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Introduction into IEA SHC Task 48

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Abstract

Solar thermal cooling technology is currently facing a very exciting challenge. Air conditioning is a large and growing energy consumer, especially in sunny and developing countries. Worldwide efforts to develop renewable energy solutions must address this critical cooling application. Solar thermal energy presents a natural and strong opportunity to do just this. However, even if reliable technologically advanced products are presently available, the solar cooling sector must leap from a pre-industrial and demonstration status into a competitive mass market. Despite this, some applications, particularly for large buildings with combined cooling and domestic hot water production, are already very close to cost competitiveness without any incentives.
This paper will concentrate on introducing an international collaborative R&D activity called IEA SHC Task 48 in the field of solar cooling and the methodology, participating entities and initial outcomes.

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1. IEA SHC Task 48 description

1.1. History

Solar Thermal Driven Heating and Cooling (STDHC) systems are included in the IEA SHC Strategic Plan Key Technologies [1] due to their potential to cover much of the rising demand for air-conditioning by utilizing solar energy. The completed IEA-SHC tasks related to Solar Air conditioning (Task 25 and Task 38) allowed us to focus

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considerable collaborative international effort to develop this technology from fundamental R&D to first market introduction.

Operating from 1999 to 2004, IEA-SHC Task 25's primary achievements were to create an outlook for solar cooling, to initiate industrial development and to encourage maturation of the technology. During Task 38 (2006-2010) the expert participants created tools and methods to help the market introduction of the emerging technology. This Task also analyzed the efficiency and reliability of the new generation of solar cooling systems and evaluated demonstration and pilot installations as well as the first commercial deployment. A recent survey has shown the estimated number of installation worldwide was about 1200 systems in 2014 (Figure 1).

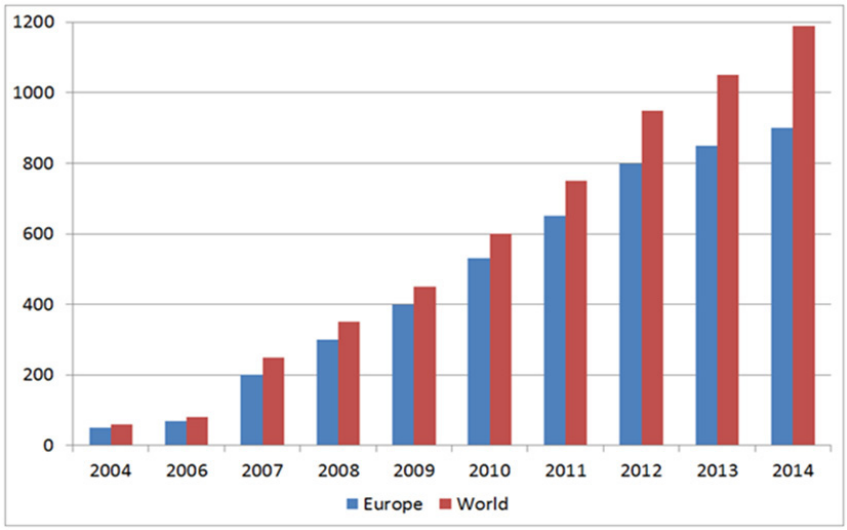

Fig. 1. Estimation of number of solar cooling installations worldwide (Source : TECSOL/SOLEM).

Further work to collect data on new solar cooling developments has shown that under certain conditions and with a considerable effort during design, installation, commissioning and operation, the technology is reliable, promising and competitive in terms of energy, amenity and environmental impact. While some earlier installations realized since 1999 could not yet be considered as reliable and cost competitive, in some of these new cases solar cooling systems have even proved not only competitive but also economical despite the emerging status of the technology.

In 2010, more than ever solar air-conditioning represented a huge potential of development for solar energy. It was reported that by 2030 [2] the expected growth of energy demand in buildings, especially in developed countries, would be far bigger on the cooling side than on the heating side. However this promising technology was perceived to face two main issues:

(1) A general lack of economic competitiveness – as is the case for many renewable energies unless incentives are in place; and

(2) Secure and proven long term energy performance and reliability.

In addition to supporting and developing solar cooling's increasingly well-known potential, and consolidating previous gains made under Task 25 and Task 38, addressing these barriers prompted the establishment of Task 48.

Task 48 addresses these obstacles [3] and the main goals of the Task are:

(1) To develop and provide various measures which lead to highly reliable, durable, efficient and robust solar cooling (and heating) systems
(2) To contribute to further cost reduction throughout the technology chain and identify the most promising market areas in terms of cost competitiveness.

This Task aims as well to enlarge current European-centric efforts and work with countries outside Europe. Countries such as China, India, Singapore, USA, Canada, South Africa and Australia are already members of IEA SHC. In these countries Solar Thermal Driven Heating and Cooling technology is dynamic and represents a much greater market potential due to characteristics such as the climate, energy market structure and issues such as peak demand. Actions to stimulate participation to these countries have been implemented under Task 48.

