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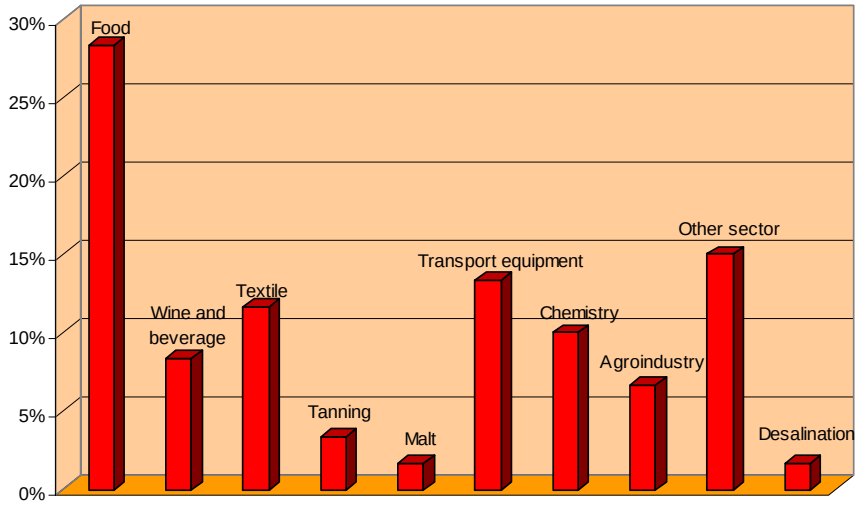
The large application potential for Solar Process Heat

At the end of 2003 the solar thermal installed capacity worldwide was about 92 GW_{th}. Compared with 48 GW of wind power and 4 GW_p of photovoltaic, solar thermal shows a leading position in the renewable energy field. Furthermore, there is one application sector, so far only slightly exploited by solar thermal, where a large potential is hidden: the industry. Solar thermal could contribute to heat supply at low and medium temperature processes (up to 250 °C) in several industry sectors: chemical, paper, textile, food processing, etc. The possible areas of application include different processes, such as process steam production, drying, chemical reactions, washing, melting or boiling and also space heating and cooling of production halls.

Only 85 solar plants for process heat are reported worldwide (see graph below), with a total power of about 27 MW_{th} (38,500 m^2), corresponding to 0.03% of the total solar thermal installed capacity.



SHIP plants reported within Task 33/IV as of October 2006: distribution by industry sector

For further information: Riccardo Battisti
riccardo.battisti@uniroma1.it

Several studies highlighted the huge potential for solar process heat: about 5 PJ/year in Austria, 21 PJ/year for the Iberian Peninsula and 32 PJ/year for Italy. Solar thermal could therefore provide the industrial sector with up to 2 - 3 % of its total heat consumption (data for industrial thermal energy demand: year 2002, source: EUROSTAT).

A report from Task 33/IV will be available in 2006, summarizing the main results of these potential studies, and mainly addressed to policy makers; it means to be a dissemination tool for promoting national and regional campaigns and policies on solar thermal for process heat production.

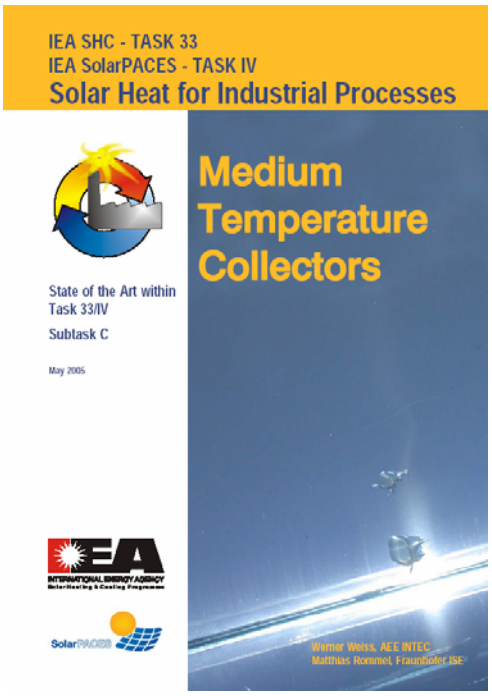
Focus on medium temperature solar collectors

New collectors which are appropriate for process heat applications in the temperature range of 80 to 250 °C are investigated in co-operation with the industry in the framework of the IEA Task 33/IV.

Which type of collectors are being developed? A report is available (www.iea-ship.org/3_1.html) which gives an overview and some background information on the present state of the development of the process heat collectors.

The report contains information on the following concepts:

- double glazed flat plate collectors with anti-reflection coated glazings (2 examples)
- stationary CPC collectors (3 examples: AoSol, Solarfocus CPC, MaReCo)
- concentrating parabolic trough collectors and linear concentrating fresnel collector (8 examples: Parasol, Solitem PTV 1800, PTC 1000, Fasol, PTC Mexico, Fix-Focus, Fresnel, CHAPS).



Report on Medium Temperature Collectors; available for download at www.iea-ship.org/3_1.html

For further information:
Matthias Rommel – Fraunhofer ISE
matthias.rommel@ise.fraunhofer.de

The collector development work is supported by activities which aim at appropriate testing procedures for process heat collectors. Test facilities are set up to test collectors at operating temperatures up to 250 °C. The parameters determined in the tests must be reliable and adequate for an exact modelling of the - technically very different - collector concepts. The goal is to compare the different collector technologies and concepts to each other with respect to thermal and economic performance as well as reliability and life service times.

In the collector development activities, investigations on materials suitable for medium temperature collectors play also an important role.

