SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

# 2023 HIGHLIGHTS

## Task 65 – Solar Cooling for the Sunbelt Regions

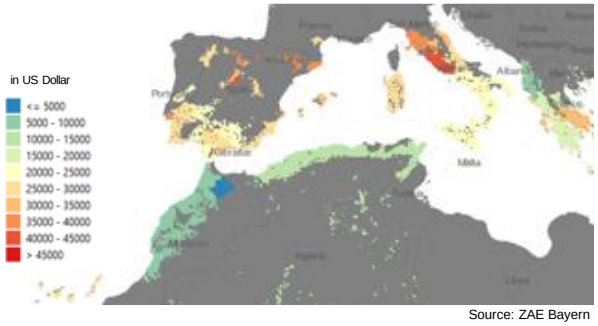
## THE ISSUE

In 2016, air-conditioning accounted for nearly 20% of the total electricity demand in buildings worldwide and consumption is growing faster than any other energy source used in buildings. If measures are not taken to counteract this increase, space cooling demand will almost triple by 2050; the demand could reach 6,200 TWh, or 30% of the total electricity used in buildings. The latest studies are primarily directed at existing conventional technology. However, greater attention should be directed at enhancing components and systems.

Solar cooling, either thermal or electrical driven systems, tend to cater mainly to niche markets. To foster affordable, safe and reliable solar cooling systems in the Sunbelt regions a combination of cost reduction, adaptation and system simplification is required. Stimulation of market conditions through policy measures is also necessary. The implementation of revised components and systems that cater to the different boundary conditions should be introduced by cooperation with industry and with support of target countries like India and UAE through the Mission Innovation (MI) Innovation Community, “Affordable Heating and Cooling of Buildings” (IC7).

## OUR WORK

SHC Task 65 targets the small to large cooling and air conditioning market (between 2 kW and 5,000 kW). Both solar thermal (ST) and photovoltaic (PV) can be integrated to support a HVAC system. When well designed and boundary conditions are met, these systems are highly competitive when compared with reference systems.



Source: ZAE Bayern

This project focuses on using solar energy across Sunbelt regions where boundary conditions vary (sunny and hot, and humid climates, between 20-40 degrees latitude in the northern and southern hemisphere). Adaptation of existing concepts is key. To utilize solar heat in industry and to support the solar thermal market, the integration of solar thermal systems into existing energy supply structures is paramount.

**Participating Countries**

*Australia*
*Austria*
*China*
*Denmark*
*Egypt*
*France*
*Germany*
*Italy*
*Mozambique*
*Netherlands*
*Slovakia*
*Spain*
*Sweden*
*Switzerland*
*Uganda*
*United Kingdom*
*USA*
*Zimbabwe*


Task Period 2020 – 2024
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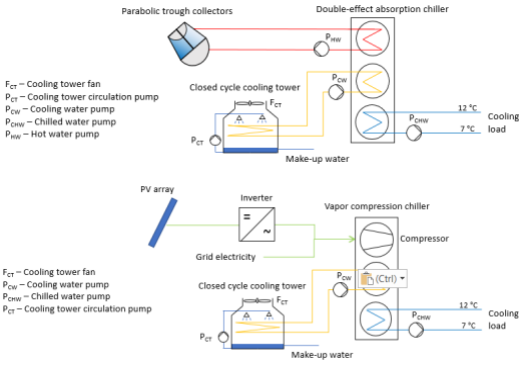
SOLARCOOLING SUNBELT REGIONS TASK65

# KEY RESULTS IN 2023

## Study on Design Guidelines

The large diffusion of solar cooling technology in market does not depend merely on the technical and economic aspects, but on the possibility of providing a systematic approach for the design and installation of the system in different climates, easily manageable even by professionals who are not experts on the specific technology. For this purpose, a comprehensive questionnaire was created that details various solar cooling components, design, sizing, and other sub-systems, such as heat rejection units and cold distribution systems. Data from 10 case studies show the performance of solar cooling systems with varying boundary conditions.



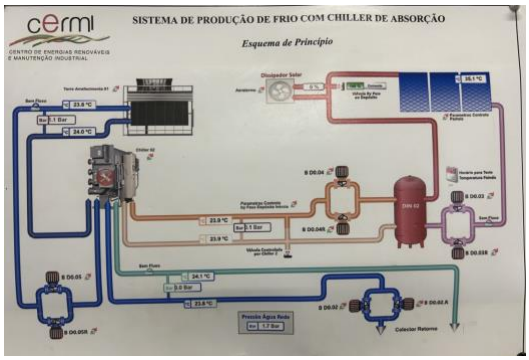

Source: ABSOLICON

Additionally, three different case studies, each with their own scope and unique characteristics, are discussed:

- Industrial cooling offers significant opportunities for solar thermal cooling applications. Such systems can achieve a high solar fraction and thus significantly reduce $CO_2$ emissions compared to conventional electricity-powered chillers.
- The integration of solar PV with vapor compression chillers is an emerging solution for the decarbonization of cooling systems. A comparative analysis considering different load and weather profiles suggests that solar PV cooling can result in a lower levelized cost of cooling compared to solar thermal.
- Hybrid chillers emphasize the potential of combining electrical and thermal chillers. Both simulation and practical results indicate a significant reduction in electricity consumption when using the topping cycle of an adsorption chiller.

## SHC Solar Academy Training for SOLTRAIN West Africa

The SHC Solar Academy and SOLTRAIN West Africa hosted with the support of ECREEE an on-site specialized course for professionals on Solar Thermal Energy with a special focus on Large-scale Solar Water Heating and Solar Cooling on October 10th and 11th, 2023 at CERMI (Center for Renewable Energy and Industrial Maintenance) in Cape Verde. SHC Task 65 expert Uli Jakob presented the topic of solar cooling to 27 West African participants.




A bonus for the participants was the onsite solar thermal cooling system, which gave them a hands-on opportunity to see how a system works. CERMI installed the system with its 70 kW cooling capacity in 2013. The system, supported by a compression chiller, cools a conference room and other rooms in the building with chilled water. The collector field consists of flat plate collectors with CPC mirrors inside. A 1,000-liter hot water tank and 500-liter cold water tank are used for energy management of the system.

Source: JER