

2015 HIGHLIGHTS

Task 53 

SHC Task 53

New Generation Solar Cooling & Heating Systems (PV or solar thermally driven systems)

THE ISSUE

A tremendous increase in the market for air-conditioning can be observed worldwide especially in developing countries. The results of the past IEA SHC Tasks and work on solar cooling in *SHC Task 38: Solar Air-Conditioning and Refrigeration* show the large potential of this technology for building air-conditioning, particularly in sunny regions. However, solar thermal cooling faces barriers to emerge as an economically competitive solution. Thus there is a strong need to stimulate the solar cooling sector for small and medium sized systems.

OUR WORK

This Task, building upon earlier IEA SHC work in this field, is working to find solutions to make solar driven heating and cooling systems cost competitive and to help build a strong and sustainable market for new innovative thermal cooling systems and solar PV. These objectives are being tackled through five activities:

1. Investigation of new small to medium size PV & solar thermal driven cooling and heating systems and development of best suited cooling and heating systems technology with a focus on reliability, adaptability and quality.
2. Proof of cost effectiveness of the above mentioned solar cooling and heating systems.
3. Investigation on life cycle performances on energy and environmental terms (LCA) of different options.
4. Assistance with the market deployment of new solar cooling and heating systems for buildings worldwide.
5. Increasing energy supply safety and influencing the virtuous demand side management behaviors.

Participating Countries

Australia
Austria
China
France
Germany
Italy
Spain
Sweden
Switzerland

The Task's scope is technologies for the production of cold/hot water or conditioned air by means of solar heat or solar electricity. That is the Task starts with the solar radiation reaching the collectors or the PV modules and ends with the chilled/hot water and/or conditioned air transferring to the application. It is focused on solar driven systems for both cooling (ambient and food conservation) and heating (ambient and domestic hot water).

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KEY RESULTS OF 2015

SHC Task 53 started in March 2014. The first results have been presented at numerous events, which can be found on the SHC Task 53 webpage.

Solar Cooling Systems 2.0

At OTTI 2015, the IEA SHC Task 53 organized a specific workshop on *New Generation Solar Cooling & Heating Systems* that focused on the status of solar cooling technology research and market developments. About 40 professionals gathered in Rome for this half-day event.

According to the IEA's *Technology Roadmap on Solar Heating and Cooling*, solar cooling should cover at least 17% of the total cooling needs by 2050. In the last 10 years, however, the development has not been as fast and effective as it was expected to be. In only a few specific cases is solar cooling economically competitive and has market appeal. The vast majority of the potential applications offer solutions that still have too long a payback time, and as a result are only installed when there are very high incentives, as happens for instance in research and demo projects. A New Generation of innovative solar cooling systems is now emerging based on PV systems and on solar thermal systems.

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Solar Cooling 2.0
A New Generation Is Growing Up

The September workshop on *New Generation Solar Cooling & Heating Systems* focused on the status of solar cooling technology research and market developments. About 40 professionals gathered in Rome for this half-day event, which was organized by IEA SHC Task 53. *New Generation Solar Cooling & Heating Systems* and the *German Environmental Institute for Technology Transfer, OTTI e.V.* the day before OTTI's 6th International Conference on Solar Air-Conditioning. Participants kicked first round about the first outcomes of SHC Task 53 that began its collaborative work in March 2014 and includes the participation of ten countries from across the globe.

The R&D Road to Competitiveness

According to the IEA's *Technology Roadmap on Solar Heating and Cooling*, solar cooling should cover at least 17% of the total cooling needs by 2050. In the last ten years, however, the development has not been as fast and effective as it was expected to be. In only a few specific cases is solar cooling economically competitive and has market appeal. The vast majority of the potential applications offer solutions that still have too long a payback time, and as a result are only installed when there are very high incentives, as happens for instance in research and demo projects.

"Due to hydraulic complexity and high investment costs, the first generation of solar cooling systems have shown not to be competitive." Daniel Hugler, Operating Agent of SHC Task 53, made clear when opening the workshop in Rome. "Because of the situation, we cannot yet talk of a marketable technology, but rather an intense R&D activity to develop a new generation of innovative systems towards Solar Cooling 2.0."

Another point discussed in the workshop was that the future trend of cooling and air-conditioning has a chance to move more towards large-scale systems, as is already happening for other applications of the energy sector. Such solutions, potentially including solar thermal energy for both cooling and heating, could also include small, medium and large district cooling grids. One additional possible feature of such plants is the parallel coexistence of different energy sources, both electrical and thermal, to supply energy for cooling.

Although the application of solar cooling primarily focuses on new buildings, the use of this technology in existing buildings should not be excluded although it does require some pre-requisites, such as the availability of sufficient roof space (an issue in modern cities with many high-rise buildings) and the capacity of the current cooling distribution system to be adapted to the energy supply by solar.

Solar Cooling 2.0: Compact and Easy to Install

What will this new generation of innovative systems look like? For sure, Solar Cooling 2.0 will be characterized by increased compactness and ease of installation, which means high compatibility for a direct coupling with chillers. Only with such a plug-and-play approach can solar cooling be a viable competitor with other technologies, heat pumps for instance.

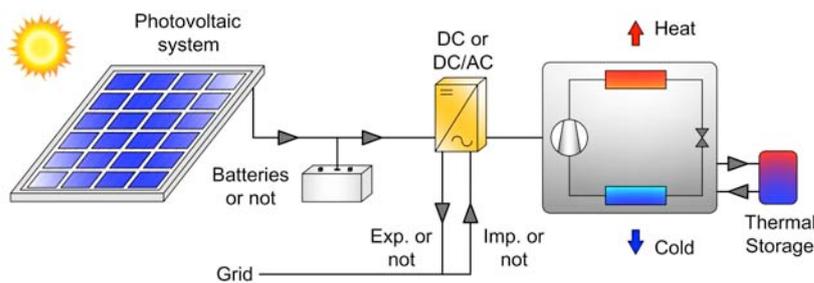


Monitoring Procedure for Field Test & Demo Systems with Compression Heat Pumps Driven by Photovoltaic Solar Energy

Monitoring of field test systems and demonstration projects for new generation solar cooling and heating systems is fundamental to analyze their performance and to identify, rate and verify the quality of the proposed solutions.

Ongoing work is to build a monitoring procedure for field tests and demo systems, which is focused on installations with compression heat pumps driven by photovoltaic solar energy. The final Task deliverable planned for mid 2016 will be a monitoring procedure integrating the following aspects:

- Generic schemes of PV driven heat pumps
- Electrical and thermal flows to be measured
- Definition of Performance Ratio Indicators (KPI)
- Measurement methods for air-to-air heat pumps
- Uncertainty analysis



Compression heat pump driven by PV panels (UMH)