Climatescope 2022

Electrified Heating Factbook

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BloombergNEF

Executive summary

Somewhat quietly but quite steadily, the popularity of electrified heat is growing as countries seek lower-carbon, more energy-secure alternatives to conventional fossil fuels. While the shift to cleaner heating sources, including heat pumps, is not progressing as quickly as the transitions to lower-carbon power or transport, the current energy crisis has created unprecedented opportunities for change. Even before war in Ukraine sent natural gas prices into the stratosphere, governments were moving to subsidize heat pump adoption or ban the use of certain conventional boilers in new buildings.

In this third Climatescope 2022 report, BloombergNEF presents the results of a 56-market survey focused on the topic of buildings and heating. Included were 28 emerging markets and 28 developed nations. Key findings:

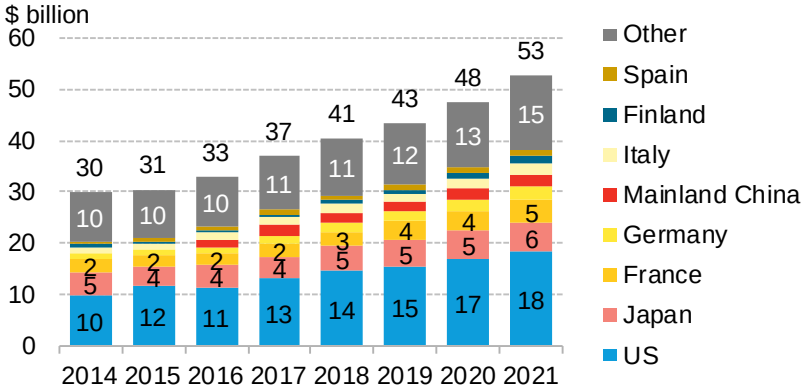
- Rising fuel prices are changing heating dynamics worldwide. National governments appear to have gotten the message and have adopted measures to soften the blow for consumers. In 2021, 24 countries implemented power price subsidies.
- Natural gas, the largest source of global residential heating, met 41% of global demand in 2020. However, gas consumption for heating slipped 3% from 2018-2020. Direct electric heating follows as the second largest heat source. Its use has grown at a compound annual growth rate of 3% 2016-2020.

10.5% The 2020-2021 growth in heat pump investment in Climatescope markets surveyed

14 Markets have legislated bans on certain boilers effective 2030

1/4 Of markets use natural gas to meet 50% or more of their residential heating needs

Global investment in electrified heat



Source: BloombergNEF. Note: Investment based on heat pump sales only, excluding direct electric heating installations.

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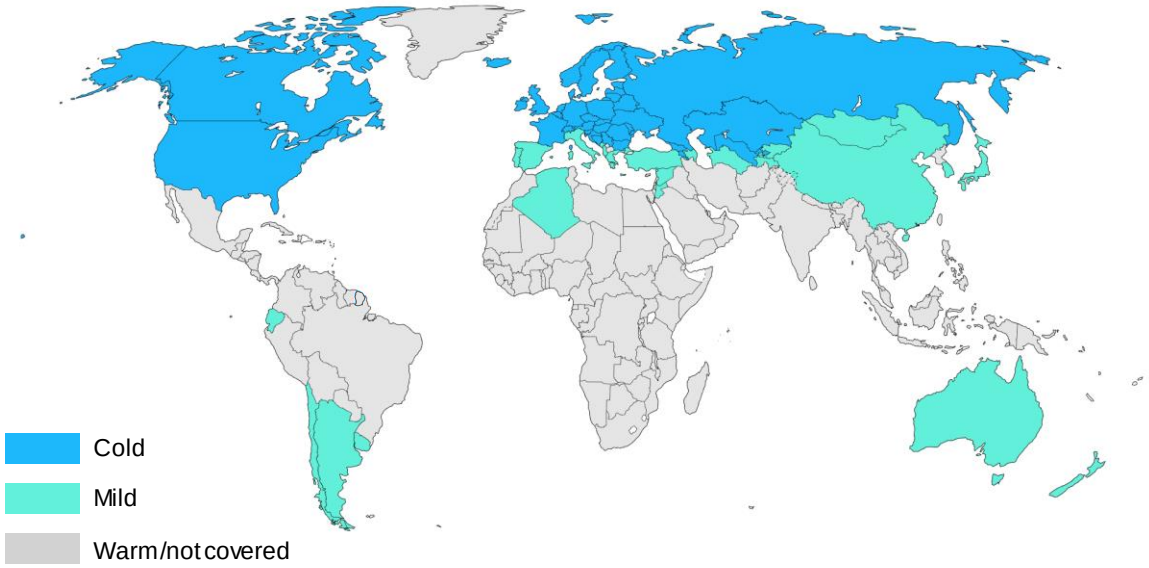
Executive summary (2)

- Heat pump investment rose almost 10.5% 2020-2021 to nearly $53 billion. In seven years, annual investment has grown by 80%. Still, activity remains concentrated in just a handful of markets with three countries – the US, Japan and France – accounting for 55% of 2021 investment.
- In terms of residential heat pumps sold, Europe, the US, Japan, South Korea and New Zealand accounted for 6.43 million units in 2021. Sales are up 49% on a unit basis since 2017, and up 22% since 2019.
- Government-backed incentives for buyers are driving the transition to cleaner buildings in certain markets. Due to high upfront costs, heat pump demand can still be quite contingent on subsidies or other consumer support mechanisms.
- Heat pump purchase grants or loans are the most popular policy mechanism among countries surveyed. Such policies are available in 27 developed countries and nine emerging markets. Low-carbon heat targets or roadmaps follow as the second most common policy mechanism with 24 developed countries and eight emerging markets offering these.
- Government bans on the purchase of certain boilers have also grown in recent years. No less than 28 bans are planned to be in force by 2030. However, most of these bans are in place for new buildings only, exempting most of the existing residential building stock.
- Climatescope scores markets based on their progress creating hospitable markets for lower-carbon heat deployment. Developed countries dominate the general ranking on buildings more clearly than in the other sectors covered by Climatescope, power and transport.
- Finland remained at the top of buildings ranking due to the number of policies and incentives it offers to support adoption of low-carbon heating systems.
- New Zealand is the only non-European country among the top 15 highest scorers. This is directly due to the country's adoption of four new policies over 2021-2022. This has included a low-carbon heat target, a boiler scrappage scheme for coal boilers, and bans on new coal boilers from 2021.
- Emerging markets overall scored lower than developed countries in the Climatescope buildings ranking. This is due to a lack of policies and regulations, and economic factors such as high costs and nascent supply chains for heat pump installations, among other factors.

