SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

2018 HIGHLIGHTS

Task 54 – Price Reduction of Solar Thermal Systems

THE ISSUE

One of the greatest challenges of the 21st century is to secure a sustainable energy supply and to considerably reduce CO_2 emissions and the serious consequence of climate change. The challenging goals with regard to the contributions of renewable energy cannot be reached without considerable growth of solar thermal markets worldwide. Therefore, cost-competitive, efficient and reliable solar thermal systems are required. Cost-competitiveness is particularly hard to achieve as the price of solar thermal systems is still not equaled by the price end-users have to pay for conventional heat supply. A great number of complex, costly and oftentimes non-transparent steps are needed to bring solar thermal from the factory to the actual users. SHC Task 54 is looking for ways to optimize each of these steps as well as looking into the social-political context in which solar thermal installations are embedded. The ultimate goal is to strengthen the solar thermal industry by finding solutions for more cost-efficient production and installation of solar thermal systems and for marketing them at an even more competitive price.

Participating Countries

Australia
Austria
China
Denmark
France
Germany
Italy
Netherlands
Norway
Switzerland

OUR WORK

SHC Task 54 aimed to reduce the purchase price for end-users of installed solar thermal systems by evaluating and developing sustainable means to reduce the production and/or installation costs of materials, sub-components and system components.

Special emphasis was placed on the identification and reduction of post-production cost drivers (e.g., channels of distribution). Extensive market research, reference system classification, cost analyses, and socio-political boundary conditions for solar thermal prices in selected regions were the basis for the evaluation of cost structures and cost reduction potentials. The Task successfully completed its work in October 2018.

KEY RESULTS IN 2018

Levelized Cost of Heat (LCoH)

To assess the impact of different measures on the costs of the heat produced by solar

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thermal systems over their lifetime a method was needed. The levelized cost of heat (LCoH), a measure based on the concept of levelized cost of energy widely used in the power sector, was chosen and defined to use with different systems and energy sources (for more details on the calculation method (see Info Sheet A01 and A13 available from http://task54.iea-shc.org/info-sheets). Now for the first time a standardized method for the calculation of the energy cost of solar thermal system is available. Picking up this method and developing it further to calculate the heat costs for other heat generating devices (e. g., heat pumps, PV heat, etc.) will allow an objective comparison between these different heat generating systems.

In 2018, 13 reference systems for different system types and configurations (e.g., conventional heating systems for single (SH) and multi-family (MF) houses, solar domestic hot water systems for single and multi-family houses or combi systems for single family houses) in different European countries such as Austria, France, Germany, Switzerland and Denmark were defined and the LCoH values were calculated. The costs calculated for these reference systems form the benchmarks for the cost reductions. Info Sheets on all reference systems can be downloaded at http://task54.iea-shc.org/info-sheets.

A simplified Software-tool for the calculation of the LCoH was developed and can be downloaded for free from the Task website as well.

The Key to a Price Reduction of More Than 40%

Three case studies were used to evaluate the potential of improving system concepts and designs.

- **Increase system performance**. The use of technology, such as a mirco-circulation inhibitor, heat storage efficiency class B, more efficient collector and/or high efficiency pump can lead to a cost reduction of the saved final energy by solar ($LCoH_{sol,fin}$) in the range of 2% to approximately 30% although the upfront investment may be higher.
- **Limit absorber temperature with overheating protection**. Overheating protection not only allows the use of less temperature-stable and therefore less expensive materials, but also reduces maintenance costs. Possible cost reduction of $LCoH_{sol,fin}$ can reach approximately 30%.
- **Standardize components**. Standardized components reduce production costs and installation costs. The possible cost reduction of $LCoH_{sol,fin}$ can reach approximately 30%, assuming mass production.

Though significant cost reductions can be reached using one of the above described approaches alone, the goal of a cost reduction of 40% can only be reached when all three approaches are combined as shown in the tables below for the German reference solar domestic hot water system in a single-family house. Table 1 shows the evolution of the parameters relevant for the $LCoH_{sol,fin}$ (investment system components, investment installation, maintenance costs, operation costs, saved final energy and service lifetime) starting from the reference system on the left hand side. From left to right, the changes of these parameters due to the three measures described above (performance increase, overheating protection and standardization) are shown. The last column shows the overall change in the parameters caused by the combination of the three measures. Table 2 summarizes the $LCoH_{sol,fin}$ of the reference system, the improved system and the resulting cost reduction.

	Reference System	Performance increase	Overheating protection	Standardisation	Change
Investment system components [€]	2600	3055	2695	2426	-11%
Investment installation [€]	1250	1250	1100	990	
Maintenance costs [€/a]	100	100	47	42	-58%
Operation costs [€/a]	21	10	10	10	-52%
Saved final energy [kWh/a]	2226	2889	2889	3033	+36%
service life time [a]	25	25	25	27.5	+10%

Table 1: Evolution of the $LCoH_{sol,fin}$ relevant parameters due to the combination of the three measures – performance increase, overheating protection and standardization.

$LCOH_{sol,fin}$ Reference System (without VAT)	0.124 €/kWh
$LCOH_{sol,fin}$ combined measures (without VAT)	0.069 €/kWh
Cost reduction potential for solar heat	44%

Table 2: Cost reduction potential for solar heat using the combination of performance increase, overheating protection and standardization.