Germany: Heat Pump Market Report

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Heat pump sales in Germany are again showing strong growth following the record year of 2020, according to sales statistics on the heating market. In 2021, heat pump sales growth was 28%. The industry is delivering – now it is up to the new German government to step up the heat turnaround in line with its announcements. The sustained positive market trend shows the high level of acceptance of heat pumps among consumers.

Since 2000, the volume of heat pump sales in Germany has increased significantly. In 2020, more than twelve times as many heat pumps were sold as in 2000.

Germany at a glance [1]
It has an area of 357,578 km². Germany is a federation. The federation and the 16 states each have areas of responsibility of their own.

Figure 1. States of Germany [1].

With 83.1 million inhabitants, Germany is the most populous country in the EU and one of the most densely populated; around 77% of its inhabitants live in densely and highly populated areas. Around 30% of the population resides in big cities with more than 100,000 inhabitants, of which there are 80 in Germany, four with more than one million inhabitants, Berlin, Hamburg, Munich and Cologne. Munich has 4,713 people per square kilometer, Berlin 4,012. Experts believe the ongoing trend of growth and innovation is reflected in the renaissance of cities – with considerable consequences for the housing market, inner-city mobility, and infrastructure.

Households by types of households:
42.3% 1-person, 33.2% 2-persons,
11.9% 3-persons, 9.1% 4-persons, 3.5% 5+ persons

Almost 50% of people in Germany live in rented accommodation, which is the highest level on a European comparison, and for this reason, many people are affected by rising rents. People who have moved into a new apartment since 2015 pay on average 7.70 € per m² without heating and other running costs. That is around 12% more than the average. The trend is particularly acute in cities like Berlin, Munich, and Frankfurt/Main. In Berlin, the average rent, excluding heating and running costs for apartments recently leased, has come to 9.10 € per square meter. This urbanization makes Germany part of a global trend.

Germany enjoys a moderate climate. In July, the mean temperature is 16.9°C, and in January -0.5°C. The most recent winters in Germany were particularly mild and the summers particularly hot. With a mean temperature of 10.5°C, 2018 was the warmest year in Germany since records began back in 1881. 2019 placed alongside 2014 as the second warmest. The highest temperature since the records began was recorded on 25 July 2019 in Lingen in Lower Saxony, namely 42.6°C.

Heating energy for a cozy home [2]
For now, most Germans still use gas to heat their homes see Figure 2. But renewables are catching up. If you're thinking about switching your heating for a system based on renewables, there are a number of new funding options and advisory services. The 10-year overview shows that there is a clear trend towards renewables, with heat pumps and district heating each gaining 10% and natural

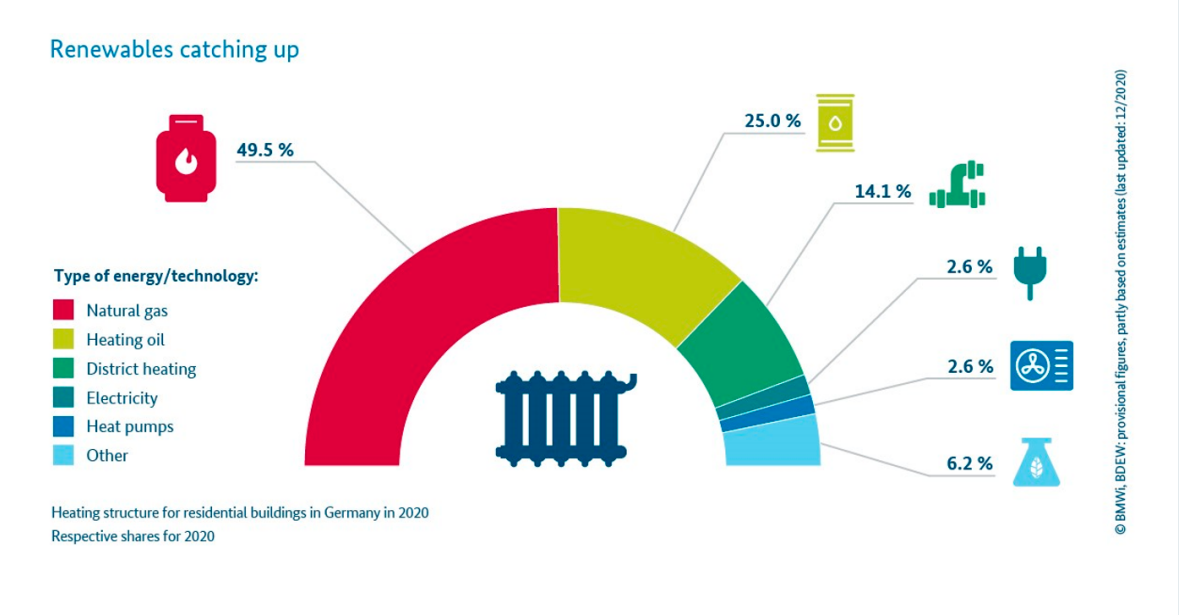

Figure 2. Heating energy for cosy homes [2].

