Towards Efficient District Heating & Cooling in Europe

Overview of the UpgradeDH solutions

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Final dissemination event of the: the Upgrade DH Project
15th September 2021
A wide range of upgrading measures…
… and a great example of effective collaboration

<table>
<thead>
<tr>
<th>FINAL USER</th>
<th>DISTRIBUTION</th>
<th>GENERATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuzla, BHZ</td>
<td>COWI</td>
<td>OPTIT</td>
</tr>
<tr>
<td>Middelfart, DK</td>
<td>FSB</td>
<td>AGFW</td>
</tr>
<tr>
<td>Sisak, HR</td>
<td>COWI</td>
<td>OPTIT</td>
</tr>
<tr>
<td>Marburg, DE</td>
<td>COWI</td>
<td>solites</td>
</tr>
<tr>
<td>Ferrara/Bologna, IT</td>
<td>LTA</td>
<td>COWI</td>
</tr>
<tr>
<td>Grudziadz, PL</td>
<td>COWI</td>
<td>COWI</td>
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<tr>
<td>Purmerend, NL</td>
<td>COWI</td>
<td>COWI</td>
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</tbody>
</table>

Main Contributor

COWI, FSB, AGFW, LTA, OPTIT, solites, AIRU
Generation

Optimization & Advanced Analytics
- CHP Scheduling Optimization in Tuzla (BIH)
- Optimised Heat & Power dispatching in Italy (ITA)

Flexibility enhancement technologies
- Heat Storage integration in Sisak (CRO)
- Heat Pumps installation in Bologna (ITA)

Transition to RES
- Biomass plants in Purmerend (NED) & Grudziadz (POL)
- Solar Thermal in Tuzla (BIH) & Salcininkai (LIT)
Lower Temperature Technologies

- New piping for lower temperature Ops in Middelfart (DEN)

Operational Network Optimization

- Thermal-hydraulic simulation modelling in Purmerend (NED)
- Hydraulic scenarios analysis in Marburg (GER)

Refurbishment & Expansion Strategy

- Long-term network refurbishment strategy in Salcininkai (LIT)
- Network expansion strategy in Grudziadz (POL)
Final user

**Consumer Engagement**
- Switch to consumption-based billing in Tuzla (BIH)
- Cooperation with prominent consumer in Marburg (GER)

**Regulation & Control Strategy**
- Expert Coaching on Substations‘ design in Tuzla (BIH)

**Digitalization & Analytics**
- Smart Substation Analytics in Ferrara (ITA)
- Thermostatic valves at the users in Tuzla (BIH)
The implementation of the various **upgrading measures** are estimated to yield significant results, in terms of **energy saving, emissions reduction, RES and Waste Heat integration increase**.

<table>
<thead>
<tr>
<th>Project KPI</th>
<th>Baseline</th>
<th>After Upgrading Measures</th>
<th>Expected Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Energy Demand (GWh/y)</strong></td>
<td>1,451</td>
<td>1,206</td>
<td>-245 (-17%)</td>
</tr>
<tr>
<td><strong>GHG Emissions (ton CO₂/y)</strong></td>
<td>290,661</td>
<td>145,687</td>
<td>-144,974 (-50%)</td>
</tr>
<tr>
<td><strong>Share Waste Heat (%)</strong></td>
<td>8%</td>
<td>10%</td>
<td>+2% (+25%)</td>
</tr>
<tr>
<td><strong>Share RES (%)</strong></td>
<td>30%</td>
<td>51%</td>
<td>+21% (+70%)</td>
</tr>
</tbody>
</table>
Economic Impacts

- Project calculated the impact of the various measures using standard financing indicators such as: IRR, NPV and payback period (PB)
- Future changes in legislation to fight climate change could impact the expected returns of many upgrading measure, making them more attractive financially

<table>
<thead>
<tr>
<th>Upgrading Measure Category</th>
<th>Demo Case Examples</th>
<th>Financial Indicators (Order by PB)</th>
</tr>
</thead>
</table>
| **Digital Optimization and Advanced Analytics of Generation and Distribution** | 1. CHP Scheduling Optimization in Tuzla (BIH)  
2. Simulation Modelling in Purmerend (NED)  
3. Hydraulic Scenarios Analysis in Marburg (GER) | PB between 1 and 1.5 years |
| **Lower Temperature Technologies** | New Piping for Lower Temperature Ops in Middelfart (DEN) | PB: 1.5 years |
| **Flexibility Enhancement Technologies** | 1. Heat Storage Integration in Sisak (CRO)  
2. Heat Pumps Installation in Bologna (ITA) | PB between 3 and 6 years |
| **Transition to RES** | 1. Biomass Plant Purmerend (NED)  
2. Solar Thermal in Tuzla (BIH) | PB > 20 years |
| **Refurbishment & Expansion Strategy** | Long-Term Network Refurbishment Strategy in Salcininkai (LIT) | PB > 10 years |
The key role of digitalisation

- Monitoring
- Advanced data analytics
- Simulation
- Forecasting
- Optimisation

The experience of the project highlighted how digitalization is becoming a key enabler for quick-return upgrading strategies, leading to modern advanced DHC systems.
Final remarks

- All DH systems are, to some extent, peculiar to the local conditions and resources… yet, whatever the maturity level, there is a very high likelihood that performance can be enhanced significantly leveraging on proven, mature technologies (and sustainable business models), with positive environmental and economic impacts.

- UpgradeDH provides a vast Knowledge Base on tools, best practices and “good stories” to inspire practical replication, as already initiated within the project.

- Collaboration and cross fertilisation is a key asset for the development of this industry. We are already networking with other DHC communities (Celsius, DHC+, …) to ensure that the momentum created by UpgradeDH can live on and contribute to the development of the industry.