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Newsletter of the International Energy Agency Solar Heating and Cooling Programme

INTERNATIONAL ENERGY AGENCY
Solar Heating & Cooling Programme

In This Issue

2008 SHC Solar Award

This year's SHC SOLAR AWARD winner is **Professor Manuel Collares Pereira**, *founder and R&D Director of AO SOL, Energias Renováveis, S.A. and professor at the Technical University of Lisbon. Mr. Collares Pereira received the award at the ISES/SHC EuroSun 2008: 1st International Conference on Solar Heating, Cooling and Buildings.*

The SHC SOLAR AWARD is given to an individual, company, or private/public institution that has shown outstanding leadership or achievements in the field of solar heating and cooling, and that supports the work of the IEA Solar Heating and Cooling Programme. Prof. Collares Pereira embodies these qualifications through his work in Portugal and internationally.

Prof. Collares Pereira is Portugal's most prominent scientist in the field of Active Solar Thermal Applications. His work, however, has always reached beyond Portugal's borders. Beginning in the 1970s, Prof. Collares Pereira conducted pioneering work on the first CPC collector (Compound Parabolic Concentrators) prototypes with Prof. Roland Winston at the University of Chicago. He continued this work over the years until his involvement led to the first commercial production of CPC collectors in the world.

Over the past 30 years, Prof. Collares Pereira has worked diligently to share the results of all his scientific work, which ranges from water purification, solar desalination, solar cooking, solar detoxification, solar process heating, PV applications, solar cooling, and recently, solar thermal electricity. To support his mission, Prof. Collares Pereira has founded numerous organizations, the most important being the Centre for Energy Conservation, the acting Portuguese Energy Agency.

As Mr. Mendes, Portugal's SHC Executive Committee member, notes, *"The passion and confidence that Prof. Collares Pereira brings to his work is contagious, and has led dozens of his students, engineers and physicists to work in the field of solar technology development. In addition, his commitment to international collaboration is shown by his participation in IEA SHC work on solar cooling and solar heat for industrial processes.*

For those working in the field of solar thermal energy, we are indebted to him. At all levels he has given the best of himself—investigating, teaching, disseminating research results to industry and to the market (taking on the risk personally on several occasions), and lobbying for solar. His current high level involvement in the European Solar Thermal Technology Platform (ESTTP) means that we can continue counting on his contributions into the future."

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SHC work concludes

Storage, SHIP, Testing & Validation

The SHC Programme completed work in three key areas – solar thermal storage, solar for industrial processes, and building energy analysis tool testing and validation. Below are highlights of the results. For more in depth information visit the Tasks on the SHC website.

TASK 32 | ADVANCED STORAGE CONCEPTS FOR SOLAR AND LOW ENERGY BUILDINGS

The objective of this five-year Task with IEA's Energy Conservation through Energy Storage Programme was to investigate new and advanced solutions for storing thermal energy to use in the heating and cooling of buildings. To do this, the Task participants contributed to the development of advanced storage solutions to reach high solar fractions in buildings, up to 100% in a typical 45N latitude climate. The Task's overall goal was to integrate advanced storage concepts in a thermal system (solar, heat pump or boiler) to use in low energy buildings rather than develop new storage systems.

HIGHLIGHTS OF KEY RESULTS

Water Tank Storage

Water tank storage is the state-of-the-art choice for solar combisystems, but improvements are needed in tank efficiency and in the overall performance of water based combisystems.

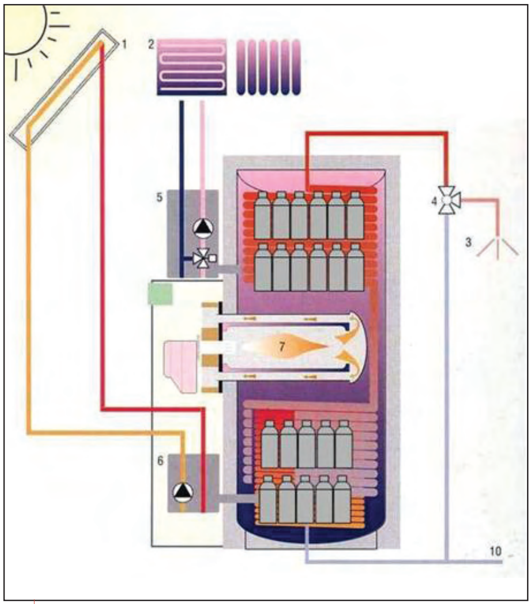
One technology used to improve tank efficiency is a stratifier. This technology is used to improve the overall temperature of hot water in a tank so that less auxiliary heat is needed. There are several devices currently on the market, but all are fairly complicated and expensive. As part of SHC Task 32, a simple device made of fabric was developed and tested in Denmark. It has exhibited promising results compared to the current devices.

