



# Annex 47

## Heat Pumps in District Heating and Cooling Systems

Heat pumps can become a cornerstone in the future district heating and cooling grids. They are able to utilize low-temperature and waste heat sources, facilitate the integration of renewable power in electricity networks, increase the share of renewable energy in the heating grids, and minimize grid losses. This makes them an economically viable option.

### Key Findings

Heat pumps can become a key technology in the future district heating grid, for several reasons.

- 1 Heat pumps, in combination with storage systems, have the potential to become a key technology in the future district heating grid, since they can balance the grid when the electrical production from intermittent renewable energy sources fluctuates;
- 2 Heat pumps make it possible to use very low (below 60 °C) and ultra-low (below 45°C) temperatures in the district heating grid, thereby reducing the grid losses;
- 3 Heat pumps increase the flexibility of district heating systems by expanding the heat generation portfolio, which enables higher reactivity through fast commissioning and low start-up costs as well

as taking advantage of the volatility of the electricity market and thermal batteries.

- 4 Heat pumps can be used to increase renewable heat generation and phase out fossil fuels from the energy system.

Heat pumps can be integrated in heating and cooling systems in many different ways. The points above are illustrated by the catalogue that has been compiled, showing 39 different cases regarding implementation and integration of heat pumps in district heating systems, from all the participating countries of the Annex.

A barrier to the large-scale integration of heat pumps is the high temperature of the existing heat networks, which reduces the efficiency of the heat pumps. The implementation of low-temperature networks helps overcome this barrier at the same time as the heat losses from the grids are reduced.

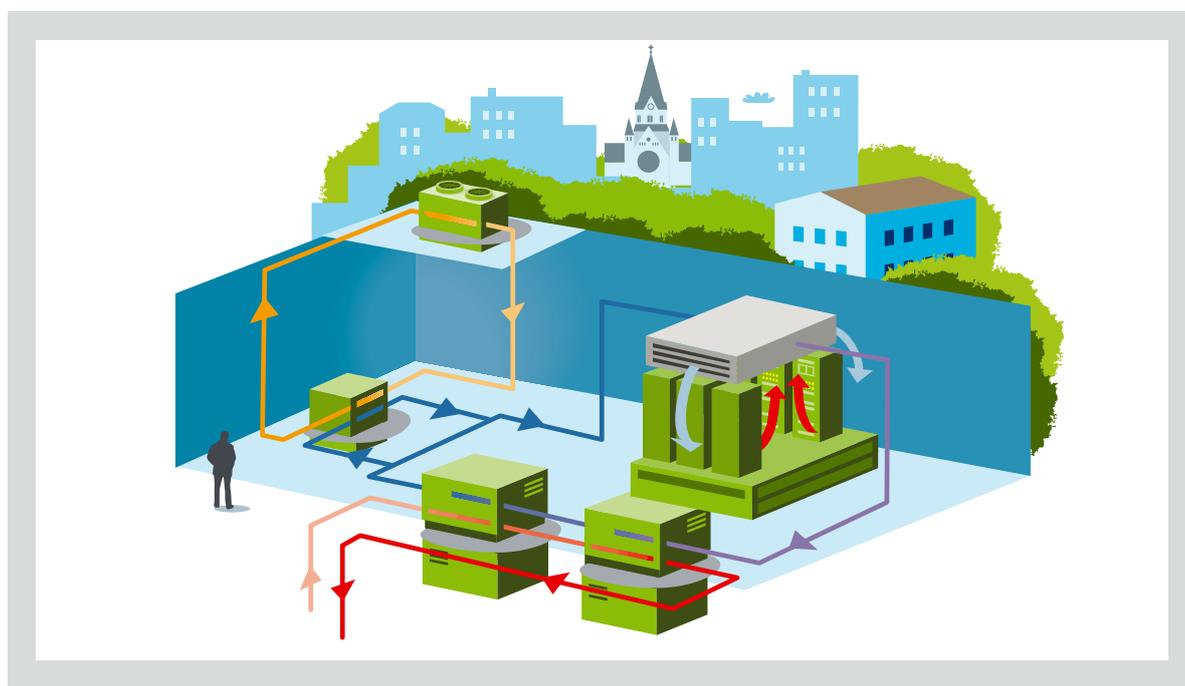


Figure 1. Profitable heat recovery with open district heating, Stockholm Exergi.

