



Cryogenic Energy Storage for Renewable Refrigeration and Power Supply

WHAT IS CRYOHUB?

An EU-funded project, entitled “*Developing Cryogenic Energy Storage at Refrigerated Warehouses as an Interactive Hub to Integrate Renewable Energy in Industrial Food Refrigeration and to Enhance Power Grid Sustainability (CRYOHUB)*”, will develop and investigate the potential of large-scale cryogenic energy storage at refrigerated warehouses and food factories. The innovative CRYOHUB technology is based on storing renewable energy and using the stored cryogen to partially refrigerate these industrial facilities, before it generates electricity to be returned to the power grid in peak demand periods.

THE PROJECT WILL:

- ✳ Balance the power grid mismatch between power demand and energy generation from renewables
- ✳ Store energy generated by renewables before supplying it back to the grid
- ✳ Provide an affordable cooling supply during power generation
- ✳ Increase the take up of renewable energy
- ✳ Reduce peak power demand and help decarbonise the grid

PARTNERS

1. London South Bank University (United Kingdom)
2. PSUTec SPRL (Belgium)
3. L'Air Liquide S.A. (France)
4. Fundacion CENER-CIEMAT (Spain)
5. Cranfield University (United Kingdom)
6. Irstea (France)
7. Technical University of Sofia (Bulgaria)
8. Corac Energy Technologies (United Kingdom)
9. Carbon Data Resources Ltd. (United Kingdom)
10. Institute of Refrigeration (United Kingdom)
11. International Institute of Refrigeration (France)
12. Mayekawa Europe nv/sa (Belgium)
13. EUREC EESV (Belgium)
14. The University of Birmingham (United Kingdom)

OUR STAKEHOLDERS

Companies throughout Europe have pledged support for this project through a Stakeholder Group of ‘CryoHub Champions’ and Advisory Board. The group reflects the food and refrigeration industries who are committed to developing this emerging technology which can meet their environmental objectives and improve sustainability.





WHAT IS CRYOGENIC ENERGY STORAGE?

The Cryogenic Energy Storage (CES) concept is simple and logical:

- ❖ During periods of low power demand and low energy price, a cryogenic gas is liquefied and stored in a well-insulated vessel (charging period).
- ❖ During times of high power consumption and high energy price, the liquefied cryogen is pumped and expanded to drive a generator of power which is restored to the electrical grid (discharging period).

Refrigerated food warehouses require large cooling capacities to maintain or reduce the temperature of food in a way, which maximise product safety and quality. Stored liquid cryogen is capable of partially refrigerating food in storage warehouses or food factories, being thereby heated for the purposes of power generation. Furthermore, integrating CES into food storage or processing facilities is a novel and attractive means for fostering the employment of Renewable Energy Sources (RES), revealing also a substantial potential to improve efficiency.



CRYOHUB OBJECTIVES:

- ❖ Evaluate the present and future potential for CES at refrigerated warehouses and disseminate this knowledge to stakeholders and end users from the energy and food refrigeration sectors.
- ❖ Determine key processes and unit operations to take advantage of CES in a common refrigerated warehouse and identify how stored cryogenic cold and waste heat could be integrated in the best possible way.
- ❖ Explore the synergistic and mutually-enabling action of CES and RES-based technologies in refrigerated food warehousing.
- ❖ Identify the energy and carbon savings which CES could achieve in refrigerated warehousing against the background of conventional facilities.
- ❖ Identify engineering solutions to consolidate a CES system into a typical warehouse refrigeration plant for performance optimisation and efficiency enhancement.
- ❖ Develop a software system for automated decision-support and management of CES and cryogen expenditure as a function of predicted warehouse, RES and grid behaviour, environmental conditions, energy demand and availability, price variation (depending on tariff plans negotiated and/or fluctuations on the stock market), etc.
- ❖ Build a CES demo-plant, validate and demonstrate the CES performance for a refrigerated warehouse.
- ❖ Elaborate a strategy for CES implementation in the food refrigeration sector across Europe.