SolarPACES Annex IV

IEA SHC Task 49

Solar Process Heat for Production and Advanced Applications

Catalogue of recommended components for advanced integration

Version 1.0, February, 2016

Author: Bettina Muster
with contribution from: Bastian Schmitt, Ilyes Ben Hassine

IEA Solar Heating and Cooling Programme

The Solar Heating and Cooling Technology Collaboration Programme was founded in 1977 as one of the first multilateral technology initiatives ("Implementing Agreements") of the International Energy Agency. Its mission is *"to enhance collective knowledge and application of solar heating and cooling through international collaboration to reach the goal set in the vision of solar thermal energy meeting 50% of low temperature heating and cooling demand by 2050.*

The members of the IEA SHC collaborate on projects (referred to as "Tasks") in the field of research, development, demonstration (RD&D), and test methods for solar thermal energy and solar buildings.

A total of 57 such projects have been initiated, 47 of which have been completed. Research topics include:

- Solar Space Heating and Water Heating (Tasks 14, 19, 26, 44, 54)
- Solar Cooling (Tasks 25, 38, 48, 53)
- Solar Heat or Industrial or Agricultural Processes (Tasks 29, 33, 49)
- Solar District Heating (Tasks 7, 45, 55)
- Solar Buildings/Architecture/Urban Planning (Tasks 8, 11, 12, 13, 20, 22, 23, 28, 37, 40, 41, 47, 51, 52, 56)
- Solar Thermal & PV (Tasks 16, 35)
- Daylighting/Lighting (Tasks 21, 31, 50)
- Materials/Components for Solar Heating and Cooling (Tasks 2, 3, 6, 10, 18, 27, 39)
- Standards, Certification, and Test Methods (Tasks 14, 24, 34, 43, 57)
- Resource Assessment (Tasks 1, 4, 5, 9, 17, 36, 46)
- Storage of Solar Heat (Tasks 7, 32, 42)

In addition to the project work, there are special activities:

- SHC International Conference on Solar Heating and Cooling for Buildings and Industry
- Solar Heat Worldwide – annual statistics publication
- Memorandum of Understanding – working agreement with solar thermal trade organizations
- Workshops and seminars

Country Members

Australia
Austria
Belgium
Canada
China
Denmark
European Commission
France
Germany
Italy
Mexico
Netherlands
Norway
Singapore
Slovakia
Spain
South Africa
Sweden
Switzerland
Turkey
Portugal
United Kingdom

Sponsor Members

European Copper Institute (ECI)
ECREEE
Gulf Organization for Research and Development (GORD)
International Solar Energy Society
RCREEE

For more information on the IEA SHC work, including many free publications, please visit www.iea-shc.org

Catalogue of recommended components for advanced integration

In this catalogue, software and hardware components are described that can help realising the integration of solar process heat in an advanced way. The list gives an overview on all important aspects and therefore embraces topics from all subtasks. For each of the software/hardware components more information can be found in specific result documents from IEA Task 49.
Although the primary intention was to focus on additional required components for integrating solar heat with new emerging process technologies, this report understands „**advanced integration**“ as **an intelligent integration concept by any means**: sensibly placed in the industrial environment, realised with best suited system concepts, featuring new stagnation concepts, and well monitored with suitable performance assessment figures. “Advanced integration” can in this sense tackle integration points with existing process equipment or link solar process heat to emerging process technologies. The integration effort might differ based on the process equipment in use, but there will be no additional required components for “new/emerging” process technologies specifically. With optimized process equipment it will rather be the aim in future to simplify integration due to better heat transfer or less heat exchange area required.

Software components/Information Sources:	**Links to specific document from Task 49**
Modelling tools to assess potential of emerging process technologies	
Advanced heat integration tools / Simulation tools for holistic heat flow analysis	Krummenacher and Muster, 2015, B1
Use of applicable integration concept	Schmitt in Muster et al, 2015, B2 Integration Guideline
Heat exchanger design tools	Krummenacher and Muster, 2015, B1
Use of applicable SHIP system concept	Helmke and Hess in Muster et al, 2015, B2 Integration Guideline
Solar simulation tools / Simulation tools for holistic heat flow analysis	Platzer et al., 2015, C2 Simulation Tool Overview Design tool, InSun Project http://www.fp7-insun.eu/DesignTool/ *GainBuddy, SPF* http://www.spf.ch/GainBuddy.297.0.html
Hydraulic planning tools	TubeCalc, SPF http://www.spf.ch/TubeCalc.65.0.html manufacturer specific software like: SAMSON valve designer Mauthner et al., Development of a design tool for the optimization of the collector hydraulics of large-scale solar thermal systems, Deliverable within Solabrew project
Performance assessment tools based on monitoring data	Platzer, 2015, C3 Performance Assessment Methodology

Hardware components	**Links to specific document from Task 49**
Suitable collector technology	Frank, 2013, A1 Process Heat Collectors - Definition Horta, 2016, A2 Overview of State of the Art of Process Heat Collectors
Suitable storage technology	Helmke and Hess in Muster et al, 2015, B2 Integration Guideline Platzer et al., 2016, C1 Design Guidelines
state-of-the-art hydraulic components	
Heat exchangers	
Pipings and insulation	
Advanced control systems	I/O controller ISFH
Suitable stagnation prevention	Frank et al., 2014, A2 Stagnation
measurement equipment for collector field efficiency and integration efficiency	Platzer, 2015, C3 Performance Assessment Methodology