Case Studies

https://heatpumpingtechnologies.org/annex57/

fit4power2heat, Austria

"Exploratory study of heat pump pooling concepts in urban district heating networks."

EY FACTS

RD&D status:
Design study

Type of heat pump:
Centralized heat pump with a district heating system

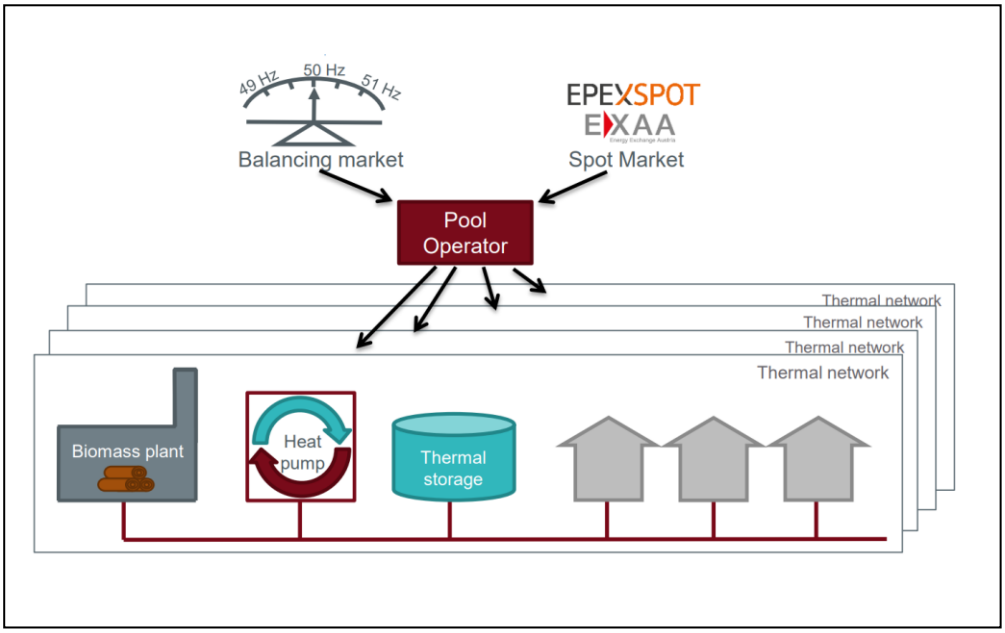
Building description:
existing buildings with a mixed use of residential and non-residential

Energy storage:
Centralized thermal energy storage

Control for the flexible heat pump operation:
Predictive control

Heat source:
Flue gas, sewage water

Power supply:
Electricity grid



Summary of the project:

The aim of the project fit4power2heat was to develop and investigate innovative business models enabling the economic integration of heat pumps in small and medium urban heating networks by creating synergies between the heat and the electricity sectors. One main focus was the application of heat pump pooling over multiple heating networks, to enable the participation in various electricity markets (day-ahead spot market and balancing markets).

Result of the project:

Through integration of heat pumps in small district heating grids and participating in the electricity markets, heat generation costs could be reduced by up to 17,7% for the use cases with flue gas as a source for the heat pump, and up to 27,5% for the use cases with sewage water. The project showed that heat pumps can be active players in the electricity and heat sector. They can increase the hosting capacity of the power grids and counteract high investment costs for grid expansion. They can expand the capacity of the district heating network and also extend the lifespan of existing biomass boilers by reducing annual operating hours. Heat pumps improve the overall efficiency of the system and result in higher profitability.

IEA Technology Collaboration Programme on Heat Pumping Technologies (HPT TCP)

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ANNEX 57 — Flexibility by implementation of heat pumps in multi-vector energy systems and thermal networks

System description:

The analysed heating grids consisted of biomass boilers and thermal storages. The heat pumps were integrated in two different ways: In the first option, the flue gas from the biomass boiler was used as the source for the heat pump. In the second option, an external heat source was used, namely sewage water.
Several heat pumps within different heating grids can be operated in a coordinated way, forming a heat pump pool. This allows the heat pumps to become active participants in the different electricity markets, like the day-ahead spot market and the balancing markets (manual and automatic frequency restoration reserve, mFRR / aFRR).

Flexibility – control strategy of the system:

To simulate the behaviour of the heating system, an operational optimization model was developed, using mixed integer linear programming. The model provides the cost optimal operation strategy for the components in the energy system. These components, which include the biomass boilers, storages and heat pumps, were imported into the model in the form of unit specific data. The input data for the biomass boilers and heat pumps considered the nominal capacity, efficiency, minimum partial load operation, ramp-up rate, operation costs and fuel costs. The storage parametrization was based on the capacity, thermal loss factor and the minimum stage-of-charge. The electricity market was parametrized based on energy prices, power prices and market call probabilities.

FACTS ABOUT THE PROJECT

Place:
-

Time frame:
2017-2019

Project owner/ leader:
AIT Austrian Institute of Technology GmbH

Project partners:
ENGIE Gebäudetechnik GmbH
ENGIE Energie GmbH

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https://nachhaltigwirtschaften.at/de/sdz/projekte/fit4power2heat.php

Published articles:

Terreros, O. et al.: fit4power2heat – Sondierung zur Realisierung des Wärmepumpenpooling für städtische Wärmenetze. Final Report 2019.

Terreros, O. et al.: Electricity market options for heat pumps in rural district heating networks in Austria. Energy, Volume 196, 1 April 2020. https://doi.org/10.1016/j.energy.2019.116875

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