Pal Kiss (Thermowatt Ltd.)

Managing Director

“Sewage heat utilisation at Budapest Demo Site”

Heat4Cool Online Training
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 CO$_2$ 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
**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 m³/day (min. 500 m³/h)
Introducing Budapest Demo Site - Buildings

NEW MARKET HALL

MAYOR’S OFFICE

GOVERNMENT WINDOW
### Introducing Budapest Demo Site - Buildings

<table>
<thead>
<tr>
<th>MAYOR’S OFFICE</th>
<th>GOVERNMENT WINDOW</th>
<th>NEW MARKET HALL</th>
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</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>
<tr>
<td><strong>HVAC system to replace:</strong></td>
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<tr>
<td>• natural gas boiler (η=0.80)</td>
<td>• natural gas boiler (η=0.80)</td>
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<tr>
<td>• electric chillers (EER=2.8)</td>
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<tr>
<td><strong>Heated/Cooled area</strong></td>
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<tr>
<td>area = 2600 m²</td>
<td>area = 1900 m²</td>
<td>area = 8000 m²</td>
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</table>
Unique configuration @Budapest Demo Site

Heat4Cool - online training - 12.05.2020
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

Heat4Cool project has received funding from the European Union’s Horizon 2020 research and innovation program under grant agreement No 723925
Demo site implementation – Monitoring
Monitoring & Data recording – Meters

- Sensors & meters installed: circuit diagram with measuring points

Circuit diagram for the extension
Monitoring & Data recording - SCADA

- SCADA – Supervisory Control and Data Acquisition system expansion
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
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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