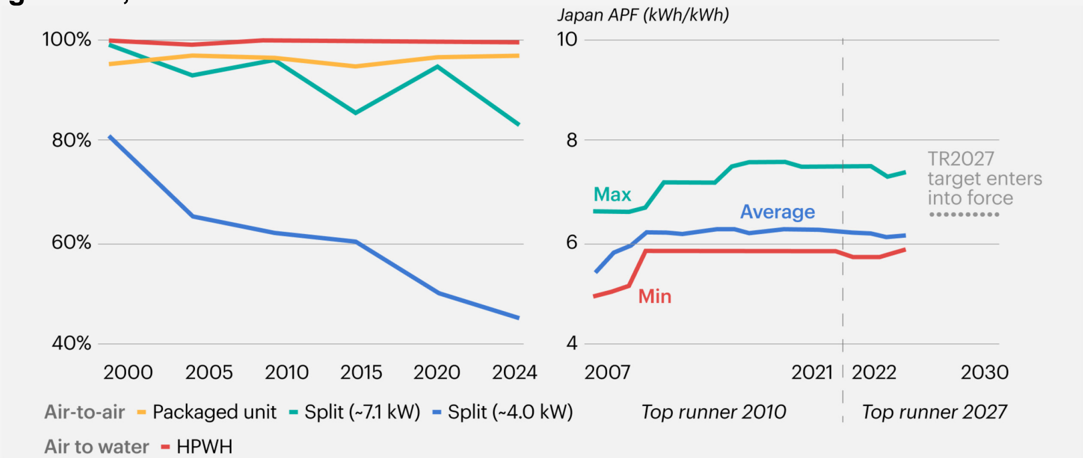
Japan accounts for around 7% of global heat pump sales and hosts the headquarters of several major manufacturers. The Japanese market is mature and has largely remained flat for several years. It is dominated by reversible air conditioners, which are the most popular type of space heating equipment, even surpassing the combined share of oil and natural gas boilers. Air conditioner ownership (including air-to-air heat pumps) has reached an average of 2.8 units per household – more than anywhere else in the world. These smaller standardised units are increasingly imported, particularly from China, whereas larger systems and heat pump water heaters, as well as their components, are predominantly manufactured domestically. Japan has the highest energy efficiency standards across global markets, but progress on improvements has slowed in recent years.

What's next?

Japan's heat pump leadership faces new challenges

In the CPS, there is no growth in the heat pump market by 2035, whereas in the STEPS there is modest growth in space heating, and sales in water heater units double. Japanese manufacturers' strengths in compressors, refrigerants and system integration provide a solid base to strengthen competitiveness in global heat pump markets, particularly in high-efficiency, high-reliability segments that are subject to increasingly stringent refrigerant regulations. Sustained policy signals will be crucial for Japan to maintain its technological edge as global heat pump markets continue to expand. Mechanisms such as the forthcoming implementation of the Top Runner programme 2027 aim to support further R&D-led improvements, combined with a strategic focus on component leadership and advanced refrigerant solutions.

Share of domestic heat pump production by segment in Japan, 2000-2024, and energy performance of small air-to-air heat pumps under the Top Runner programme, 2007-2030



Notes: HPWH = heat pump water heater. Domestic production excludes firms receiving products from overseas. Energy performance data since 2022 is based on the forthcoming Top Runner programme (TR2027). Small air-to-air heat pumps refer to 2.8 kW units. Japan APF (Annual Performance Factor) is a seasonal efficiency metric combining annual heating and cooling performance.
Source: IEA analysis based on data from METI.

Domestic production has slowed in recent years, while energy efficiency gains have plateaued as technologies mature.

What is driving adoption of heat pump water heaters?

Current status

Japan's Eco-cute heat pump water heater is a global benchmark for innovation and efficiency

