TASK 65 INTERVIEW

Solar Cooling for the Sunbelt Regions

Uli Jakob

The SHC Programme finalized its work on Solar Cooling for the Sunbelt Regions (SHC Task 65) this year. To learn first-hand about the Task's impact, we asked the Task 65 Manager, Uli Jakob of Dr. Jakob energy research GmbH & Co. KG in Germany, to share his thoughts on this 4-year project.

Why was a project like this needed?

Uli Jakob (Uli): As the energy demand for air-conditioning is growing faster than any other energy consumption in buildings, this project was very important to tackle this issue using solar technology that provides innovations for affordable, safe, and reliable Solar Cooling systems for the Sunbelt regions worldwide – the Global South. Therefore, the know-how capitalized in OECD countries (Europe, the US, Australia, etc.) on Solar Cooling technology (both thermal and PV) was already very relevant, but very few efforts had been made to adapt and transfer this know-how to Sunbelt countries such as Africa, MENA, Asian countries, which are all dynamic emerging economies.

Solar Cooling was already the subject of four SHC Tasks: Task 25, Task 38, Task 48, and Task 53. The previous Tasks achieved substantial progress for Solar Cooling systems. However, the implementation/adaptation of components and systems for the different boundary conditions was forced in Task 65 by cooperation with industry and with the support of target countries like UAE and India through Mission Innovation (MI) Innovation Community "Affordable Heating and Cooling of Buildings" (IC7).

What is the current status of the applications used for solar cooling?

Uli: The main applications that we identified in Sunbelt countries are in public buildings (34%), with an average working span of 8 hours/day, while some others were utilized in the domestic building (25%), process industry (9%), and food processing sector, among others. It is also interesting that manufacturers and system providers of solar cooling kits or large-scale systems have adapted their products for the Sunbelt region conditions. The focus here is on the heat rejection systems for dry and hot or humid and hot climates and, thus, the operational safety of these systems and kits. In addition, using medium-temperature solar systems to operate two-stage absorption chillers is becoming increasingly popular to increase competitiveness against traditional compression chiller systems.

The future markets for solar thermal cooling systems are in the Global South, where the demand for cooling is increasing rapidly due to the constantly growing population and extreme heat waves. Moreover, an important driver for solar cooling technology is its potential to reduce GHG and peak electricity demand, particularly in those countries with significant cooling needs and grid constraints. Today, for example, 30% of India's total energy consumption in buildings is used for space cooling, reaching up to 60% of the summer peak load. This is already stretching the capacity of the Indian national electricity supply dramatically. In other countries, like the USA, the peak load through conventional air conditioning reaches >70% on hot days.

Is there one result/outcome that surprised you?

Uli: Yes, the GIS tool developed by the Task participants from ZAE Bayern in Germany. They integrated geographic data to establish local reference boundary conditions for evaluating solar cooling systems in Sunbelt regions. By incorporating data such as population density and purchasing power, the tool provides a foundation for future market potential studies on specific products or technologies. As a result, potential sites can be identified and economic factors can be considered to identify (future) markets.

What is a Task success story from an end-user or industry?

Uli: The success stories I would highlight are our comprehensive roadmap and proposed actions that address specific challenges and opportunities to enhance the applicability of the existing Australian Standard AS 5389 on solar cooling to Sunbelt climates. This is crucial for making the technology comparable, calculable, and promotable in Sunbelt regions. And to support this effort, an existing life cycle cost-benefit analysis (LCCBA) tool was further developed to meet the specific requirements for modeling solar cooling systems in Sunbelt countries. Both results are extremely important for the industry to develop markets. The strong interest from industry and business was evident in the number of Task 65 participants from solar thermal

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collector manufacturers, sorption chiller manufacturers, system suppliers, consultancies, business developers, and ESCOs. Overall, 50% of the 83 Task experts came from industry and SMEs.

How has the Task's work supported capacity and skill building?

Uli: The widespread adoption of solar cooling in Sunbelt countries does not depend solely on removing technical barriers but also non-technical barriers. Financing, policy advice, and dissemination/communication of success stories are important activities to overcome non-technical barriers. Therefore, we organized 11 workshops, two onsite trainings in South Africa and Cape Verde, and two online trainings for the Caribbean and Türkiye, reaching over 565 participants (manufacturers and installers, consultants, policymakers).

What is the future of solar cooling – new developments, markets, policies, etc.?

Uli: Whether or not there will be a take-off of solar cooling, a key driver could be the UNEP's Global Cooling Pledge, which offers the opportunity to take concrete actions to promote "Sustainable Cooling." In total, 71 countries have signed the Pledge so far. The aim is to reduce cooling-related emissions by 68% by 2050 compared to today, significantly improve access to sustainable cooling by 2030, and increase the global average efficiency of new air conditioning systems by 50%. The emissions targets are based on models from the UNEP Cool Coalition 2023 report.

To drive this effort forward, current and future product development is focused on compact, small-scale solar air conditioning units with air-cooled absorption and adsorption chillers, as well as small and large multi-stage desiccant systems featuring solar thermal collectors or desiccant coated components. In addition, the development and launch of x.N stage chillers (half, single, 1.N, double, triple) paired with new medium temperature collectors, as well as thermally driven heat pump systems for heating and cooling, also in hybrid operation with vapor compression chillers. Not forgetting the future market penetration of small PV-driven components with new heat pumps/chillers that use natural refrigerants, such as propane.

What were the benefits of running this as an IEA SHC Task?

Uli: The Task was able to build a strong international network of experts from academia and industry with an interest in solar cooling and motivation to support and leverage existing know-how for the Sunbelt regions. The involvement of the GN-SEC experts (especially from Africa) was also very important and fruitful for the Task work to consider regional needs and requirements. This was highlighted by two GN-SEC experts who acted as activity leaders. In addition, the lively exchange of ideas and sharing of research and commercial project results between the experts was very fruitful, leading, for example, to several funded research activities.

Will we see more work in this area in the IEA SHC Programme?

Uli: The Task experts discussed several topics of interest for future work, including new focus areas (e.g., agri-food, commercial, tourism, industry), technical (e.g., storage, hybrid chillers, etc.), and socio-economic research areas (e.g., adaptation to climate change, etc.) and market needs (e.g., advanced GIS tool to identify markets and geographical areas, development of business cases, etc.).

A follow-up Task on "Solar Cooling for the Global South" to demonstrate the potential for sustainable and efficient heating and cooling solutions using a systems approach for industrial and commercial applications, including thermal energy storage and industrial waste heat recovery, is fully prepared and ready for kick-off in the future.