District Energy in the City of Gothenburg

-the evolution of the District Heating network since 1952.

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Regulation and practice: issues, solutions, opportunities

Gothenburg
Sustainable city – open to the world
Gothenburg

- Founded in 1621
- 500,000 inhabitants
- 65,000 students
- District heating was initiated in 1950’s
- Planning ahead
  - ✓ By 2050 the city will have a sustainable and fair level of carbon dioxide emissions*
  - ✓ Policy: a holistic view and to make the best of resources already available

*The level is today interpreted to 1.9 tonnes of carbon dioxide equivalents per inhabitant and year.
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### World CO₂ emissions:

<table>
<thead>
<tr>
<th>Region</th>
<th>CO₂/pop (t CO₂/capita)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>0.96</td>
</tr>
<tr>
<td>Asia</td>
<td>1.58</td>
</tr>
<tr>
<td>Non-OECD Americas</td>
<td>2.44</td>
</tr>
<tr>
<td>World</td>
<td>4.47</td>
</tr>
<tr>
<td>China</td>
<td>6.66</td>
</tr>
<tr>
<td>Non-OECD Europe and Eurasia</td>
<td>7.14</td>
</tr>
<tr>
<td>Middle East</td>
<td>7.72</td>
</tr>
<tr>
<td>OECD</td>
<td>9.36</td>
</tr>
<tr>
<td>Curaçao</td>
<td>30.43</td>
</tr>
<tr>
<td>Kuwait</td>
<td>22.94</td>
</tr>
<tr>
<td>Bahrain</td>
<td>21.8</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>19.31</td>
</tr>
<tr>
<td>Trinidad and Tobago</td>
<td>17.15</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>16.57</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>16.4</td>
</tr>
<tr>
<td>Gibraltar</td>
<td>16.25</td>
</tr>
</tbody>
</table>

Source: IEA
A growing city

From large town – to green city where nothing’s far

- Vision Älvstaden
- Traffic Strategy
- Green Strategy
- Expansion Planning

Jointly indicate the direction in which Gothenburg will develop by 2035

+150,000 residents more than today!
The History of district heating in Gothenburg

1951  Decision to build CHP plants at Rosenlund and Sävenäs (coal).

1952  Deliveries of district heating starts from Sävenäs to the newbuilt suburb of Kortedala (9 000 apartments).

• 1955  Deliveries of district heating starts from Rosenlund to the center of town.
The History of district heating in Gothenburg

- 1972  Deliveries from the regions waste incineration plant starts.

- 1973  The oil crisis slows down the expansion.

- 1980  Deliveries of waste heat from the St1/Shell refinery.

1983  The municipalities heat supply plan is decided.
The History of district heating in Gothenburg

1983  Cooperation with the municipal of Mölndal.
1985  New coal hot water boiler at Sävneäs (HP3).
1988  Natural gas through pipeline reach Gothenburg
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The History of district heating in Gothenburg

- 1995 District heating to the municipal of Partille.
- 1997 Deliveries of waste heat from the Preem refinery.
- 2000 District heating to the municipal of Ale.

2004 Sävenäs HP3 converted to wood chips.

2006 The Rya CHP.

2007 Sörred Energi (Volvo) is bought by Göteborg Energi
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Key Figures District Heating in Gothenburg:

- **DH Production**: 3500 – 4000 GWh/year
- **Electricity Production**: 300 – 1200 GWh/year
- **Connected DH Substations**: Approx. 20 000
- **Production Capacity**: 1 800 MW
- **System Length**: 1400 kilometers
- **Volume Water**: 80 000 m³
- **Height Difference**: 280 m

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Key Figures District Heating in Gothenburg:

✓ + 90 % of the apartments are heated with District Heating

✓ ~ 20 % of the small houses are heated with District Heating
DH History in Sweden

Sweden introduced district in the late 1940s and since then is has been continuous extension. District heating is today the dominant form of heating in the central town of more than 240 of the 290 municipalities.

