Absorption heat pump for using waste heat in district heating

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Heat pumps play critical role in decarbonizing district heating networks by replacing or decreasing the use of fossil fuels. Absorption heat pumps can be more efficient than electrical heat pumps in certain conditions.

In colder European regions, district heating is a vital service and it should be affordable and green at the same time. On its way to 4th generation district heating, waste heat use and heat pumps are important for district heating production. Helping to reduce electricity demand in the process to achieve environmental goals, absorption heat pump can be one possible solution.
One waste heat source for heat pumps can be district cooling base load. Integrating heat pumps into district energy production plants to use this waste heat is a solution colder European regions need, because it can add renewable heat into network.

Introduction

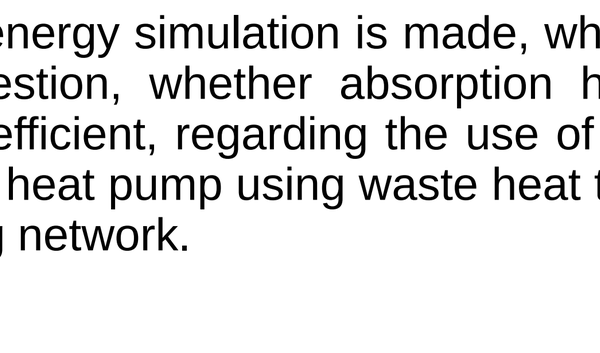
In the current research utilization of waste heat from district cooling with different types of heat pumps, i.e. absorption heat pumps and electrical heat pumps, is compared.

This study is about using low temperature waste heat as a possible driving heat for absorption heat pump to produce heat for district heating network.

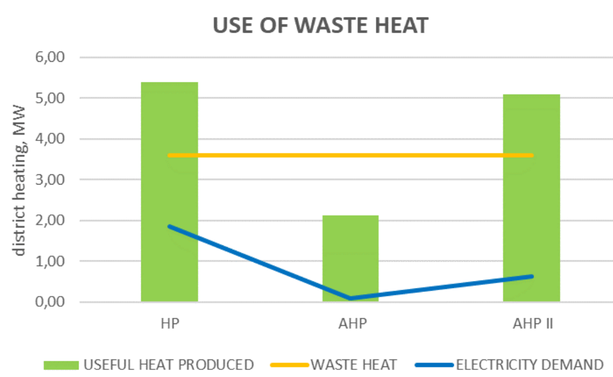
In this paper energy simulation is made, which should answer a question, whether absorption heat pump can be more efficient, regarding the use of electricity, than electrical heat pump using waste heat to produce district heating network.

Methods

District cooling and heating network data from 2023 in Tallinn was analysed to determine waste heat capacity and need for heat.
Energy simulation model was done in excel to compare different solutions and operating points using different types of heat pumps.
Chosen scenarios were compared using performance indicators: technical and economical.

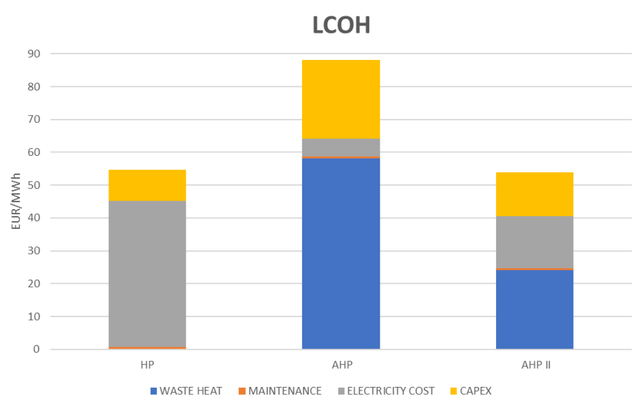


Results



Results show that absorption heat pump can produce 5,1 MW of useful heat from 3,6 MW of waste in cascade connection. Compared with base scenario 5,4 MW using conventional electrical heat pumps, it is about 6% less, but absorption heat pump needs 66% less electricity.

Conclusion



Analysis shows that levelized cost of heat would be the smallest when using absorption heat pump in cascade with smaller electrical heat pump. Waste heat price has big impact on the price of heat.
Waste heat sources with temperatures around 50°C can be used as driving heat in absorption heat pump and produce heat with a competitive price.