Heat4COOL project has received funding from the European Union’s Horizon 2020 research and innovation program under grant agreement No 723925

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Sewage heat utilisation at Budapest Demo Site
Heat4Cool Webinar 01.10.2020
Technology: Sewage heat utilisation

- Energy from sewage - Renewable energy source, innovative technology
- Efficient energy supply – same system for both heating & cooling
- Large supply structure → district compatibility
Technology: Efficient exploitation of sewage

- **Sewage** – optimal heat resource for Heat Pumps
- **Goals:**
  - Efficient heat transfer
  - Efficient thermal energy production
  - Safe, reliable operation
  - Lower CO₂ emission
  - Satisfying high energy demands
  - Simple maintenance, easier implementation

- **Developments within Heat4Cool:**
  - Focus on main elements:
    - Heat exchanger & Fine Screen
Developments of Heat4Cool

- **Objectives**: enhancing
  - Performance
  - Operational safety
  - Economic operation

- **R&D Tasks**:
  - Heat Exchanger development:
    design planner tool, prototype designs, economic assessment
  - HEX Cleaning methods:
    experimentation, evaluation
  - Fine Screen development:
    built-in washer, interchangeable perforated plates
Results of R&D

• **Results:**
  – 5 new HEX designs / 2x2 implemented
  – 1 new Fine Screen design
  – 2 cleaning methods

• **Outcome:**
  – Higher energy saving potential
  – Lower energy consumption
  – Lower CO₂ emission
  – Larger market possibilities

→ *Trial operation at Demo Site*
Introducing Budapest Demo Site

- **Location**: Hungary, Budapest – District 4 (St. Stephen Sq)
Introducing Budapest Demo Site

- Focusing on:
  - Thermal supply for District heating/cooling structure
  - Improving thermal supply efficiency
Introducing Budapest Demo Site - Sewage

**Sewage source:**
- Municipal main sewer below the street of the Southern side of the Sq.
- Combined system, distance from main collector: 5.7 m (2xDN500)
- Daily average flow 18-20 000 m$^3$/day (min. 500 m$^3$/h)
Introducing Budapest Demo Site - Buildings
# Introducing Budapest Demo Site - Buildings

<table>
<thead>
<tr>
<th>MAYOR’S OFFICE</th>
<th>GOVERNMENT WINDOW</th>
<th>NEW MARKET HALL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public building: municipality administration (offices, meeting rooms)</td>
<td>Public building: municipality administration, government-issued documents (offices, meeting rooms)</td>
<td>Mix-use building: Public, commercial, cultural (food market, theatre,…)</td>
</tr>
<tr>
<td>1899-1900 - renovation: 2010-2011 - under historic preservation</td>
<td>2001 (no renovation yet)</td>
<td>New construction 2016 - 2018 (S2)</td>
</tr>
<tr>
<td>3 floors, 2 inner garden areas - av. inside height: 4.2 m</td>
<td>5 floors, basement, basilica level - av. inside height: 2.8 m</td>
<td>3 floors, 2 underground garage levels</td>
</tr>
</tbody>
</table>
| **HVAC system to replace:**  
  • natural gas boiler (η=0.80)  
  • electric chillers (EER=2.8) | **HVAC system to replace:**  
  • natural gas boiler (η=0.80)  
  • electric chillers (EER=2.8) | / |
| **Heated/Cooled area:**  
  area= 2600 m² | **Heated/Cooled area:**  
  area= 1900 m² | **Heated/Cooled area:**  
  area= 8000 m² |
Unique configuration @Budapest Demo Site

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Integration of prototypes
Integration of prototypes

- Easy monitoring and observation in trial period
- Simple access for maintenance and adjustments
- Separate sensors, meters + SCADA expansion
Budapest Demo site - System implementation

- Site preparatory works, parking place demolition
Budapest Demo site - System implementation