Does a stratifier make a difference? Denmark investigated three combisystem configurations with the only variation being the stratification scheme in the water tank. The system using two stratification devices, one for the solar loop and one for the return loop, performed best— a 20% improvement in the annual solar energy delivered to the load in the best case compared to the no stratifier scenario.

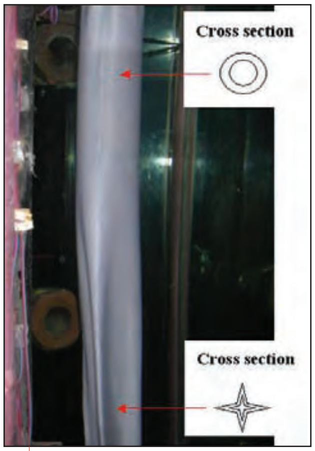
Storage with Phase Change Materials (PCM)

SHC Task 32 demonstrated that PCMs used in a water storage tank can improve the overall annual performance of a solar combisystem. Sodium acetate with graphite is a good candidate due to its transition temperature at 58°C. However, at this time the improvement to the system's performance by using sodium acetate is not great enough to cover the higher investment cost.

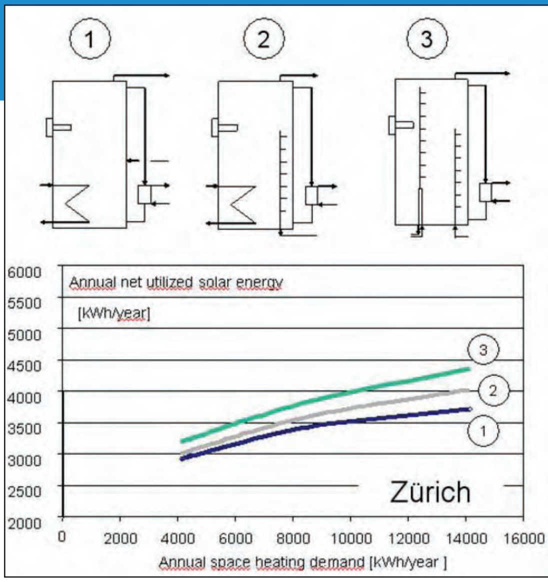
Other materials, such as commercially available PCMS, with a temperature change around 35°C placed in the bottom of a tank were found to be even more interesting than sodium acetate, but requires further investigation.



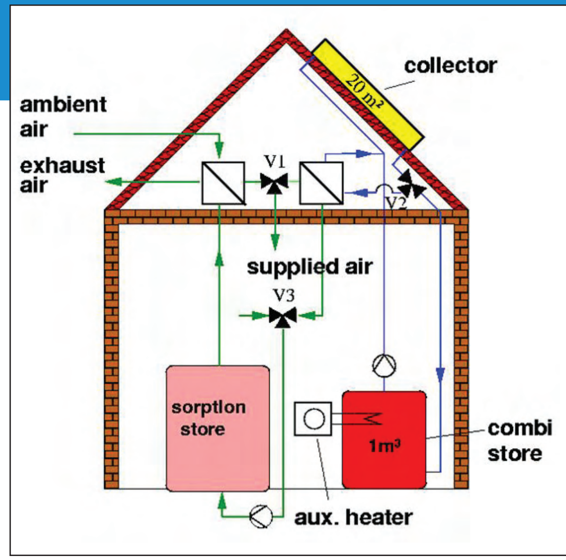
A combisystem with a water storage tank filled with bottles of PCM was tested and simulated at HEIG-VD in Switzerland.



