GROUNDWATER BASED HEAT PUMPS AND SOLAR HEATING IN GL. RYE - DENMARK

Grundvandsbaserede varmepumper og solvarme i Gl. Rye

Fig 1: The project includes 2 400 m² of solar heating which helps to substitute natural gas-based district heating with renewable energy sources [Rye Kraftvarmeværk].

Summary of the project

Groundwater is found in many areas of Denmark and with constant temperatures around 8 – 9 °C, it is a potential heat source for several heat pump projects. In 2015, the natural gas-based district heating company in Gl. Rye established an electrically-powered heat pump which in combination with a thermal energy storage tank can integrate fluctuating energy sources, such as wind energy and solar power, in district heating. The project includes 2 400 m² of solar heating which helps to substitute natural gas-based district heating with renewable energy sources. Renewable energy contributes with approximately 80 % of the total energy produced at Rye Kraftvarmeværk. The consumers are additionally benefitted with district heating prices below the national average.

The heat pumps are oversized to use and optimize the flexibility of the storage tank. Hereby the heat pump can produce heat in hours with low electricity prices. In summer periods when the demand is low, heat is produced by solar heating. The heat pump can accordingly produce two thirds of the total heat demand. The natural gas-based units are accordingly only used in periods of high electricity prices. The operation is mainly based on the present heat demand, but can be modified using the combined flexibility of the units.

There are currently two groundwater wells. By adding a third groundwater well, the oversized heat pump can potentially increase the total share of renewable

" INTEGRATE FLUCTUATING ENERGY SOURCES SUCH AS WIND ENERGY AND SOLAR POWER IN DISTRICT HEATING "

Fig 2: The heat pumps are oversized to use and optimize the flexibility of the storage tank. Hereby the heat pump can produce heat in hours with low electricity prices. [Rye Kraftvarmeværk].

energy produced to 90 %. Rye Kraftvarmeværk is accordingly well-prepared and equipped to act in the future Danish energy system.

Results

- Decreased natural gas consumption by 80 %.
- Heat cost is averagely reduced by 23.6 % for each household.
- Energy is extracted from the groundwater and it is returned to the ground at 2 °C through a percolation plant.
- Extra water filtering and treatment needed due to ferrous groundwater, which stalled the project for half a year.
- The heat pump is mostly driven at night, when there is no solar heating and electricity prices often are low.
- Joint operation of the heat pump and the solar heating plant is weakened as solar heating can disturb the returning water to the heat pump.

FACTS ABOUT THIS PROJECT

Building type: -

Heated floor area [m²]: -

Installed heat capacity [kW]: 2 000 kW

District heating network: 368 consumers

Heat source: Groundwater

Investment cost: 10.2 million DKK

Participating countries: Denmark

Time frame: Finished in 2015

Link to web page or report:
http://ryekv.dk/ (in Danish)

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