Countries with mild to cold climates have substantial heating needs

Countries by climate type



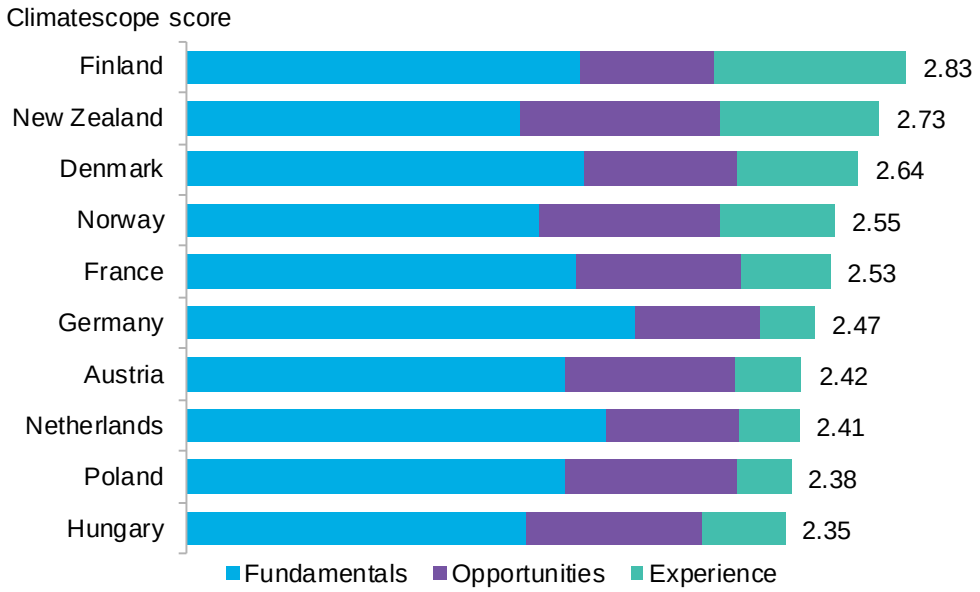
Generating heat for buildings represents a major source of energy demand in nations which can get quite cold, but this is obviously less of an issue in warmer nations. In most countries designated as “cold” (average annual temperatures below 54ºF/12ºC), a quarter of final energy is used for such purposes with around 15% used in “mild” countries (average temperatures 54-62 º F/12-16.5ºC). Decarbonizing heat in these countries could therefore substantially lower global greenhouse gas emissions.

The Climatescope report and rankings only assess heating data and policies in these designated “heating” countries (shown in blue and turquoise on the map). Countries with warm or hot climates are not covered in this report. Countries not included in the overall Climatescope ranking, or where heating data is unavailable, are also excluded.

Source: BloombergNEF. Note: Building’s share of final energy consumption in cold and mild climates is based on 2018 or 2019 data. Heating needs is based on “heating degree days” data, based on temperatures and the number of days with average temperatures below 62º Fahrenheit (17º Celsius). Mapped data show climate type for distinct economies.

Developed countries dominate the Climatescope buildings ranking

Top 10 markets for the Climatescope Buildings sector



Source: BloombergNEF

The Climatescope buildings ranking considers 30 indicators split into three parameters: fundamentals, opportunities and experience. It scores (on a 0-5 scale) the relative attractiveness for clean heating investment in the 56 markets surveyed, which includes 28 developed and 28 developing markets.

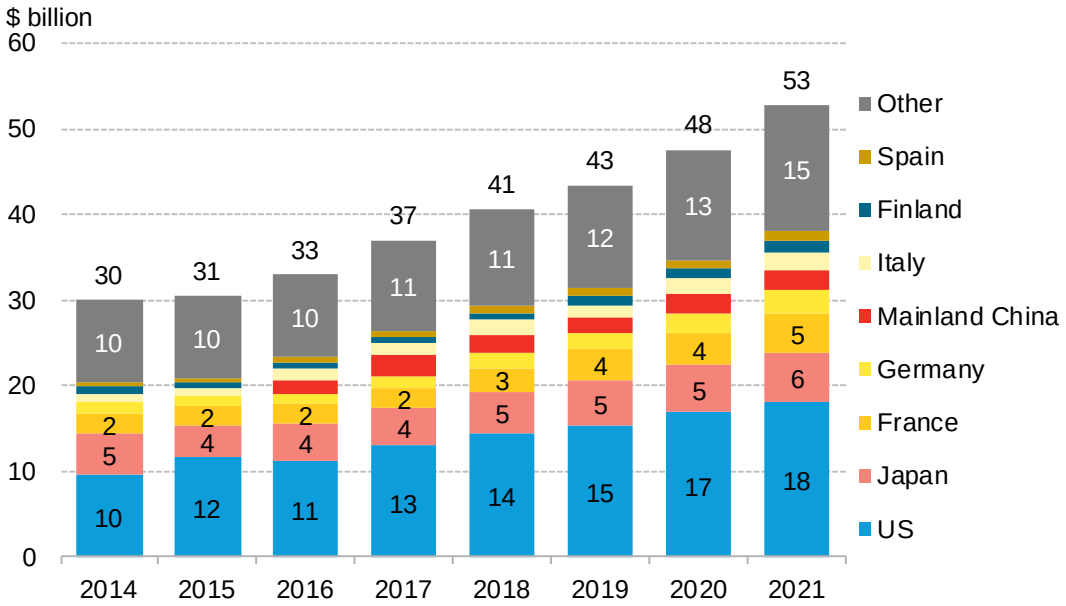
The top 10 countries for electrified heat investment are all developed countries. The first developing country that appears in the Buildings ranking is Mainland China and it is placed at the 22nd position.

