HEATLEAP PROJECT

VALORIZING WASTE HEAT FOR ENHANCED ENERGY EFFICIENCY





Co-funded by the European Union

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Background

Energy supply, energy affordability and mitigating environmental impact are at the centre of EU policy, investments and increasingly consumer concerns. Despite efforts to prioritise energy efficiency, significant potential remains unexplored when it comes to reducing energy waste across the entire energy value chain and making the best use out of the energy that we have available.

> Waste heat recovery and utilisation is a largely untapped energy efficiency resource, which presents important opportunities across many sectors and applications. To unlock this potential, policy must recognise its potential and promote all applications for waste heat recovery and utilisation for heat and/or power production, in both industry and district heating.

> Most energy losses in energy conversion, industrial processes and energy consumption take the form of heat waste. There is a range of waste heat recovery methods and applications, depending on heat quality, proximity to a potential customer, specific customer needs, availability of the resource short, medium and long-term, as well as potential contractual constrains and requirements involved. Based on technical, commercial and local circumstances, waste heat may be used on-site or in district heating, in the form of heat and/or power.

> The **HEATLEAP project** started from this premises aiming to demonstrate the environmental and economic benefits of **waste heat recovery** systems such as **large heat pumps** in energy intensive industries and **gas expanders** in gas distribution networks by testing these technologies at real scale.

Valorisation of waste heat and cascading its use can help decarbonise hard-to-abate industries and cities, thus delivering system integration locally and industrial symbiosis, playing a key role in the global decarbonisation path.

The **project** is funded under the **LIFE programme**, the **EU's funding instrument** for the **environment** and **climate action**.



Project's team

The project is funded under the LIFE programme.

The project includes the participation of Turboden (a Mitsubishi Heavy Industries group company) ORI Martin (European integrated steel groups), COGEN Europe (European Association for the Promotion of Cogeneration), RINA Consulting – CSM (private innovation centre), CSMT (Technology Transfer Centre based in Italy) and a2a (italian life company).

Turboden



Turboden is an Italian firm and a global leader in the design, manufacture and maintenance of Organic Rankine Cycle (ORC) systems, highly suitable for distributed generation, that generate electric and thermal power exploiting multiple sources, such as renewables (biomass, geothermal energy, solar energy), traditional fuels and waste heat from industrial processes, waste incinerators, engines or gas turbines.

ORICIP

ORI Martin

Founded in 1933, ORI Martin is one of the main European integrated steel groups, active in the production of quality steels for the automotive, bolting, mechanical and construction sectors. With more than 200 grades of steel in production for the main special applications in the mechanical and automotive sectors, ORI Martin has a strong presence in all major European and non-European markets.



COGEN Europe

European Association for the Promotion of Cogeneration. It is the cross-sectoral voice of the cogeneration industry. Its mission is to work with EU institutions and stakeholders to shape better policies and eliminate administrative, regulatory and market barriers to the wider use of cogeneration in Europe.



RINA Consulting - CSM

A private innovation centre with extensive experiences in the development and application of innovative processes and materials. The innovation capacity of CSM (which stands for Materials Development Centre) is based on its own know-how, developed during more than fifty years of industrial projects on steel, metals and ceramic, power generation, transport and defence. Today CSM is part of the RINA Group.



CSMT

A Technology Transfer Centre based in Brescia (Italy), one of the most developed industrial areas in Lombardy region, whose mission is to bring innovation into applications by combining the most qualified academic know-how with concrete industrial needs and abilities.

A2A



Italian multi-utility, operating in the environment, energy, heat, grids and technologies for smart cities sectors. District heating owner. Utilizer of Gas Espander (LHP).



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Large Heat Pump in ORI Martin steelworks

Low-grade waste heat (< 70°C) is often widely present in several Energy Intensive Industries, however it can be hardly valorised by using conventional technologies (e.g. organic Ranking cycles). Conversely, some innovative technologies are emerging and can provide further energy improvement and CO2 saving.



Large Heat Pump technical features:

- 6 MWth design, heat delivered with output temperature up to 120°C
- Full **integration** with DH network. Control system designed to be highly flexible depending on: DH network operating temperature, steam production boiler heat production
- High flexibility with 2 compression stages and variable frequency driver
- Working fluid: Low GWP HF0, R1233ZD

Innovative Gas Expander





Project's Highlights

Project's Highlights of the can be synthesized into five points.

01 Development of innovative Large Heat Pump (LHP)

Innovative Large Heat Pump with a size of up to 6MWth, able to supply District Heating with temperatures up to 120°C and characterized by a COP between 5 and 8, thanks also to an innovative working fluid.

02 Innovative Gas Expander (GEX)

Innovative Gas Expander (GEX), able to recover pressure drop from thede-compression of Gas from the grid generating electricity in the range <1 MWe.

03 Implementation of a monitoring system

Implementation of a monitoring system collecting and processing data in order to evaluate the real environmental benefits (e.g. air pollutant and greenhouse gas reduction, etc...).

Chart 2: According to a study commissioned by Turboden to RINA consulting the theoretical potential Italian market can be described as follow:

Stations	Units	potential GEX production	potential generation	potential investments
Small	n. 530	100 ÷ 550 kWe	584 ¹ GWh/y of clean energy	690 M€ ²
Large	n. 70	550 kWe up to 2+MWe	208 ¹ GWh/y of clean energy	140 M€ ²

1. assuming average value of 275 kWe for Small Stations and 750 kWe for Large Station with 4000 hour/y of operation.

2. assuming Capex of 1.3 M€ in Small Stations and 2 M€ in Large Station for a GEX turnkey project





04 New business model replication tool

Adoption of new business model replication tool in order to overcome the major barriers for waste heat recovery solutions in energy intensive industries.

05 **Communication and dissemination activities**

Continuative communication and dissemination activities to advocate for policies implementation at EU level.



Chart 1: Waste heat potential in each EU country by temperature level and country (Source: Papapetrou et al, 2018)



Benefits

The HEATLEAP project aims to demonstrate the environmental and economic benefits of waste heat recovery systems such as large heat pumps in energy intensive industries and gas expanders in gas distribution networks by testing these technologies at real scale.



Environmental benefits

Waste heat recovery reduces greenhouse gases GHG and harmful emissions such as Sox and NOx. It will help stop global warming and improve air quality. The project aims to reduce 5.750 ton of CO2 by recovering 22.000 MWhth per year into the production process, and by generating 2.000 MWhel per year.



Socio-economic benefits

Waste heat recovery will make the European industry (for examples: steel, pulp&paper, refinery,chemical, plastic forming, dairy) more competitive and supply citizens with waste heat via district heating (utilities). Benefits are also created on technology developers such as LHP, GEX, and various engineering companies.

Energy security

Waste heat recovery reduces the dependence on fossil fuels and provides a reliable source of heat for surrounding buildings.



Water saving

This system allows for reduced water use resulting in savings and the possibility of installing these solutions in environments with high levels of drought.

European policy objectives

Waste heat recovery is a crucial solution for Europe to achieve its climate and energy goals.



Heatleap Project 2023

Contact

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