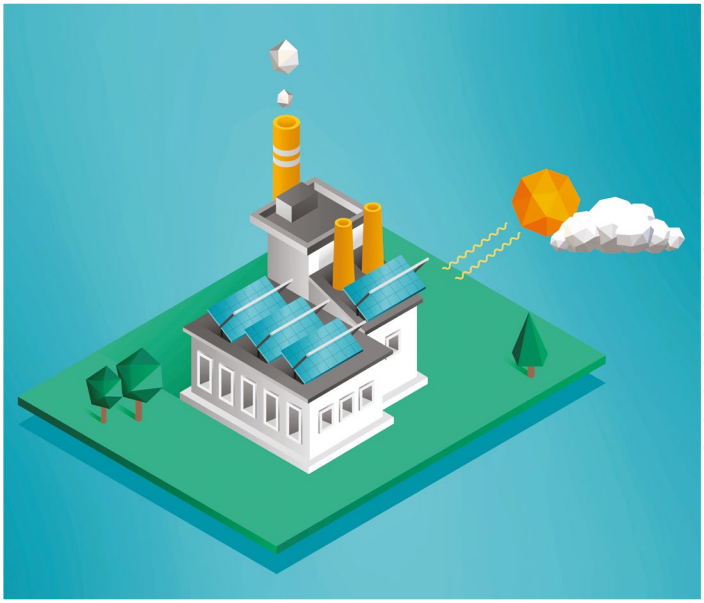
HYCOOL PROJECT

hycool©
Solar Cooling Systems



Industrial Cooling through Hybrid system based on solar heat

http://hycool-project.eu/

Co-founded by
the European Union
GA No. 792073

H2020

HYCOOL PROJECT

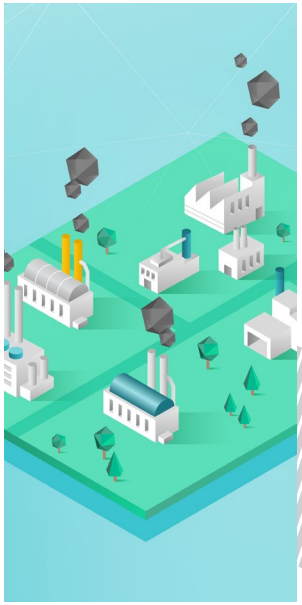
Solar Cooling

The cooling demand is growing worldwide with a wider variety of use, including industry. The objective of HYCOOL is to minimize emissions of gases with high Global Warming Potential into the atmosphere (CO_2, SO_2 and NOx) by maximizing exploitation of renewable energy systems in industrial refrigeration.

HyCool will use the latest available developments in Concentrated Solar Panels, Thermal Storage fields and Hybrid Heat Pumps to develop two innovative Hybrid Solar System concepts based on solar steam for cooling generation: one for chemical industrial processes, and one for the small food industry.

Strengths of HYCOOL:

- Flexibility of application in the context of fluctuating supply/demand profiles
- Approach: Simulation, demonstration and monitoring in two industrial environments
- Work out business models for rapid market uptake



HYCOOL

Excellence

Mission & Objectives

HyCool Project Mission is **to increase the current use of Solar Heat in Industrial Processes.** To do so the project proposes the **coupling of a new Fresnel CSP Solar thermal collectors (FCSP) system with specially build Hybrid Heat Pumps (HHP)** (a "two-in one" combination of adsorption and compressor based heat pumps) for a wider output temperature range (Solar Heating & Cooling –SHC-), and a wide range of design and operational configurations to increase the potential implementation of the proposed Solar Heat in industrial environments.

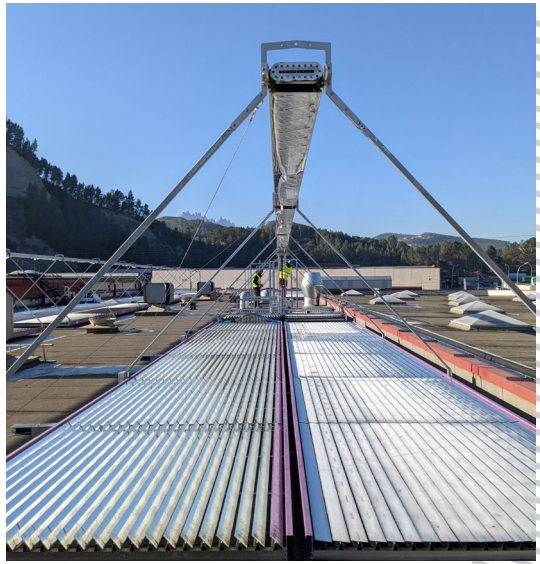
To achieve HyCool's mission, three overarching goals are proposed:

1. To improve industrial integration of current Solar Heating Systems;
2. To achieve a cost effective solution in total costs;
3. To generate trust in the solution proposed in key leading industry sectors, basically Chemical and Food Industry.

