SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

2015 HIGHLIGHTS

SHC Task 49
Solar Heat Integration in Industrial Processes

THE ISSUE

Solar Heat for Industrial Processes (SHIP) is currently at the early stages of development, but is considered to have huge potential for solar thermal applications. Currently, 120 operating solar thermal systems for process heat are reported worldwide, with a total capacity of about 88 MWth (125,000 m^2). The first applications have been experimental and relatively small in scale. In recent years, significantly larger solar thermal fields have been applied and are currently in the project pipeline. There is great potential for this market and technological developments as 28% of the overall energy demand in the EU27 countries originates in the industrial sector and the majority of this is heat of below 250˚C.

In several specific industry sectors, such as food, wine and beverages, transport equipment, machinery, textiles, pulp and paper, the share of heat demand at low and medium temperatures (below 250˚C) is around 60%. Tapping into this potential would provide a significant solar contribution to industrial energy requirements.

OUR WORK

The work of SHC Task 49/SolarPACES IV is dedicated to three main areas: process heat collectors, process integration and process intensification and design guidelines. Improved solar thermal collectors and solar thermal system integration for production processes will be reached through advanced heat integration and storage management and advanced methodology for decisions on integration place and integration types.

Within the Task new developments of the advanced pinch analysis for heat exchanger and storage design will be reached as well as the identification of the increasing potentials of process intensification and new applications. The Task will prepare a worldwide overview of SHIP results and experiences (including completed and ongoing demonstration system installations using monitoring data, as well as carrying out economic analysis) in order to lower the barriers for market deployment and to disseminate the knowledge to the main target groups.

This is a 4-year collaborative project with the IEA SolarPACES Programme's Task IV.

Participating Countries

Austria
Belgium
China
France
Germany
India
Italy
Mexico
Portugal
South Africa
Spain
Sweden
Switzerland
United Kingdom
USA

Task Date 2012-2016
Task Leader Christoph Brunner
AEE INTEC, Austria
Email c.brunner@aee.at
Website http://www.iea-shc.org/task49

KEY RESULTS OF 2015

Guideline on Testing Procedures for Collectors Used in Solar Process Heat

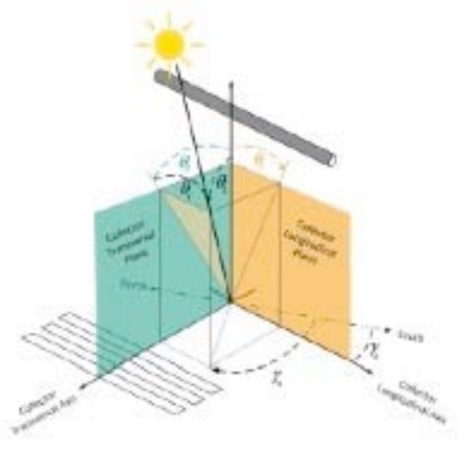
Solar process heat collectors include a wide range of collector technologies from standard flat plate collectors over air heating collectors to highly concentrating Parabolic Trough or Linear Fresnel collectors.

If solar thermal technologies are to successfully enter the important market of process heat applications, it is crucial for the manufacturers to be able to provide reliable figures to succeed in tenders, to be able to predict energy yields with sufficient accuracy, and to be able to prove liability in operation. Each of these require commonly agreed upon key figures and testing procedures.

Existing test standards provide solutions for many of these questions and the majority of technologies. First and foremost is ISO 9806:2013, which originally was for the field of low temperature domestic hot water systems, but now has a wide scope and also includes highly concentrating collectors. But as the range of solar thermal technologies has increased, and the formerly almost separated fields of non-concentrating low temperature and concentrating high temperature applications meet and merge in the middle, many questions arise as how all of these can be tested and compared fairly.

The present guideline targets manufacturers, project engineers, contractors and end-users. It tries to give them an outline of the existing regulations to be aware of and to help them understand, interpret and compare test results. It also highlights what is missing and shortcomings in the directives that may be obstructive to fair competition.

In spite of the diverse technologies available, the present guideline mostly focuses on the problems connected to concentrating collectors as no contributions from other fields were made.



Transversal and longitudinal directions and plans of the collector (hofer et. al. 2015a. Comparison of Two Different (Quasi-) Dynamic Testing Methods for the Performance Evaluation of a Linear Fresnel Process Heat Collector. In: *Energy Procedia* (69), S. 84–95).

Potential Studies Worldwide

A review on potential studies for the use of solar heat for industrial processes (SHIP) was conducted based on studies available from Spain, Portugal, Austria, Italy, Netherlands, Sweden, Cyprus, Greece, Wallonia (Belgium), Germany and Australia. More recent studies were added from Germany, India, South Africa, Tunesia, Chile, Morocco, Pakistan and Egypt. In addition to the country studies, European and worldwide potential studies have been integrated into the document.

The total global process heat demand was approximately 98 EJ in 2008 [19]. Based on the evaluation within the potential study review, about 4% or 3.9 EJ global technical potential for solar process heat is a conservative estimate. To roughly calculate the order of magnitude of this, one could assume a mean useful annual solar irradiance (not specifying if global or beam) of 1200 kWh/(m^2a) and an annual solar thermal system efficiency of 40%. This would result in a solar collector area of close to 2300 million m2. For the year 2050, Taibi et al. estimate a technical potential of 5.6 EJ, corresponding to about 3200 million m2. In Europe 155 million m2 of solar collectors are installed, which can be compared with individual country studies:

- Morocco – 2.4 million m2
- Egypt – 4.6 million m2
- Chile – 6 million m2
- Pakistan – 7.1 million m2
- Germany – 35 million m2
- Europe – 155 million m2 complement and confirm this magnitude.

Installed SHIP plants according to ship-plants.info showing the large untapped potential for solar process heat.