

Definition of heat pumps and their use of renewable energy sources

The term “Heat Pump” is getting more popular as the use of this technology is expanding into buildings and houses. The general purpose and concept of heat pumps may be understood but how are they defined at the European level? Which EU documents introduce the heat pump technology as a solution?



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Introduction

Heat pumps are part of the environmentally friendly technologies using renewable energy. They are quoted in the European Directives on the use of Renewable Energy (RES), on the Energy Performance of Buildings (EPBD) and on Energy related products (ErP). In addition, heat pumps are also referenced in the Directive on the promotion of the use of energy from renewable sources (2009/28/EC, RES Directive, § 2). The Directive recognizes the technology as using renewable energy sources from air, water and ground. Heat pumps are seen as a great opportunity to reach the EU target for a reliable, affordable and sustainable energy supply.

What are the definitions of heat pumps from the European commission?

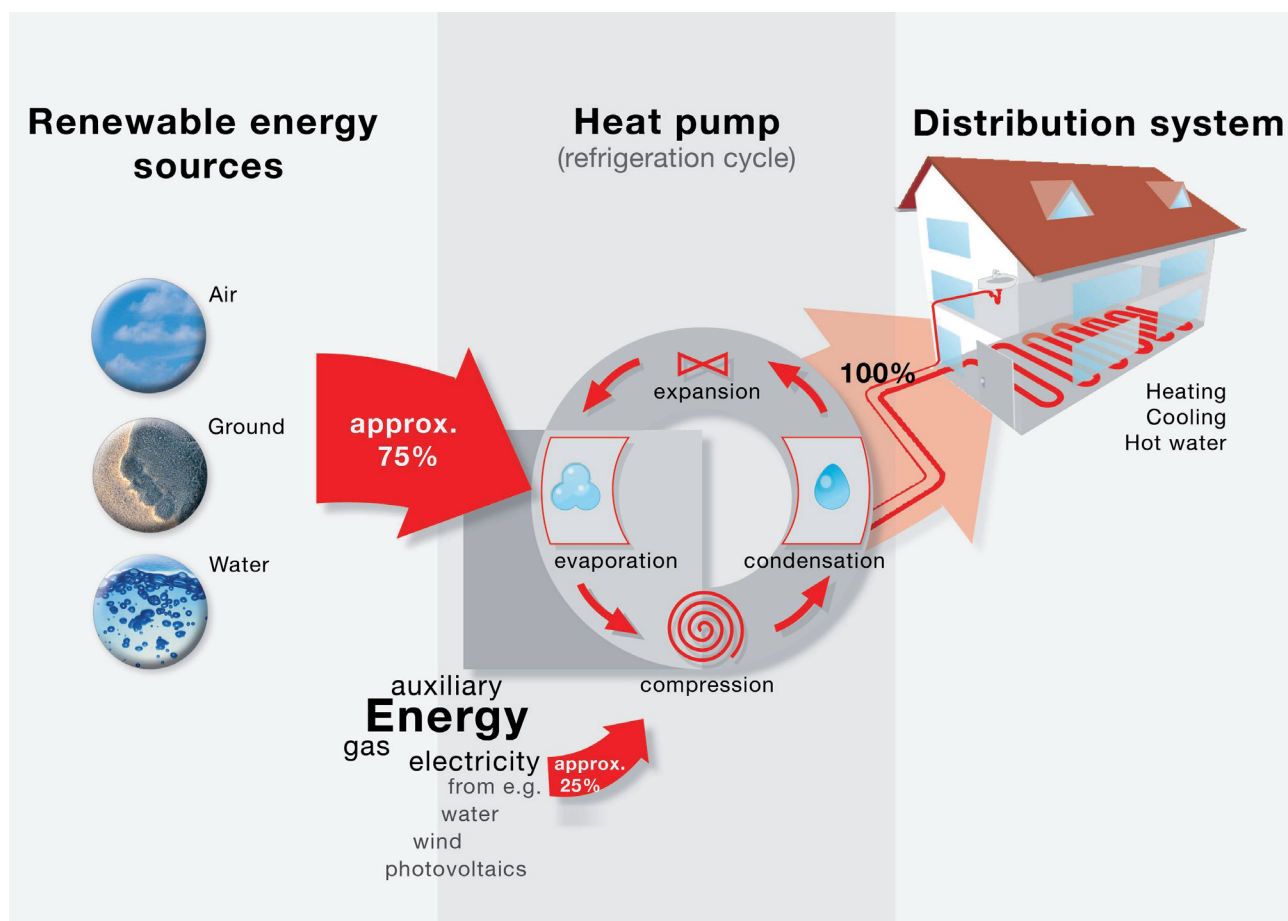
In the Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the **energy performance of buildings** (EPBD) recast, *Article 2 point 18*, ‘heat pump’ means a machine, a device or installation that transfers heat from natural surroundings such as air, water or ground to buildings or industrial applications by reversing the natural flow of heat such that it flows from a lower to a higher temperature. For reversible heat pumps, it may also move heat from the building to the natural surroundings;

