

# Heat Pump Systems

## 1 Technical Introduction

### 1.1 General Function

- Device that extracts heat from one place and transfers it to a higher temperature level
- Heat is being extracted from the environment (e.g. groundwater, air...) and then transferred to a heat distribution system

#### Heat pump cycle step by step:

- Deprivation of heat from nature → this heat is used to evaporate a refrigerant
- Compression of gas that is produced in this process
- Heat exchanger transfers energy to the heating cycle
- Pressurized refrigerant is being liquified again

To be a sustainable system, heat pumps should be used in combination with renewable energy sources, such as wind or solar energy.

### 1.2 Different types of heat pumps

There are several different types of heat pumps:

- Sole-water heat pump
- Air-to-water heat pump
- Water-to-water heat pump
- Hybrid heat pumps ("Duel-Fuel-Systems")

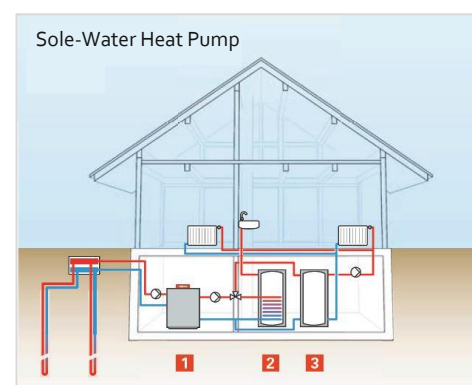


Figure 1: Sole-Water Heat Pump. Source: Viessmann [1]

## 2 Implementation

### 2.1 Current state in the Baltic Sea Region

Political framework: heat pumps are defined as renewable energy technologies in the *EU Renewable Energy Directive* and in the *Energy Efficiency Directive*.

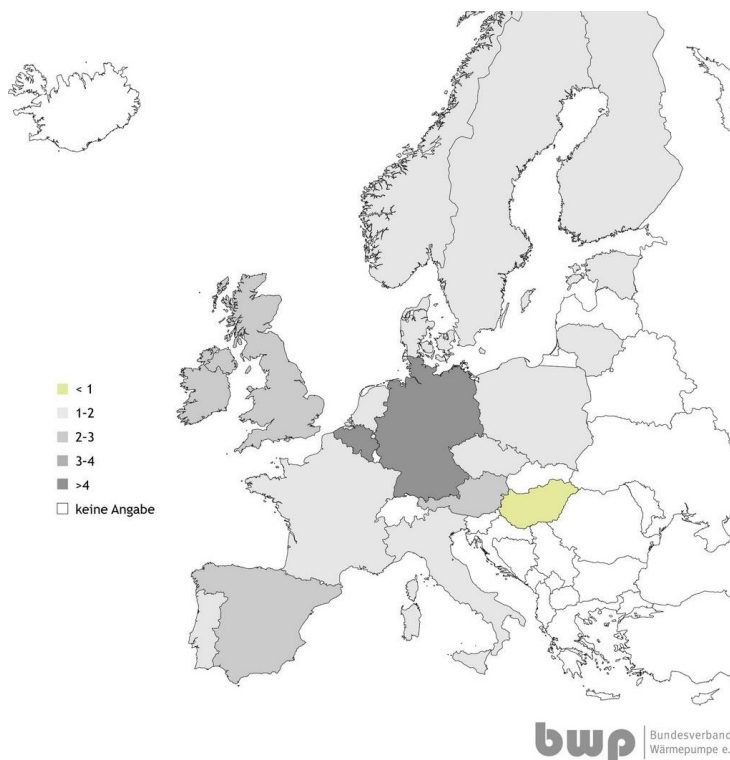


Figure 2: Price Ratio: Energy from Heat Pumps vs. Oil in Europe. Source: BWP [2]

**But:** despite their benefits, heat pumps are still being implemented below their potential rates in large parts of Europe.

#### SWOT Analysis:

- Strengths: e.g. multi-function, environmental protection, safety
- Weaknesses: e.g. costs, lack of know-how of building professionals

Currently the price ratio of energy from heat pumps vs. oil in Europe is still diverse. In the majority of countries, the heat pump energy is more expensive.

## 3 Conclusion

- Heat pumps are efficient heating and cooling systems
- Efficiency and costs depend on different factors (e.g. environmental surroundings)
- Local heat generation by heat pumps is an independent way
- Can result in economical benefits, installation costs normally amortize quickly
- Positive impact on climate mitigation goals (up to 90% less CO<sub>2</sub> emissions than standard oil or gas heating systems)

## 4 References

- [1] Viessmann. <https://www.viessmann.de/de/wohngebaeude/welche-heizung/waermepumpen.html>
- [2] BWP. Bundesverband Wärmepumpe e.V.. <https://www.waermepumpe.de/presse/zahlen-daten/>

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