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 Eastbavarian Institute for Technology Transfer, OTTI e.V. the day before OTTI's 6th International Conference on Solar Air-Conditioning. Participants learned first hand 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 have 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 Mugnier, Operating Agent of SHC Task 53, made clear when opening the workshop in Rome. "Because of this 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.

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What else is needed? There is a need for new standards and more data monitoring. Potential customers want to know upfront how a system performs in real time. Another message coming from the workshop was the need to 'keep it simple'. A model example of such a philosophy is the relatively small (130 m^2) solar plant in Banyuls, France, where the produced heat is used for air conditioning the 4,500 m^2 wine cellar – the system has been operating for about 25 years without major failures and mainly due to its simplicity.

The good news is that something is moving in the industry. In his presentation, Wei Zheng, from the large and well-known chiller manufacturer Yazaki of Japan, announced that they are working on improving some of their chillers to make them more suitable for solar use. It is no longer only solar moving toward the cooling machine industry, but also the chiller producers working to be compatible with solar! The main technical issue Yazaki is working on is to allow their chillers to be activated at lower temperatures and with lower flow rates, thus increasing the efficiency of the solar field. An example shown by Yazaki reported an increase in the solar fraction from less than 50% to 66%, thanks to such improvements.

Photovoltaics: A Partner or a Competitor?

A peculiarity of SHC Task 53 is that it is also dealing with solar PV cooling and is working in collaboration with the IEA Photovoltaic Power Systems (PVPS) Programme. Gaetan Masson, Operating Agent of PVPS Task 1, put it clearly, "For our business plans to work with feed-in incentives no longer available in the key countries, PV has to maximize self-consumption and cooling demand. This is the main reason why compact units with PV modules directly coupled to a cooling machine are taking their position in the market at the moment."

So, is PV a collaboration partner or a merciless competitor of solar thermal in the struggle for potential customers? When explicitly asked about that, Mugnier explained his point of view, "PV will be the main technology for small to medium scale single-user cooling applications, for instance mono or multi-split systems, while solar thermal is possibly still the best option for large scale (industry, grids) systems."

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