Finland tops the Climatescope buildings ranking for the second consecutive year. This can be attributed to well-established policies and incentives for low-carbon heating systems. In addition, heat pump sales have increased steadily since 2015.

New Zealand is the only non-European country in the top 10 and follows Finland as second most attractive country for electrified heat. The country put in force four new policies over 2021-2022, including a low-carbon heat target, a scrappage scheme for coal boilers, and bans on new coal boilers from 2021 and all boilers by 2037.

Record global heat pump investment is concentrated in relatively few nations

Global investment in electrified heat



Global investment in electrified heat rose almost 10.5% 2020-2021 to near $53 billion. In seven years, the sector has grown over 75%. However, investment remains concentrated in just a few markets, with eight nations accounting for 72% of total 2021 investment.

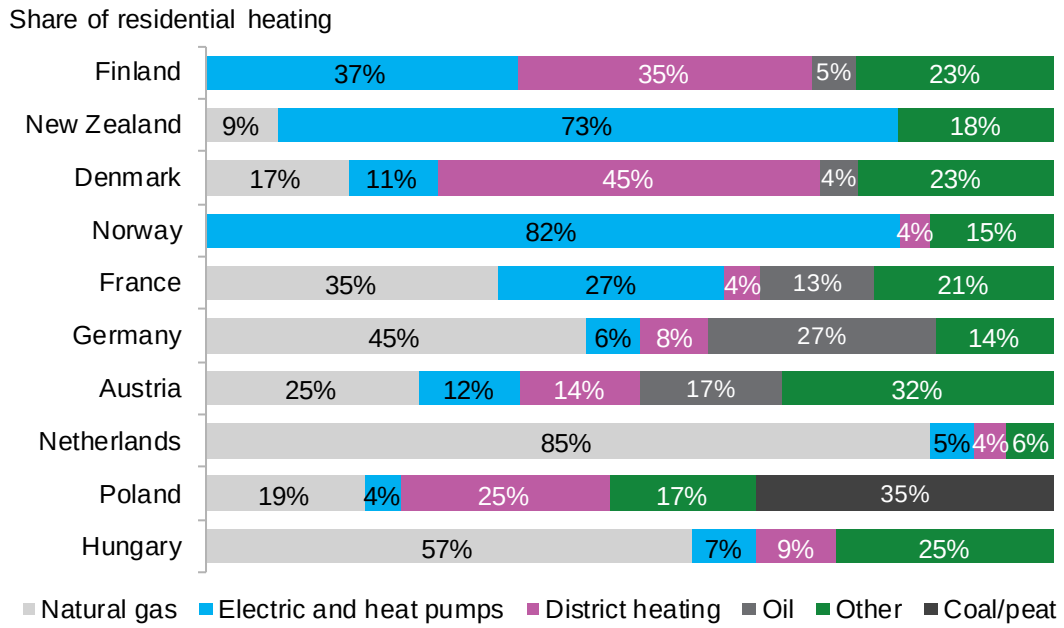
The US and Japan are the top heat pump markets globally, representing 45% of total investment in 2021. The US alone accounted for a third of the global investment in 2021, and the market has grown by around a billion dollars each year since 2014. Japan follows in second place with $6 billion in 2021.

France, Germany and Italy were the main European markets for investment in electrified heating in 2021. The three nations accounted for 18% of the global investment in the same year, with a record $9.5 billion. New regulations and government funding programs, especially related to the pandemic recovery and to the energy crisis, have driven the increase in Europe.

Source: BloombergNEF. Note: Investment based on heat pump sales only, excluding direct electric heating installations.

Clean heating has a long way to go, even in top heat pump markets

Residential heating mix in top 10 Climatescope markets as ranked by Buildings scores, 2020



Most countries in the top 10 of the Climatescope 2022 Buildings ranking still rely heavily on fossil fuels for their heating supply. Eight of the top 10 countries use natural gas. The Netherlands and Hungary are most dependent on this source with 85% and 57%, respectively, of residential heating relying on gas in 2020.

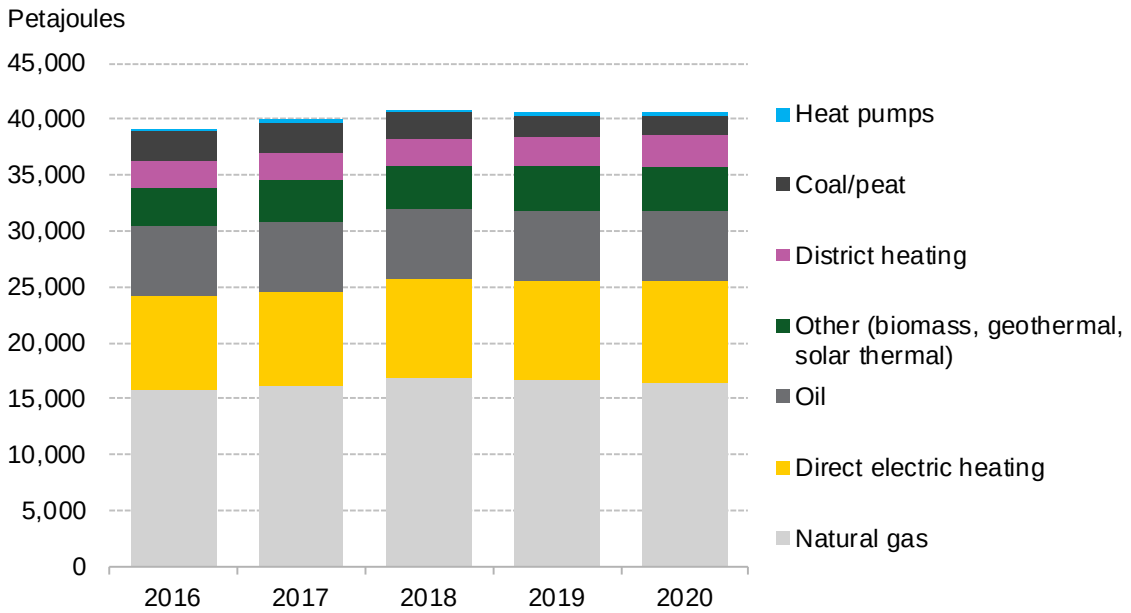
Finland, New Zealand, Norway and France are the only countries with over 20% of the heating mix composed by electrified sources. Regional and national policies and the absence of large gas grids are the main drivers for increasing the adoption of such sources.

