DEMONSTRATION OF 4GDH SOLUTIONS IN A LARGE CITY DEVELOPMENT AREA

INTERNATIONAL CONFERENCE ON SMART ENERGY SYSTEMS AND 4TH GENERATION DISTRICT HEATING
TRACK 7: SMART ENERGY SYSTEMS

Copenhagen

25 August 2015
BEING SMART?
- PERSPECTIVE OF A DISTRICT HEATING COMPANY

- Smart energy
- Smart electricity
- Smart district heating
- Smart city

... or just being clever
# Deliver Flexibility to the Electricity System

<table>
<thead>
<tr>
<th>LARGE ENERGY STORES</th>
<th>Storage capacity (GWh)</th>
<th>Cost (kr/kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas store, methane</td>
<td>11000</td>
<td>1</td>
</tr>
<tr>
<td>Gas store, hydrogen</td>
<td>3500</td>
<td></td>
</tr>
<tr>
<td>District heating system</td>
<td>300 - 500</td>
<td>3 - 7</td>
</tr>
<tr>
<td>Heat pumps outside gas and district heating networks</td>
<td>10 - 30</td>
<td></td>
</tr>
<tr>
<td>1.5 million electric cars</td>
<td>30 - 50</td>
<td>300 - 500</td>
</tr>
</tbody>
</table>
How may a district heating company provide flexibility to the electricity system

• Utilize the heat capacity in heat stores, pipelines, and buildings to receive ‘surplus’ electricity; e.g. by means of electric boilers and heat pumps.
• Utilize the heat capacity to accept lower heat production, allowing lower electricity production.
• If it owns cogeneration facilities, heat and/or electricity production may be increased beyond scheduled production.
• If it owns cogeneration facilities, heat production may be by-passed to produce extra electric power.
SMART OPERATION OF HEAT PUMPS
- A SIMPLE EXAMPLE

1 MJ/s heat pump operated full load (24 hours per day)

replaced by a

2 MJ/s heat pump operated the cheapest 12 hours every day
FEASIBILITY OF SMART HEAT PUMP

Average spot market electricity prices (DKK/MWh), January 2014:

- Average prices 24 hours per day:
  - Full-day: 32 €/MWh
  - 12-hours: 28 €/MWh
  - Saving: 13 %

- Average buying price:
  - Full-day: 144 €/MWh
  - 12-hours: 140 €/MWh
  - Saving: 3 %

<table>
<thead>
<tr>
<th>Electricity tariff</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Spot market</td>
<td>32</td>
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<tr>
<td>Duties and taxes</td>
<td>112</td>
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<tr>
<td>Total price</td>
<td>144</td>
</tr>
</tbody>
</table>

2 MJ/s heat pump
Extra investment 530,000 €. Extra O&M 2,700 €/year.
Electricity saving 12,500 €/year -> Simple pay-back 54 years
In a smart energy system, the major price elements should have a dynamic component.
SMART DISTRICT HEATING

Heat storage not only for the sake of the electricity system

Key objective is to reduce expensive peak-load heat generation
EFFICIENT ENERGY MANAGEMENT OF BUILDINGS

- Data from smart meters, consumption budgets and degree days based reporting ensures the right knowledge and focus.
- Simple and correct follow-up & know-how
- Training of operational staff is essential
DISTRICT HEATING IS ALREADY SMART

... or just clever?
Nordhavn
Former free-port
Future:
40,000 living
40,000 working
40 years

EnergyLab Nordhavn
RD&D Project
2015 – 2019

Budget 17 million €
Public funding: 10 million €
EnergyLab Nordhavn
New Urban Energy Infrastructures
www.energylabnordhavn.dk
Thank you for your attention

Nordhavn: A Smart City

JØRGEN BOLDT
JOB@HOFOR.DK
+45 – 2795 2732