The fabric stratifier for water tank storage developed by the Technical University of Denmark (DTU)**.**



Detailed simulations from the Technical University of Denmark (DTU) **demonstrated that the best performer in a Zurich climate was clearly the double stratifier solution.**



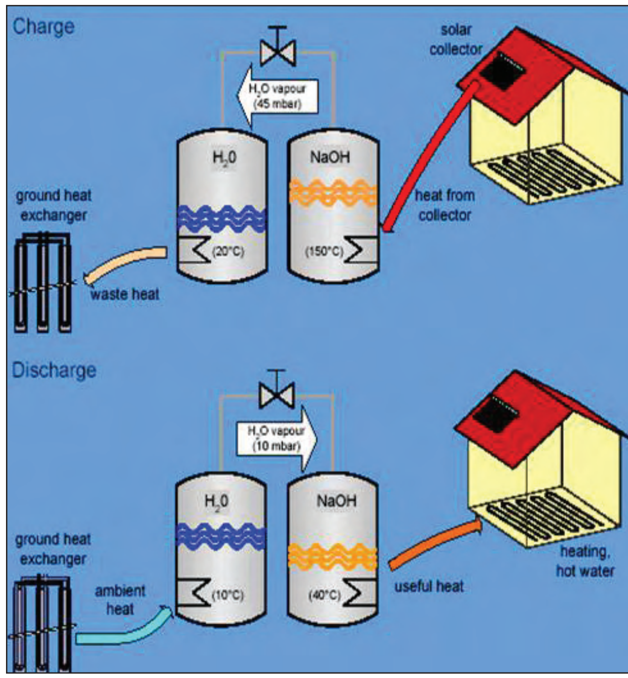
The Monosorp storage concept from the Institute of Thermal Engineering (ITW, University of Stuttgart) **in Germany.**

Sorption Storage

This type of storage technology is based on the ability of sorption materials to release water vapor when heated and to release heat when the water vapor is adsorbed or absorbed. For example, during the summer the heat produced by solar collectors would dry up the material, and in the winter water would be put back onto the surface of the material to release the heat for use.

A new method for using extruded solid zeolite with air channels showed interesting properties in the laboratory at the Institute of Thermal Engineering in Germany. Simulations demonstrated that an 8 m^3 storage volume would be enough for 70% of the heating load of a low energy house. A laboratory prototype will deliver more information in 2008.

The Swiss Federal Laboratories for Materials Testing and Research (EMPA) built a storage unit prototype based on sodium hydroxide desorption at 150°C. First results show that the material can dry in the summer even better than anticipated (65% concentration reached) reducing the needed charging temperature to 120°C. It is anticipated that a 10 m^3 storage unit could deliver all the heating needs of a low energy house during the winter, but the process requires a low grade temperature heat source such as a borehole in the ground. The pilot installation is being monitored over the next two years.



The principle of a NaOH / H_2O storage system tested at EMPA in Switzerland.

Storage with Chemical Reactions

The high density of storage with chemical reactions makes this topic attractive, however, before a product is commercially available many barriers must be overcome. The choice of an adequate reaction has kept the attention of the Energy Research Centre of the Netherlands (ECN). A promising material is magnesium hydroxide seven hydrates, which could theoretically store 777 kWh/m^3 at 122°C, a factor 10 compared to the 77 kWh/m^3 for water between 30°C and 100°C. The principle is to dry the material in summer with solar heat and in winter re-hydrate it to deliver back the energy. Work with this material and its ability to dehydrate and re-hydrate is only at the beginning stage.

To learn more and download Task 32 reports visit http://www.iea-shc.org/task32/index.html or contact the former Operating Agent Jean-Christophe Hadorn of Groupe Berney - BASE Consultants SA, Switzerland, e-mail: jchadorn@baseconsultants.com.