Poland is one of few major heating markets that relies heavily on coal for residential heating, with domestic coal boilers providing 35% of domestic heat. Poland has a long tradition of coal mining, and favors the domestic fuel over imported gas. However, the distributed burning of coal has caused major air pollution problems. Government programs to tackle pollution is a key driver of the record-high heat-pump uptake seen in Poland.

Source: BloombergNEF. Note: "Other" category includes biomass, geothermal and solar.

Residential heating is very gradually switching to cleaner sources

Total residential heat consumption among 56 markets surveyed



Total residential heat demand in studied countries* grew around 4% 2016-2020. The technologies with the highest growth were heat pumps, with an increase of 73% from 2016 to 2020, and district heating, having increased 18% from 2016 to 2020.

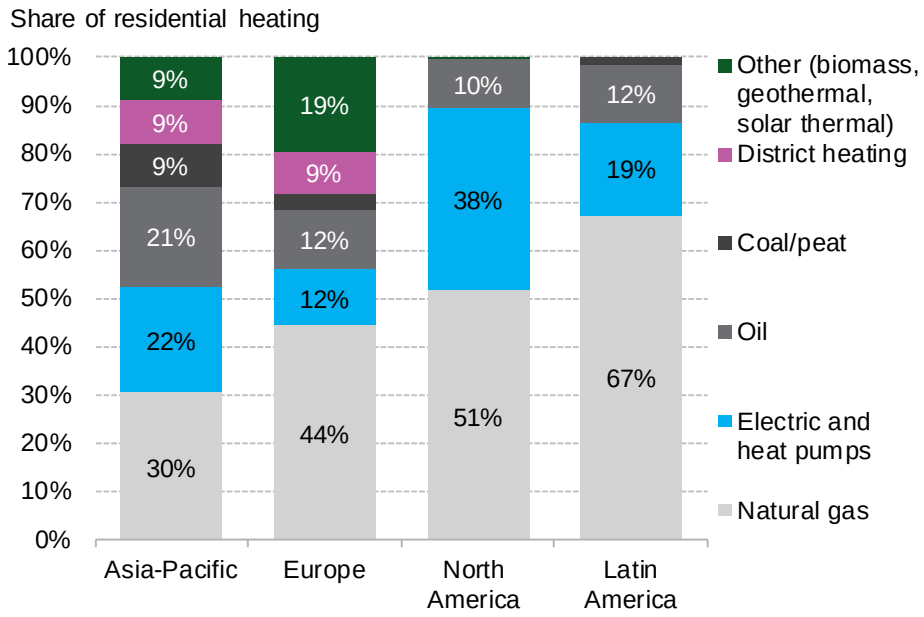
Natural gas is still the largest source of global residential heating representing 41% in 2020. However, gas consumption for heating decreased 3% over 2018-2020. Direct electric heating follows as the second largest supply source, with a compound annual growth rate of 3% since 2016.

Direct combustion of fossil fuels in the heating sector has decreased over the past couple years. Consumption of oil and coal in the residential sector for heating decreased 1% and 5%, respectively over 2020-2021.

*Source: BlooombergNEF, Eurostat, IEA. Note: *Heating countries include 56 cold and mild countries with more than 800 heating degree days per year. Where heating data is lacking, residential energy use is used as proxy and electric heating is assumed to make up two thirds of residential electricity consumption.*

Natural gas and electricity are the primary sources in all major regions

Residential heat mix per region, 2020



The Asia-Pacific region has the most diverse energy mix for heating though fossil fuels remain the main source, accounting for 60% of the residential heating in 2020. Nonetheless, the use of electric heating has risen over the past five years and, in 2020, electricity became the second biggest source, just behind natural gas.

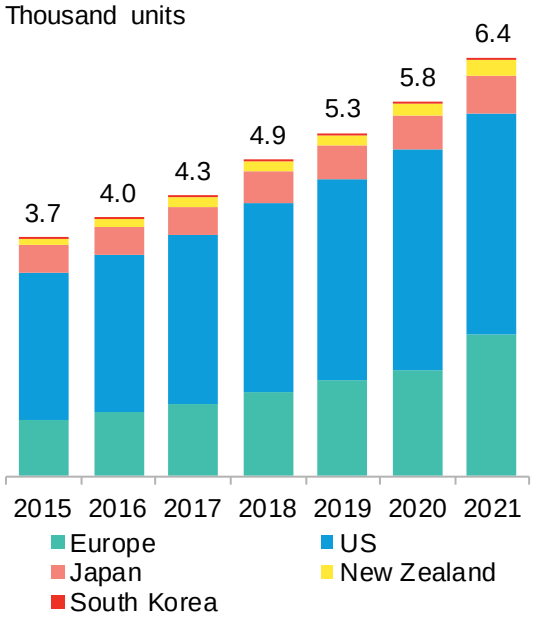
Europe still has a high presence of gas boilers fueling its building stock. Almost 60% of the residential heat mix in Europe comes directly from fossil fuels, with natural gas alone accounting for 44%. Electrified sources and district heating together represent just around 20% of the heating mix in the continent, which despite the low share, still creates opportunities for decarbonizing district heat with large-scale heat pumps.

The Americas could benefit from a high share of electricity in heating. With increasing renewable electricity production, electric heating has the best prospects of decarbonizing and heat pumps are often easy to install in properties already using direct electric heating. However, the presence of natural gas in many countries in the region is a barrier for increasing electrification.