Feasibility study for a “solar dairy” in Austria

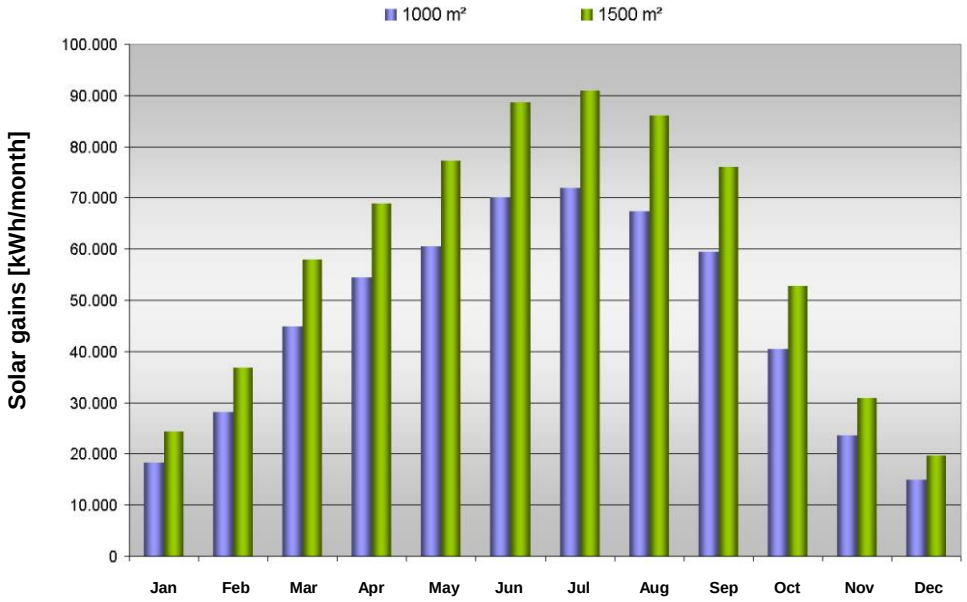
Within the scope of the IEA Task 33/IV, the possibilities for heat recovery and use of solar thermal energy in an Austrian dairy have been examined. In this company 25,000 l/h of milk are processed to produce 15,000 t/a of different kinds of cheese.

The first step of the investigation was the optimisation of the heat use. With the structural approach of the “Pinch analysis”, a heat recovery system for this industrial process has been calculated. The results of this calculation show the optimised situation of energy demand by implementing heat exchangers and the additional minimal heating and cooling demand for the production.

In the next step, a detailed analysis of the possibility to use a solar thermal plant was considered. To simulate the solar plant, the average weather data from the last 10 years at the location of the factory were used. The first output is the annual energy yield (“solar gains”) from the solar plant, as shown in the table below, where two different scenarios are presented From this value, the amount of natural gas savings can be calculated.

Combining energy efficiency and solar application, a total energy saving of 80% could be reached. The annual economic savings lead to reasonable investment payback times.

Collector area	**1.000 m²**	**1.500 m²**
Solar gains [MWh/a]	553	710
Gas savings (η=65%) [m³/a]	85.000	109.000
Reduced CO_2 – emissions [t/a]	170	218



For further information:
Cristoph Brunner – JOINTS
christoph.brunner@joanneum.at

Contank: a 360 kW solar thermal system for an industrial washing process

The solar plant of Contank in Castellbisbal (Barcelona, Spain) started operation in March 2005. The industrial process carried out there is the cleaning of railway containers for the transport of liquid goods.

The plant is composed by two solar fields, which preheat the water for the washing processes; the water is then further heated up by steam to the final temperature of 70–80 ºC, required for the washing processes.

View of the Contank solar plant

Technical data of the Contank solar plant

Solar collector type	Selective flat plate
Installed capacity	360 kW (510 m^2)
Collector inclination	20º
Collector orientation	24º south-east
Storage volume	40 m^3
Flow rate	16,35 l/m^2 h (water – glycol 30%)
Auxiliary heater	Natural gas steam boiler

The solar plant, installed on the roof of the factory hall, provides heat gains of 429 MWh (841 kWh/m^2) and the corresponding solar fraction is more than 20%. The investment cost for the system is 268,000 €, partially financed by IDAE and ICAEN with 130,000 €. The estimated annual savings are 14,300 € (at a cost for natural gas of 25 €/MWh). Taking into account costs for operation and maintenance (about 1,250 €/year), the net savings are about 13,050 €/year, with a simple pay-back of 10 years.

For further information: Hans Schweiger
hans.schweiger@gmx.net

Task 33/IV experts meet industry and market representatives in Italy

In the framework of the 6th Task 33/IV Experts Meeting, the Department of Mechanical and Aeronautical Engineering (University of Rome "La Sapienza") will organize in Rome, on 31st March 2006, a workshop addressed to different actors of the solar thermal sector: solar companies, Energy Service Companies, energy manager of industries, bank and Institutions.

This event aims at establishing a solid network among the researchers, the solar industry, the policy makers and the final users.

The workshop will be divided in two parts. During the international session (mainly in English), the state of the art will be presented by means of technological focuses and analysis of the existing solar plants for industrial applications in Italy and Europe. Within the country specific session (in Italian) the national regulation, economic and market framework will be analyzed and discussed in order to set future strategies and activities to overcome the barriers

CONTACTS

Operating Agent:

Werner Weiss
AEE INTEC-Arbeitsgemeinschaft Erneuerbare Energie
Institute for Sustainable Technologies
Feldgasse 19 A-8200 Gleisdorf Austria
e-mail: w.weiss@aee.at