2011 HIGHLIGHTS

SHC Task 44
Solar and Heat Pump Systems

THE ISSUE

Combining solar and heat pump technologies is relevant in several aspects: a high renewable fraction can be achieved, the flexibility of the solution makes it a good choice for many homeowners, the solar heat can help enhance the performance of the heat pump by raising the evaporation temperature, the solar heat can be stored at low temperature (0-20 C) thus making good use of the collectors even during the cold season, cloudy days or at night, and a good use of the latent heat of 1 m3 of water changed into ice.

Another advantage is that the solar heat can be stored to be further boosted in temperature by the heat pump if the temperature is not sufficient for direct use. Also the solar heat storage can be used directly for the load eventually reducing the need for peak electricity during a cold but sunny day. This is also an advantage since electricity cannot be stored easily at present.

Solar PV can also help to reduce the power called from the grid, and the necessary heat storage can be used to store heat pump production and indirectly solar electricity.
Thermally driven heat pumps can also benefit from some solar collectors input and solar heat storage during the sunny season.

PARTICIPATING COUNTRIES

Austria
Belgium
Canada
Denmark
Finland
France
Germany
Italy
Portugal
Spain
Sweden
Switzerland
USA

OUR WORK

The objective of this Task is to assess performances and relevance of combined systems using solar thermal and heat pumps, to provide a common definition of performances of such systems, and to contribute to successful market penetration of these new promising combinations of renewable technologies. The scope of the Task considers solar thermal systems in combination with heat pumps, applied for the supply of domestic hot water and heating in family houses – small systems in the range of 5 to 20 kW with any type of solar collectors.

This is a joint effort with the IEA Heat Pump Programme Annex 38.

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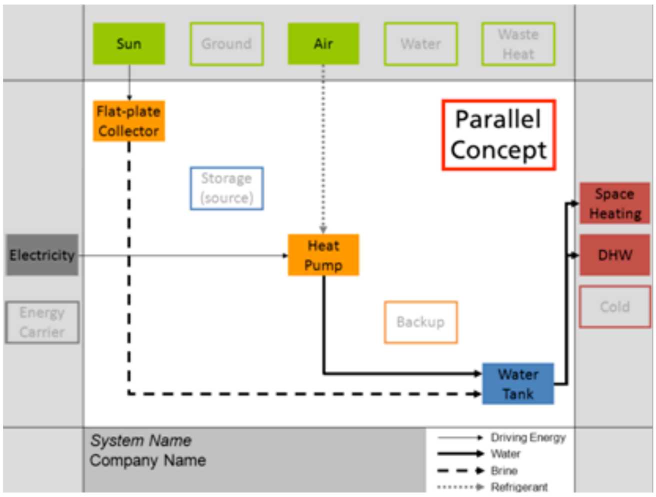
KEY RESULTS OF 2011

Description of 80 existing systems

A survey was conducted to analyze the various configurations on the market

The survey was designed to get an overview of all systems existing on the market in order to be able to find "basic" combinations. This was not easy as experts found a broad variety of configurations from simple parallel running to very complicated system designs. However, experts found four basic configurations to represent most of the combinations. The work now is to understand the benefits of each and to quantify them in several climate and load configurations.



Task 44 also developped a new way to represent flows in a combined system, multisources and multiagents. The report on this work will be available on the SHC website in 2012: http://www.iea-shc.org/task44

System simulation framework

Simulation of systems is one way to understand the operation of the system and to optimize a given configuration through sensitivity analysis.

A common set of parameters was defined so that each team can calculate its preferred configuration and compare the results with others. Three climates were chosen for this framework: Helsinki, Strasburg and Athens, and three reference buildings were chosen: very low demand:15 kWh/ m2 year, medium 45 and usual 100.

Component models also were evaluated, validated when possible, and chosen for the solar collector, including condensation and ice formation, heat pumps (both air and ground-coupled), and heat storage.

The groundwork was set in 2011 for the simulation work of combined solar and heat pump systems to take place during 2012.