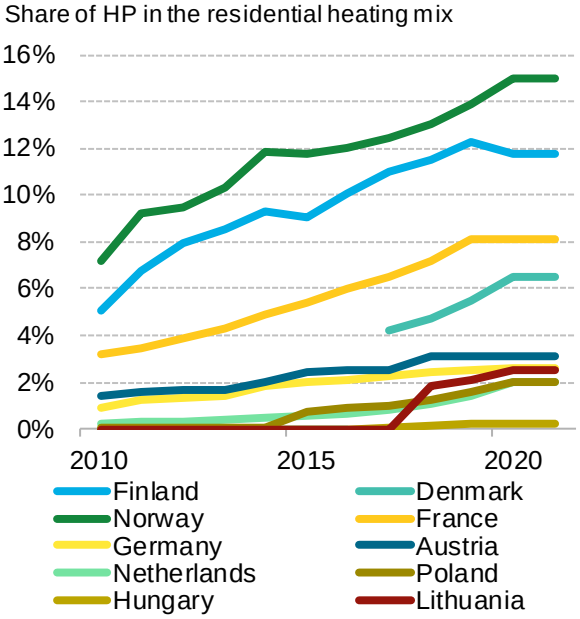
Source: BloombergNEF, Eurostat, IEA. Note: Share is calculated on the % of total heating final energy consumption.

Residential heat pump adoption is growing in key markets

Europe, US, Japan, Korea and New Zealand heat pump sales



Top 10 countries, heat pump share of heating



Across Europe, the US, Japan, South Korea and New Zealand, residential heat pump unit sales hit 6.4 million units in 2021. This was 22% higher than 2019 sales and up almost 50% from 2017.

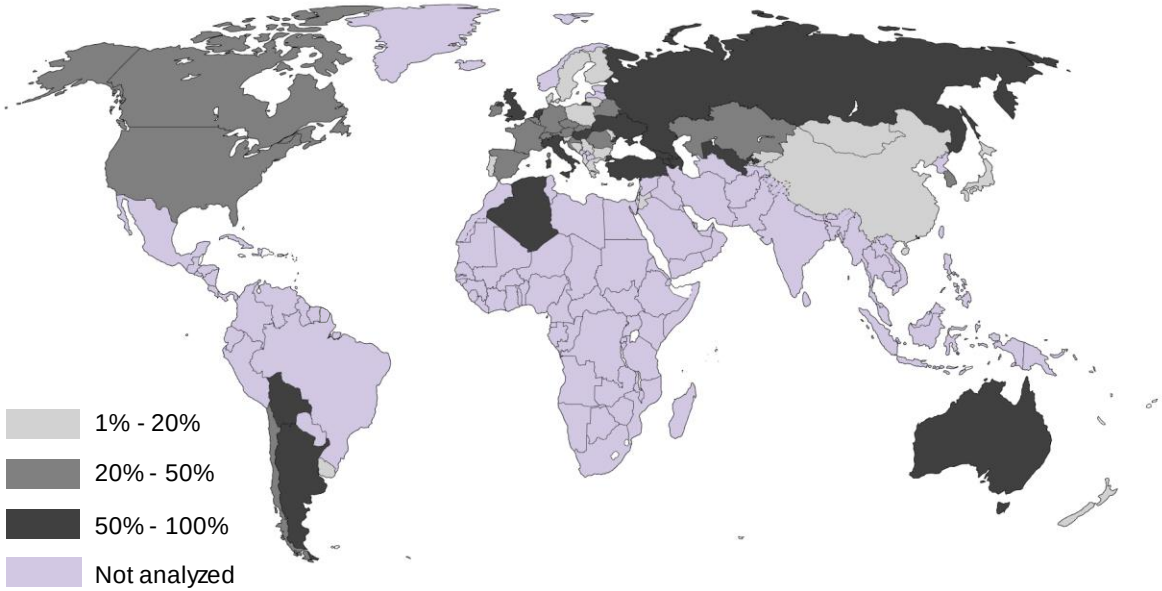
Norway and Finland are estimated to have the highest shares of heat pumps in residential heating consumption of the top 10. However, shares could be higher for many countries as heat pump usage data is often estimated or underreported. Sweden, for instance, scores outside of our top 10, but is an established and relatively saturated heat pump market with an estimated 10% share of heat pumps in its residential heating mix in 2021.

Heat pump uptake usually leads to reduced energy consumption as a heat pump produces 2-3 times more heat than traditional electric heaters using the same amount of electricity. In very cold countries, such as Canada, the more expensive ground-source heat pumps work better but have yet to gain wide popularity.

Source: BloombergNEF. Share is calculated on the % of total final heating energy consumption.

The energy crisis puts the use of natural gas for heating at stake

Natural gas share in residential heat



Source: BloombergNEF. Note: Natural gas share is calculated as % of final energy consumption for residential heating. Mongolia and Norway are not considered in any range as they have no share of natural gas in their heating source. Mapped data show natural gas share in residential heat for distinct entities.