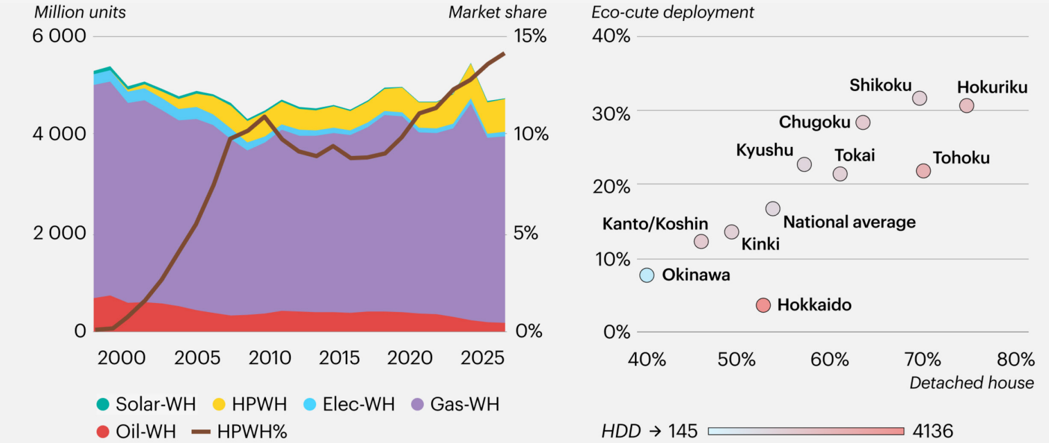
Since 2000, water heating has accounted for around 20% of final energy consumption in buildings, with about 80% of such demand supplied by fossil fuels. In residential buildings, water heating demand exceeds that of space heating, reflecting cultural preferences for baths. To reduce the associated energy consumption and CO_2 emissions, the "Eco-cute" – the market nickname for a CO_2 refrigerant-based heat pump water heater – was developed and introduced in 2001. Deployment has since expanded rapidly, capturing around 10% of the water heating market within a decade, although natural gas units remain dominant. Early uptake was backed by policies such as financial incentives and, more recently, policies encouraging participation in demand response have started to be planned. In most cases, the Eco-cute offers substantially higher efficiency and lower lifetime cost than alternatives. However, deployment varies significantly by region, driven by lifetime cost and dwelling types.

What's next?

Harmonised standards and targeted incentives could expand Eco-cute adoption

Current Eco-cute standards are mainly designed for detached housing and focus on system resilience, setting requirements for water tank size. Aligning such standards more closely with those applied to gas and other types of water heaters could unlock greater deployment, particularly in areas with lower adoption. At the same time, subsidies for a wide range of equipment – including hybrid water heaters, fuel cells and high-efficiency gas and oil systems – shape the relative economic attractiveness of heat pump water heaters. More targeted incentives for Eco-cutes and the harmonisation of technical standards could strengthen their value proposition.

Water heater sales, 2000-2025, and Eco-cute deployment by dwelling type and by region, 2023



Notes: WH = water heater; HP= heat pump; HDD = heating degree days. HPWH (heat pump water heater) refers to Eco-cute. Oil-WH refers to kerosene, Gas-WH refers to natural gas and liquefied petroleum gas, Elec-WH refers to electric resistance.

Sources: IEA analysis based on data from METI and MoE.

The market share of heat pump water heaters has rapidly expanded, but further growth will depend on harmonised standards, targeted subsidies and overall lifetime cost.

United States

Current status

Heat pumps now lead sales of new heating equipment in the United States

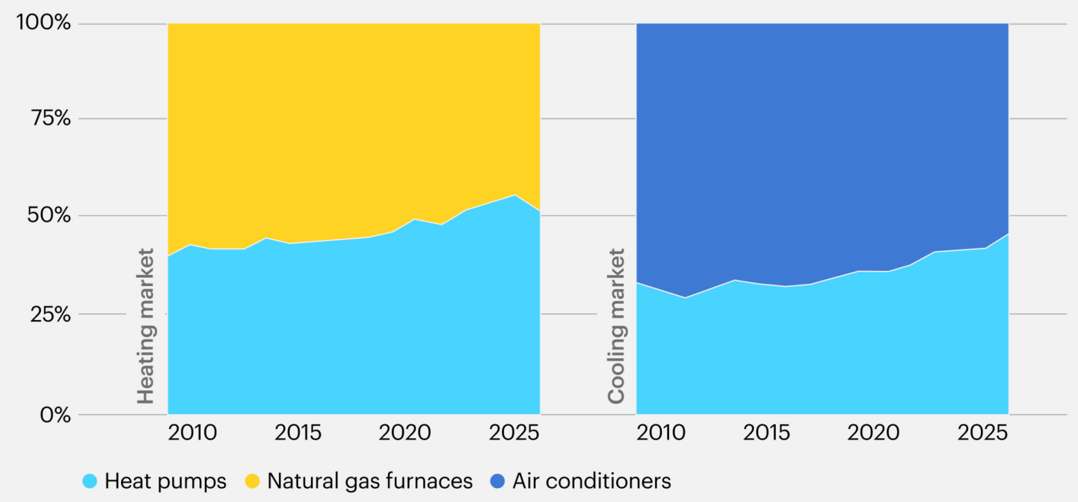
Heat pumps have been a mainstream technology in the United States for decades. As early as 1990, roughly 6.4 million homes (around 7% of households), and 450 000 commercial buildings (around 10% of the total), used a heat pump for space heating. Their footprint has continued to expand steadily: over the past decade, heat pump sales have almost doubled, and in recent years they have consistently outpaced natural gas furnace sales. In 2025, heat pump sales were around 12% higher than those of fossil fuel heating systems, and over 20% US households now rely on a heat pump as their primary heating equipment.

