Case Studies

https://heatpumpingtechnologies.org/annex57/

ANNEX 57

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

Waste heat utilization spa Vienna, Austria

"Use energy from the thermal waste water of spa Vienna"

KEY FACTS

RD&D status:
Large-scale demonstration

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

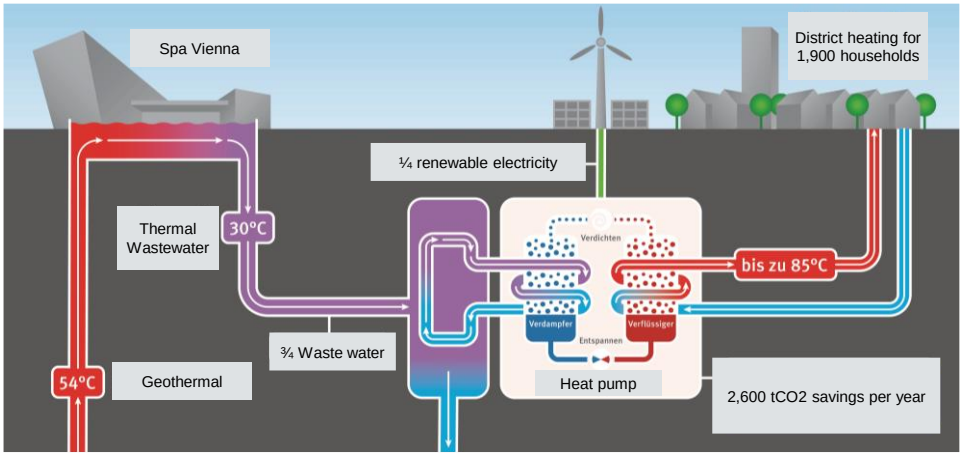
Building description:
Mix of new and existing residential buildings

Energy storage:
Centralized thermal energy storage

Control for the flexible heat pump operation:
Heat driven control

Heat source:
Thermal water

Power supply:
Electricity grid



Summary of the project:

The overall system was developed to utilise the waste heat of the thermal (waste)water of "Spa Vienna" located in district "Oberlaa". The system based on heat pumps with a supply of about 2,2 MW to the DH network of the City, depending on the temperature and the mass flow of the source. The heat pumps are designed to get a maximum output temperature of 84 °C. An additional electrical boiler of 375 kW thermal energy increases the temperature up to 90 °C if the outdoor temperature is below -5 °C. Yearly produced heat amounts to around 11 GWh.

Results of the project:

The plant has not completed a full year of operation yet and is still in trial operation. It is expected to be fully operational in course of 2023.

Expected results:

- Produced heat of 11 GWh/a, supply for around 1,900 households
- Reduction of carbon emissions of around 2,600 t/a
- Reduction of biomass consumption of around 1,200 t/a

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

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System description:

The innovation of this concept lies in the intelligent use of waste water of the spa, which was unused before. The project is part of a larger strategy to use new/renewable sources of heat for the district heating system. By 2040, Wien Energie aims to connect 56% of the Vienna households to the district heating system.

The heat pumps for the use of waste heat are operated on the source side by the thermal water pipe, which flows into the main sewage treatment plant in Vienna. The heat pump system consists of 2 identical heat pumps. The heat pumps are designed as water-cooled compact heat pumps with the refrigerant ammonia (NH3, R717). The refrigerant ammonia was chosen for the heat pumps due to the low GWP and ODP value.

Flexibility –control strategy of the system:

The challenge in this project consists in the fact that both, the source and the sink are varying with respect to volume and temperature. This is especially true for the source (waste water from the spa), less so for the sink which varies with respect to temperature on an hourly basis, the volume is more or less constant. This is in contrast to a typical DH grid, which has mainly seasonal fluctuations, less so on an hourly basis. Due to these challenges, the HP is working in parallel to the heat exchangers of the DH system, as the peaks cannot be covered by the HP. In addition, the lowest operational point is 300kW for the HP. Therefore, the HP is designed to cover the 'medium' load of the system.

The plant is dispatched in a flexible way to make economic sense, depending on the constellation of gas and electricity prices. Depending on their relation, it can make economic sense to cover large parts of the heat load by the CHPs.

Participation on the balancing market was considered but decided against in the end. To prequalify for the balancing market would have triggered additional investments and technical upgrades that where not justified by the economics. In addition, there are practical problems with regards to the fact that in particular heat supply and the availability of waste water is not predictable and compatible with the lead times required by the balancing market.

Published articles:

FACTS ABOUT THE PROJECT

Place:
Vienna, Austria

Year of realisation:
2022

Project owner/ leader:
Wien Energie

Project partners:
Green Energy Lab
AIT Austrian Institute of Technology GmbH
AEE Intec
TU Vienna, Energy Economics Group

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https://greenenergylab.at/projects/abwaermenutzung-aus-thermalwasser-therme-wien/

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