1.2. Why an IEA project ?

The International Energy Agency offers an ideal platform for international collaborative R&D effort. Several added values can be identified in a collaborative, international project compared to national activities. For one, participating countries profit from the specific know-how of each of the other participants and internationally significant work, such as studies of the international state-of-the-art, have only to be done once with minimal effort from each member. Further, tools such as design or computer simulation programs may be applicable in different regions while international projects make it possible to bring together industry and research, enabling new services and equipment to be developed, adapted and made available to global markets. Overall, the net profit for every participating country seems to be significantly higher compared to national activities with a similar level of effort.

1.3. Scope of the task

The scope of Task 48 is to investigate technologies for the production of cold water or conditioned air generated by means of solar heat. This means the subject area covered by the Task begins with solar radiation reaching the solar thermal collector and ends with the chilled water and/or conditioned air being transferred to the application. Although the interaction between the solar system, the distribution system and the building is not the main topic of this task, it will be considered where necessary.

The main objective of Task 48 is to assist the strong and sustainable market development of solar cooling systems, noting that these systems can also be used in heating mode. All systems including some form of solar thermal cooling technology are considered under the Task, with no capacity limitation or solar collector field area restrictions in place. This avoids the risk of overlapping with the ongoing IEA-SHC Task 45, entitled Large Scale Solar Heating and Cooling Systems, which mainly focus on district heating systems.

1.4. Objectives

Task 48 is thus intended to create a logical continuation of the IEA SHC work previously carried out by trying to find solutions to make solar thermal driven heating and cooling solutions efficient, reliable and cost competitive. These three key goals will be reached by applying four groups of activities:

1) Development of tools and procedures to characterize the main components of solar cooling systems

2) Creation of a practical and unified test procedure, adapted to specific best technical case configurations

3) Development of three performance requirement targets:

i. Prescriptive "deemed to minimum performance" approach (cooling capacity < 20 kW):
Manufacturers who offer a standard packaged solution declare the performance level of the package under certain rating conditions. This rated performance can then be used in a variety of policy interventions (eg: eligibility for certificates, restriction on sale of low performance products, thresholds for subsidies etc.).

ii. Prescriptive "deemed to satisfy engineered" approach (cooling capacity > 20 kW):
Where customised solutions are more appropriate, prescribed engineering design and implementation requirements can be specified to ensure the quality of the system from component to overall system design, installation, overall operation etc. The ability to "qualify" and label installations is useful in a variety of policy interventions (eg: minimum performance requirement for subsidies, overcoming information barriers, metrics in building rating schemes etc.).

iii. "Evidence-based performance" approach (cooling capacity > 20 kW):
While the prescriptive methods described above will be useful within their field of relevance, installers/providers of Solar Thermal Driven Heating and Cooling solutions must also have the ability to innovate and offer tailored solutions outside the direct scope of the prescribed approaches. This can be achieved by allowing direct metering and verification of performance. The ability to benchmark actual performance against alternative solutions can be used in a variety of policy interventions (eg: promotion of energy performance contracting, eligibility for certificates etc.).

1.5. Task structure

The work in this Task is organized in four Subtasks (Figure 2). Each Subtask consists of several work packages or activities, each with a specific focus and outcome contributing to the Subtask goal.

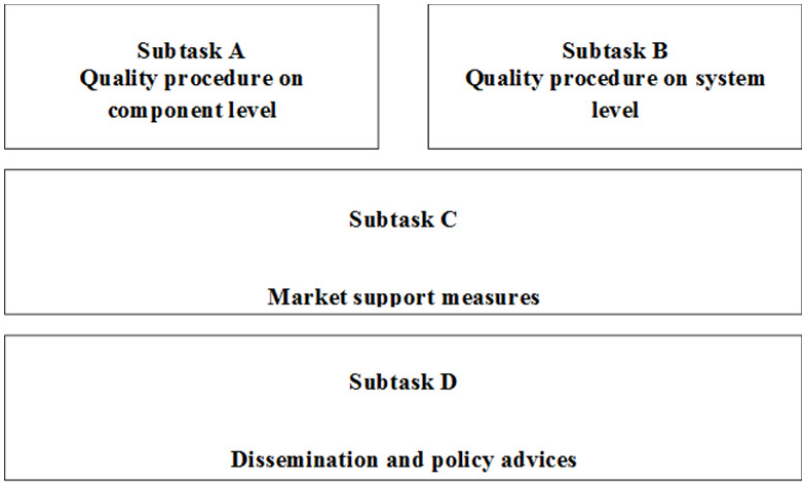

Fig. 2. IEA SHC Task 48 structure.

The project, started in October 2011 has been 3.5 years long (i.e. until March 2015). The detail of all the activities inside the mentioned subtasks can be found in the IEA SHC Task 48 Workplan [3].

