emilie

Projet cofinancé par le Fonds Européen de Développement Régional (FEDER)
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Identified Technologies for the SunLab pilot plant

PROJECT TITLE: ***Enhancing Mediterranean Initiatives Leading SMEs to innovation in building energ technologies***

AXIS: ***Strengthening innovation capacities***

OBJECTIVE: Dissemination of innovative technologies and know-how

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1 Introduction

This report is the Italian fold of Deliverable D4.1.1., which aims at detailing the technologies that will be implemented within the pilot actions of the EMILIE project. Overall, 6 pilot plants will be installed: one per participating region. The 6 pilot plants are:

- SunLab in Italy, Friuli Venezia Giulia region, under the lead of AREA
- HVACLab in Spain, Andalousia region, under the lead of IAT
- SmartEE in France, PACA region, under the lead of Capenergies
- InfraSun in Slovenia, Ljubljana region, under the lead of IJS
- Glassolating in Spain, Aragon region, under the lead of CIRCE
- SunCool in Croatia, Kvarner region, under the lead of REA

The next sections:

- explain why the demonstration site for the SunLab pilot action has been chosen,
- what are the energy saving challenges and
- present the technologies that will participate in the challenge solving.

2 Presentation of the demonstration site

Introduction of the demonstration site: Why this site has been chosen?
What are the energy saving challenges?
Which of these challenges the pilot action will address?

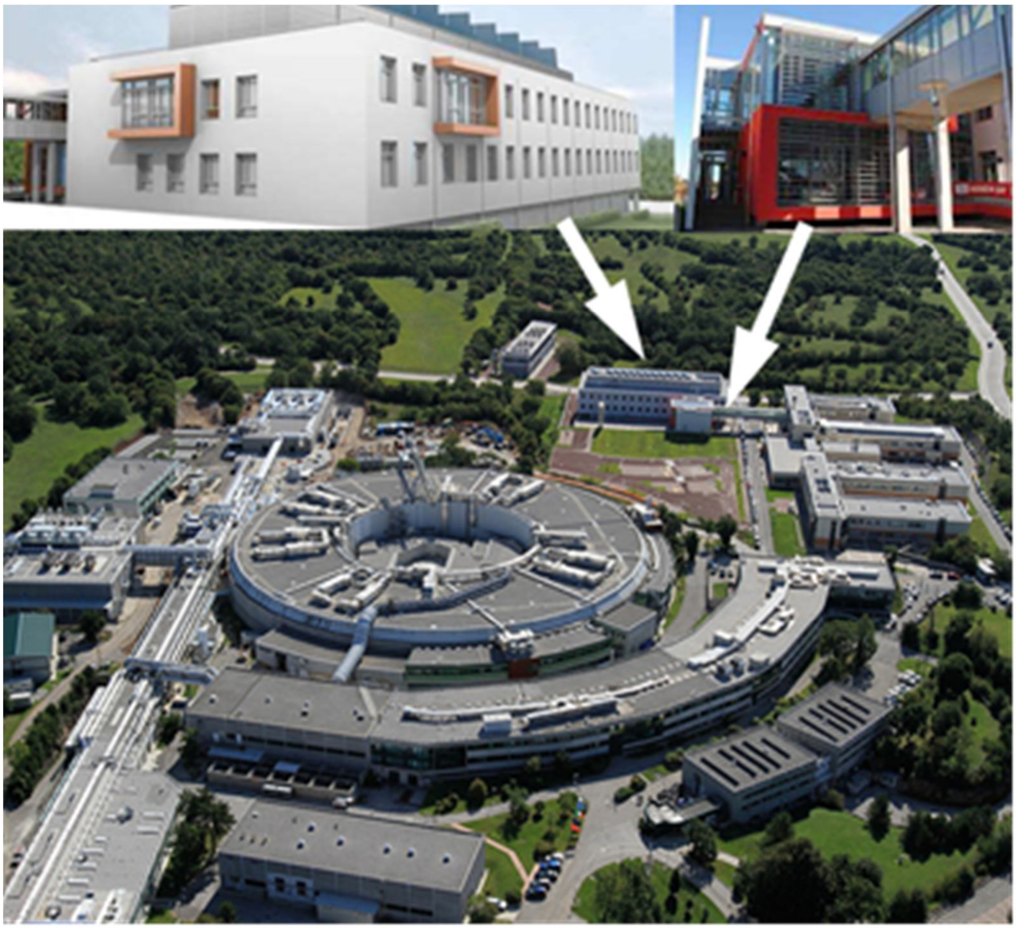
Cooling from renewable energies and particularly solar cooling technologies (SC) represents a key issue within the European Union energy policy.
Solar heating became a widely accepted concept by the general public for hot water production and nowadays it is benefitting from a high level of market penetration.
On the other hand, Solar Cooling has rather low levels of market penetration and public acceptance levels although it represents a mature technology.
Generally speaking solar powered cooling involves using the high temperature in the middle of the day as energy provider to generate a cooling effect. The solar energy can be used to cool buildings since the demand for air conditioning rises and falls more or less parallel to the amount of solar energy available.