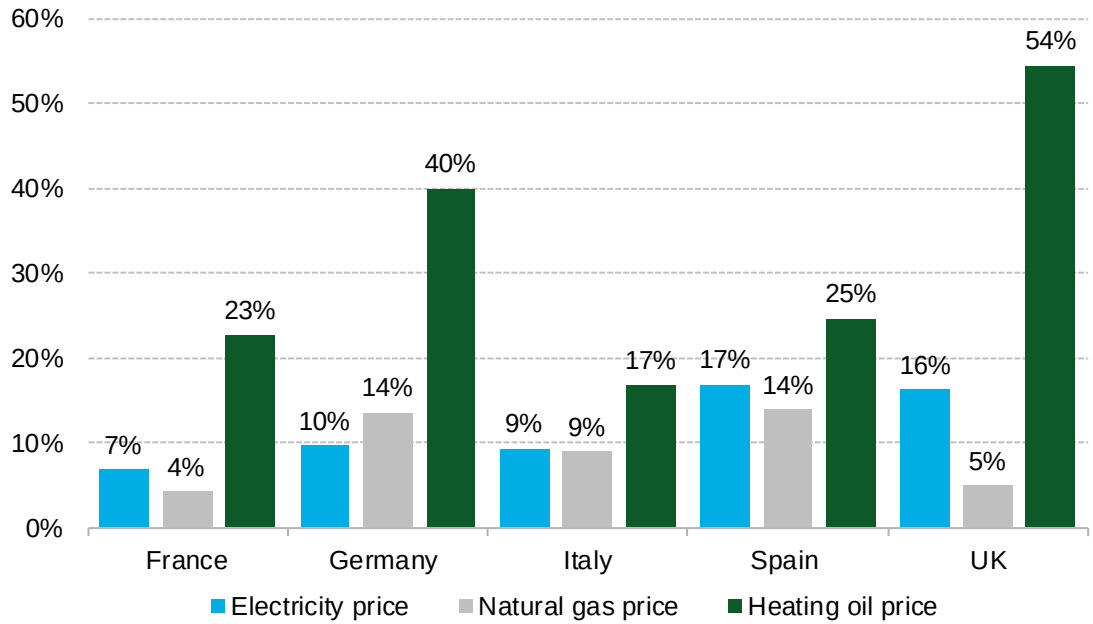
Natural gas supplies over half of residential heating in almost a quarter of the surveyed countries. Europe and North America are the regions that rely on gas the most.

Historically, the lower cost of gas heating was the main driver of adoption in European countries. However, the ongoing global energy crisis and higher natural gas prices have called into question the economics and energy security risks related to the fuel.

Fuel-switching to low-carbon hydrogen is an alternative, but less likely, way of decarbonizing gas heating. Low-carbon hydrogen is likely to first be deployed for industrial purposes, rather than for residential use. To enable residential use of hydrogen, considerable investment would be needed to both individual boilers and gas distribution networks. Another option would be air source heat pumps that can reduce overall natural gas demand from a well-insulated home by 64%, according to BNEF's Heating and Hot Water Load Profile Tool.

Fuel and electricity prices skyrocketed in 2021

Residential cost increases in select European countries, 2020-2021



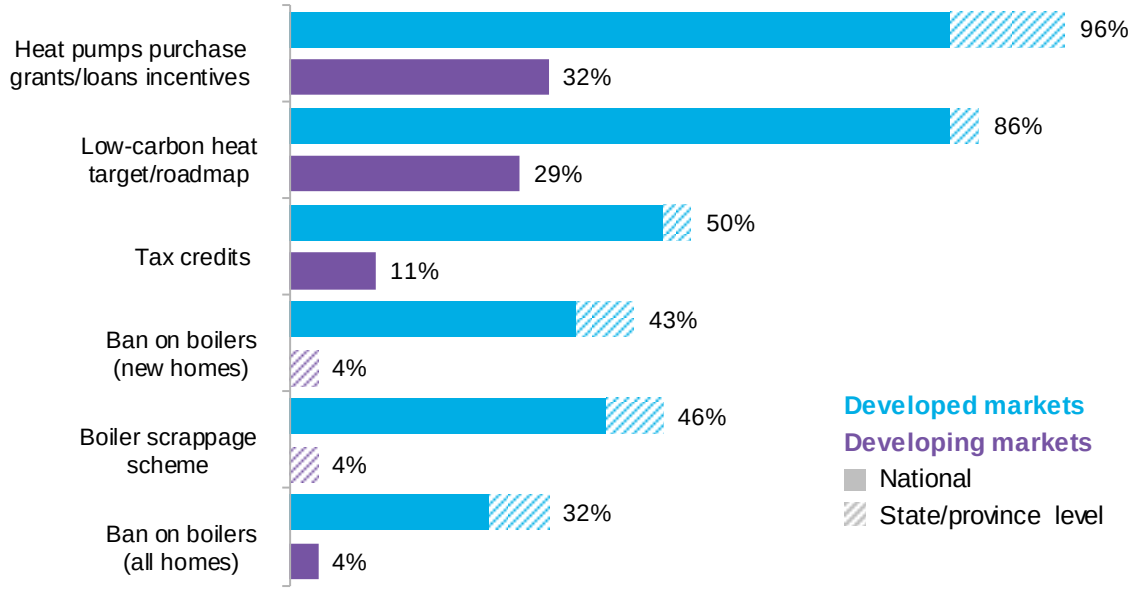
Fuel prices and energy bills for households and businesses rose substantially in 2021. The economic rebound from Covid-19 put upward pressure on natural gas prices, particularly in Europe where gas rose an average 9.2% across France, Germany, Italy, Spain and the UK 2020-2021. Governments have adopted measures to cushion consumers from the worst effects of the higher prices.

In 2021, 24 countries implemented power price subsidies. The energy crisis has seen the strongest response in European markets, with 19 nations implementing subsidies on electricity prices, but other regions are also exploring such measures. Three of the largest markets in Asia-Pacific including Japan and New Zealand also adopted subsidies to limit the impact of electricity price shocks on households.

Source: BloombergNEF

Clean buildings policies are highly concentrated in developed nations

Share of Climatescope markets with a clean buildings policy in place



Three quarters of developed markets surveyed in Climatescope have at least three clean buildings policies. A lack of incentives has limited decarbonization of the sector in emerging markets.