What's next?

Favourable economics, air conditioning replacement cycles and incentives underpin demand

The US heat pump market benefits from four structural tailwinds: firstly, generally favourable lifecycle economics in many regions, particularly where electricity prices are low or winters are mild; secondly, policy and market support at federal, state and utility level, including incentives and financing programmes that reduce upfront costs and encourage contractor uptake; thirdly, a large air-conditioning replacement pipeline that can "upgrade" to heat pumps using established installers and supply chains; and fourthly, growing momentum in heat pump water heaters, which remain a small share of today's market but offer significant expansion potential. Together, these factors underpin continued market growth: under both current and stated policies, US heat pump sales are projected to double by 2035, translating into a substantial expansion of installed heat pump capacity in buildings.

Market share of heat pumps versus natural gas furnaces (left), and market share of heat pumps versus air conditioners (right) in the United States, 2010-2025



Notes: Market shares based on unit sales. Air conditioners include systems used only for cooling, while heat pumps include reversible systems that can be used for heating and/or cooling.

Heat pump sales have more than doubled since 2010 and now outsell gas furnaces, in part driven by systems that can be used for both heating and cooling.

Can the existing air-conditioning stock offer a rapid entry point for heat pumps?

Current status

AC systems are already widespread

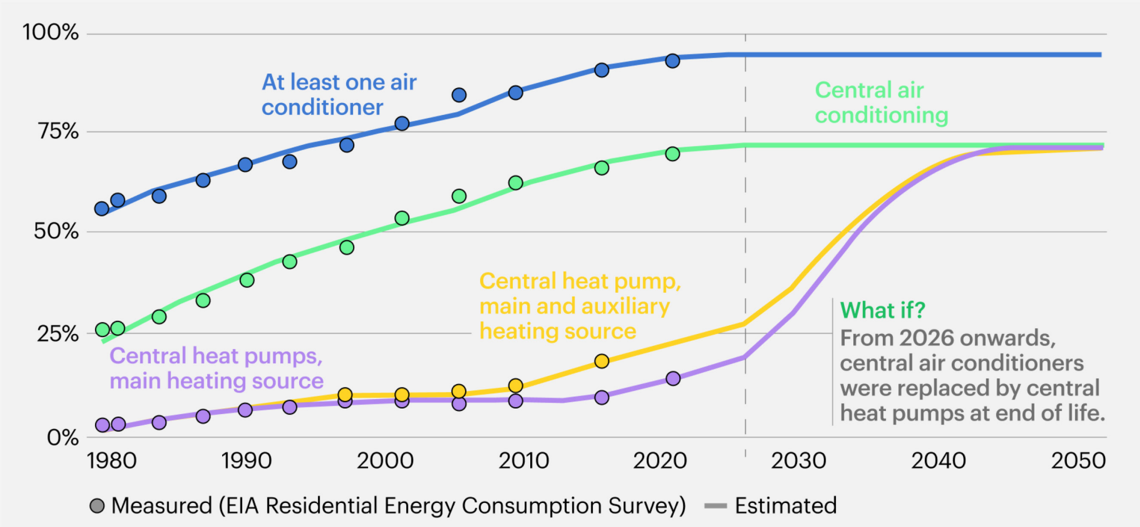
More than 90% of US households use air conditioning (AC). Of these, around 75% rely on central AC systems with ducts and distribution infrastructure already in place. A large share of these central AC systems are designed for cooling only, even though upgrading to a reversible system typically costs just USD 200-500 more than purchasing a non-reversible unit. In colder regions, systems sized for cooling may need to be upsized to cover peak heating loads, increasing installed costs. Even so, heat pumps can still meet most annual heating demand or operate alongside existing systems during peak periods.

What's next?