TASK 32 PARTICIPATING COUNTRIES

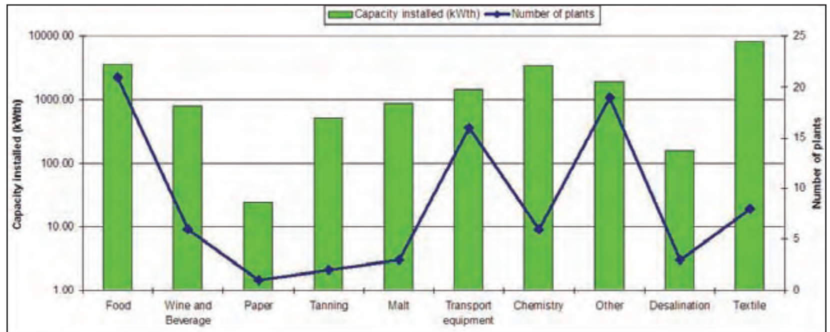
- Austria
- Denmark
- France
- Germany
- Netherlands
- Spain
- Sweden
- Switzerland

continued on page 4

SHC Work continued from page 3

TASK 33 | SOLAR HEAT FOR INDUSTRIAL PROCESSES

The objective of this four-year Task with IEA's SolarPACES Programme was to build solar thermal plants for industrial process heat. To reach this goal, studies on the technology's potential were conducted in the participating countries, medium temperature collectors were developed for the production of process heat up to temperature levels of 250°C, and solutions were sought to the problems of integrating the solar heat system into industrial processes. In addition, demonstration projects were realized in cooperation with the solar industry.



Solar industrial process heat plants by industry sector.

HIGHLIGHTS OF KEY RESULTS

Potential for Solar Process Heat and Existing Plants

As shown in the graph, the prime areas for solar heat plants are in the food and beverage industries, the textile and chemical industries, and the simple cleaning industries such as car washes. These are key industries because they require low processing temperatures (30°C -90°C), and therefore flat-plate solar collectors can be used to not only provide the process heat, but also to heat the production halls.

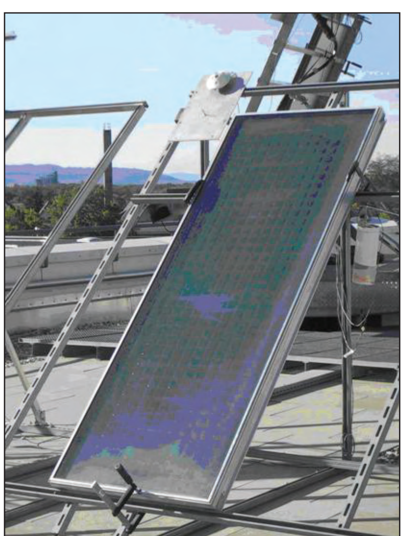
To provide heat for industrial processes in the temperature range of 80°C - 250°C, three categories of process heat collectors are being developed and tested:

- Improved flat-plate collectors with double anti-reflecting glass and noble gas filling,
- Low concentrating flat-plate collectors (CPC collectors), and
- High concentrating collectors like small parabolic trough collectors or linear Fresnel collectors.

Integration of Solar Heat into Industrial Processes

A challenge for this technology is to integrate the solar heat into the industrial process itself. To do this, the temperature of the available heat, the variability of solar radiation, and the heat profile required by the industrial process must all be considered.

To address this challenge, more than 20 system concepts and a "matrix of indicators" were used to create a comprehensive database to serve as a decision support tool for solar experts. In addition, Task worked focused on the reuse of the excess heat generated during production. The computer program Pinch Energy Efficiency (PE^2) developed within Task 33 can calculate the heat recovery potential and design a technically and economically feasible heat exchanger



Three of the12 process heat collectors that were developed or investigated within SHC Task 33. Round Robin tests were carried out at three test centers in Germany and Portugal.

network to optimize the heat recovery for a given process. The remaining heat demand is then partially or completely met using solar thermal energy.

Demonstration Plants
To demonstrate solar's contribution, nine pilot systems were designed and installed in close cooperation with industry.

Publications
The final Task results are summarized in four booklets and a CD:
- Potential of solar heat for industrial processes
- Process heat collectors
- Design guidelines for space heating of factory buildings
- Pilot projects for solar thermal plants in industry
- CD: demo version of the Pinch Energy Efficiency - PE2 computer program, and the matrix of industrial process indicators.