The "Solar Technology Lab - SUNLAB" is meant to represent a laboratory based on the solar cooling technology which will be open to all potential users. More in details SunLab pilot plant aims to:

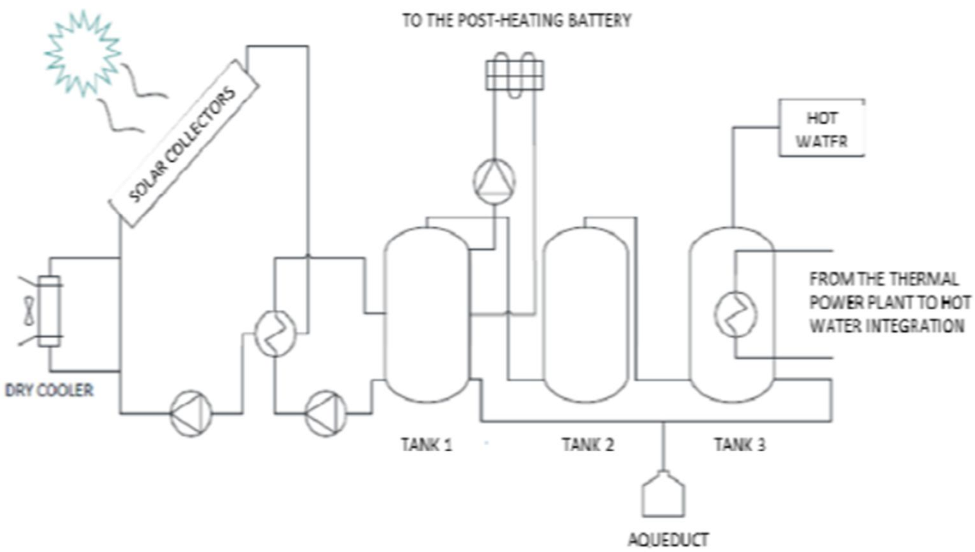
- ease the access to innovative technologies on a transnational level.
- promote the spread of solar cooling technology for building air conditioning in order to gain an increasing independence from fossil fuels.
- develop useful guidelines to adopt a new range of conditioning products and / or plants for residential and tertiary buildings.

The "Solar Technology Lab - SUNLAB" will be settled in the Basovizza campus (Trieste), that is part of Area Science park.
In Basovizza campus, home to the ELETTRA Synchrotron Light Laboratory, stands a new building called "Q2 building" dedicated to cutting-edge biotechnology.
The "Q2 building" is a modern construction with a high-impact from an architectural point of view with an inner surface of 7,000 s.q.m. with great flexibility and adaptability to specific security and functional requirements.
On the roof top of the "Q2 building" there is an existing solar thermal power plant which produces the hot water used in the building and serves to the post-heating treatment in the batteries of air conditioning plant.
The technical data of the existing solar power plant are the following:

- Vacuum type solar collectors system:
- 12 collectors (30 tubes each) - Thermics DTH 30
- 36 collectors (20 tubes each) - Thermics DTH 20
- Surface: 100,00 sqm
- Thermal power: 40 kW
- Estimated annual energy production 70,00 MWh / year (medium irradiation and
- environmental conditions)
- 2 hot water storage tanks of 2.000 litres each



Location of the Q2 building in Basovizza (Trieste).



The existing solar power plant on the roof top of the Q2 building (scheme)