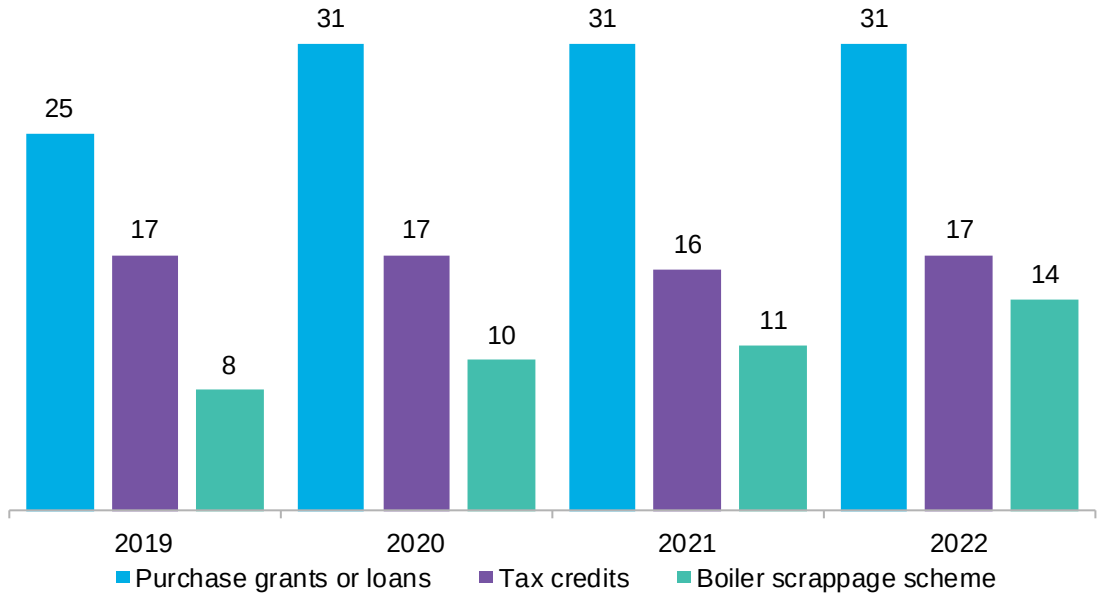
Heat pump purchase grants and loans represents the most popular policy mechanism among countries surveyed. These are present in 96% of developed markets and in 32% of emerging markets. Tax credits are also relatively popular with 50% of developed markets using these to support heat pump adoption, including Finland and Germany.

Low-carbon heat targets or roadmaps are the second most common policy. These mechanisms are in place in 86% of developed economies and 29% of emerging markets.

Source: BloombergNEF. Note: includes 56 countries, being 28 developed markets and 28 developing markets.

Heat pump incentives are becoming more popular

Number of heating countries with heat pump incentives in force



Heat pump incentives are likely to be needed to accelerate the transition to a cleaner buildings sector. Due to high upfront costs, demand for heat pumps still often depends on policies offering subsidies.

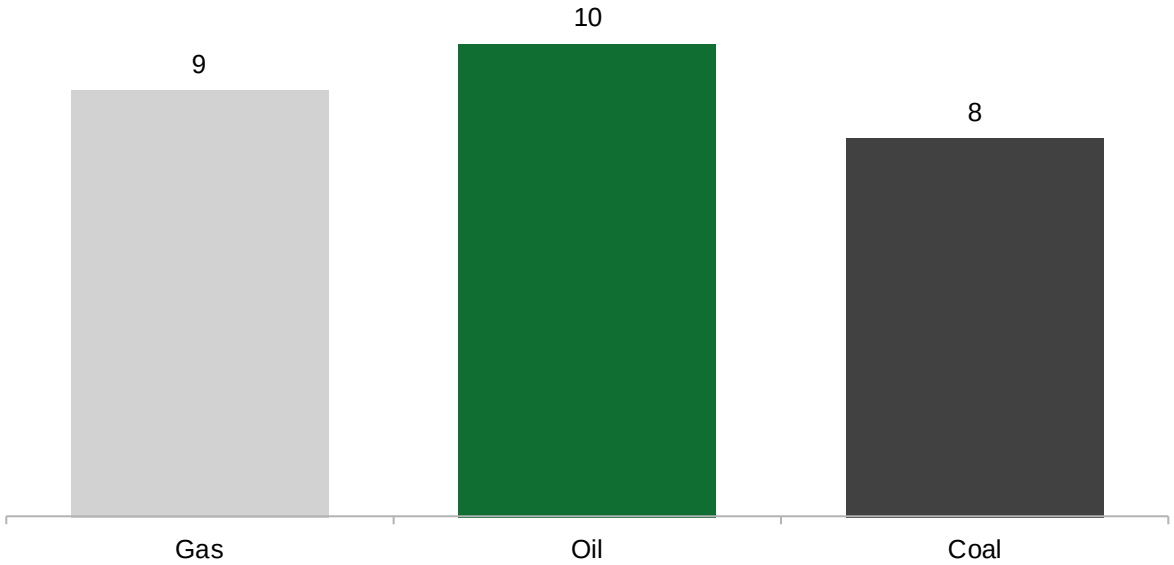
Heat pump purchase grants or loans and tax incentives for both commercial and residential consumers have been consistently in force over the past four years. Purchase grants or loans are present in over half of the heating countries surveyed by Climatescope.

Boiler scrappage schemes is the only mechanism that saw a jump in adoption, from eight countries in 2019 to 14 in 2022. Once many residential and commercial customers already have gas or oil boilers in use, replacing them by electric heat pumps through such schemes is the most readily available route for reducing emissions from the buildings sector.

Source: BloombergNEF

Governments lean on boiler bans in new homes

Countries with boiler bans in force by technology type



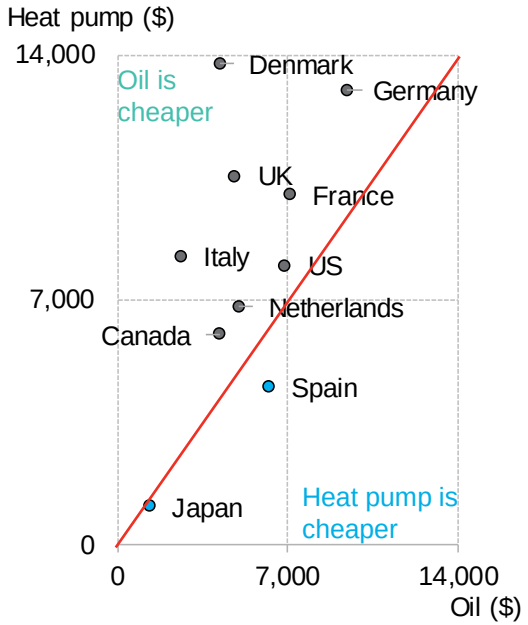
Government bans on the purchase of certain types of boilers have increased in recent years. Of 56 countries surveyed by Climatescope, 14 have legislated bans on boilers for one or more technology. However, most of these bans apply to new buildings only.

