

18-PART SERIES

HEAT PUMPS: YOUR BURNING QUESTIONS, ANSWERED NOW

4/18

The Heat Pumps Fact Check: Ten Myths Scientifically Disproven

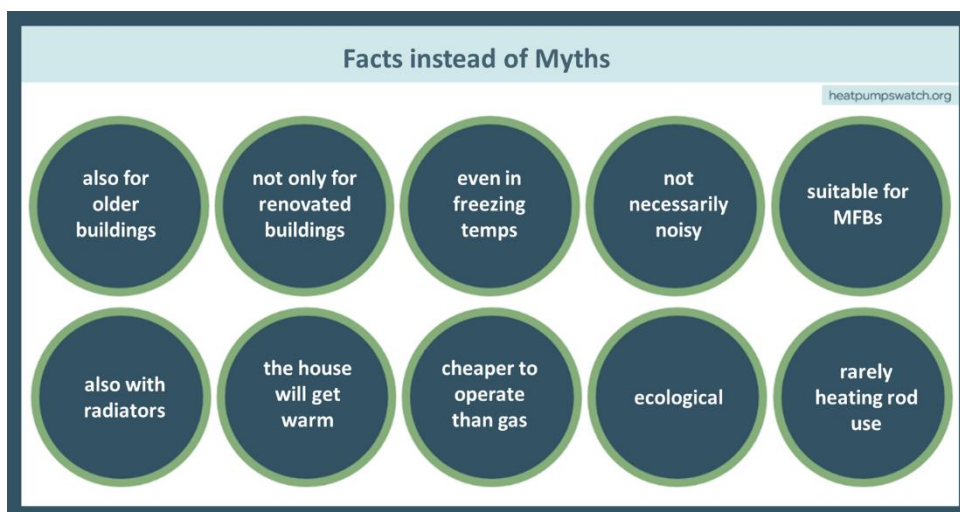
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Despite numerous scientific refutations, many unfounded prejudices about heat pumps persist in public debate.

However, the issue requires nuance: it is not a simple black-and-white question, because a clear distinction must be made between the “optimal conditions” for maximum efficiency and “good performance” in many common existing situations.

These myths stem from the circumstance that the absence of these optimal conditions is used as a pretext for blanket and general criticism of the technology.

Heat-pump myths persist because isolated non-optimal cases are wrongly taken as proof the technology does not work, though it performs well in most real-world situations.



This is yet another approach to address these myths in a well-founded manner analyze their background.

1. Misconception: “Heat Pumps Function Solely in New Buildings”**Facts:**

- Let us begin with a statistic: In 2023, 365.000 heat pumps were sold, 85 percent of which into existing buildings, and only 15 percent into new constructions.
- There is overwhelming evidence for the effective functioning of heat pumps in existing buildings. The latest findings are from a project conducted by Fraunhofer ISE¹. Many other projects with the clear

Heat pumps already work effectively in existing buildings, as proven by both strong sales and extensive real-world evidence.

result of heat pumps working in existing buildings can be found in Episode 2 of this series².

Origin of the Myth:

Many of the widespread myths, including the one that „heat pumps work solely in new buildings“, emerged during the initial heat-pump-boom in Germany in the 1980s. At that time, the technology was not yet mature, and negative examples cast doubt on the reliability of heat pumps.

In the 1990s and 2000s, manufacturers and installers focused on new buildings because planning uncertainty was higher for existing buildings and new buildings posed fewer risks for installers.

