SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

2013 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 (solar + the heat pump heat source) and the safety 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. And the solar heat can be stored at low temperatures (0-80° C) thus making good use of the collectors even during the cold season, cloudy days or at night. A good use of the latent heat of water changed into ice around 0° C can also be achieved.

Indeed solar heat can be stored at a low temperature to be further boosted in temperature by the heat pump if the temperature of the collection 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 in smart grids since electricity cannot be stored easily at present.

Solar PV also can 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
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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 the 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 single-family homes – small systems in the range of 5 to 20 kW with any type of solar collectors.

SHC Task 44 is a four-year collaborative project with the IEA Heat Pump Programme.

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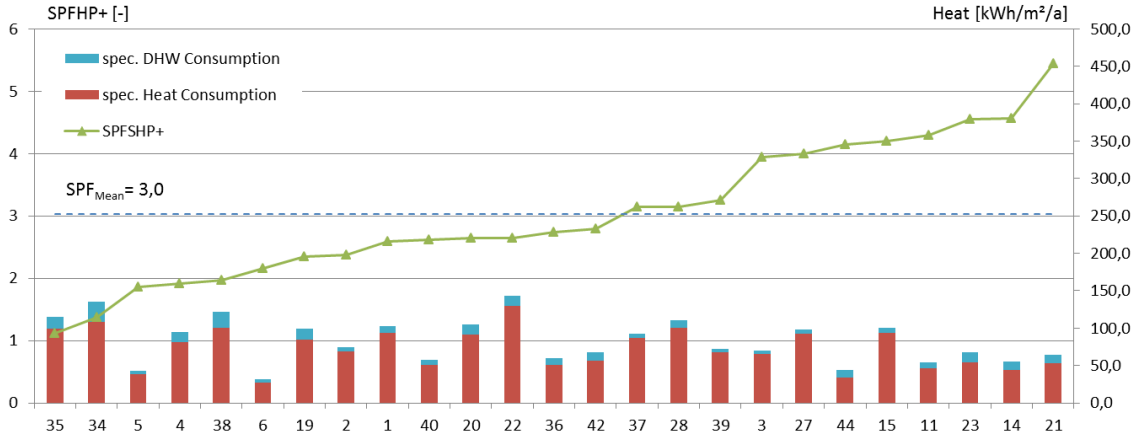
KEY RESULTS OF 2013

Field Test Monitoring: Best Practice Considerations Are Available

Several SHP systems have been monitored for 1- 2 year

About 25 different SHP systems have been monitored during this Task. A diagram of all the observed seasonal performance factors (SPF_{HP+} as defined in subtask B) is shown in the illustration. High performances have been measured in some cases allowing Task 44 to propose best practice recommendations, which will be published in the Task 44 handbook in June 2014.



Credit: ISE

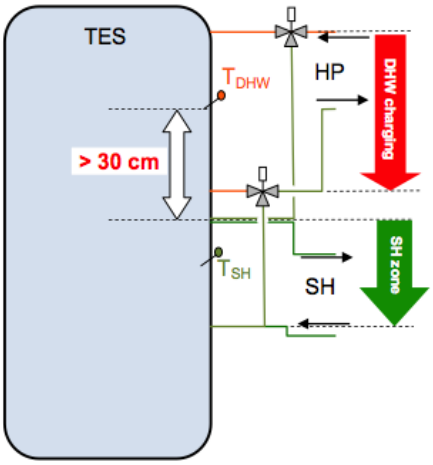
The detailed analysis of these results also will be available in the final handbook. Check for announcements on how to order the book on the Task web site in June 2014: http://task44.iea-shc.org/publications

Simulation Results: Optimization Is Needed

Task 44 has developed a range of tools to simulate all kinds of solar and heat pump combinations. National teams have used these tools and the Task framework to optimize several aspects of a solar and heat pump combination. One of this aspect concerns the heat storage, which is shared by the solar collectors and the heat pump in the most common parallel arrangement.

Recommendations derived from many simulations have been formulated:

1. The position of the DHW sensor for boiler charging control must be placed at a safe distance from the space heating zone of the storage.
   a. This distance is system specific (it depends on the stratification capabilities of the storage).
   b. As a first guess, a minimum distance of 30 cm is recommended.
2. The return from the storage to the heat in DHW mode must be placed above the space heating zone of the storage.
3. It can be advantageous to bypass the storage when the heat pump runs in the space heating mode.



Credit: SPF