• Sewage shaft draining and cleaning
Budapest Demo site - System implementation

- Lifting the underground engine house’s ceiling
Budapest Demo site - System implementation

• HEX transportation and placement
Demo site implementation – Heat Exchangers
Demo site implementation – Heat Exchangers
Demo site implementation – Fine Screen
Demo site implementation – Monitoring
Monitoring & Data recording – Meters

- Sensors & meters installed: circuit diagram with measuring points
Monitoring & Data recording - SCADA

- SCADA – Supervisory Control and Data Acquisition system expansion
### Monitoring – Data collection, reporting

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**Monitoring Report for 01/01/2020 – 31/01/2020**

**Reporting Person: Per Klaes**

- **Date:**
  - 01/01/2020

**System Setting Characteristics**

- **System:**
  - Outdoor temperature 2°C
  - Measured criteria: cooling and heating demand, HVAC heating, HVAC cooling, system load

**System Load**

<table>
<thead>
<tr>
<th>Date</th>
<th>Cooling Demand</th>
<th>Heating Demand</th>
<th>HVAC Heating</th>
<th>HVAC Cooling</th>
<th>System Load</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/01/2020</td>
<td>50°C</td>
<td>60°C</td>
<td>70°C</td>
<td>80°C</td>
<td>90°C</td>
</tr>
</tbody>
</table>

**System Efficiency**

- **System Efficiency:**
  - Cooling efficiency: 0.85
  - Heating efficiency: 0.95

**Data Collection**

- **Data Collection Method:**
  - Outdoor temperature 2°C
  - HVAC system load

**Data Analyses**

- **Analyses Method:**
  - Statistical analysis
  - Trend analysis

**Data Reporting**

- **Reporting Period:**
  - 01/01/2020 – 31/01/2020

**Meeting Notes**

- **Meeting Notes:**
  - Discuss performance metrics
  - Identify areas for improvement
  - Plan for next reporting period

**Confidential**

[Confidential Note]
Monitoring – Data collection, reporting

- Monitoring reporting – monthly
  - Monitoring since October 2019
  - Collection and arrangement of operating data
  - Report of operating system settings, consumption and HEX cleanings
  - Notification of significant circumstances, events (in operation and external alike), building occupancy, weather data, ...

- Objectives:
  - Observation, assessment and analysis of key element & system performance
  - Testing different settings, operation modes
  - Via real time data evaluation:
    - recommendations for improvements of system operation, efficiency
    - determination of optimal control strategies, operating protocol

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• **Present focus:**
  
  – Monitoring data and simulation results comparison
    * Thermal energy consumption, Electricity consumption
    * HEX temperature data (ww, cw), HP temp. data (MO+GW, NMH)
  
  – Heat pump operation, control strategy assessment
    * aiming at identifying optimal operating strategy

*HEX wastewater side - monitoring vs. simulation data (5th January)*
Demonstration of benefits, achievements

• **Benefits → expected achievements:**

  – no necessity of the implementation of separate heating and cooling solutions in the buildings connected to the district network
    
    ➢ Realisation of savings potential – especially in larger networks: space & cost effective, sustainable
    ➢ Supported high probability of future connection of additional buildings to the thermal energy supply network
  
  – simultaneous heating and cooling supply is possible, completely green and renewable, with the elimination of fossil energy sources
    ➢ Realisation of potentials in sewage as thermal energy source: emission reduction, sustainable, subsidised
Demonstration of benefits, achievements

- through a collective impact of the new HEXs, the new cleaning methods as well as the developed fine screen higher efficiency and operation safety levels are achievable
  - Realisation of the offering of a reliable and highly efficient, sustainable and green heating & cooling solution

- **Cooperation and communication achievement:**

  - Long term support of Municipality of District 4 (Újpest):
    - Supporting the Heat4Cool solutions’ implementation in Municipality buildings
    - Setting good example for the district’s residents, and other municipalities too
    - Clear commitment to sustainable building heating & cooling
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