

Heat Recovery from District Heating Networks using Large Heat Pumps

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INTRODUCTION

A district heating network is an effective way to distribute heat to end consumers. It is a well-proven technology delivering 60% of the heating needs in Denmark from more than 400 district heating plants. However, there is big room for improvement in their efficiencies. Almost 40% of the energy produced in these plants is lost in the piping network and thus not sold. One of the major causes is the high temperature of the water in the Return Flow (RF), normally around 40°C, containing large amounts of energy unused.

THE IDEA

Use large heat pumps to recover unused heat from the return water flow and increase the overall efficiency of district heating networks.

METHODS

The district heating network of the *Svebølle Viskinge Fjernvarmeselskab* has been studied to check the idea. The current network is supplied by a biomass boiler combined with a 10.000 m² solar thermal installation and heat accumulation tanks, a similar configuration to many other plants in Denmark. Two large ammonia-based heat pumps connected to the return water flow are considered. They will supply two different areas accounting for around 35% of the network. The economic and environmental benefits have been analyzed.

RESULTS

Using large heat pumps to absorb heat accumulated in the RF, recovers unused heat by reducing the temperature of the RF. This brings many benefits to the district heating company, both economic and environmental. Specifically:

- 40% of the heat lost recovered
- 1.5 million kilograms of CO₂ emissions reduced per year
- 1.2 million DKK earned by selling energy savings to other companies
- 190 DKK/MWh heat production price (lower than 210 DKK/MWh from biomass)
- 15% efficiency increase in the condensing scrubber
- 3% efficiency increase in the solar thermal plant

CONCLUSIONS

Heat pumps connected to the RF can improve the efficiency of district heating networks by recovering heat at a very competitive price. Using this configuration, heat pumps can help to meet both the energy-saving targets for district heating companies and the ambitious CO₂-reduction goals in Denmark. Moreover, heat pumps are the only feasible way to blend the heat and electricity networks into Smart Grids. This simple solution can bring us one step closer to Low Temperature District Heating and a more sustainable future, helping to transform renewable electrical power into heat.