Bottlenecks in district heating networks and how to eliminate them
Bottlenecks?

- Pipes with too small dimensions to sufficiently meet consumer needs
- With lower $\Delta T$ of 4GDH (40-20°C instead of 80-40°C) comes higher flows in existing areas
- With less bottlenecks it will be easier to lower the supply temperature
Aim

• To investigate different bottleneck solutions and see when they work and how much they cost
Method

• Simulations of a fictive bottleneck area
  – 10 MW at dimensioning outdoor temperature
  – Highest dp of 600 kPa and lowest of 0 kPa before any measures were taken
  – Aim: 100 kPa

• Economical estimation of cost of measures
  – Input data from district heating companies/experts for each measure
  – Net present value calculated on 20 years operation time of the measure and with service and maintenance and operational costs included
  – The measure was assumed to be needed 1 week, 1 month or 6 months per year
The DH case area
Simulation scenarios

• Scenario A - Original
• Scenario B - Heat sparse
• Scenario C - Larger altitude differences
• Scenario D - Ring structure
The DH case area
Bottleneck measures

- More pumping
- Bigger pipe
- Higher supply temperature
- Better cooling in the substations
- Local heat supply
- Demand side management (DSM)
Result simulations

- More extensive measures was needed in heat sparse areas and areas with a ring structure
- The outcome of pumping was harder to predict in areas with ring structure
- In areas with larger altitude differences, it is important to evaluate the pressure increase and/or decrease
- Better cooling in the substation was needed at 5-50 consumers, depending on scenario
- DSM was needed at 4-8 consumers, depending on scenario
Results economy

• Prosumers was always the cheapest alternative
• More pumping with existing pumps was also a cheap alternative if the district heating network was fairly small
• One of the most expensive solutions was to increase the supply temperature in a big network
• Important: no economic benefits from the measures have been included in the study
## Example list economy (Scenario A - original)

<table>
<thead>
<tr>
<th>More expensive</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prosumers</strong></td>
</tr>
<tr>
<td>Existing pump small network</td>
</tr>
<tr>
<td>DSM</td>
</tr>
<tr>
<td>Increased supply temperature small network</td>
</tr>
<tr>
<td>Existing pump big network</td>
</tr>
<tr>
<td>Extra small pipe</td>
</tr>
<tr>
<td>Peak heat boiler</td>
</tr>
<tr>
<td>Better cooling in substations</td>
</tr>
<tr>
<td>Heat pump</td>
</tr>
<tr>
<td>Exchange pipe into a bigger one</td>
</tr>
<tr>
<td>New pump in the small network</td>
</tr>
<tr>
<td>Increased supply temperature big network</td>
</tr>
</tbody>
</table>
Conclusions

• The simulations show that different measures are not equally suitable for all the network configurations

• The economic result depends on a lot of different parameters that varies in different networks
Thank you!