

Cogeneration heating plant with geothermal water heat pump

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ABSTRACT:

In 2002 an unconventionally designed heat source with utilisation of geothermal water of 30° C temperature supplied from a well was put in operation in the town Děčín in the Czech Republic, as a replacement of the existing central heating system of the town supplied by heat from non-ecological local boiler houses.

The heat generation in the source is based on the co-operation of ammonia heat pumps, cogeneration gas engines and gas boilers. The main source of energy is the natural gas. In heat pumps the geothermal water from a well is cooled down from 30° C to 10° C and the heat of condensation is used for preheating the heating water of the heat source to 72° C. Geothermal water is then treated to drinking water and supplied to the town water supply system. The heating water is further after-heated in cogeneration gas engines to 80° C at the output of the heat source (during summer season). At the same time the gas engines cover the heat source home consumption of electric energy. The heat accumulation system forming also a part of the heat source provides for equalising the peak consumptions of heat supplies during summer and transition periods. During winter period the gas boilers join in the heat generation and the utilisation of heat accumulation stops working.

The heat source is designed as fully automated with possible operation without service. At the same time the heat source performs the function of heating plant control system for the connected heat transfer stations.

The heat output supplied to the heating system network during summer period represents 2.5 MWt at heating water temperature of 80/55° C and during winter period 39 MWt at heating water temperature of 110/65° C. The generated electric energy: summer period – max. 792 MWe and winter period – max. 2734 MWe. The shares of individual sources in the annual heat generation (project design value 360 TJ/year) amount to: boilers – 46%; engines – 16%; heat pumps – 38%.

The paper records the operation experiences, economic and environmental aspects. It is focused on the use of heat pumps in the heat source under directing the project design to provide for maximum heat pump heat generation during the whole year. The main contribution is represented by the decrease of natural gas consumption and environmental burden by emissions.

This heating plant combining utilisation of different heat source equipment under utilisation of geothermal water represents unique energy source in its heat output category in the Middle Europe.