SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

2024 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.

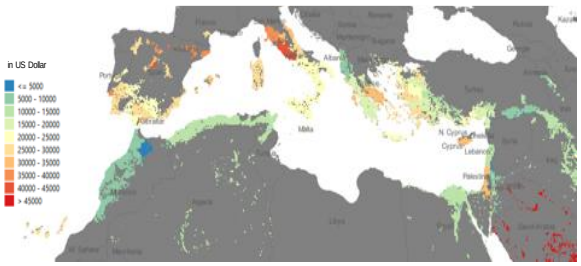
Solar cooling, either thermal or electrical driven systems, tend to cater mainly to niche markets. To foster affordable, safe and reliable solar cooling systems in the Sunbelt regions a combination of cost reduction, adaptation and system simplification is required. Stimulation of market conditions through 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).

Participating Countries

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

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 system designs 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.

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SOLARCOOLING SUNBELT REGIONS TASK65

KEY RESULTS IN 2024

Database for Technical and Economic Assessment

For the successful design of solar cooling systems, it is necessary to have a comprehensive database of technical and economic data for solar cooling components in Sunbelt countries, supporting extensive assessments and providing insights into future scenarios. The database allows a solid framework for sensitivity analyses and future scenario planning for solar cooling concepts. The IEA SHC Task 53 databases formed the basis for the economic analysis of solar cooling systems (total system, ST- or PV-based, including all already installed main components). An internal expert survey of Task 65 has shown that the average investment costs per kW cold for different system sizes are:

- 2,100 €/kW for small ST-based or 1,500 €/kW for small PV-based systems (<10 kW),
- 1,600 €/kW for medium ST-based systems or 1,200 €/kW for medium PV-based systems (10-50 kW),
- 1,200 €/kW for large ST-based systems (50-100 kW) and
- 1,000 €/kW for ST-based systems over 500 kW.

These costs are critical for techno-economic analysis and future scenario planning. Economic parameters influencing key performance indicators (KPIs) include economic base data, consumption-based costs, operational costs, and capital costs. The Climate Profiling Tool helped to assess local weather conditions for solar cooling potential. Life-Cycle Cost-Benefit Analyses (LCCBA) were used to develop business models and financing solutions, emphasizing dynamic cash flow models. Learning curve models showed cost reductions through experience, though their application is limited by data availability for complex solar cooling systems. A detailed economic and financial LCCBA model focused on dynamic cash flow and KPIs such as internal rate of return (IRR), net present value (NPV), and levelized cost of energy (LCoE). Sensitivity and risk analyses helped to optimize project outcomes and support financial due diligence. The concept of 'Multiple Benefits of Energy Efficiency' was applied to solar cooling projects to capture additional benefits and drivers.

Key Messages from Task 65

The key messages and takeaways from the work of Task 65 for the implementation/ adaptation of components and systems for the different boundary conditions to develop a market uptake of solar cooling in the Sunbelt regions are:

- Designing effective solar cooling systems in Sunbelt regions requires a comprehensive understanding of the climatic conditions to use the solar resources for efficient and eco-friendly cooling solutions.
- Further demonstration projects are necessary to gain experience and create confidence in the technology in Sunbelt regions.
- Wide penetration of solar cooling in Sunbelt countries is not only depending on the accomplishment of technical barriers.
- Non-technical barriers often have a critical role. Financing, policy advise, and dissemination/communication of success stories are among the important activities to overcome also non-technical barriers

Sources: PURIX, SolarNext