In addition, “optimal” is often confused with “necessary.” In new buildings with very low heating energy requirements and the resulting very low heating circuit temperatures, heat pumps tend to work more efficiently than in existing buildings. However, this does not mean that heat pumps do not work in non-optimal conditions.²

2. Misconception: “Heat Pumps Only Work Combined with Underfloor Heating”

Facts:

- The functioning of heat pumps is generally not dependent on the type of heat transfer. Heat pumps can work with surface heating (usually underfloor heating) as well as with radiators, fan coil units, and other systems. As a general rule, the lower the temperature that the heat pump has to provide, the more efficient it is. This is why low-temperature radiators are a good option, especially for houses that have not been renovated.
- Similar to the first preconception, field studies (episode 2)² can be cited here that clearly demonstrate heat pumps’ good compatibility with radiators. The last two “existing building projects” conducted by Fraunhofer ISE even show that the efficiency achieved in some systems with radiators was higher than in houses with underfloor heating. It is not only the heat transfer system that is decisive for efficiency, but also the careful planning, installation, and adjustment of the heat pump system.

Heat pumps work efficiently with different heat-transfer systems, including radiators, when properly planned and adjusted.

Origin of the Myth:

When talking about underfloor heating or radiators, one actually discusses the temperatures with which both systems are or can be operated. With underfloor heating temperature usually does not breach 35 centigrade (°C) while radiators for fossil fuel system were configured for up to 70 degrees in in most homes. Heat pumps of the past did not reach such temperatures.

For at least 15 years, a temperature of 55 degrees is no longer a challenge for heat pumps. A study of the *ifeu* Institute even proposed a standard “NT (lower temperature)-ready”³, in which the flow temperature is 55 degrees or less. For several years now, there have also been many heat pump models on the market that can deliver flow temperatures of up to 75 degrees Celsius⁴.

On the other hand, the underfloor-myth might stem from the very first heat pump to be installed in Germany; in the year 1968 by heat pump pioneer Klemens Oskar Waterkotte. After all, this heat pump was equipped with underfloor heating.

3. Misconception: „The House Must First Be Completely Renovated“

Facts:

- One thing is for sure: The fewer heating energy a house requires, the better. Renovations with the goal of saving this energy are therefore sensible – that goes for all heating systems.
- Renovation is, however, not a requirement for the heat pump to work. Monitoring projects from various countries² have shown that heat pumps can even function successfully in non-renovated buildings. The right circulation temperatures are critical. In many older houses, heating surfaces are already oversized. This often allows the flow temperature to be reduced and the heat pump to be operated efficiently.
- In some cases, steps such as replacing windows are necessary to make good use of the heat pump, but this is not the rule. Relatively inexpensive, quick measures—such as replacing individual radiators—can further improve efficiency. This is because modern radiators transfer the same amount of heat even at lower flow temperatures. Such measures can be the first step toward better efficiency.⁵

Heat pumps can work in unrenovated buildings, often needing only small upgrades to achieve efficient flow temperatures.

Origin of the Myth:

Overall, the myth is based on technical limitations of the past, structural requirements, and sometimes conservative consulting approaches. However, it is clearly refuted by current research and practice. Modern heat pumps are also useful and efficient in many unrenovated existing buildings.

The idea that houses must first be completely and very expensively renovated before a heat pump can be installed was one of the core arguments in the heated debate surrounding the Building Energy Act in 2023. Many media outlets have incorrectly claimed that a massive energy-efficient renovation is necessary before installing a heat pump. Examples include articles in “Die Welt,” “Focus Online,” and the “FAZ”⁶.

4. Misconception: „The House does not Properly Warm Up“

Facts:

- Whether or not a house becomes „properly warm“ depends of the house itself – more precisely on its energy losses. The higher the losses, the higher the heating demand and the higher must the circulation temperatures of the heating system to remedy the losses. Alternatively, the heating surfaces must be enlarged accordingly.
- As already described in the first three myths, modern heat pumps are designed to deliver the temperatures needed to heat the house as usual in winter. The latest study from the UK, based on an analysis of 4,600 homes, comes to the positive conclusion that replacing radiators or renovating is necessary in fewer cases than previously assumed.⁷
- Most homeowners find that their home is more comfortable and “warmer” after switching to a heat pump, as the system usually heats more evenly and around the clock at pleasant temperatures without nighttime fluctuations.

Modern heat pumps can reliably keep homes warm—even in many older buildings—often without major upgrades, while providing steadier, more comfortable heating.

