Solar Cooling for the Sunbelt Regions

Highlights from Task 65 activities

SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

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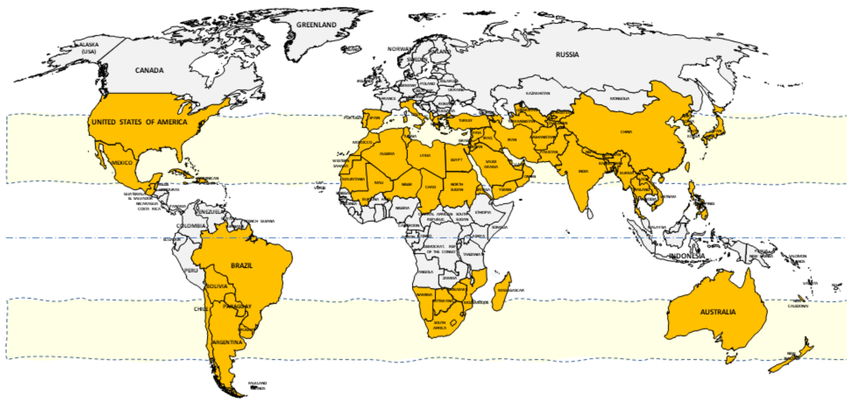
About the project

The energy demand for air-conditioning is growing faster than any other energy consumption in buildings. The main share of the **projected growth for space cooling comes from emerging economies and will more than triple by 2050 to 6,000 TWh/a globally**.

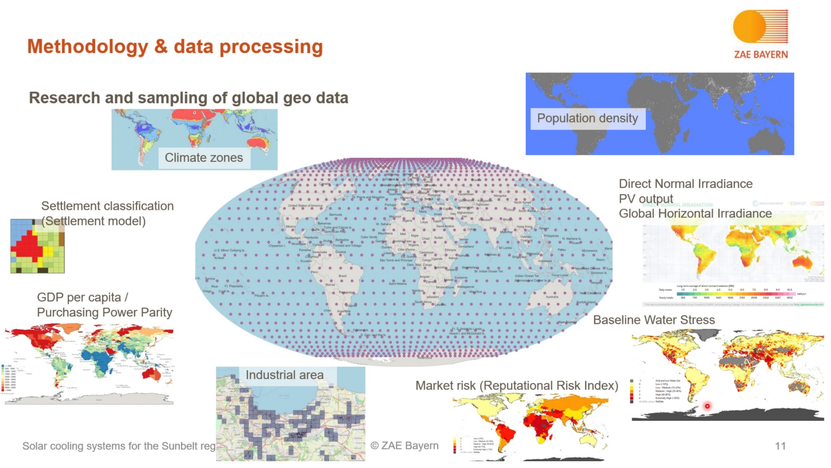
Therefore, the IEA SHC Task 65 “Solar Cooling for the Sunbelt Regions” (July 2020 – June 2024) is focusing on innovations for affordable, safe and reliable Solar Cooling systems for the Sunbelt regions. The innovation is the adaptation of existing concepts/technologies to the Sunbelt regions using solar energy, either solar thermal or solar PV.



Sunbelt regions (sunny and hot, and humid climates) between 20-40 degrees latitude in the northern and southern hemisphere.
(Source: NB)

Climatic conditions & applications

In general, climatic conditions and typical applications for (solar) cooling heavily depend on the location. In order to be able to deduce regionally specific requirements for Solar Cooling systems, it’s therefore obvious to use geographical data. To process such data a Geographic information system (GIS) is needed. **A GIS-Tool was employed to amalgamate geographical data in a manner conducive to ascertaining localized reference conditions for solar cooling systems within Sunbelt regions**. Moreover, this methodology can be adapted to generate insights into potential deployment sites and the feasibility of specific solar cooling systems. Supplementing this approach with data such as population density and purchasing



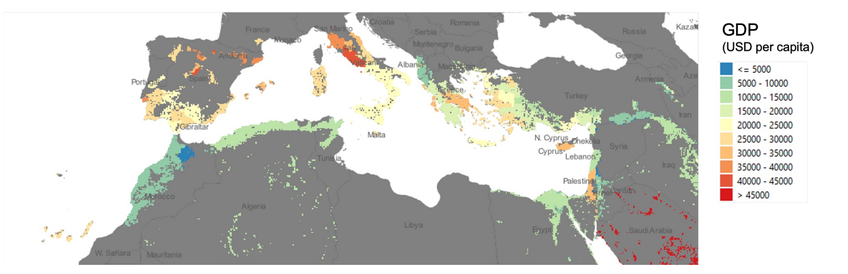
Design guidelines

Data has been gathered from case studies, detailing component capacities and sizing procedures, to illustrate the performance of solar cooling systems under varying boundary conditions. The summary is as follows:

Industrial Cooling Potential: Industrial cooling holds significant promise for solar cooling applications. These systems can achieve a high solar fraction, leading to a considerable reduction in CO_2 emissions compared to conventional electricity-driven chillers.

Solar PV and Vapor Compression Chillers: The integration of Solar PV with vapor compression chillers is examined as an emerging solution for decarbonizing cooling systems. A comparative analysis involving different load and weather profiles, suggests that solar PV cooling can result in a lower levelized cost of cooling compared to solar thermal. The study underscores the significance of thermal storage and the effectiveness of lower temperatures in solar thermal collectors for cost competitiveness.

Hybrid Electrical and Thermal Chillers: The focus is on combining electrical and thermal chillers. Both simulation and real-world outcomes demonstrate a significant decrease in electricity consumption when utilizing the topping cycle of ab-/adsorption chillers. Progress in policies and economies of scale is expected to boost the cost-effectiveness of these innovative methods.



Developed GIS-Tool to identify potential Solar Cooling markets based on specific geographic data about irradiation, population density, industrial areas or water availability.
(Source: ZAE Bayern)

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Technology Collaboration Programme
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