To learn more and download Task 33 reports visit http://www.iea-shc.org/task33/index.html or contact the former Operating Agent, Werner Weiss of AEE, Institute for Sustainable Technologies, Austria, e-mail: w.weiss@aee.at.

TASK 33 PARTICIPATING COUNTRIES
Australia
Austria
Germany
Italy
Mexico
Portugal
Spain

TASK 34 | TESTING AND VALIDATION OF BUILDING ENERGY SIMULATION TOOLS

The objective of this four-year Task with IEA's Energy Conservation in Buildings and Community Systems Programme was to undertake pre-normative research to develop a comprehensive and integrated suite of building energy analysis tool tests that could provide software quality assurance. To accomplish this, the Task participants investigated the availability and accuracy of building energy analysis tools and engineering models used to evaluate the performance of innovative low-energy buildings. Activities included the development of analytical, comparative and empirical methods for evaluating, diagnosing and correcting errors in building energy simulation software.

HIGHLIGHTS OF KEY RESULTS

Software
This work has led to direct improvements in software tools used for evaluating the impacts of energy efficiency and solar energy technologies commonly applied in innovative low-energy buildings. Specifically, the Task has identified 63 results disagreements that have led to 58 software fixes. This improved accuracy in simulation models has increased confidence in their use by architects and engineers who rely on building energy simulation tool calculations to perform their work.

Research
The Task's tool evaluation research is linked to the needs and recommendations of the world's leading building energy analysis tool developers. A recent study comparing 20 whole-building energy simulation tools indicated that 19 of the 20 tools reviewed had been tested with at least one of the IEA BESTEST procedures, and that 10 of the tools had been tested with more than one of the BESTEST procedures. The study also indicated that test procedures developed by the SHC Programme dominated the set of available tests.

Codes & Standards
National and international building energy standards organizations have used test cases developed in this Task and earlier SHC Tasks to create standard methods of tests for building energy analysis tools used for national building energy code compliance.

Examples include:
- ANSI (American National Standards Institute) and ASHRAE (American Society of Heating, Refrigeration, and Air Conditioning Engineers) adopted SHC software validation work into their standards.
- Several EU countries, as part of the building energy performance assessments under the European Community's Energy Performance Directive, use software tools that have been checked with IEA BESTEST.

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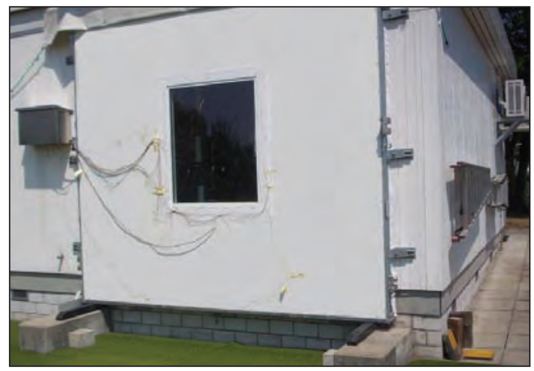

Two Task 34 test facilities: EMPA Test Cells in Duebendorf, Switzerland (on the top) **and Aalborg University Double-Skin Façade Test Facility in Aalborg, Denmark** (on the bottom).

switzerland

solar shines in switzerland

Switzerland has a long history in solar heating in both research and market implementation of active and passive solutions. This has been the result of a well coordinated program between research, administration and market activities, and has led to the establishment of scientific research centers and experienced engineering companies. The Swiss MINERGIE building standard, promoted by the government and the cantons, has also stimulated demand for energy efficient buildings and the use of solar energy.

Market Situation in Switzerland

2007 was a mixed bag for solar in Europe. Countries with large market shares – Austria and Germany – saw a decline in installations. While other countries such as Switzerland, experienced double digit growth rates. The Swiss solar thermal market grew 26% in 2007 continuing its steady growth since 2004 (see Figure 1).

In 2007, 78,000 m^2 of collectors were installed and a remarkable amount of an additional 67,000 m^2 were exported (see Figure 2). Of the new collectors, 35% were installed on multi-family houses for hot water production, 25% were installed on single family houses, of which 19% were combined systems for hot water production and space heating.