End-of-life replacement of AC systems could provide an opportunity to scale heat pumps

If, at end of life, every cooling-only air conditioner was replaced by a reversible system that could also be used for space heating, heat pumps could supply heating in roughly 60% of US households by 2035. This shift would be gradual, in step with predictable replacement cycles, but the physical prerequisites for warm-air heat delivery are often already in place. Over time, the normal replacement of older AC units could translate into a large expansion of heating-capable heat pumps, even without a one-off retrofit push. Under both current and stated policies, the share of households using heat pumps reaches more than 35% by 2035. Exploiting the synergies between air conditioners and heat pumps can be a transformational lever for more rapid scale-up.

Share of households using air-conditioning systems and heat pumps in the United States, 1980-2050



Note: Projections beyond 2025 assume that all central air conditioners are replaced by heat pumps at end of life.
Source: IEA analysis based on data from EIA.

Upgrading existing central air conditioners to reversible heat pump systems at end of life could provide heating in 60% of households by 2035 at low additional cost.

Pillar D. Policies

A range of policy measures exist to support heat pump adoption, either directly or indirectly, and these vary across regions and sectors depending on national priorities and institutional capacities.

Pillar D of the Heat Pump Monitor provides an overview of existing policies in key markets and highlights notable international examples across different policy types that may offer insights and inspiration for other countries.

Policy mapping

Heat pump-relevant policies in selected countries

				CA	CN	FR	DE	IT	JP	KR	UK	US
Deployment	Buildings	Incentives	Grants	✓	✓	✓	✓	✓	✓	✓	✓	(✓)
			Loans					✓			✓	
			Tax credits and deductions				✓	✓				
			Reduced VAT rate			✓		✓			✓	
		Regulations	Limits FFB use in new buildings	✓	(✓)	✓	✓	✓			✓	(✓)
			Limits FFB use in existing buildings		(✓)	(✓)	✓					
			MEPS	✓	✓	✓	✓	✓	✓	✓	✓	✓
			Labelling system		✓	✓	✓	✓	✓	✓	✓	
		Energy & Emission	Carbon tax			✓			✓			
			Emissions trading system			✓	✓	✓	✓	✓		
	Industry	Incentives	Grant, loans and tax credits	✓	✓	✓	✓	✓	✓	✓	✓	
		Regulations	Heating electrification plan			✓	✓	✓				
			Renewable energy targets		✓	✓	✓	✓	✓	✓		
		Energy & Emission	Carbon tax	✓		✓			✓		✓	
			Emissions trading system	✓	✓	✓	✓	✓	✓	✓	✓	(✓)
	District heating	Incentives	Grant, loans and tax credits	✓		✓	✓				✓	
		Regulations	Mandatory heat mapping			✓	✓				✓	
			Renewable energy targets			✓	✓	✓				
Industrial competitiveness	Manufacturing	Investment	Incentives to manufacturer	(✓)	✓	(✓)	(✓)	(✓)	(✓)	(✓)	✓	✓
		Employment	Skills training	✓		✓	✓	✓			✓	✓
		Refrigerant	F-gas regulation	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Trade	Tariffs	Equal or lower tariff than average	✓	✓	✓	✓	✓	✓	✓	✓	(✓)

Notes: Policy status ✓ = applied nationally, (✓) = partially (e.g. by fuel as coal or oil only) or regionally applied. CA = Canada, CN = China, FR = France, DE = Germany, IT = Italy, JP = Japan, KR = Korea, UK = United Kingdom, US = United States. FFB = fossil fuel boilers; MEPS = minimum energy performance standards. Limits on FFB use in new/existing buildings include bans, clean heat standards (renewable quotas, restrictions on fossil fuel subsidies) and building energy codes. "Tariffs" compares any heat pump tariffs to tariffs on similar goods between key trade partners. Does not include non-tariff measures.

Sources: IEA analysis based on IEA (2025) Global Energy Policies Hub; IEA (2025) World Energy Employment.

International examples

Current status

Multiple policies support heat pump deployment, primarily in buildings.

For heat pumps in buildings, governments mainly use financial incentives, while long-term frameworks, regulatory and pricing reforms are less common. In district heating and industry, dedicated targets and regulations are limited, with progress driven by innovation funds, planning, pricing mechanisms and renewable requirements within broader heat or sectoral transition strategies.

