decagone

DEmonstrator of industrial CArbon-free power Generation
from ORC-based waste-heat-to-Energy systems

CONSORTIUM	DURATION	START-END DATE	BUDGET	TECHNOLOGY
16 partners 10 countries	4 years	01/06/2022 31/05/2026	18M€	Organic Rankine Cycle

Industrial Waste Heat Recovery and Energy Efficiency

Industrial Waste heat recovery is a necessary energy efficiency measure to limit carbon emissions, specifically from heat-intensive industries.

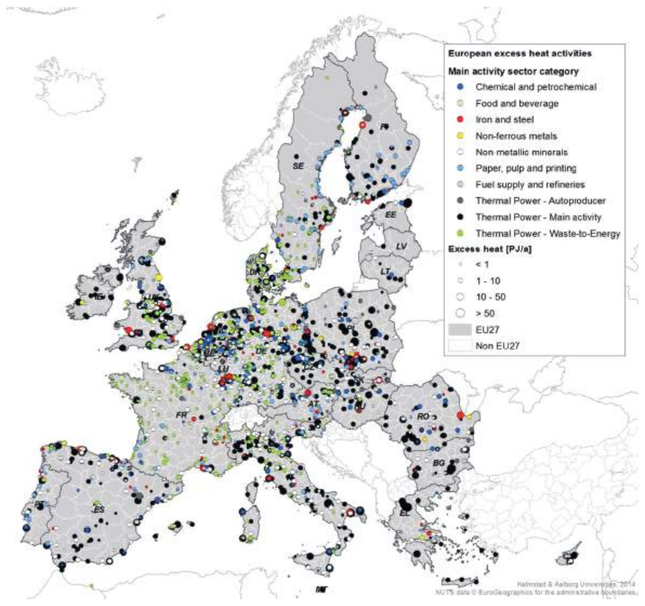
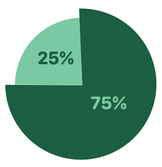
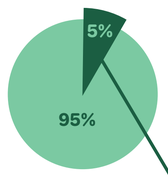


Figure 1: Map of industrial sites with significant waste heat recovery potential in Europe[1]

Potential of industrial waste heat recovery for electricity generation in EU27



Excess heat not recovered in energy intensive industries in Europe[1]



Potential electrical production by means of excess industrial waste heat in EU27[2]

→ 150 TWh_{el} /yr

Demonstrating innovative ORC Technology

DECAGONE proposes key innovations making ORC systems more efficient, compact, cost-effective, safer and adaptable to diverse sectors. They will be demonstrated in a 2 MWe ORC unit integrated into a steel production plant.

ORC: a mature technology to exploit industrial waste heat recovery

The electricity generated on-site by the ORC:

- Does not cause any additional emissions,
- Is dispatchable and reliable,
- Can be used directly on-site, reducing the load of transmission and distribution grid,
- Can contribute to the reduction of EU's dependency on imported fuels.

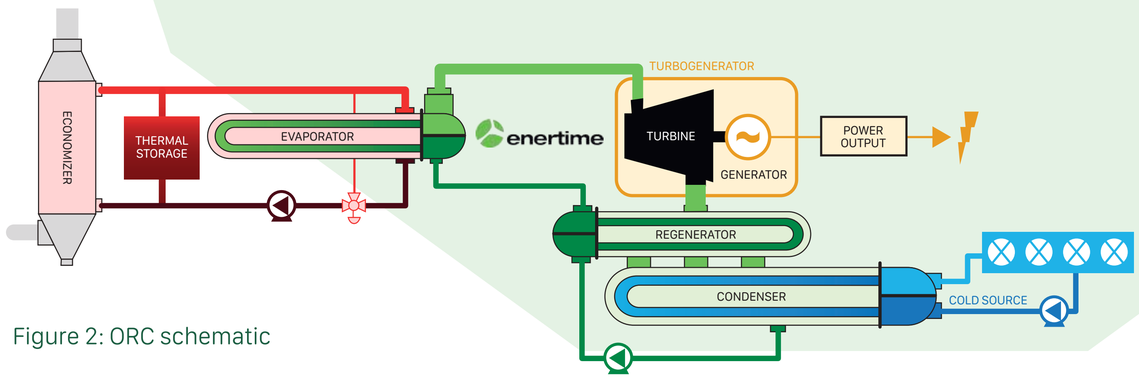


Figure 2: ORC schematic

Target industries

- Steel
- Metal
- Cement
- Petrochemical
- Glass
- Oil and gas

Adressed Key-Challenges

Financial risk
Esco model reduces investment risk for industries and guarantees against the fluctuation of the electricity market prices.

Lack of harmonisation in EU legislation
High-level policy recommendation about the benefits of ORC for waste heat to power application, since, most of EU countries do not recognize the generated electricity as renewable.

Energy availability
Waste heat to power as a way to increase energy availability for industries, supporting local economy for EU regions, and sustaining local energy demand.

Decarbonization of energy intensive industries
Waste heat to power participates to lower the environmental footprint of power generation through the production of carbon-free electricity.

Tax regime on energy efficiency measures
Disseminate to EU decision makers the benefits of energy efficiency and energy recycling.

Cost of electricity
DECAGONE technology lowers the system's cost of ownership, reducing the price of electricity generated for self-consumption.

Objectives & Results

1 Develop new components, models, architectures and technologies

- Innovative hermetic 2 MWe turbogenerator
- Active magnetic bearings
- Thermal storage for buffering of transient and intermittent heat source
- Advanced heat exchangers and heat recovery unit
- Active charge management

2 Validate innovative approaches using new experimental design

- Combined models for basic and detailed engineering based on quasi steady-state and dynamical modelling
- Optimized instrumentation for rationalized advanced monitoring, control and data processing
- Validated models and retrofit of the component design
- Tool for predictive maintenance

3 Demonstrate real-life operation and validate LCA models

- Installed, commissioned and operating industrial 2-MWe demonstrator plant
- Near-zero maintenance of the running ORC system
- Validated process and LCA models

4 Prepare the next commercial generation of ORC-based waste heat recovery systems derived from DECAGONE

- Technical-economic analyses of the overall system
- Transposability assessment of the solution in several industrial sectors
- Detailed industrialization route for a nominal point tracking system

5 Promote benefits of ORC-based waste heat recovery and foster industrial uptake

- Communication and dissemination on DECAGONE to relevant stakeholders and the general public
- Exploitation of the DECAGONE results through industrialization and proposed business models
- Partnerships with key stakeholders in the energy intensive industries and across the ORC value chain

[1] U. Persson, B. Möller and S. Werner, "Heat Roadmap Europe: Identifying Strategic Heat Synergy Regions," Energy Policy, 74, p. 663 –681, 2014.
[2] Thermal Energy Harvesting The Path to Tapping into a Large CO2-free European Power Source

This project has received funding from the EU Horizon Europe research and innovation programme under grant agreement No 101069740.

decagoneP · decagone-project · www.decagone.eu