Origin of the Myth:

The perception of warmth is often associated with heat radiation. Even when it is super cold outside, we feel “warm” when we are sitting in front of a campfire or holding a hot cup in our hands. Even in houses with really high heat loss, a really warm spot (like a “hot” radiator or tile stove) was often more important for feeling warm than having even heat and comfort throughout the whole place.

Heating with a heat pump is designed to provide a continuous and even supply of heat, which differs from classic boilers with rapid heating. This may be why there are sometimes doubts as to whether a house without a source of noticeable heat radiation can be “properly warm.”

5. Misconception: „Heat Pumps do not Work in Freezing Temperatures“

Facts:

- Most heat pumps in Europe are installed in the coldest countries. Nordic countries lead the heat pump statistics. By way of comparison, in 2024 there were 632 heat pumps per 1,000 households in Norway and 54 in Germany.
- Heat pump components are also available for very low temperatures. The compressors are crucial here, as they guarantee an available, efficient energy yield down to -20 degrees Celsius without any additional technical refinements.
- Several field studies⁸ have been conducted in extremely cold climates, considering temperatures below -10 degrees and down to -30 degrees. These include a study from Alaska that confirms an average efficiency of 1.8 at -35 degrees.⁹

Heat pumps operate reliably even in very cold climates, as shown by widespread use in Nordic countries and field studies confirming strong performance far below freezing.

Origin of the Myth:

The claim that heat pumps do not work at sub-zero temperatures probably stems from a fundamental lack of understanding of how heat pumps work.

How can freezing cold outside air still be described as a source of “heat”? From an energy perspective, it is not the degrees Celsius that are decisive, but the so-called absolute zero point of 0 Kelvin. Everything above -273.15 centigrade contains heat energy that can be extracted. And it is precisely this energy that heat pumps use to provide heat at higher temperatures thanks to thermophysical principles.

6. Misconception: „Heat Pumps are Extremely Noisy“

Facts:

- One thing must be emphasized: reducing acoustic emissions (commonly referred to as noise) is crucial to further increasing the acceptance of heat pumps for heating and cooling, and must be taken very seriously.
- A lot has changed in this area. Noise levels have been reduced by approximately 10-15 dB(A) over the last 20 years, which roughly corresponds to a halving of the volume (more on this in part 3 of the series).
- Modern heat pumps are quieter than their reputation suggests and are not perceived as disruptive. However, there is a wide range of models available. There are still models that are not whisper-quiet, but the general trend is moving in this direction. When it comes to noise, the focus is mainly on air-to-water heat pumps, because geothermal heat pumps generally cause very little noise.
- The location of heat pumps has a significant influence on how people perceive the device. The correct installation of heat pumps is described in detail in the “Noise Guide,” for example.¹⁰
- If necessary, additional noise-reducing measures can be taken—so-called “noise protection hoods” are one example. Planting vegetation to reduce the visibility of the heat pump also reduces the perception of noise.

Modern heat pumps are much quieter today than their reputation suggests, and with proper placement and, if needed, simple noise-reduction measures, they are rarely perceived as disruptive.

Origin of the Myth:

Heat pumps used to be noisier than they are today. When it comes to sound, it is important to note that people perceive acoustic emissions very differently. The results of hearing tests for psychoacoustic analysis¹¹ showed that, in addition to the sound level, other acoustic parameters such as loudness, roughness, and sharpness also have a significant influence on the perception of heat pump noise.

7. Misconception: „Operating Heat Pumps is more Expensive than Gas Systems“

Facts:

- The opposite is true: operating costs usually decrease significantly when switching heating systems.