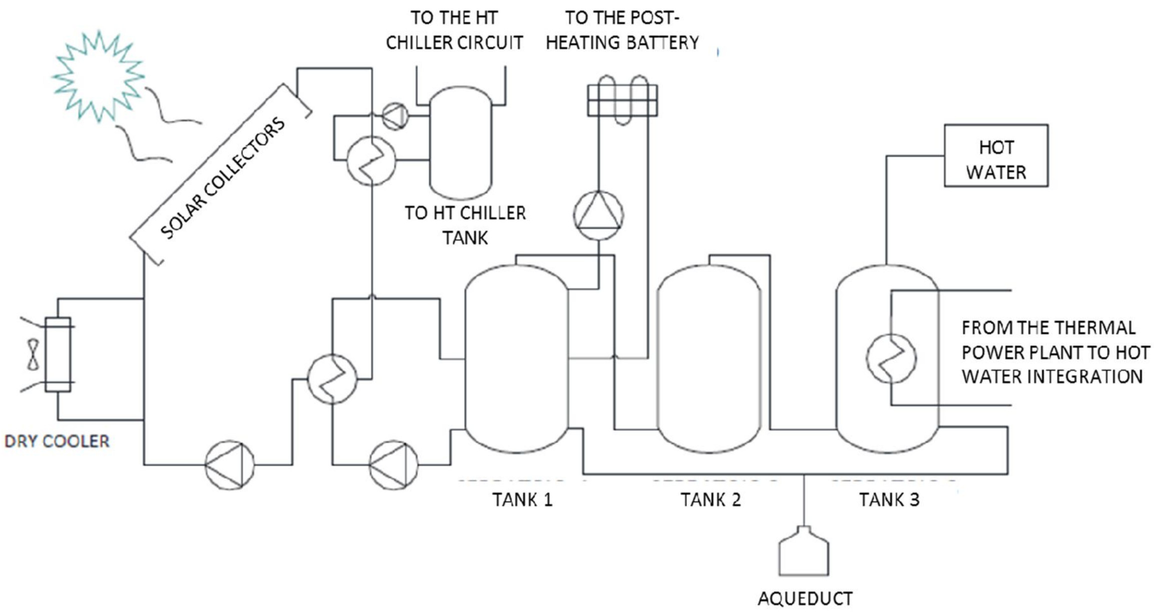
In SunLab laboratories the cooling effect will be provided by an adsorption chiller. In this kind of cycle the cold is produced on the basis of a thermodynamic cycle that exploits mainly heat; its performance remains acceptable even if the heat is administered at lower temperatures (50-70 ° C). Such temperatures can increase the amount of energy captured by the solar thermal collectors optimizing the use of solar cooling. Moreover the adsorption cycles has got an attractive specific cost if compared to absorption and implies less active components to be installed in the plant.
They can be supplied in lower potential elements as well, therefore suitable for integration with solar thermal systems of a few tens of square meters such as those typical of small residential compound.

The existing solar power plant on the roof top of the Q2 building

3 Description of the pilot plant

What is the approach to face the energy saving challenge you choose to address ?
What are the technologies that will be demonstrated to address the challenge ?

On the basis of the thermal power provided by the solar field, the power of the chiller refrigerator adsorption might be around 15 kWf combined with the need to maintaining a share of thermal power for the production of hot water and taking into consideration the budget constraints.
Regarding the use of the cooling capacity produced, this capacity could be used as a supplement to existing cooling plant, in which liquid is circulated at 10-15 ° C.
On the basis of this hypothesis, instead of building a cold tank it may be necessary to use heat accumulation. Its volume would depend on the size of the accumulation of the adsorption chiller and performance expectations. In any case we reckon that a volume of about 500-1000l would be sufficient for the considered application.
In the pilot plant project design it would be favourable to consider the use of a chiller in heat pump in order to exploit the system during the winter period as well. In addition, further analysis on the use of other sources of heat (cogeneration plants) may reveal interesting opportunities.
Finally, the choice of location chiller unit (adsorption system) should be made taking into account factors of technical / economic feasibility.



SUN LAB: first hypothesis scheme

4 Expected impacts

SunLab plant is one of the first Italian demonstrators able to integrate the solar cooling technologies and, at the same time, to provide a platform for testing new components and control strategies.
Thanks to the monitoring activity that will begin after the pilot plant installation, SunLab will provide useful data on the pilot plant impacts on energy efficiency, cooling performance and calculation of the ROI (Return of Investment).
Therefore, along with the installation of the pilot plant, a data acquisition system will be installed.
It will integrate the SW and HW components already available in Basovizza campus related to other energy systems already installed in order to collect data and spread technical know-how on solar cooling performances.
More in details, the SW acquisition will be developed preferably in environment using NI LabVIEW NI CompactRIO hardware. The main data that will be monitored will be:

· weather station data + pyranometer (if already available on the central roof technology);
· primary circuit solar thermal power;
· thermal power of HT chiller circuit;
· thermal power of LT chiller circuit;
· thermal power of MT chiller circuit;
· power input of the chiller (including heat sink and circulation unit).

4.1 Energy savings

SunLab will enable to collect useful data on the performance of the solar cooling system and on the potentiality of that technology in terms of electricity saving and fuel for cooling and heating.
Some tests will be conducted on the panels concerning the required different flows of heat transfer fluid and therefore different temperatures of operation. The uptake efficiency of the panels and the coefficient of performance of the adsorption cycle will be measured at different flow rates.
By means of other experimental facilities already available in the Basovizza, it will also be possible to make an accurate comparison between the solar cooling performance with solar thermal collectors and the performance with photovoltaic collectors using a compression chiller.
All these data will be available and published on the Emilie website and presented to SMEs and Public Authorities in many technical workshops organized by Emile project.

4.2 Other environmental benefits

SunLab will demonstrate that it is possible to reduce the CO_2 emission and gain an increasing independence from fossil fuels thus moving towards a “low carbon economy”.

4.3 Social impact

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4.4 Financial advantages

Thanks to the monitoring activity on the pilot plant efficiency, SunLab will provide useful data on the ROI (Return of Investment).

4.5 Other impacts

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