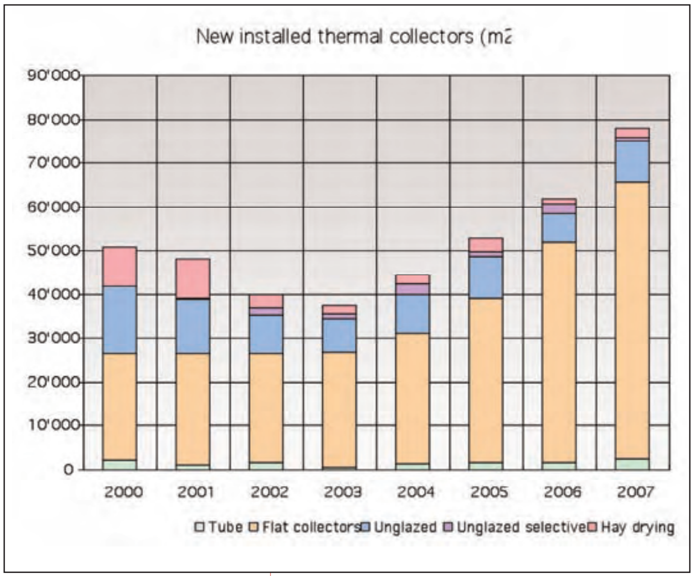

Figure 1: Installed solar collectors in Switzerland from 2000 to 2007.

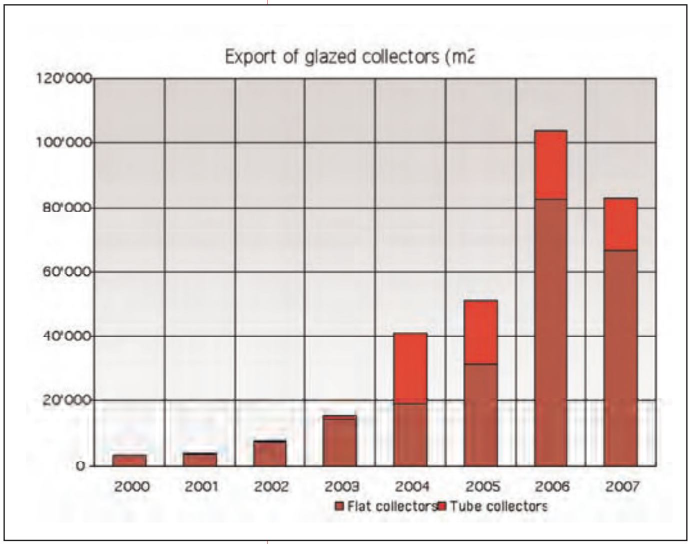

Figure 2: Exported Swiss solar collectors from 2000 to 2007.

Solar Buildings

As a result of the Swiss Federal Office of Energy's Pilot and Demonstration Programme, Switzerland is home to many solar sustainable buildings. These buildings not only include solar, but often innovative building concepts or technologies. The following are examples of such buildings.

Marche International office building in Kemptthal

Objective: Architecturally appealing zero-energy and zero carbon building using active and passive solar technologies.

Features:

- MINERGIE-P-ECO certified
- High quality building envelope
- Fully glazed south façade for passive use of solar heat in winter time
- Roof top PV plant of 45 kW peak power

Marche International office building in Kemptthal.

"Sunny Woods" in Zurich

Objective: High efficiency multi-family building with 4 storey wood construction.

Features:

- Net zero energy balance for heating
- Use of innovative materials (vacuum insulation)
- Solar thermal tube collector integrated in balcony
- Roof integrated PV plant of 2.7 kW peak power per flat
- Electricity use of heat pump covered by PV-plant

EAWAG's research, teaching and office building in Dubendorf

Objective: Model building planned and constructed according to sustainable development criteria.