Policy measures and aims	Sector	Selected international examples
Sustaining market signals *Long-term strategic frameworks*	Buildings	• Canada's Green Buildings Strategy provides a guide for building codes and regulatory actions to improve building performance.
	District heat	• Austria's national commitments to fully decarbonise district heating networks.
	Cross-sector	• China's Heat Pump Action Plan sets goals, targets and actions to accelerate the development, deployment and industrial competitiveness of heat pumps.
Strengthening deployment *Deployment targets, bans*	Buildings	• Belgium (Flanders)'s ban on natural gas connections and fossil heating systems in new buildings.
	District heat	• Moldova's national energy & climate plan details planned measures to integrate about 7 MW of heat pump capacity into the two main district heat utilities.
	Industry	• New Zealand's ban on new industrial coal boilers, and phase-out of existing ones by 2037.
	Cross-sector	• Korea's Heat Pump Deployment Activation Plan targets 3.5 million heat pumps by 2035.
Improving affordability - upfront cost *Grant, subsidies and financial incentives*	Buildings	• Canada's Oil to Heat Pump Affordability Program provides upfront grants to low- to median-income households switching from oil heating to heat pumps.
	District heat	• France's Fonds Chaleur subsidises renewable and recovered heat infrastructure.
	Industry	• The Netherlands' SDE++ grant programme is directed at low-carbon heat solutions.
Improving affordability - operational cost	Buildings	• Ireland's Renewable Heat and taxation support includes lower taxes on electricity and heat pump installations (e.g. reduced VAT).

Policy measures and aims	Sector	Selected international examples
Tax reallocation, time-of-use rates, Carbon Pricing, Obligations	District heat	• The United Kingdom's Green Heat Network Fund for the development, commercialisation and expansion of low- and zero-carbon heat networks.
	Industry	• Spain's Electro-Intensive Facilities Statute: A new Reserve Fund for energy (FERGEI) state-backed power purchase agreement (PPA) risk-sharing/guarantee mechanism for long-term renewable power purchase agreements.
	Cross-sector	• The Netherlands' Energy Savings Obligation for large electricity and gas users to implement energy-saving measures with a payback period of 5 years. • The Netherlands' reduced electricity taxes (2024-34).
Strengthening competitiveness *Skills training, and industrial policies*	Buildings	• Canada's heat pump training for skilled workers. • Poland's restrictions ensuring only lab-tested units with heat pump quality certifications are eligible for its subsidy programme.
	Cross-sector	• The EU Net-Zero Industry Act (NZIA) targets manufacturing and supply chains, with heat pumps listed as a strategic net zero technology.
Supporting innovation *Innovation funds, auctions*	Industry	• The US Industrial Heat Shot Initiative targets R&D and demonstration of technologies that can cut industrial heat emissions by 85 % by 2035. • Japan's Green Innovation Fund supports long-term R&D, demonstration and industrial scale-up of decarbonisation technologies.
	Cross-sector	• Canada's Strategic Innovation Fund provides financial support for large, transformative projects across sectors (including in manufacturing).

Technical notes on the dashboards

Common abbreviations

AC	Air conditioning
CPS	Current Policies Scenario
COP	Coefficient of Performance
GWP	Global warming potential
HFC	Hydrofluorocarbons
HP	Heat pump
HPWH	Heat pump water heater
HVAC	Heating, ventilation and air conditioning
IPF	International Patent Family
NZE	Net Zero Emissions by 2050 Scenario
STEPS	Stated Policies Scenario
TRL	Technology readiness level

Heat pump definition

The definition of heat pumps used in the Heat Pump Monitor for buildings is consistent with the definition used in the IEA Heat Pump Taxonomy: "*heat pumps used as primary heating equipment, intended as the main equipment providing heat and covering the majority of heating needs. The boundary includes reversible units (such as reversible air conditioners) when they serve as the primary heating equipment. However, units used solely for cooling, or as a minor short-term complement to other heating equipment, are excluded*."

For industry, Mechanical Vapour Recompression (MVR) devices are considered as industrial heat pumps. Devices providing heating and cooling at the same time are also considered.

For district heating, both MVR and thermally driven heat pumps such as absorption heat pumps are considered as district heating heat pumps. Devices providing heating and cooling at the same time are also considered.

Coefficient of Performance (COP) represents the ratio between thermal energy provided by the heat pump and the energy supplied to make it work.

Deployment in buildings

Share of space heating needs refers to the share of useful energy demand for space heating covered by heat pumps.

Share of heat pumps using air-distribution systems over water-distribution ones is assessed based on 2024 sales capacity. Water-distribution refers to hydronic systems, while air-distribution refers to ducted and unducted reversible air conditioners.