This definition of a heat pump is based on the physical characteristics of energy transfer. This definition is

kept widely open to any machine, device or installation which will do the job of energy transfer. It leaves open doors to all existing or future technologies and hopefully improvements for innovative and more energy efficient models will show up. It does not set criteria how the upgraded low-temperature free heat is transferred to useful temperatures. Apart from all the natural sources of energy listed, the waste heat is not referenced but offers large opportunities for energy recovery from air or water side.

In the European Directives on the use of **Renewable Energy** (RES), point 31: “Heat pumps enabling the use of aerothermal, geothermal or hydrothermal heat at a useful temperature level need electricity or other auxiliary energy to function. The energy used to drive heat pumps should therefore be deducted from the total usable heat. Only heat pumps with an output that significantly exceeds the primary energy needed to drive it should be taken into account.”

To achieve energy transfer, it requires auxiliary energy depending on the technology: there are electrical, gas driven or gas absorption heat pumps. The ratio between the auxiliary energy consumption and the thermal energy transfer is currently around one third depending on the technology used, the efficiency of the device and the temperature conditions. Obviously, a minimum level of efficiency should be established to ensure reduced energy consumption so that a heat pump deserves to be considered as a sustainable energy device. However, the definition is quite unclear about this as it only states that the energy output should significantly exceed the primary energy consumption. A tentative calculation method is defined in Annex VII but terms are not accurately defined yet and it is announced that they will be clarified for January 2013 by the Commission.



Operation principle of a heat pump. (Source: EHPA/Alpha Innotec)

In extreme cold conditions, the efficiency of aerothermal heat pumps dramatically drops. An alternative heating system thus needs to enter into action. This alternative may not be from a renewable energy source and therefore will reduce the global efficiency of the heat production through the year and its environmental sustainability. How to address this issue into heat pump qualification?

Larger definition of Heat Pumps

Gathering the above considerations and keeping the EU arguments and style, a broader and extended definition may be suggested:

A “heat pump” is a machine, device or installation using renewable natural energy sources from aerothermal, geothermal or hydrothermal heat or non-natural processed wasted heat from water or air and which transfers it to buildings or industrial applications by reversing the natural flow of heat such that it flows from a lower to a higher useful temperature.

Primary energy input from electricity, gas or fuel is needed to drive this process. In extreme climatic conditions, additional heating device must compensate the reduced heat production from heat pumps. Only heat pumps with an output that significantly exceeds the primary energy needed to drive them and the additional heating device energy should be considered. Obviously, an acceptable minimum level of efficiency should be established to ensure reduced energy consumption for the heat pump to deserve to be considered a sustainable energy device. When heat pumps are reversible, it may also move heat from the building to the natural surroundings. This should be considered and maybe integrated into the efficiency factor. Not to multiply production systems into a same infrastructure.”

Due to the complexity and the multiple parameters to consider for heat pumps, the calculation of their efficiency is a real challenge. Efficiency will also be subject to local climatic conditions of where the device will be installed. This challenge is part of the road to reduce our impact on the environment by choosing the best heat pump technology or selecting the right equipment. ☞