1.6. Participating countries

Task 48 has a clear ambition to include experts from all continents and leading countries regarding the air conditioning sector and market. From the Task kick-off meeting in Marseille in 2011 and during all the following meetings, an important effort has been to enlarge the participating countries both beyond Europe and towards industry. Numerous expert meeting until 2015 involved solar cooling experts from 8 countries (Germany, Austria, Australia, Italy, Japan, Spain, USA, France, China) and included attendance by industry observers from Austria, Germany, Japan and the US for instance.

1.7. IEA SHC Task main results

Since Task 48 began at the end of 2011, 20 final deliverable reports and tools have been completed thanks to a lot of activities developed by Task 48 experts.

The full content of the reports including these results are available online at the Publications or Tools Section of the Task 48 website :

- http://task48.iea-shc.org/publications
- http://task48.iea-shc.org/tools/

A full picture of the very diversified set of reports an d tools can be seen in the Figure 3.

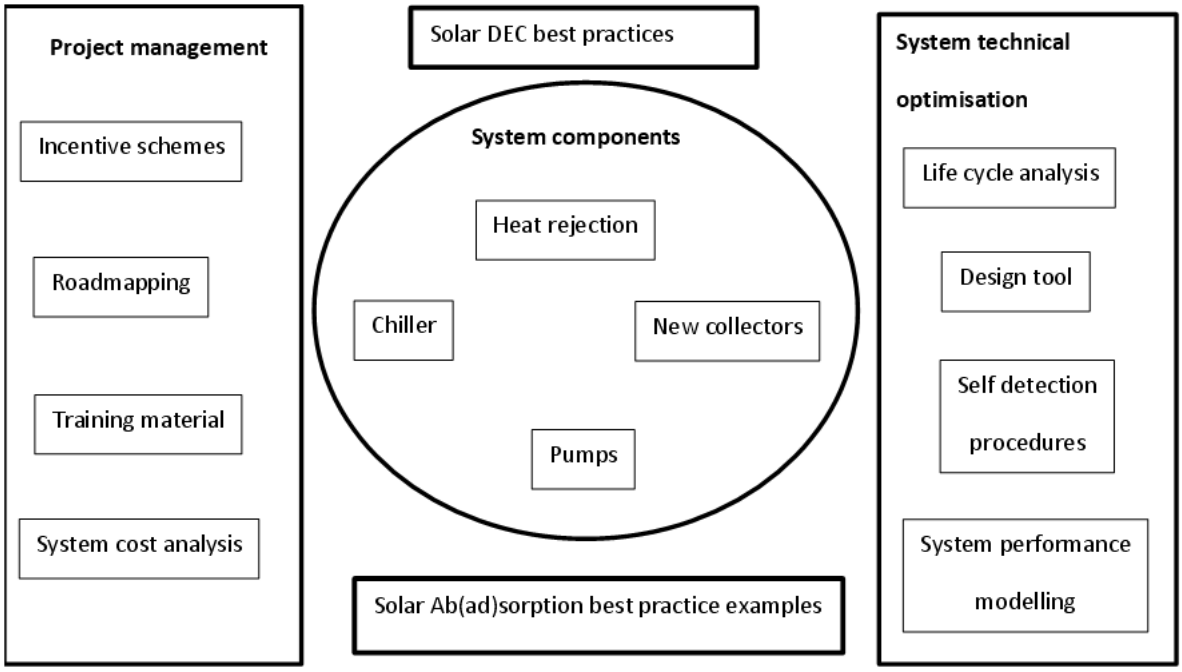

Fig. 3. IEA SHC Task 48 result conceptual scheme.

1.8. Conclusion

The IEA SHC Task 48 on Quality Assurance and support measures for solar cooling represents a very interesting tool for the development of this sector. The Task fits particularly well with the growing needs of the sector as it aims to improve the quality of solar air conditioning systems. Thanks to the international cooperation on this topic within the IEA Solar Heating and Cooling Program, numerous high level international experts assembled their findings and have developed reports and tools to enhance the market deployment of solar thermal cooling. Numerous interesting outcomes have been achieved and are available in the Task 48 website.

References

[1]. P. Murphy et al., "IEA Solar Heating and Cooling Programme Strategic Plan 2009-2013, http://www.iea-shc.org/Data/Sites/1/documents/strategicplan/SHC_Strategic_Plan.pdf, (2009)

[2]. B. Sanner et al. ,"Common Vision for the Renewable Heating and Cooling sector in Europe: 2020 - 2030 – 2050", http://www.rhc-platform.org/fileadmin/Publications/RHC_BROCHURE_140311_web.pdf, (2011)

[3]. D. Mugnier. "Quality assurance and support measures for Solar Cooling - Task description and Work plan", http://task48.iea-shc.org/documents, (2011)