gas/ bio-methane losing roughly 15% over the last decade. No heating is built for eternity, and a regular replacement is a good opportunity to switch over to renewables. Those making this decision can benefit from various efficiency programs for buildings, such as the new federal funding programs for efficient buildings [3].

Market for Heat Pumps [4]

Since 2000, the volume of heat pump sales in Germany has increased significantly. In 2020, more than twelve times as many heat pumps were sold as in 2000. Heat pump sales in Germany are again showing strong growth following the record year of 2020, according to sales statistics on the heating market. In 2021, heat pump sales growth was 28%.

54,000 heat pumps were sold in Germany in 2021. Air-to-water heat pumps experienced the greatest growth: 127,000 units (+ 33%) were sold in total, of which around 83,500 were monobloc units (+ 48%) and 43,500 split units (+ 12%).

Brine-water heat pumps grew by 12%, with 27,000 ground-coupled systems.

Air-water systems were able to slightly increase their market share again in 2021 to 82 % (2020: 79 %), while ground-coupled systems had a market share of 18%.

The sales of domestic hot water heat pumps rose by 15% compared to the previous year. The number of units sold was 23,500 units.

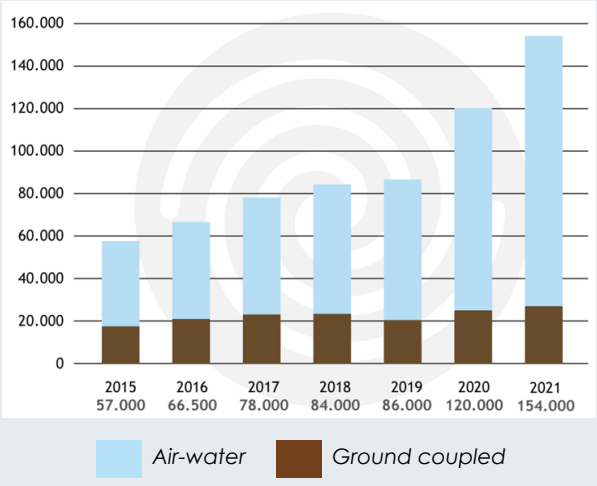

Figure 3. Sales of heat pumps [4].

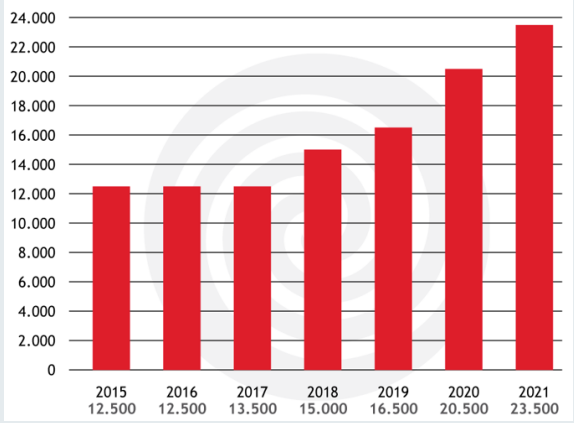

Figure 4. Sales of domestic hot water heat pumps [4].

The positive market trend is thus proving to be extremely stable despite Corona-related restrictions and global supply-chain complications. This is also reflected in the high demand for the new federal subsidy for efficient buildings, which replaced the market incentive programme this year.

The continuing positive market trend is indicative of the high level of consumer acceptance that heat pumps now enjoy. Heat pumps are on the way to become the standard heating system in the country.

Challenge

One of the main barriers for the successful rollout of heat pumps is the electricity price. It cost on average 23.8 cent/kWh in 2021. This makes it significantly more expensive than fossil fuels (heating oil, natural gas) or pellets. This is mainly due to state-regulated price components, which are not charged for most other heating energy sources, and which account for almost 60% of the price [4].

