DHC Challenge
“The first DHN in the city of Genk”
Summary

- Current situation
- Goals
- Concept
  - Planning of the DHN
  - Design of the DHN
  - Other measures
- Conclusions
Overview of Genk and the city nearby

Heat demand density

*http://www.heatroadmap.eu/maps.php
**googlemaps
Overview of Genk and the city nearby

Heat demand density of Hasselt

Heat demand density of Genk

*http://www.heatroadmap.eu/maps.php
Current energy mix for the city of Genk

<table>
<thead>
<tr>
<th>Energy source</th>
<th>%*</th>
<th>Heat demand Genk (TJ)</th>
<th>Heat demand Hesselt (TJ)</th>
<th>EUR (x10^6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural gas</td>
<td>61</td>
<td>405</td>
<td>412</td>
<td>12,13</td>
</tr>
<tr>
<td>Fuel oil</td>
<td>27</td>
<td>179</td>
<td>183</td>
<td>9,05</td>
</tr>
<tr>
<td>Electricity from the net</td>
<td>8</td>
<td>53</td>
<td>54</td>
<td>8,19</td>
</tr>
<tr>
<td>Wood</td>
<td>2</td>
<td>13</td>
<td>14</td>
<td>0,21</td>
</tr>
<tr>
<td>Coal</td>
<td>1</td>
<td>7</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Gas from tank</td>
<td>1</td>
<td>7</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>664</td>
<td>676</td>
<td>29,57</td>
</tr>
</tbody>
</table>

*Main heating source - Flemish region, 2010
**Eurostat

![Current energy mix for the cities of Genk and Hesselt](chart.png)

<table>
<thead>
<tr>
<th>Energy source</th>
<th>(EUR/KWh)**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural gas</td>
<td>0,0534</td>
</tr>
<tr>
<td>Fuel oil</td>
<td>0,09</td>
</tr>
<tr>
<td>Electricity from the net</td>
<td>0,275</td>
</tr>
<tr>
<td>Wood</td>
<td>0,028</td>
</tr>
</tbody>
</table>

*Main heating source - Flemish region, 2010
**Eurostat
Overview of the concept
Strategy for the heating source

- Mines (~35°C) possible usage as storage
- Possibility to use central solar, but in a small scale (land too expensive)

- Potential: Nuclear at about 50% of electricity production to be banned till 2050.
- Belgian framework: biomass too expensive, coal not possible → gas

Thermal Power Generation for electricity production (coal → wood palets?)

Iron and steel manufacture
Total theoretical excess heat annually: 0.48 PJ
- >100°C temperature
- Base load

New CHP plant

Insights:
- Mines (~35°C) possible usage as storage
- Possibility to use central solar, but in a small scale (land too expensive)
Main problems and challenges of the H&C systems

- Tradition/ mindset/acceptance
- Low gas price / concentrated gas grids
- High investment cost / time delay / long term investment
- Demand high support from local authorities (obligation to connect, low taxes if connected,..) / financial facilities ( banks,..)

GOALS
- ✓ Reduce CO2 emissions
- ✓ Gains for the local community

REDUCE CARBON footprint → DHC!
Overview of the concept

Cost:
- Phase I: 13 m€
- Phase II: 18 m€ + storage
- Phase III: 30 m€
- Phase IV: 50 m€
Phase I + Phase II: Load duration curve for the full potential of the steel factory without storage for the city of Genk

Overview of the concept
First step: Excess heat of steel industry as heat source

<table>
<thead>
<tr>
<th></th>
<th>EUR (x10^6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network cost</td>
<td>31</td>
</tr>
<tr>
<td>Substations cost</td>
<td>8</td>
</tr>
<tr>
<td>Cost for installations in production site</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>47</strong></td>
</tr>
</tbody>
</table>
Overview of the concept
Second step : Addition of storage

| Energy | 130TJ |
| DT     | 30/ 50°C |
| Volume | 1 / 0.6Mm³ |
| Cost (pit storage) | 16M€ |

Assuming 45% of losses
Overview of the concept
Proposition of a cascade network for the LT district

High Temperature areas – Old buildings

Low Temperature areas – New buildings

Source – Steel industry (Excess heat)

Mine Storage

60 C

90 C

40 C

90 C

90 C

40 C
Planning of the DHN

- Total overview

<table>
<thead>
<tr>
<th>Heat demand TJ/km²</th>
<th>Distribution cost capital EUR/MWh</th>
<th>Substation cost EUR/MWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>85</td>
<td>20.47</td>
<td>7.69</td>
</tr>
<tr>
<td>210</td>
<td>10.76</td>
<td>7.69</td>
</tr>
</tbody>
</table>

Total Cost (Meuros) for genk: 60
Total Cost (Meuros) for Hasselt: 50
Total Cost (Meuros) for storage: <16
Organisational steps and measures

- Involving customers
- Involving local authorities
- Framework conditions, policy makers
- Building energy efficiency measures – Regulations
- Premium tariffs for DH
- High tax on fossil fuels
- Integrate DH pipe works when developing new cities
Thank you!