COMBINED DISTRICT HEATING AND COOLING – WHICH SOLUTIONS ARE AVAILABLE AND ARE THEY APPLICABLE IN A DANISH CONTEXT?

Funded by the European Union’s Horizon 2020 Research and Innovation Programme under Grant Agreement no. 846463
New built area in Køge Nord

Illustrations from and based on masterplan by COBE [COBE - Køge Nord Masterplanrevision – 2019]
Boundary conditions

- Surplus heat at around 15 °C
- Surplus heat from datacentre at around 30-35 °C
- Close by existing district heating network (area planned for district heating supply)
- Drinking water sensitive area → no ATES or BTES
Cooling vs. Heating demand
PRELIMINARY

Annual energy demands in kWh/m² per year

<table>
<thead>
<tr>
<th></th>
<th>Space Heating</th>
<th>Domestic hot water housing</th>
<th>Domestic hot water offices</th>
<th>Cooling dwellings low</th>
<th>Cooling dwellings high</th>
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<tbody>
<tr>
<td></td>
<td>28.5</td>
<td>16.3</td>
<td>5</td>
<td>4.9</td>
<td>14.1</td>
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Scenario 1

Heating direct – cooling through central chiller (Existing district heating as source)

+ Simple direct heat supply
+ Optimized cooling network

÷ Electricity consumption in heat pump
÷ Too much surplus heat & no long term storage
**Scenario 2**

**Cooling direct – heating through central heat pump** (Surplus heat at 15 °C as source)

+ Make use of surplus heat source
+ Reduced heat loss from network

÷ Dependent on surplus heat temperature \(\rightarrow\) need for central chiller to provide cooling?
÷ Too much surplus heat & no ATES or BTES
÷ Small deltaT in network?

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**SUBSTATION**

<table>
<thead>
<tr>
<th>COLD</th>
<th>DHW</th>
<th>SH</th>
<th>WARM 15°C</th>
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</table>

**CLUSTER STATION**

<table>
<thead>
<tr>
<th>COLD 10°C</th>
<th>SUPPLY 55°C</th>
<th>RETURN 30°C</th>
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Scenario 3

Cooling through central chiller – heating through heat pump (Surplus heat at 35°C as source)

+ Make use of surplus heat source
+ Reduced heat loss from network
÷ Need for heat pump for heating and air conditioner for cooling (double equipment)
÷ Small delta T between sink and source can be difficult?
Surplus heat from cooling vs. Heat demand

PRELIMINARY

Estimated value of heat for 5 summer months during 20 years at a price of 20 €/MWh correspond to:

~ 250 €/dwelling
~ 50 €/m pipe

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Summary

- Available heat sources and boundary conditions are definable for the possible scenarios

- Cooling as a separate service – not only a source of surplus heat (is this reasonable?)

- ATES or BTES can have a central function for combined heating and cooling

MORE RESULTS LATER THIS YEAR AT WWW.KOHESYS.DK