DRYFICIENCY
A SUCCESS STORY 4 PLANET

Emission Reduction and Energy Efficiency for the Process Industry
Potential Impact Showed in Three Demo-Cases

The Context

In this day and age, as we face our greatest environmental crisis, reducing CO_2 emissions and saving energy have become increasingly urgent, and energy-intensive industries are stepping up their efforts to combat climate change.

The DryFiciency Project – Industrial Heat Pumps

One of these initiatives is the DryFiciency project (full title Waste Heat Recovery in Industrial Drying Processes). Funded by Horizon 2020, under a SPIRE call, it was launched on 1 September 2016, and ended in 2021, hence being one of the projects transitioning from the SPIRE cPPP, to its current continuation, the Processes4Planet partnership.

The Aim

Coordinated by A.SPIRE's member AIT AUSTRIAN INSTITUTE OF TECHNOLOGY, DryF aimed to lead the European energy-intensive industry to high energy efficiency and a reduction of fossil carbon emissions through waste heat recovery, working towards a vision of competitiveness, improved security of energy supply and sustainability.

Implementation
The Approach and The Demonstrators

The path towards this ambitious goal was developing and demonstrating at Technology Readiness Level (TRL) 7 three advanced high-temperature vapour compression heat pumps. The solution was implemented in three demo sites: AGRANA (food industry), WIENERBERGER (brick industry) and SCANSHIP (waste management) - all three pictured on the next page. The innovative approach consists of two types of heat pumps - open and closed loop systems - both representing efficient waste heat recovery tools.

The Scanship demonstrator

The closed-loop heat pumps are efficient devices that move heat using a cycle of four main parts (compressor, condenser, expansion valve and evaporator). They use a small amount of electricity. In the DryF project, they were used to replace natural gas in industrial drying processes, using waste heat to save energy and reduce costs. The closed-loop pumps were integrated into two of the three demonstrators.

Open-loop heat pumps, also known as Mechanical Vapour Recompression (MVR) systems, are used in drying processes where steam is involved. In the DryFiciency project, these systems use advanced, cost-effective turbo-compressors from the automotive industry, making them efficient and capable of reaching high temperatures (up to 160°C). This saves energy by reusing the steam instead of wasting it. An open-loop pump was installed in the third demonstrator.

DryF also developed training to support the implementation of these innovative technologies.

Results, Replicability and Potential Impact– Up to 80% Carbon Emissions Reduction

In May 2024, a representative from AIT, the project coordinator, said that the closed-loop heat pump demonstrators used for air drying were operated for more than 4,000 hours each and showed carbon emission savings of up to 80%.

Furthermore, the refrigerant used for the two closed-loop prototypes reduces the use of F-gases. According to the European Commission, F-gases (Fluorinated greenhouse gases) have a warming impact that is often thousands of times higher than that of carbon dioxide (CO2).

The Agrana demonstrator

The open-loop heat pump demonstrator was combined with a novel highly efficient MVR dryer technology and was also tested in an industrial setting in a two-stage compression. The efficiency of the dryer technology was increased by 75% and its energy consumption was reduced by 70%.

Moreover, the representative stressed that the solutions are highly replicable.

The Wienerberger demonstrator

Heat pumps require a process heat source that is then upgraded as a process heat supply and can therefore be an integral part of the industrial process. Hence, process innovations such as breakthrough technologies for energy-intensive industries can benefit from the integration of heat pumps to optimise the heat flows and further increase efficiency.

The Success Story

The level of absolute carbon emission savings can be increased by upscaling the prototypes to larger capacities and testing them in various industrial processes and sectors including food/beverage, chemical or pulp and paper.

For the project coordinator, the project is a success story in various ways:
"Firstly, the consortium demonstrated for the first time in industrial settings at TRL7 that high-temperature heat pumps reliably work up to 160°C. Secondly, the projects' activities and results created broad awareness on the topic of industrial heat pumps in general and high-temperature heat pumps in particular reaching +460.000 people in Europe and beyond."

A.SPIRE considers DryFiciency a success story because its tangible results and proven replicability contribute to the 2050 SIRA vision – towards a climate-neutral and circular Europe (the first Key Performance Indicator of the P4Planet partnership is CO2 Eq. emission reduction by integration of renewable energy & energy efficiency, measured on a relevant number of demonstrators).
Therefore, DryFiciency is an inspiring project, a valuable tool to help limit global warming to 2 degrees Celsius while fostering a highly performant and sustainable European industry.

Check out the DryFiciency project website for more information.
Learn more about A.SPIRE and the Processes4Planet partnership.

Join us and become part of the European network transforming the process industry for a prosperous society.

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