Bans on oil-fired boilers are most common, present in 10 out of 28 developed markets covered. These bans are typically put in place due to a combination of cost and environmental factors, including goals to phase out fossil-fuel intensive heating systems.

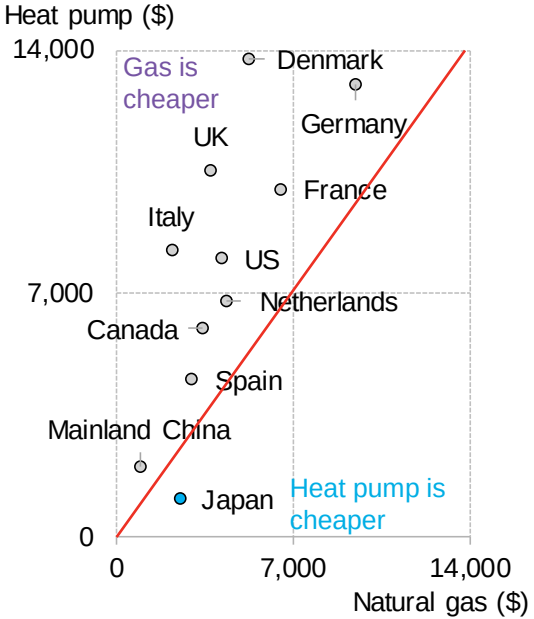
Source: BloombergNEF. Note: Countries with bans planned in more than one technology are counted twice.

Changes in costs influence heating market shift

Upfront cost of heat pumps* vs oil-fired boilers



Upfront cost of heat pumps* vs gas-fired boilers



Heat pumps are still not economic in many developed markets and struggle to compete with gas-fired boilers. Among 10 countries analyzed, heat pumps are cheaper than gas boilers only in Japan. As a result, governments often need to support the up-front cost of heat pumps or encourage consumers to switch from fossil fuel boilers.

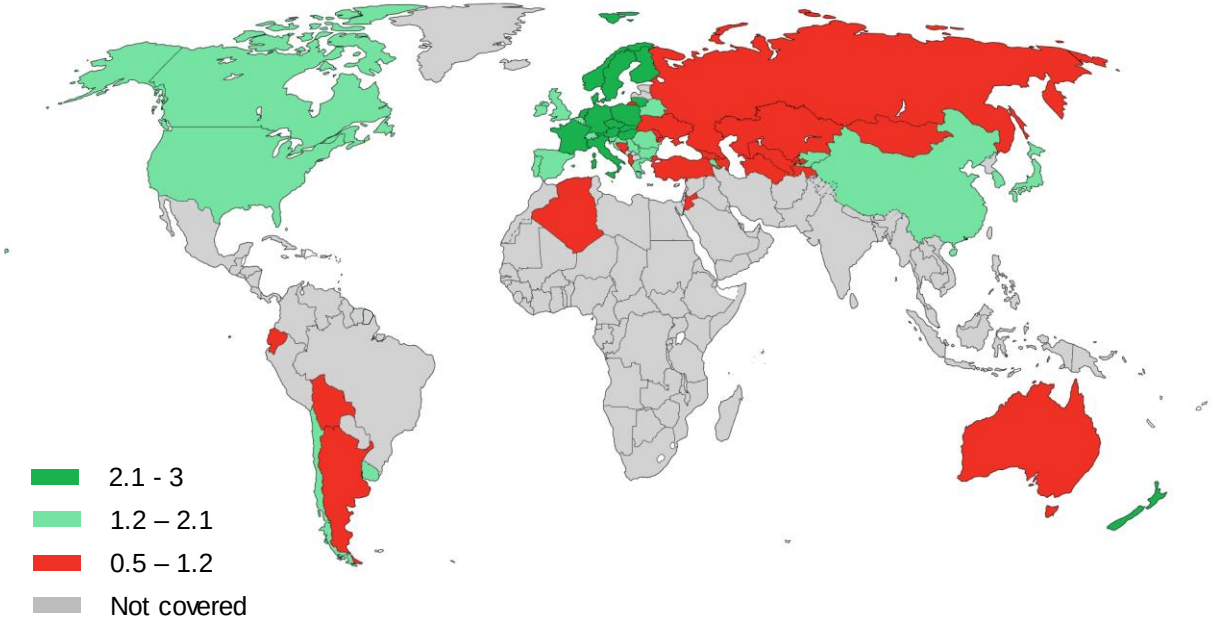
When compared to oil-fired boilers, heat pumps are already more competitive in two countries: Japan and Spain. Japan offers the lowest average upfront cost of heat pumps ($1,100) compared to both gas ($2,479) and oil-fired ($1,327) boilers.

Even though heat pumps are still not competitive on a unit basis in many markets, they can be more sustainable and cheaper on a total cost of ownership basis over time. Software for optimizing the use of heat pumps can help households to save energy and money.

*Source: BloombergNEF. Note: *Costs exclude subsidies and are an average of air-to-air and air-to-water costs.*

Developing nations have considerable room for improvement

Climatescope scores for heating countries



Source: BloombergNEF. Mapped data show Climatescope score for distinct economies.

The lack of policies and incentives for clean heating systems in emerging markets is evident in their comparatively low Climatescope scores. Most emerging markets have maximum scores of 1.2 (out of 5) while developed nations' scores range from 2.1 to 3. This is largely due to a lack of policies and regulations, and economic factors such as high costs and nascent supply chains for heat pump installations, among other factors.

Mainland China is the highest ranked emerging market but is just 22nd among all markets. The country has in place three out of the six clean heating policies counted by Climatescope.

The lowest-scoring markets have a combination of limited policy support for heat pumps and high shares of fossil fuels in their heating mix. Albania, for example, fueled almost half of its residential heating mix in 2020 with coal.

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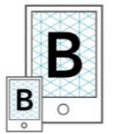

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