

CIRQLAR – HEAT CIRCULARITY



Low temperature heat recovery is an energy efficiency route with a largely untapped potential. Despite considerable technical progresses in reducing energy consumption, a significant amount of the input energy is still lost in the form of waste heat. As heat temperature is lower, it is more difficult to recover: the reason is that the useful amount of work that a waste heat stream can produce depends directly on the temperature difference between the heat source and the heat sink. At a temperature range around 100°C and a heat sink of 25°C theoretical maximum heat recovery performance is around 20%, which makes difficult to find profitable actions (Second Law of Thermodynamics).

The CIRQLAR project will enable the recovery of low-temperature waste heat at around 100°C and its upgrading to 150°C by using a high temperature heat pump. By recovering this low temperature heat, an amount of greenhouse gas (GHG) emissions will be abated, equivalent to the natural gas combustion avoided in site boilers due to the additional steam production. This new unit will be integrated in the real production environment of Repsol A Coruña Refinery in Spain and will be the first step in an ambitious plan to replicate the concept in other refineries and other intensive-energy industries. The principal technologist of the project is Rank-Expander Tech, who has extensive experience with rotating machinery and thermodynamic cycle design, and Técnicas Reunidas will be responsible for the technology integration in the current production process due to their knowledge working in industrial environments such as Repsol industrial sites. The project will produce up to 4 megawatt (MW) of usable heat in the form of steam, through the recovery of 3 MW of low-temperature waste heat from a production process, reducing the energy consumption of the processing unit by 24%.

CIRQLAR will overcome some barriers in low-temperature heat recovery technology, such as the optimisation of the thermodynamic cycle, the reliability of the machines working in severe conditions, and its integration into an energy network. This is driven by the fact that heat pumps are the best low temperature heat recovery route in terms of decarbonization, due to the inherent electrification process and the amount of energy recovered.

The project will exploit a concept that could potentially apply to any energy-intensive industry. This will allow key industrial sectors to offer their products and services in a more efficient and sustainable way to consumers whilst reducing their external energy cost dependence. CIRQLAR will reinforce the EU industry value chain of waste heat recovery and heat pumps, providing a cost-competitive technology to the market. It will deliver more sustainable processes with lower emissions, which will respond to today's environmental challenges, while also reducing consumption and dependence on natural gas throughout the EU.

Some Project Facts

- 24.000 MWh/year of low temperature heat recovered.
- 60.000 tCO₂ abated in the first 10 years of operation.
- April 2025 is the planned date of entry into operation.



Co-funded by the
European Union under
the EU Innovation Fund

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for them.