Features:

- Advanced shading system and free cooling therefore no active cooling system is necessary
- Roof top solar tube collector for hot water production and space heating
- Roof integrated PV plant of 77 kW peak power that covers one third of overall electricity consumption of the building

Swiss Research Programme on Solar Heat and Heat Storage

The Swiss research programmes work under four-year strategic plans. The main targets in the solar R&D programme for the next four years (2008-2011) are:

- New materials for collectors to substitute copper;
- Collectors with enhanced life time;
- Building integration – development of ultra thin collectors;
- Heat storage technologies (PCM, sorption materials, thermo-chemical storage);
- Optimized solar thermal systems;
- Glycol free solar systems;
- Integrated solar and HVAC systems; and
- Release of the planning tool Polysun 5.0.

Swiss Solar Research Center (SPF)

The Swiss solar research center, SPF, in Rapperswil has been engaged in applied research and the development on thermal solar technology since 1981. Over these years, SPF has gained extensive experience in designing thermal collectors and solar systems for buildings, as well as in failure analysis.

"Sunny Woods" multi-family building in Zurich.

SPF has about 20 staff (engineers, physicists and technicians) working in all areas of solar heat:

- Materials and components dealing with absorber coatings, transparent covers, pumps, compensators.
- Collectors, all types such as flat-plate, evacuated tube collectors, liquid and gaseous heat transfer media, and concentrating devices.
- Systems, mainly solar domestic hot water systems, combined systems for space heating and hot water, and solar cooling.
- Design tools, the software named "Polysun" calculates and optimizes thermal collector systems. Users can simulate any type of thermal system using the intuitive graphical interface. In its 4th version, this software had been distributed worldwide for more than 10 years. Polysun is a great companion of the Swiss solar software "Meteonorm," which provides meteorological data for any place in the world.

SPF also serves as a technology transfer platform between the research and development centers and the solar industry. In doing so, SPF acts as a link between users, investors, educational institutions, manufacturers and installers. SPF also consults on solar collectors and system designs for numerous companies all over the world.

The Swiss Federal Office for Energy (SFOE) has been a major source of commissions for the SPF since its inception. Thanks to long-term research commissions from SFOE, the institute has been able to develop an internationally recognized center of expertise. As the number of industrial commissions has increased, the proportion of public funding has decreased. This is in accordance with the aims of SFOE, that applied research and development should increasingly be financed by industry.

The Future of Solar in Switzerland

Despite low subsidies levels in Switzerland, standards and building regulations have set boundary conditions in favor of energy savings and the use of solar energy. On the production side, the small domestic market of Switzerland is mainly covered through SME production companies. And, the growth in exports is a result

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Switzerland *continued from page 7*

"EAWAG" research, teaching and office building in Dubendorf.

of high quality Swiss products that have a good reputation beyond Switzerland's border. On the solar application side, the use of solar is continuing to grow. However, for solar energy to represent a significant and sustainable share of the Swiss building sector's energy supply there is still a long road ahead that will need to be paved with market initiatives, research activities and product innovations.

This article was contributed by the Swiss SHC Executive Committee member, Andreas Eckmanns of the Swiss Federal Office of Energy; andreas.eckmanns@ bfe.admin.ch, www.sfoe.admin.ch and a former SHC project leader, Jean-Christophe Hadorn of Base Consultants, jchadorn@baseconsultants.com

Related websites

www.solarenergy.ch
www.velasolaris.ch
www.meteonorm.com
www.solarch.ch

The Future of Solar Thermal Collectors – Color

One main barrier to the acceptability of using solar thermal collectors in facades are their black appearance and the visibility of piping or absorber irregularities through the glazing. An extensive European survey conducted by the LESO-PB, within the framework of the SOLABS project, gave an indication of how the technology could be improved so as to be widely accepted by clients. As a consequence of this survey, work has focused on producing colored thermal collectors suitable for smooth façade integration.

To facilitate façade integration, the project developed selective filters reflecting only a small part of the solar spectrum in the visible range while letting the rest of the radiation heat the absorber. These filters, which were then combined with a diffusing glass treatment, have achieved the desired masking effect with only a minor impact on the collector efficiency (less than 10%).

