DISTRICT HEATING NETWORK RIEHEN (BASEL) - SWITZERLAND

Wärmeverbund Riehen (Basel)

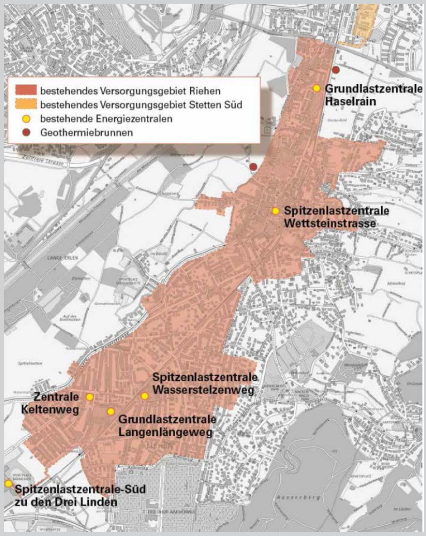

Fig 1: Overview of the supply area of the district heating network Riehen with the geothermal power plant Haselrain.

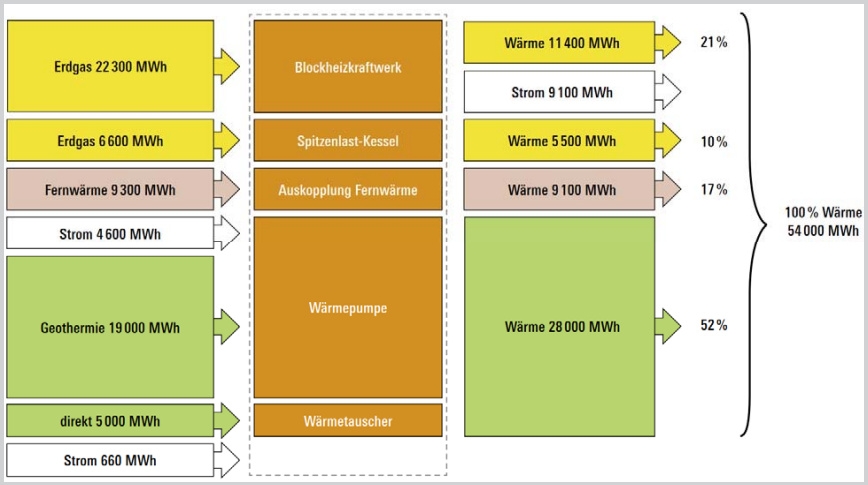

Fig 2: Energy flow diagram of the district heating system Riehen.

Summary of the project

The district heating network Riehen near Basel supplies at temperatures above 60 °C a large share of the buildings of the municipality of Riehen with space heating and domestic hot water. The supply area currently comprises approximately 540 properties, mainly residential and office buildings, historic buildings and new buildings built according to the standard Minergie®. The supply area has a total heating demand of 54 000 MWh/year and electricity demand of about 9 100 MWh/year. The core of the district heating network Riehen is the geothermal thermal power plant, the largest so far in Switzerland. For more than 23 years, deep groundwater has been pumped at a temperature of 65 °C and has been used to supply the district heating network with the help of heat pumps. In addition to the geothermal source, two gas-fired combined heat and power (CHP) units are used to supply the district heating network. Three gas boilers are used to cover the peak loads.

The realization of the project and the lesson's learned

The geothermal plant in Riehen has been operating since 1994. The 65 °C warm aquifer deep water

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is extracted from a depth of 1 547 m at a rate of 25 l/second and returned at approx. 25 °C. In the heat recovery system, the return water from the distribution network is first preheated with the geothermal water by means of a heat exchanger from approx. 53 °C to 57 °C and then lifted to approx. 70 °C using an ammonia heat pump. The coefficient of performance of the heat pump is high and lays at about 6.3.

The second heat source for the base load supply is provided by the two gas-fired CHP plants. With their twenty cylinders each, they are probably among the largest of their kind in Switzerland. The electricity generated by the CHP plant is used to run the heat pumps. The surplus electricity is sold at the usual tariffs in the region of Basel. The heat generated during the combustion process is fully transferred to the district heating network. Additionally, since 2013, heat is extracted from the municipal district heating network of the city of Basel and fed into the Riehen heating network via a connection line. The distribution network is now meshed and extends over

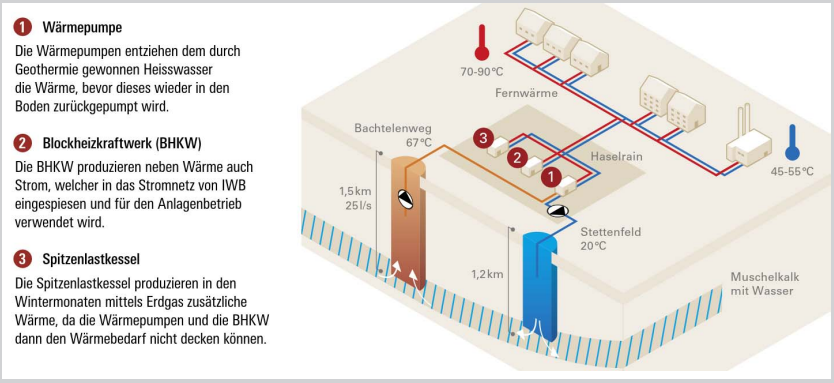

Fig 3: Overview of the geothermal plant with the heat pump (1), the CHP (2) and peak load gas burner (3) and distribution network.

a length of 37.3 km, supply flow between 70 and 90 °C and return flow between 47 and 55 °C.

In order to enable an optimized operation of the geothermal energy system as well as the combined heat and power plants, three heat storage tanks with 100 000 liters each are available to compensate the demand fluctuations in the heat network.

Over the past 28 years of operation, valuable experience and know-how in the operation of the geothermal plant has been gathered. The following is a selection of the most important conclusions and lessons learned:

- The heat network belongs to more than 50 % to the municipality of Riehen (not private) and the acceptance among the population and politicians is therefore very high.
- The thermal storage (300 m^3 in the base load central unit) is no longer adequate for the entire district heating network. A new decentralized storage could relieve the network.
- It is recommended to section the network with redundant heat generation and pumps.
- Leakage monitoring is recommended in order to identify construction defects after the construction work as well as a long term monitoring of the energy fluxes in order to optimize the operation of the network.
- The return flow temperature is important for the overall efficiency of the system. In order to achieve a good efficiency, all transfer stations must be individually controlled and optimized.

FACTS ABOUT THIS PROJECT

Building type: Residential buildings, office buildings, commercial buildings, educational & leisure institutions (school, museum, library, swimming pool,...)

Heated floor area [m^2]: 540 properties

Installed heat capacity [kW]: 42 360 kW (Only heat pumps 3 470 kW)

Heat source: Aquifer geothermal heat

Investment cost: 82 millions CHF (from 1988 - 2015)

Participating countries: Switzerland

Time frame: 1976-2017

Project organisation:

Project leader: Gruner Gruneko AG

Project partners:

- Municipality Riehen (Share holder 73 %)
- Industrielle Werke Basel (Share holder 27 %)

Link to web page or report:
http://www.erdwaermeriehen.ch/ (in German)

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IEA HPT

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