Sources of historical heat pump data for buildings: European Heat Pump Association (EHPA); the Air-Conditioning, Heating and Refrigeration Institute (AHRI); the Japan Refrigeration and Air Conditioning Industry (JRAIA), and ChinaIOL.

Deployment in district heating

Produced heat from absorption heat pumps utilised for flue gas heat recovery inside combined heat and power (CHP) plants is reported based on the fuel the heat was derived from and is therefore not included in the metrics presented on heat supplied from heat pumps in district heating.

In the China Building Energy and Emission Yearbook 2024 district heating is referred to as “Northern Urban Heating (NUH)”.

In the figure “District heating supply by source in China and Europe, 2022 and 2023”, heat supply sources are counted as follows, based on the categories presented in the original sources:

Figure categories	Original categories (Europe)	Original categories (China)
Coal, oil, peat	• Coal, oil & Peat	• Coal-fired CHP for DH • Coal-fired heat-only boilers for DH
Bioenergy	• Bioenergy	
Natural gas	• Natural gas	• Gas-fired CHP • Gas-fired heat-only boilers for DH • Gas-fired individual household boiler
Other renewable	• Geothermal • Solar Thermal	• Renewable energy heating
Electricity (inc. heat pumps)	• Heat pumps & boilers	• Electrification
Waste heat	• WH (flue gas) • WH (industry) • WH (non-bio waste)	• Industrial waste heating
Other	• Other	

Deployment in industry

Heat pump potential per industry considers the heat output potential for those sectors. For the food and tobacco, chemical and paper sectors, the same assumptions as in the article by Marina et al. (2021) are used. Other sectors either use a sector-specific assumption or an assumed deployment potential of 95% of temperatures below 60°C, 50% between 60°C and 100°C, 30% between 100°C and 150°C, 3% between 150°C and 200°C and no deployment potential above 200°C. The total amount of industrial heat demand is estimated using internal IEA data.

In the electricity-to-gas price ratio figure, average industrial end-user prices for 2024 are used. Those prices include specific taxes and network cost for industrial users associated with those fuels.

For levelised cost calculations, a discount rate of 8% is assumed. CAPEX includes equipment and installation cost but not grid connection cost.

2024 values are estimated using values from JEHC, IEA HPT TCP Annex 48, Annex 68, and ACEEE.

Operational cost

In the electricity-to-gas price ratio figure, annual average residential end-user prices for 2024 are used. Those prices include specific taxes and network cost for industrial users associated with those fuels. Prices for EU member states as per Eurostat; others as per the IEA Energy Prices Database.

Patents

The number of International Patent Families (IPFs) is used as a proxy for unique inventions. An IPF is defined as a group of patent applications relating to the same invention that are filed in at least two national or regional patent offices.

Heat pump-related patents are identified using a combination of relevant Cooperative Patent Classification (CPC) codes and a keyword search for “heat pump” and related terms in the title and abstract of each patent document. Sectoral classification is based on the primary CPC codes assigned to each patent family.

In cases where an IPF includes multiple inventors from different countries, fractional counting is applied where each country is assigned a proportional share of the patent family.

It should be noted that this approach aims to capture heat pump-related technologies as comprehensively as possible. However, some patents relevant to heat pump technologies may not explicitly mention “heat pump” in the title or abstract, and in certain cases abstracts may be incomplete or unavailable.

Consequently, the results should be interpreted as an indicative measure of innovative activity in the heat pump sector based on the information available in the PATSTAT database, rather than as an exhaustive count that could only be obtained through a detailed manual assessment of individual patent documents.

Refrigerants

The projections assume full compliance with the Kigali Amendment and the EU F-gas Regulation. In China's case, current HFC consumption remains well below the Kigali baseline limits, and prevailing market trends indicate a continued decline. As a result, the near-term projections are set below the Kigali threshold levels.

To estimate the share of HFC use attributed to heat pumps in the United States, 50% of HFC consumption in reversible air-conditioning systems is allocated to heat pump applications.

Geographical scope

China: Includes (The People's Republic of) China and Hong Kong, China.

Europe: European Union regional grouping and Albania, Belarus, Bosnia and Herzegovina, Gibraltar, Iceland, Israel, Kosovo, Montenegro, North Macedonia, Norway, Republic of Moldova, Serbia, Switzerland, Türkiye, Ukraine and United Kingdom.

Caspian: Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan.

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