

## WASTEWATER AS HEAT SOURCE IN KALUNDBORG - DENMARK

### Spildevand som varmekilde i Kalundborg



Fig 1: The heat pump unit is constructed of three 3.3 MW heat pumps and control of the heat output is done by switching the lines on and off [Kalundborg Forsyning].

#### Summary of the project

In 2017 operation of a 10 MW electric heat pump, using heat from wastewater to produce district heating, was initiated in Kalundborg. It is currently the largest heat pump facility in Denmark.

The heat pump has an important role in the city, as the nearby central power plant Asnæsværket, is set to convert from coal to biomass. Throughout the conversion period, the heat pump will supply the local district heating network with 30 % of the total heat production. Afterwards the heat pump is supposed to cover 10 % of the heat production and act as a peak- and reserve load.

The conversion of Asnæsværket is expected to be finished at the outset of 2019.

**” THE HEAT PUMP UTILIZE HEAT FROM THE NEARBY WASTEWATER TREATMENT PLANT, WHICH HAVE A WASTEWATER TEMPERATURE ABOVE AVERAGE, DUE TO THE LOCAL INDUSTRIES ”**

The heat pump utilize heat from the nearby wastewater treatment plant, which have wastewater temperatures above average, due to the local industries Novo Nordisk and Novozymes. The return water from the district heating network is heated from approximately 55 °C to 80 °C.



The heat pump is the final part of a setup, which utilize the wastewater three times:

- Firstly, it is used at Novozymes, where organic content is withdrawn from the wastewater and used for biogas production.
- Secondly, the wastewater treatment plant utilizes the temperatures between 20 °C and 35 °C to accelerate biological processes.
- Thirdly, the wastewater with a temperature between 20 °C and 25 °C is recovered in the heat pump. The wastewater is cooled approximately 10 °C in the heat pump.

The heat pump facility is set to replace two obsolete oil fired peak- and reserve load boilers of 5.1 MW and 8.7 MW from 1968 and 1975. By replacing natural gas from oil boilers, the heat pump contributes with energy and CO<sub>2</sub>-savings, benefitting both consumers and the environment. The heat pump unit is constructed of three 3.3 MW heat pumps and control of the heat output is done by switching the lines on and off.

The project was benefitted by the district heating company and the wastewater treatment company being a part of the same municipal utility company, Kalundborg Forsyning. The organizational structure of this was an advantage and the project was erected in just six months.

## Results

- The COP have been increased from 3.6 to approximately 4.0 by improving operation of heat pump compressors.
- The heat pump can supply the district heating network with a temperature of 86 °C, however, so far, it has typically been around 79 °C.
- Wastewater filters is automatically purified, but congested in heavy rain. During 2 000 hours of operation the three filters have each been cleaned 8 000 times.
- The first two years of operation, the heat pumps will have approximately 8 000 operation hours, due to the biomass conversion of Asnæsværket. Afterwards, the heat pump is expected to have 900 operation hours annually.
- The heat pump unit is expected to save Kalundborg Forsyning 250 000 DKK weekly until Asnæsværket is converted to biomass.

## FACTS ABOUT THIS PROJECT

Building type: -

Heated floor area [m<sup>2</sup>]: -

Installed heat capacity [kW]: 10 000 kW

District heating network: 5 010 consumers

Heat source: Wastewater

Investment cost: 54 million DKK

Participating countries: Denmark

Time frame: Finished in 2017

Link to web page or report:

<https://www.kalfor.dk/> (in Danish)

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