- The following parameters are necessary to compare the operating costs of a heat pump with another heating system: gas and electricity prices or the ratio between the two prices, the ratio between the efficiency of the heat pump and the efficiency of the gas boiler, and the size and heating energy requirements of the house.
- Since all of these parameters can change over time (except for the size of the house), it is necessary to assume specific values.
- The following assumptions were made for a sample calculation: (1) The efficiency of the heat pump corresponds to the average values from the field study in existing buildings¹ of 3.4; (2) an average efficiency of the gas boiler of 90 percent; and (3) a house that has not been renovated or has only been renovated to a minor extent, with a floor space of 150 m² and a heating energy requirement of 150 kWh/m² per year. The prices used were the average prices for new customers from the energy monitor “Die Zeit,” updated on November 16, 2025—electricity price 23.6 cents per kWh and gas price 8.6 cents per kWh.
- Based on the assumptions made, the operating costs with the heat pump are 588 Euro per year cheaper than with a gas boiler. In the past, these values have varied greatly. Especially at the beginning of the war in Ukraine, the savings were up to €4,000.
- In the long term, it is more likely that gas prices will rise for a variety of reasons. At the same time, it is possible to positively influence electricity prices—for example, by using flexible electricity tariffs or even by using your own photovoltaic system.

Switching to a heat pump significantly reduces operating costs compared to a gas boiler, offering hundreds of Euros in annual savings with long-term advantages due to expected rising gas prices.

Origin of the Myth:

Compared to other countries, electricity prices in Germany are relatively high and gas prices relatively low. According to Eurostat data¹², electricity in Germany was even the most expensive in the first half of 2025. Gas prices were in the middle range at the same time. This means that the electricity-to-gas ratio is unfavorable for heat pumps. In the past, before 2022, gas prices were even lower, which led to a negative balance for heat pumps.

Part of the claim that gas heating is cheaper also stems from false assumptions about the efficiency values of heat pumps in existing buildings. As already described in Episode 2², the real efficiency is higher than is often claimed.

8. Misconception: "Heat Pumps are not Climate-friendly in Operation due to Their Electricity Consumption"

Facts:

- The CO₂ savings achieved by using electrically powered heat pumps depend on two factors: the CO₂ intensity of the electricity and the efficiency of the heat pump. The first factor indicates how “clean” the electrical energy is generated, i.e., how many grams of carbon dioxide are emitted when providing one kilowatt hour of electricity. Although this

value varies between different regions and over time, meaningful average values can be given.

- Depending on the source and type of statistics, public net electricity generation in Germany reached a record share of renewable energies of around 60 percent in 2024.¹³ The German electricity mix was cleaner than ever before. This also means that emission values are lower than ever before. In 2024, an average of 363 grams of CO₂ was emitted per kilowatt hour of electricity consumed in Germany.¹⁴
- The latest Fraunhofer ISE study calculates that heat pumps reduce CO₂ emissions by an average of 64 percent compared to gas heating systems (based on field results) when using the dynamic, quarter-hourly calculation of the German electricity mix—only four percentage points less than the static calculation of 68 percent.
- The use of heat pumps leads to a significant reduction in CO₂ emissions compared to fossil fuel-based heating systems such as gas boilers. These savings will increase even further with the expansion of renewable electricity generation.

Heat pumps significantly reduce CO₂ emissions—by around 64 % compared to gas heating in Germany—and their climate benefits will grow as the electricity mix becomes greener.

Origin of the Myth:

Historically, there was a period when a heat pump had to achieve an efficiency of around 3.0 in order to be ecologically superior to a gas boiler with the electricity mix at that time. Heat pumps at that time achieved precisely this efficiency as an average value in field tests. With today's emission values, the efficiency must be around 1.5 – even very poorly performing heat pumps achieve significantly better values. Apart from that, today's average efficiencies are significantly higher.

9. Misconception: "Heat Pumps are only Suitable for Single-Family Homes, not for Multi-Family Homes."

Facts:

- There are countless examples that impressively demonstrate the use of heat pumps in multi-family homes. Many can be found in the database of case studies collected as part of the international "Annex 62" project. By the end of 2025, the database will contain almost 100 examples from several countries.
- Another statistic: In France, the number of heat pumps in newly built apartment buildings has risen from 4 percent in 2018 to 45 percent in 2023 in just five years.¹⁵
- However, the use of heat pumps in multi-family homes is even less common than in single-family homes and therefore less standardized.
- The main reasons for this are, on the one hand, the heat source connections, which are often more challenging than in single-family homes, and, on the other hand, the higher temperatures that are necessary due to higher losses—especially for hot water production.