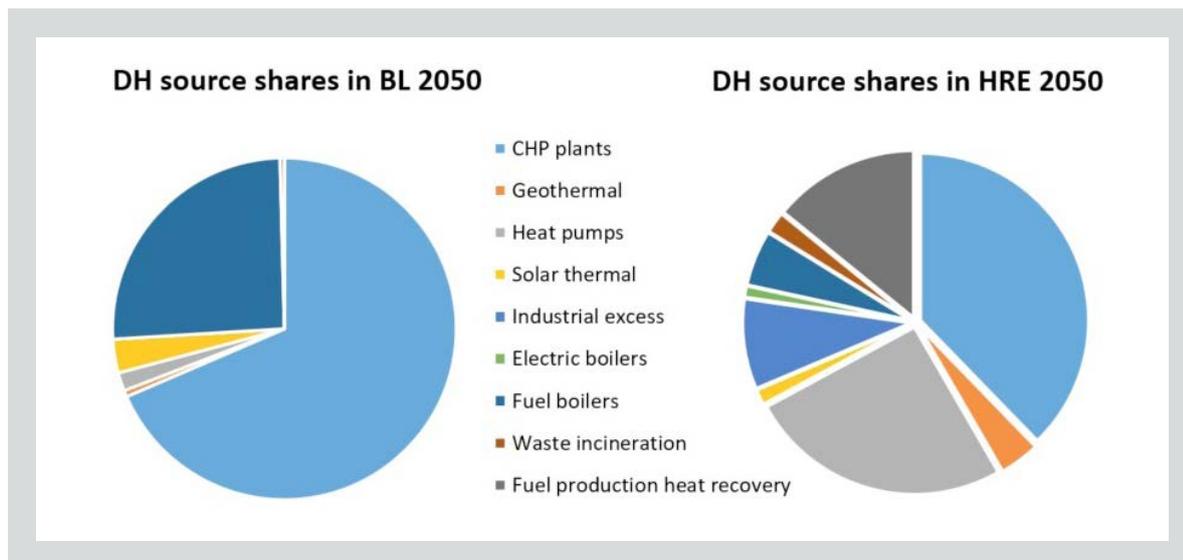


Fig. 2: Two scenarios from the "Heat Roadmap Europe 4 scenarios (HRE4)" showing district heating sources share. The HRE 2050 (Heat Roadmap Europe) scenario shows that it would be possible to achieve a much more decarbonized DH in 2050 than in the BL2050 (Base line) scenario which represent the current situation of the heating and cooling sector.

## Background

District heating in general and heat pumps connected to the grids in particular are predicted to play a key role in the energy grid and supply for the future. With the implementation of district heating, it is possible to cover up to 50% of the heating demand in Europe, and heat pumps can deliver at around 25% of the energy transported by the district heating grid, or even more if new concepts and solutions for ultra-low temperature thermal grids are developed.

The *Heat Roadmap Europe 4* scenarios (HRE4) with a larger share of district heating in the energy system show that the CO<sub>2</sub> emissions can be reduced with more than 70% compared to today's situation. See Figure 2.

## Objectives

The objectives of this Annex were

- » to gather information and ideas for policy makers, decision makers, and planners of energy systems in urban areas concerning the possibilities and barriers related to the implementation of heat pumps in district heating and cooling (DHC) systems;
- » to suggest how heat pumps can be implemented in both new and older district heating systems in the best way. This should include different types of integration, taking into account differences and possibilities of integration in central and local systems;
- » explore the possibility to increase a larger share of renewable energy in the electric grid, or to use excess heat in the heat grid;
- » explore the possibility to minimize heat losses from the DHC system by using heat pumps;
- » for each of the participating countries, to describe existing projects where heat pumps are integrated in district heating systems.

## Further information

Contact person:	Operating Agent was Svend Vinther Pedersen from Danish Technological Institute, Denmark. <a href="mailto:svp@teknologisk.dk">svp@teknologisk.dk</a>
Participating countries:	Austria, Denmark, Switzerland, Sweden, the United Kingdom
Publications:	Final report of Annex47 and Executive Summary of Annex 47, available at <a href="https://heatpumpingtechnologies.org/publications/">https://heatpumpingtechnologies.org/publications/</a>
Internet:	<a href="https://heatpumpingtechnologies.org/annex47/">https://heatpumpingtechnologies.org/annex47/</a>