In 2012, DH distributed over 53 TWh of district heating.

Of this amount around,

- 60 percent for all home heating
- 30 percent for heating service sector premises
- 10 per cent of heat demand within industry.
- Present in every community with more than 10 000 inhabitants
- Still growing
- Turnover 2 billion Euro
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DH History in Sweden

District Heating 1955-2012, GWh

Very Cold 2010

District Heating 1955-2012, GWh

Fjärrvärme
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How success was supported

Political support at national level
- Taxes (CO2 = super powerful)
- investment grants
- environmental requirements

Political support at local level
- municipal affairs
- municipal real estate company or administrations = early adopters
- Building Law Requirements
- Development before economy

Limited competition for the options
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Lessons learnt:

In wake of the deregulation of the electricity market (1996):

- Municipalities sold their energy companies (risk averse)
- Got a lot of cash
- New investors wants ROI
- Prices go up
- Customers unhappy
- Debate and national inquiries; “Third Party Access”
- The DH industry are struggling with regaining trust
- The “Price Dialogue” is introduced
“Price Dialogue”:

Cooperation between the suppliers and the customers.

As a provider, you should:
- maintain an open dialogue with your customers about price changes
- give your customers insight into your pricing and future price changes
- give the customer a long term stability to the price changes, so that the customer gets a predictable price for district heating

A yearly process.
“Price Dialogue”:

Price Change in 2017 and forecasts until 2021

As agreed in the operational group 18/4 2016

<table>
<thead>
<tr>
<th>ÅR</th>
<th>Prisändringar</th>
<th>Prisändringsintervall</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>Prisändring</td>
<td>-0,50%</td>
</tr>
<tr>
<td>2018</td>
<td>Prognos år 2</td>
<td>+/- 1%</td>
</tr>
<tr>
<td>2019</td>
<td>Prognos år 3</td>
<td>+0-2%</td>
</tr>
<tr>
<td>2020</td>
<td>Prisindikation år 4</td>
<td>+0-2%</td>
</tr>
<tr>
<td>2021</td>
<td>Prisindikation år 5</td>
<td>+1-3%</td>
</tr>
</tbody>
</table>

2017: Climate measures:

A combination of measures, but primarily it is to replace a portion of the natural gas with biogas and prioritize bio-heat with pellets compared to the CHP with natural gas.

Estimated cost 70 million SEK (~ 8 million US$)
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What can we expect from the future?

- Political support at national level will decrease
- Political support at local level will decrease
- The customers will buy less, due to efficiency measures
- Competition from heat pumps will increase
- Environmental KPI’s, not always favorable for District Energy.
- Confidence at our customers – where will that go?
- The future costs of fuels?
- The need to reinvest in old networks
- Low interest rate – for how long?
European perspective:

The Energy Efficiency Directive (EED) from 2012 is considered to be a breakthrough for district heating at EU level. The first time as district heating is referred to as technology for energy efficiency.

but, implemented very differently in the member states: example Sweden: we measure energy efficiency in the proportion of purchased energy, which creates incentives for producing heat in the building, for example through an electric heat pump.
European perspective:

Heating and cooling in our buildings and industry accounts for half of the EU’s energy consumption.

In February 2016, the Commission proposed an EU heating and cooling strategy.
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European perspective:

**EU Energy Security Strategy**

The EU imports 53% of the energy it consumes, costing more than 1 billion € per day.

For each energy source, the EU imports:
- 42% of solid fuel
- 66% of gas
- 88% of oil

It imports from Russia:
- 39% of total imported gas
- 33% of total imported oil

#EnergySecurity

Energy security of supply concerns every Member State.
European perspective:

There is enough waste heat produced in the EU to heat its entire building stock...

...there is just no distribution network available to transport it from where it is produced to where it is needed and can be used.
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Upcoming event!

Stay tuned for more updates!

District Heating and Cooling Conference
Gothenburg, November, 2017
Thank you!

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