Industrial Thermal Energy Recovery Conversion and Management ‘I-ThERM’

- **EE-18-2015** New technologies for utilisation of heat recovery in large industrial systems, considering the whole energy cycle from heat production to transformation and end use
- 1 October 2015 - 31 March 2019
I-ThERM Project Case Study

1. The EU/ SPIRE needs
   - Recover and utilize waste heat for industrial process heating and power generation.
   - Reduce energy demand from the grid, fossil fuel use and greenhouse gas emissions.

2. The Project Solution
   - New efficient plug and play technologies for heat recovery and conversion.
   - Technologies for low and high temperature waste heat applications.

3. How will this happen?
   - Manufacture and demonstration of technologies.
   - Cost reduction and commercialization of heat recovery and heat to power technologies by the partners.
   - Licensing of specific component IP.

4. Value to Customers
   - Energy savings – reduction of operating costs.
   - Reduction of GHG emissions and carbon taxes.
### Key expected sustainability impacts of I-ThERM

<table>
<thead>
<tr>
<th>Indicator (Max 3-4 key indicators)</th>
<th>Baseline</th>
<th>Expected Impact</th>
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<tbody>
<tr>
<td><strong>Fossil fuel energy demand reduction</strong></td>
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<td>Based on demonstration case studies (estimates)</td>
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<td>▪ sCO2 heat to power conversion (70 kWe) (Demonstration -1)</td>
<td>Unavailability of suitable high temperature heat to power technologies</td>
<td>D1- Reduction of 1.85 MWh/a in fossil fuel demand (estimated)</td>
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<td>▪ Trilateral Flash Cycle system (120 kWe) (demonstration -2)</td>
<td>Unavailability of suitable low temperature heat to power technologies</td>
<td>D2- Reduction of 3.18 MWh/a in fossil fuel demand (estimated).</td>
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<td>▪ Flat heat pipes for high temperature heat recovery (Demonstration - 3)</td>
<td>Unavailability of high efficiency high temperature technologies to recover radiant heat.</td>
<td>D3- Reduction of fossil fuel demand = 1.75 MWh/a thermal.</td>
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<td><strong>Reduction in CO2 emissions</strong></td>
<td>No technologies to perform the same function</td>
<td>D1. 0.245 MtCO2/a – per unit</td>
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<td><strong>Reduction in operating costs</strong></td>
<td>Demonstration will cover only a small proportion of the overall plant energy consumption</td>
<td>D2. 0.420 MtCO2/a – per unit</td>
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<td>D3. 0.324 MtCO2/a – per unit</td>
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<td>D1. 80520 Euro/per annum/unit</td>
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<td></td>
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<td>D2. 138600 Euro/per annum/unit</td>
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<td>D3. 77088 Euro/per annum/unit</td>
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Outputs from I-ThERM that will be of value to other SPIRE projects

• Learnings from the design of very compact CO2 turbomachinery (cooling and lubrication) applicable to other working fluids.
• High temperature innovative heat exchangers for direct heat recovery to supercritical CO2 – this technology will also be applicable to conventional Organic Rankine Cycle systems.
• Flat heat pipe heat exchangers being developed are applicable to many heat recovery and heat transfer applications – high and low temperatures.
• Learnings from development of coatings for heat transfer enhancement and corrosion protection can be used in many harsh environments outside the project.
• EINSTEIN tool developed can be used for assessment of heat recovery and heat to power conversion potential in many industrial complexes.
So much waste – we aim to put it to good use
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