Heat pumps

Key to the energy transition – yet some questions to solve

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September 2021

Heat pumps are used in both new building projects and in renovation projects as an energy efficient replacement of the conventional heating system or as an addition to the existing heating system (so-called hybrid systems) and thus they become an integral part of our life. As a consequence, questions arise related to the their use, correct size, efficiency and the resultant energy bill. How to tackle these questions?

Know how to interpret the performance data.
The efficiency of a heat pump is expressed in terms of COP (for heating) and EER (for cooling) and is basically the ratio of the heat supplied or heat removed from indoors (what we receive) to the power consumption (what we pay). The COP and EER are highly dependent on the temperature of the sources and the difference between those and are determined according to EN 14511. Be aware that these only indicate the performance of the heat pump at the standard rating conditions. However, the real performance of a heat pump is dependent on the source temperature and therefore is dynamic. This has been addressed in the Ecodesign directive by the use of EN 14825: Testing and rating at part load conditions and calculation of seasonal performance. Using the methods described in this standard the SEER (seasonal energy efficiency ratio), the SCOP (seasonal coefficient of performance) as well as seasonal space heating and cooling efficiencies can be calculated using the test results obtained at part load conditions. Today, there are still questions on how good the seasonal efficiencies calculated this way reflect the real life performance of heat pumps and there is some ongoing work in the standardization committees to produce better methods for the determination of seasonal efficiencies. So when designing, be aware of the pitfalls and avoid disappointment afterwards.

It is not a gas heater.
From a more technical perspective, heat pumps consist of four main components namely; a compressor, an evaporator, a condenser and an expansion device. They work between two energy sources and transfer heat from low temperature to high temperature while using some amount of driving energy in the compressor. This is in no way comparable to the combustion-principle of a gas heater. Heat pumps are often named according to the energy sources used during their operation which can be air, water and ground. Recovered energy from exhaust air, wastewater or industrial processes can also be used as the energy source. The energy used in the heat pump to drive its fans and compressors can also come from renewable energies in the thermal or

electrical form, making heat pumps an environmentally-friendly solution for heating, cooling and domestic hot water production.

Heat pumps that use water as a means for heating provide relatively low temperatures and work more efficiently with low temperature distributors such as floor heating systems. Since heat pumps work well under fairly steady output conditions and are less capable of providing peak values the way a gas heater does, the thermal insulation of the building is a factor to consider in the design and engineering process.

There is (more) noise.
Another parameter that is important when speaking of heat pumps is the sound produced by them which also has an effect on the design and installation. The sound power levels of heat pumps are determined according to the methods described in EN 12102 and are also shown in the energy label of the heat pump.

Since april 2021 the Dutch Building Code has noise requirements for the maximum sound pressure level at plot boundaries, as a result of the operation of installations used for heating and cooling of indoor spaces. The sound pressure level should not exceed 40 dB(A). If the produced sound has a tonal component i.e. has audible tonality, + 5 dB(A) must be added to the measured value. Because heat pumps have sound power levels of between 50-70 dB(A), implementing these devices within building projects can be a challenge and creative solutions are sometimes needed.

The maximum sound power levels as well as minimum seasonal efficiencies for different type of heat pumps are set by the Ecodesign and Energy Labelling Directives of the European Union. The Ecodesign directive creates a framework for energy using products and pushes manufacturers to increase the energy efficiency and reduce the environmental impacts of such products by providing guidelines such as setting the minimum requirements.

You'd better prepare, the heat pump is here to stay.
According to EHPA (European Heat Pump Association), the heat pump stock of 14.9 million units in 2020 in EU-21 contributed to 41.1 Mt of CO2 emission savings, 160 TWh of renewable energy, 90000 jobs and 521 GW of storage capacity and 1.6 million heat pumps are sold. Considering the big share of heating and cooling in the final energy demand (52 % in EU), the targets and obligations addressed in legislations such as the Building Energy Directive, Energy Efficiency Directive and the Green Deal, heat pumps seem to be more and more popular due to their main characteristics and play an important role in the transition towards a sustainable energy system. The market share is therefore expected to increase even further and product development will result in enhanced performance and more sophisticated heat pump applications.

A bit overwhelming?

The Energy Labelling Directive provides the rules related to energy labels of products to give consumers a clear indication of the energy efficiency and other key features such as the heating/cooling capacities and sound power levels. The European Union regulations related to heat pumps are 206/2012, 626/2011, 811/2013, 813/2013, 812/2013, 814/2013 and 2016/2281 and each of these regulations cover some part of heat pumps according to their capacity and type. We can imagine that this is a bit overwhelming. Call us for clarification.

More information

More information by our independent Heat Pump Expertise Centre. Feel free to contact:
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