WELCOME
To HyCool

HyCool project is a systematic approach for developing operationally integrated solar, thermal and electric components and systems from TRL4-5 to TRL7 and beyond.

The Hybrid Solar concepts are based on the same basic configuration: the combination of a Concentrated Solar Heat solution coupled with a Hybrid Cooling unit.



Fresnel Concentrated Solar Panels System

The Modular Fresnel Concentrated Solar Panels System (FCSP) solution proposed is a cheap and easy-to-install solar mirror system that concentrates the solar radiation onto a receiver, generating steam directly in said receiver. The adaptation of its temperature to requirement demands will be done through the internal FCSP Control. Depending on the configuration of the HyCool System, this steam can be directly used in existing industrial steam systems for production, can be stored using a Primary High Thermal Storage based on high temperature PCMs or can be derived to the Cooling production unit. This unit is formed basically by a Hybrid Heat Pump (HHP) which is a modular flexible system composed by compression and adsorption heat pumps. This HHP can be easily adapted to be coupled to any present energy source above the FCSP thermal output, efficiently converting and upgrading both electric surplus and thermal energy sources of any industrial plant.

Our mission is to increase the implementation of Solar Heat in Industrial Processes (SHIP) by proposing a cost effective solution with reduced technical complexity.

Objectives & Strategies

Improve industrial integration of current Solar Heating Systems

Extending the range of application of the Solar Heat produced by increasing the flexibility of the system configuration, so that the produced energy can be used in cooling applications below 10 °C on the one hand and for process heat up to 240 °C. This flexibility allows for a better integration in more industrial sectors.

Achieve a TOTEX cost effective solution

The TOTEX strategy will depend on the Life Cycle of each industrial installation. In small industries located in sunny areas, the strategy centers on the **Efficiency Feature**, the simplest configuration possible to reduce CAPEX and maximize average stationary efficiency for the best OPEX. However, large industrial environments can integrate several different processes. For these cases, the **Operational Flexibility Feature** will increase CAPEX to allow the HyCool smart control the opportunity to select among different options to maximize efficiency between internal production flows and the Solar Heat produced.

Innovation
Technologies

Fresnel solar thermal collectors

Process heat up to 230°C
Designed to achieve temperatures of up to 230°C and 25 bar. Heat can be delivered as direct steam, pressurized hot water, thermal oil, or hot air.

Reduce costs
With efficient and flexible solar thermal energy use, an automatic cleaning system and prefabricated technology to reduce on-site installation costs.

Optimise space
A modular and adaptable system designed for both rooftop and terrain installations. The reduced shadowing effect among mirror stripes enables a very high density of mirror area per ground area.

Hail and wind resistant
The flat mirror system (module height < 20 cm) reduces wind exposure and is designed to withstand hail up to 4 cm ice balls. This also makes it lightweight which avoids complex system foundations or substructures.

100% renewable
Solar thermal energy can help reduce your industrial CO2 footprint thanks to its efficiency and flexibility. It also allows to easily save up to 30% of the yearly fossil fuel consumption and potential carbon taxes.

Phase Change Material

Versatile in terms of power and applications of temperature
The storage in HyCool is based on special durable steel alloys that enable high temperature storage of up to 500 °C. Within this project we demonstrate up to 230 °C.

Suitable for different renewable heat systems
These thermal energy storages are suitable for process heat, district heating, power generation and domestic heating.

Scalable
The PCM storage solutions developed in HyCool are "modular solutions". Storage in the scale of many 100 MWh can be easily achieved by combining many modules of 100 kWh each to achieve almost arbitrary total storage capacity.

High Energy Density
PCM-based thermal storage allows for more energy to be stored in the same amount of volumen

Hybrid Adsorption/ Compression Chiller

Cascade chiller tested between +20°C and -16°C chilled brine temperature (LLT).

Reliable operation under design and off-design conditions.

Cooling power ranges between 22 kW and 7kW.

EER up to 40% higher than standard solutions (R134a chillers).

Efficient operation with heat at 70°C, such as waste heat.

Demonstration
HyCool Pilot Sites

HyCool will use the latest available developments in both Concentrated Solar Panels and Thermal Storage fields to develop **two innovative Hybrid Solar System concepts**: one for Chemical Industrial Processes primarily meant for Solar Steam and Cooling energy provision and one for the Small Food Industry primarily meant for Solar Cooling production.

Bo de Debò

FOOD INDUSTRY

The food case pilot targets specialized small food industries in high solar irradiation areas with cooling needs in their processes. Here the industrial cold installation is necessary for the good preservation of the product, it serves different rooms to achieve them the following final temperatures in the chamber:
Production area: 6-8°C
Delivery area: 10-12 °C

Givaudan

CHEMICAL INDUSTRY

The chemical case pilot targets industries with several processes in high solar irradiation areas with steam and cooling needs. Givaudan's cold installation makes use of a glycolic water chiller to keep the water entering the liquid ring of the vacuum pumps at 7°C. The thermal demand for the installation was calculated at 125.5 kW.

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NEWSLETTER

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