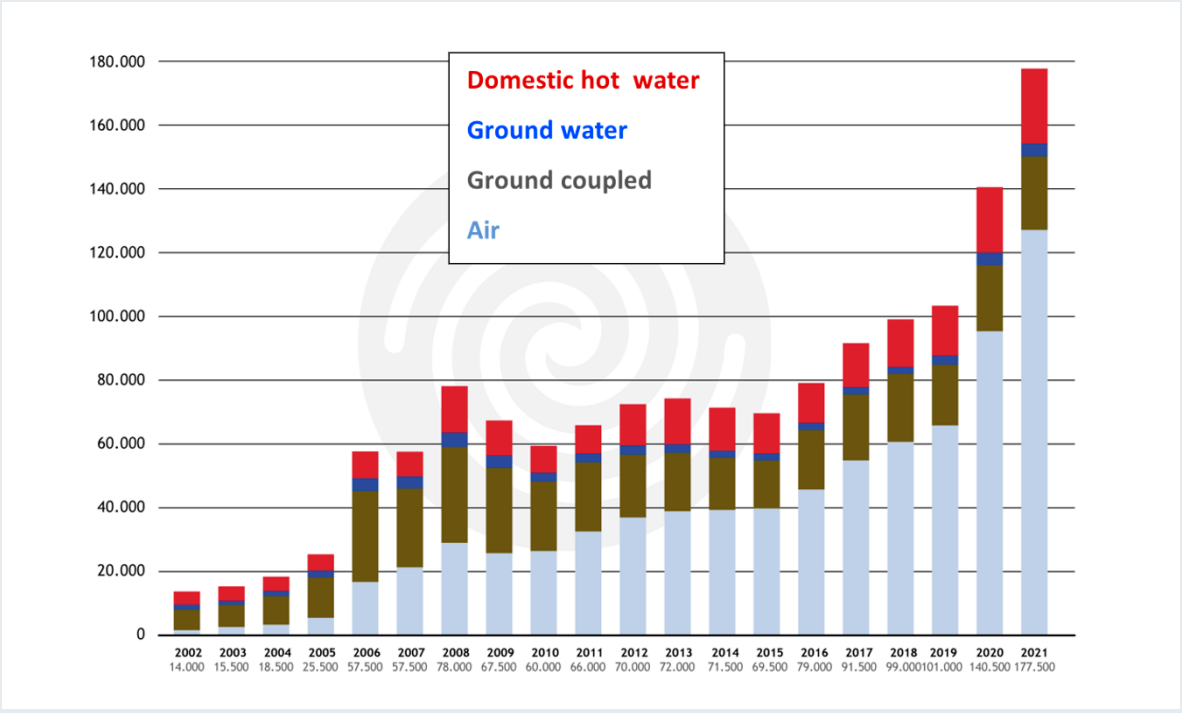

Figure 5. Total sales of heat pumps 2002–2021 [4].

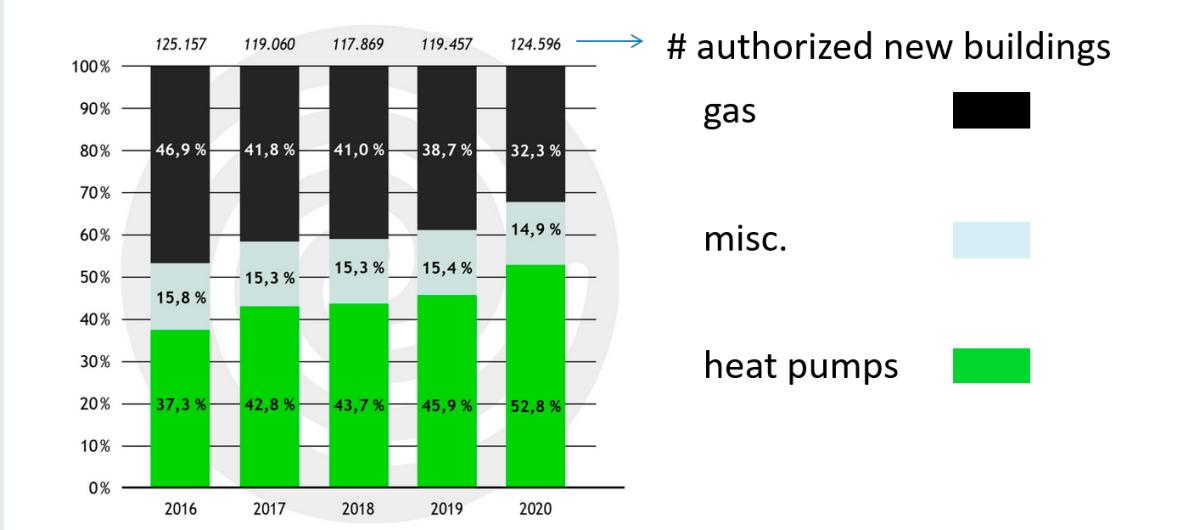

Figure 6. House building permission [5].