Heat pumps are increasingly used in multi-family homes, though adoption is slower than in single-family homes due to more complex heat connections and higher temperature demands.

Origin of the Myth:

The idea that heat pumps are not right for apartment buildings is mostly based on the fact that they are way more common in single-family homes. Plus, even though the tech is already out there, it is not really familiar, standardized, or widespread yet. But both research and industry are changing this fast. A good example of this is the large-scale “LCR290” project¹⁶, which focuses, among other things, on replacing gas-fired floor heating systems.

10. Misconception: „Heating Rods Runs very often and Cause High Electricity Costs“**Facts:**

- Heating rods are a useful component of any air-to-water heat pump system and serve to prevent the systems from being unnecessarily oversized. Above a certain temperature (the so-called bivalence point), the heating rods support the heat pump or even take over the heat supply for a few hours a year. However, these moments are very rare and, with correctly designed, installed, and adjusted heat pumps, have little influence on overall efficiency and therefore only a minor impact on operating costs.
- Also, heating rods can serve as an emergency heating appliance in case of a heat pump failure.
- Field studies (Episode 2)² generally demonstrated that heating rods are used extremely rarely. Most systems were found to be inoperative. Heating rods account for less than 2 percent of total electricity consumption on average, which is comparable to the share used for control and regulation. Even during the coldest period measured, only a few heating rods were in operation.

Heating rods in heat pumps are used extremely rarely and usually serve only as an emergency back-up.

Origin of the Myth:

The “fear of heating rods” probably stems from a time when heat pumps were unable to provide the necessary output and/or temperatures and the gap was filled with heating elements. This reduced the advantages of heat pump systems, lowered average efficiency, and worsened cost-effectiveness. However, we are now far removed from the teething problems of heat pumps in the 1980s, not only in terms of time but also in terms of technology.

Conclusion

The ten myths presented here show that many preconceptions about heat pumps are based on outdated information, historical weaknesses from the past, misunderstandings, or deliberate misinformation. An objective examination of the facts is worthwhile for anyone who wants to make an informed decision about heating.

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⁹ Shen, Bo, et al. *Finalize field testing of cold climate heat pump (CCHP) based on tandem vapor injection compressors*. No. ORNL/TM-2017/176. Oak Ridge National Lab.(ORNL), Oak Ridge, TN (United States). Building Technologies Research and Integration Center (BTRIC), 2017.

¹⁰ Bundesverband Wärmepumpe (BWP) e.V., *BWP-Leitfaden Schall: Rechtssichere und akzeptierte Aufstellung von Luft/Wasser-Wärmepumpen*, Berlin 2021

¹¹ Reichl, C. (Hrsg.). (2021). *Acoustic Signatures of Heat Pumps* (Report no. HPT-AN51-1). AIT Austrian Institute of Technology GmbH. Annex 51.

¹² Euronews. (13. November 2025). *Strom- und Gaspreise in Europa: Welche Länder sind am teuersten?* Euronews. Abruf am 16.11.2025 unter <https://de.euronews.com/business/2025/11/13/strom-und-gaspreise-in-europa-welche-lander-sind-am-teuersten>

¹³ Fraunhofer-Institut für Solare Energiesysteme (ISE). (2025). Öffentliche Stromerzeugung 2024: Deutscher Strommix so sauber wie nie. Pressemitteilung. Abruf am 16.11.2025 unter <https://www.ise.fraunhofer.de/de/presse-und-medien/presseinformationen/2025/oeffentliche-stromerzeugung-2024-deutscher-strommix-so-sauber-wie-nie.html>

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