Excess heat from hospital chillers in Viborg, Denmark

This case study is part of a project catalogue produced by ReUseHeat to provide inspiration on how to utilize excess heat from urban sources for heating and cooling purposes. The catalogue contains 25 existing or planned projects out of which 12 cases are Danish and 13 cases are from other European countries[2].

Facts about this case

Installed heat capacity: 2.5 MW
Heat source: Excess heat from chillers (43 °C)
Heat pump COP: 7.9
Production: 4700 MWh per year (the majority is in the three hottest months)
Investment cost: € 1.0 M

Period: Project begun in 2017
Link to web page:
http://www.viborg-fjernvarme.dk/

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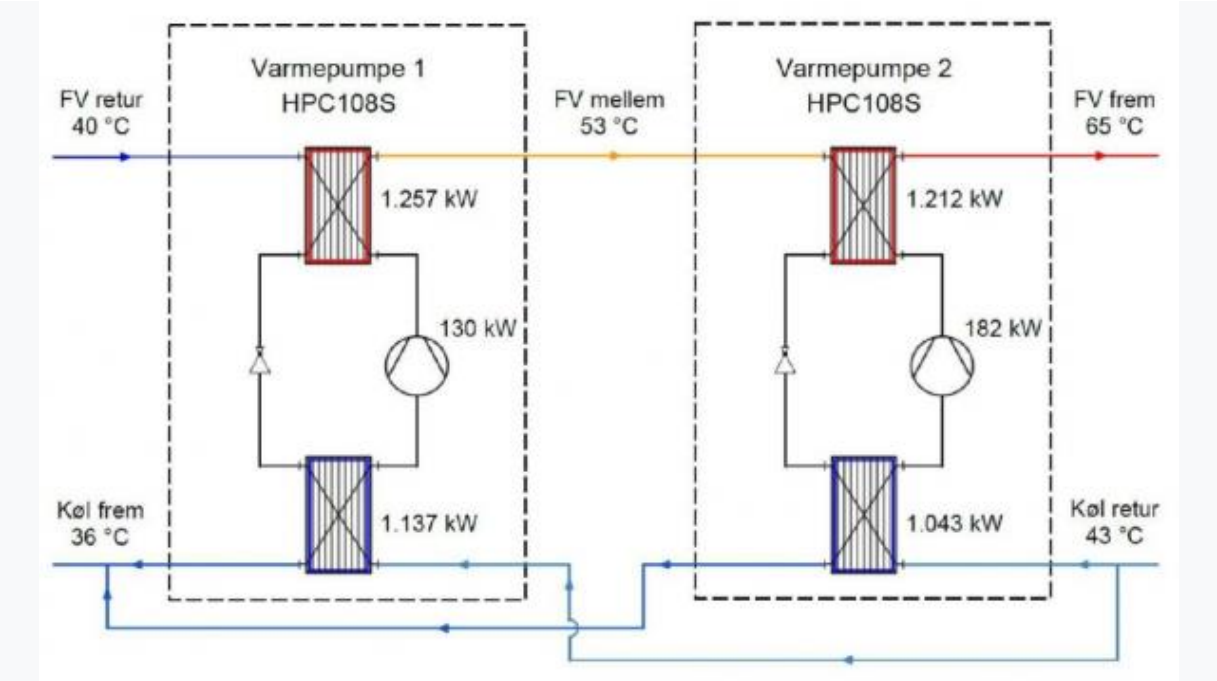

Source: PlanEnergi/Viborg Fjernvarme[1]

Description

A heat pump solution at the Regional hospital in Viborg is planned to utilize excess heat from chillers and distribute it to the local district heating network. Hereby great amounts of unused energy can be harvested from the hospital dry-chillers.

The project comprises a new heating distribution system for the Regional hospital in Viborg, where excess heat from the dry-cooling process is enhanced through heat pumps to deliver district heating to the local district heating company Viborg Fjernvarme. Hereby the existing steam boilers can be decommissioned.

The cooling needs of the hospital is not only fluctuating on annual basis, but also with hour-to-hour variations within a single day. It is possible to reuse some of this unused heating internally at the hospital in Viborg and there is no delivery of excess heat during winter. The excess heat is accordingly available from April until start November. The heating potential is annually 4700MWh of which the majority is in the three hottest months, June, July and August. During daytime, the excess heating capacity reach approximately 3MW while it drops to, or close to, zero during night. Hereby the operation hours will be limited to specific periods of the year. There are however no problems with heat allocation, as the heat demand in Viborg is sufficient during summer.

The cooling water is 43 degrees Celsius when it reaches the heat pumps and is 36 degrees Celsius when it returns to the cooling unit. With district heating temperatures increasing from 40 to 65 degrees Celsius, the COP is very high. At the given temperatures and operation conditions, the cooling capacity of one heat pump is approximately 1MW. Calculations on the optimal heat pump system show, that two heat pumps can utilize 87% of the total excess heat. Hereby a COP of 7.9 is reached. The two heat pumps accordingly reach a high utilization ratio and a low electricity consumption. The total cooling capacity of the system is approximately 2MW, while the heating capacity is approximately 2.5MW. The heat pumps can cover the main cooling needs during summer. The existing dry-cooling system is however still needed to supply cooling peaks. The two heat pumps are serially connected to the district heating grid, increasing the temperature in two stages from 40 to 53 degrees Celsius and from 53 to 65 degrees Celsius.

The total investment costs are expected to be approximately e 1.0 M, of which e 537,000 are the heat pump facility. Other costs include buildings, district heating connections and electricity connections. The total heat cost is expected to be e 28 per MWh of heat, which is a low cost compared to other heating production units. Of this the majority is capital investment costs and expenses for electricity consumption.[2]

References

1. PlanEnergi/Viborg Fjernvarme
2. Handbook - 25 cases of urban waste heat recovery