House-building permission [5]
According to the Federal Statistical Office, a total of 124,596 residential buildings were approved for construction in 2020. Of these, 55,544 are to be heated with environmental heat and 10,257 buildings with geothermal heat - a total of 52.8% of approved residential buildings. So more and more building owners are opting for climate-friendly heating systems, which is good news.

Gross electricity consumption [6]
Development of gross electricity consumption until 2030: The consortium of Prognos, Öko-Institute and Fraunhofer ISI, on behalf of the Economic Affairs Ministry, carried out an ad-hoc (Nov. 2021) estimate of the development of gross electricity consumption up to the year 2030. The continuing positive market trend shows the high acceptance of heat pumps among consumers. Electric heat pumps are becoming increasingly important in the heating sector. In this scenario, the number of installed heat pumps increases from nearly 1 million in 2018 to 5.5 million in 2030. This does not take into account small uncoupled hot water heat pumps. The majority of heat pumps are in residential buildings, with a small proportion in non-residential buildings. The non-residential buildings are usually larger buildings with more powerful heat pumps. The 5.5 million heat pumps are associated with electricity consumption of around 33 TWh (in 2018, under 7 TWh). At the same time, the use of large heat pumps in district heating is also increasing (+ 9 TWh). Overall the electricity consumption of heat pumps increases by 35 TWh to around 42 TWh between 2018 and 2030 in the scenario. If the small uncoupled hot-water heat pumps are also included, the electricity are added, the electricity consumption of heat pumps increases by an additional 3 TWh to a total of 45 TWh.

The German government has now a clear understanding of the significance of heat pumps and about the size of ~6 million heat pumps and the associated additional electricity consumption in 2030.

Research [7]
The German government is aiming for a climate-neutral building stock by 2045. In order to achieve this goal, it is necessary to reduce the heat demand on the one hand and achieve a climate-neutral heat supply on the other. The German government is, therefore, funding projects in the areas of research, development and demonstration as a part, e.g. of the 7th Energy Research Programme. The Energy Research Programme is a strategic element of the Federal Government's energy policy that aims to support this continuous research and innovation process [7].

Since 2010, research projects in the fields of heat pump and refrigeration technology have been funded with more than **71 million €**. In the past few years, development has focused mainly on heat pumps for buildings (single-family houses, multi-family houses, non-residential buildings), and the main areas of development are refrigerants, components, integration and demonstration. There are also some projects addressing heat pumps for the industry.

Currently, another main topic is the generation of cold at temperatures below 0°C by water-based absorption and adsorption processes.

In addition, a major project on the topic of heat pumps in district heating networks, "Reallabor GWP", has been started as of 01.04.2021. The Federal Ministry of Economic Affairs and Energy is funding this project with **21 Mio. €.** [8]

A large number of universities, research institutes and industrial companies are working on heat pump technologies in Germany.

In particular, the Fraunhofer Institute for Solar Energy Systems ISE, the Technical University of Dresden and the E.ON Energy Research Center at RWTH Aachen University on the research side and Vaillant, Viessmann, Stiebel Eltron and Bosch-Thermotechnik on the industry side are to be mentioned.

New Institutes for large energy systems:
- German Aerospace Center's (DLR) Institute of Low-Carbon Industrial Processes
- Fraunhofer Research Institution for Energy
- Infrastructures and Geothermal Systems (IEG)

(This enumeration is not intended to be complete or definitive)

Conclusion
- Heat pumps as heating systems are dominant in new buildings.
- There is further a great potential in the building stock.
- A government scheme rewards property owners for replacing older oil-fired central heating.
- Air to water heat pumps have ~80% market share.
- Great potential also in commercial + industrial applications
- High electricity prices in comparison to gas and oil are a strong barrier for Heat Pumps.

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