

COMPRESSION HEAT PUMP AT THE ÖKOENERGIEPARK BERGHEIM - AUSTRIA

Kompressionswärmepumpe beim Ökoenergiepark Bergheim



Fig 1: Picture of the Ökoenergiepark Bergheim [Salzburg AG]

Summary of the project

The district heating network in Bergheim (Austria) with a pipe length of about 10 km supplies up to 800 possible private households with heat at a flow temperature of at least 85 °C and a maximum volume flow rate of 150 m³/h (average of autumn 2017 is about 60 m³/h). Within this network at the Ökoenergiepark-Bergheim a solar thermal system (215 m²), two parallel compression heat pumps (1 MW), a biogas cogeneration plant (0.6 MW_{th}, 0.4 MW_{el}), a biomass heating plant (3 MW) and a natural gas heating plant (5 MW) for peak load are installed to supply heat for the district heating network.

The different heat generators operate depending on the heating demand of the district heating network and are activated according to the previously listed sequence. In consequence the biomass heating plant is only in operation during the winter months when the heating demand is higher than the heating capacity of the solar thermal system, the compression heat pumps and the biogas cogeneration plant. Furthermore, the solar yield of the solar thermal system is low in the winter months. This is a result of the location because the system is shaded by a mountain.

During a year the heat source of the heat pumps differs according to the activated heat generator. Hence, during

” TO MAXIMIZE THE OPERATING HOURS OF THE HEAT PUMP THE HEAT SOURCE IS SWITCHED BETWEEN FLUE GAS CONDENSATION IN THE WINTER MONTHS AND SOLAR THERMAL ENERGY IN THE SUMMER MONTHS ”

the winter months the heat source of the heat pumps is mainly heat from flue gas condensation in the biomass heating plant (with small amounts of waste heat due to the operation of the natural gas heating plant at peak load). During the summer months the heat source of the heat pumps is mainly heat from the solar thermal system.

The different heat sources are connected via a hydraulic circuit and a hydraulic separator to the evaporators of the heat pumps. The evaporators of the heat pumps are arranged in serial to ensure lower return temperatures to the heat source (55/25 °C inlet/outlet). This is an advantage to increase the solar yield of the solar thermal system and the amount of flue gas condensation. The produced heat of the heat pumps is fed into the return flow of the district heating network.



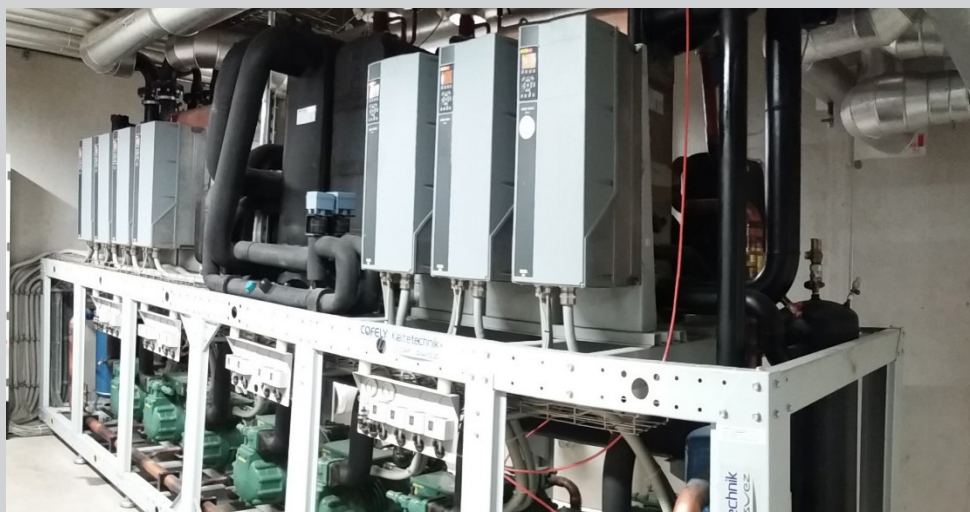


Fig 2: Cofely heat pumps Ökoenergiepark Bergheim [Salzburg AG]

For this the condensers of the heat pumps are connected in parallel to the return pipe. The minimum required volume flow rate to operate the heat pumps is 20 m³/h and the maximum possible volume flow rate is 140 m³/h.

Both compression heat pumps use R134a as refrigerant and were manufactured by the company Cofely (Engie). The high temperature heat pump uses 3 compressors (Bitzer 6FE-50Y-40P) and the low temperature heat pump uses 4 compressors (Bitzer 6GE-40Y-40P). The heat pumps reach an efficiency of about COP_H=5.25 and a heating capacity of about 1 MW at a heat source temperature of about 50/30 °C and a heat sink temperature of about 50/60 °C. The nominal volume flow rate through the condensers of the heat pumps is about 100 m³/h.

Results

- The heating demand during the summer months has to be increased through a higher number of customers.
- The minimum required volume flow rate of the heat pump is not available during the whole summer months.
- The heat pump is in operation the whole winter months.

References

Fink et al., 2016

Fink, C., Knabl, S., Wagner, W., Stelzer, R., Windholz, B., Helminger, F., 2016, Wissenschaftliche Begleitforschung zum Förderprogramm "Solarthermie – Solare Großanlagen 2011"

FACTS ABOUT THIS PROJECT

Building type: Residential and commercial buildings

Heated floor area: Up to 800 households

Installed heat capacity: 9.5 MW (1.1 MW heat pump)

Heat source: Flue gas condensation, solar thermal energy, waste heat of the natural gas heating plant

Investment cost: 9 100 000 EUR (all heat generators and the district heating grid)

Participating countries: Austria

Time frame: In operation since 2013

Project organisation: Salzburg AG

Link to web page or report:
http://www.solare-grossanlagen.at/files/pdf/Endbericht_Begleitforschung_Solare_Gro%C3%9Fanlagen_2011_compressed.pdf
 (in German)

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