Stockholm – a new generation of energy networks

Birgitta Resvik, Vice President Corporate Relations Sweden, Fortum Corporation
We develop the future district heating together with our customers
Together with our customers we take care of energy, which otherwise would be wasted
We are creating a totally new market to recover surplus heat in Stockholm
Open District Heat network has many winners
The total surplus heat in Stockholm is estimated to 1 TWh – corresponds to 12% of the district heating volume in Stockholm. It can be compared to all heat and hot tap water used in a city with 130 000 inhabitants in a year.
The surplus heat from data centers in Stockholm is 500 GWh – corresponds to heat and hot tap water for 57,000 flats.
District heating and cooling production sites in Stockholm with surroundings
Our geographical presence today

<table>
<thead>
<tr>
<th>Region</th>
<th>Power generation (TWh)</th>
<th>Heat sales (TWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nordic countries</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power generation</td>
<td>46.5</td>
<td>13.9</td>
</tr>
<tr>
<td>Heat sales</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distribution customers</td>
<td>1.6 million</td>
<td></td>
</tr>
<tr>
<td>Electricity customers</td>
<td>1.2 million</td>
<td></td>
</tr>
<tr>
<td><strong>Russia</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power generation</td>
<td>20.0</td>
<td>24.2</td>
</tr>
<tr>
<td>Heat sales</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Great Britain</strong></td>
<td>1.0</td>
<td>1.8</td>
</tr>
<tr>
<td><strong>Poland</strong></td>
<td>0.6</td>
<td>4.0</td>
</tr>
<tr>
<td><strong>Baltic countries</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power generation</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Heat sales</td>
<td></td>
<td>1.1</td>
</tr>
</tbody>
</table>

**Key figures 2013**
- Sales: EUR 6.1 bn
- Operating profit: EUR 1.7 bn
- Balance sheet: EUR 24 bn
- Personnel: 9,900

**OAO Fortum**
- Power generation: 20.0 TWh
- Heat sales: 24.2 TWh
- TGC-1 (~25%)
- Power generation: ~7 TWh
- Heat sales: ~8 TWh

Listed at the Helsinki Stock Exchange since 1998
More than 130,000 shareholders
Market cap ~14 billion euros
Fortum's European power generation based on hydro and nuclear power – wide flexibility in heat production

Fortum's European power generation in 2013

- Nuclear power: 48%
- Hydro power: 37%
- Other: 2%
- Natural gas: 3%
- Biomass: 3%
- Coal: 7%

European generation 48.7 TWh
(Generation capacity 10,873 MW)

Fortum's European heat production in 2013

- Biomass: 28%
- Oil: 1%
- Peat: 2%
- Waste: 12%
- Natural gas: 19%
- Heat pumps, electricity: 16%
- Coal: 22%

European production 18.6 TWh
(Production capacity 8,193 MW)
Good examples
The ICT company Bahnhof with its site Pionen

- The data servers are chilled by cooling machines, which produce surplus of heat which is vented away.
- Not possible to have district cooling to the building
- The company Bahnhof installs a heat pump to produce cooling and the surplus heat is delivered into the district heating network.
Grocery Stores - Coop Konsum Rådhuset

- Excess heat from the refrigerators and freezers in the store,
- Both district heating and cooling networks are connected in the building,
- The cooling machines in the form of CO2-plant is producing high temperature - is delevered on the heating network - and it is at the same time chilled by district cooling – giving residual heat – which totally increases the efficiency.
From idea to reality
From idea to reality

Background;
• political debate about third party access,
• tough competition with alternatives,
• need to optimise the investments,
• getting closer customer relations
Inauguration of pilot in Open District Heat Network - March 2013
Open District Heat Network in the media

Techworld nr 10 2012

Hallå där...
Per Gullbrand, chef för produktledning på Fortum

VÄRME FRÅN DATABALLAR NOG FÖR EN HEL KOMMUN

Energi & Miljö 130822

Mitt i 130910
Time schedule of Open District Heat Network

- February 2012: project started
- March 2013: inauguration of first pilot
- Autumn 2013: tens of pilots in operation
- 2013: develop the technical solutions and the economical models together with the pilots,
- 2014: The launch to the total market
The business models in Open District Heat Network
The offer and the basis for the business

- Participation in the development of a new market for heating and cooling,
- A market compensation for delivered surplus of energy,
- The trading gives mutual benefits,
- The businesses will contribute to more sustainable energy use,
- Knowledge and experience will be shared
Business models (pilot project)

Three offers

• Open spot market price on heating ("first-rate heating"):  
  Purchase price depends on outdoor temperature as "first-rate" district heating is delivered on feed lines. The supplier has an option on delivering and gets paid by delivery at the current price.

• Open returned heating price ("second-rate heating"):  
  Purchase price depends on outdoor temperature as "second-rate" district heating is delivered on return lines. The supplier has an option on delivering and gets paid by delivery at the current price.

• Open residual heating price ("residual heating"):  
  Purchase price depends on delivery temperature during December-March when "residual heat" is delivered on district cooling return lines. The supplier has an option on delivering and gets paid by delivery at the current price.
We buy excess heat at market value

http://advantage-environment.com/video/open-district-heating/
We publish the price a day ahead – exemple of prices in pilot

- Prima värme som levereras på fjärrvärme framledning
- Energipris SEK/MWh sätts av Fortum senast kl 11.00 dagen före leverans baserat på Meteos prognos för Stockholm

<table>
<thead>
<tr>
<th>Utetemp (°C)</th>
<th>-13</th>
<th>-12</th>
<th>-8</th>
<th>-7</th>
<th>-6</th>
<th>-5</th>
<th>-4</th>
<th>-3</th>
<th>-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEK/MWh</td>
<td>855</td>
<td>837</td>
<td>775</td>
<td>768</td>
<td>748</td>
<td>702</td>
<td>691</td>
<td>683</td>
<td>637</td>
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<tr>
<td>Utetemp (°C)</td>
<td>-1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
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<tr>
<td>SEK/MWh</td>
<td>623</td>
<td>579</td>
<td>484</td>
<td>403</td>
<td>346</td>
<td>299</td>
<td>249</td>
<td>243</td>
<td>214</td>
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<tr>
<td>Utetemp (°C)</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
<td>21</td>
<td>21+</td>
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<tr>
<td>SEK/MWh</td>
<td>206</td>
<td>192</td>
<td>173</td>
<td>158</td>
<td>138</td>
<td>131</td>
<td>115</td>
<td>83</td>
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</tr>
</tbody>
</table>
The Open District Heat network is one part of the development of the system approach in Stockholm.

Biokraftvärmeverk
1.8 million ton flis per år från Norden, Baltikum, och Ryssland varav 90% med tåg och båt – sparar 20 000 ton koldioxid per år.

Rökgaskondensering
710 GWh utvinns i Brista, Högdalen och Värtaverket – motsvarar 10% av värmeproduktionen eller uppvärmning av 81 000 lägenheter.

Öppen fjärrvärme
1 TWh överskottsvärme kan tas tillvara i Stockholm – motsvarar värme för Norrköpings 133 000 invånare under ett år.

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Värmetävling
Sänker bostadsföreningars energiförbrukning med 17 Gwh – motsvarar uppvärmningen av 1 950 lägenheter.

Fjärrkyla
156 GWh från fjärrkylanätet ger 220 GWh fjärrvärme – motsvarar uppvärmningen av 25 000 lägenheter.
Thanks!