SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

2012 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 I 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 in smart grids 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
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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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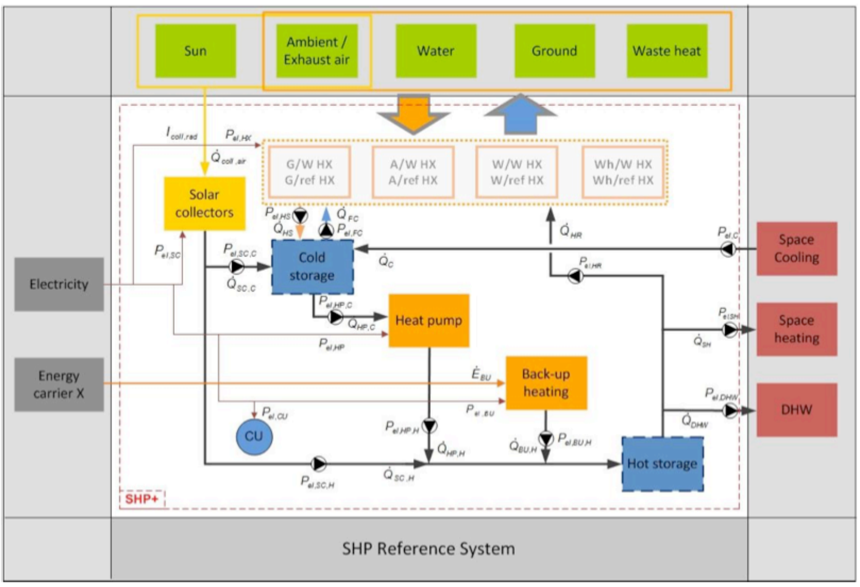
KEY RESULTS OF 2012

Definition of Performance Figures

Common understanding of system boundaries helped define common system performance figures

System boundaries inside a typical solar and heat pump configuration were defined by Task 44 during 2012. Different limits have been drawn starting from around each component (like around the heat pump to define its COP) to the complete system defining the system seasonal or annual performance factor SPF or APF such as the SHP+ limit depicted in the illustration.



Task 44 has issued all possible definitions at every boundary. The report on this work will be available on the SHC website in 2013: http://www.iea-shc.org/task44

Common Definitions in Existing Standards

A review of existing standards was performed and from this work and a set of common definitions were compiled that include:

- ***COP*** *(Coefficient of Performance): In all reviewed standards it is used for the performance of the heat pump unit under constant operating conditions. However, the consideration of the liquid circulation pump's influence on the energy inputs and outputs differ among the standards. It is generally only used for heating applications.*
- ***EER*** *(Energy Efficiency Ratio): The same as COP, but used for cooling applications in most of the European Standards. In many US standards it is defined as Btu/hr of cooling energy per W electricity consumption.*
- ***SCOP*** *(Seasonal Coefficient of Performance): Used only in one standard to express the calculated heating efficiency of the heat pump for an assumed climate, building load etc.*
- ***SEER*** *(Seasonal Energy Efficiency Ratio): Same as SCOP, but for cooling applications.*
- ***SPF*** *(Seasonal Performance Factor): In the German VDI guideline it is used to express roughly the same efficiency as SCOP, but takes into account only the heat pump unit with some auxiliary energy and not the whole system. In European standards (e.g. EN 15316-4-2) it is used as a figure to express the efficiency of the overall system including all auxiliary energy inputs.*