Glass of various colors combined with several diffusing finishings (acid etching, structured glass, etc.) can be produced that are able to hide the absorber. Such glazings allow the use of the same product both on façade areas equipped with solar absorbers (as collector external glass) and in front of non-exposed areas as façade cladding. This advancement is opening the way to a broad variety of active façade designs and allowing architects to use solar thermal technology more freely in their designs. Current work is focused on adapting the results to regulations and costs constraints.

This project has been supported by the Swiss Federal Office of Energy's Solar Heating and Heat Storage research program since 2003.

More details at:
http://leso.epfl.ch/e/research_renew_colored.html
http://leso.epfl.ch/e/research_nanotec_colorcoll.html

SHC Work *continued from page 5*

- CEN used IEA BESTEST to check their reference cooling load calculation general criteria.
- Australia and New Zealand referenced IEA BESTEST in their codes and standards.
- Researchers translated previous IEA BESTEST work into Dutch, German, and Japanese.

To learn more and download Task 34 reports visit http://www.iea-shc.org/task34/index.html or contact the former Operating Agent, Ron Judkoff of the National Renewable Energy Laboratory, United States, e-mail: ron_judkoff@nrel.gov.

TASK 34 PARTICIPATING COUNTRIES

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Canada
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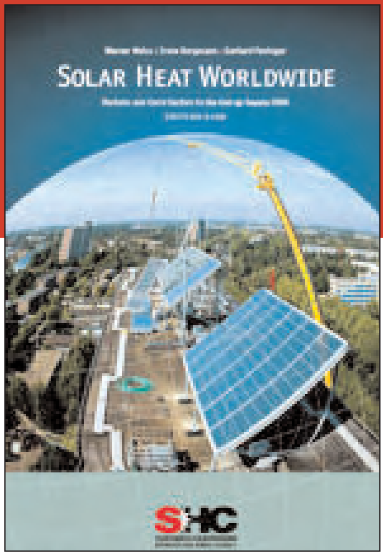
Germany
Ireland
Japan
Netherlands
Sweden
Switzerland
United Kingdom
United States

SHC new publications



SOLAR STATISTICS

Solar Heat Worldwide – 2008 Edition
Werner Weiss, Irene Bergmann, Gerhard Faninger

Find the data you need on solar thermal energy. This year's edition of the SHC Programme's, Solar Heat Worldwide: Markets and Contributions to the Energy Supply 2006, presents statistics from 48 countries. The report includes data on solar thermal's total capacity, on market developments, on solar's contributions to the energy supply and CO_2 reductions, and includes country specific information.

Download your copy at http://www.iea-shc.org/publications/downloads/IEA-SHC_Solar_Heat_Worldwide-20081.pdf.

MODEL TESTING & VALIDATION

International Energy Agency Building Energy Simulation Test and Diagnostic Method (IEA BESTEST): In-Depth Diagnostic Cases for Ground Coupled Heat Transfer Related to Slab-on-Grade Construction

This report documents a set of idealized in-depth diagnostic test cases for use in validating ground coupled floor slab heat transfer models. These test cases represent an extension to IEA BESTEST, which originally focused on testing and validation of building thermal fabric models, but addressed only cursorily the modelling of heat transfer between the building and the ground.

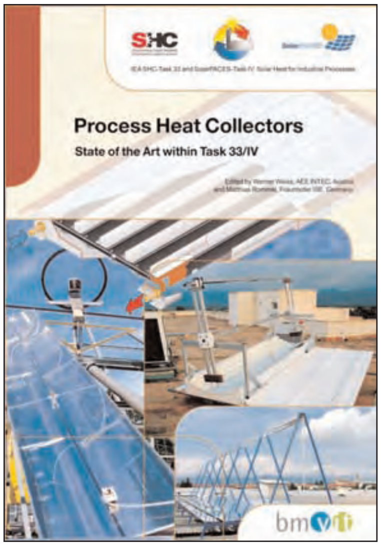
Download your copy at http://www.iea-shc.org/publications/downloads/Task%2034%20-%20%20BESTEST%20for%20Ground%20Coupled%20Heat.pdf.

SOLAR HEAT FOR INDUSTRIAL PROCESSES

Process Heat Collectors: State of the Art within Task 33/IV

The use of solar energy in commercial and industrial companies is insignificant compared to solar's other applications. However, the potential is great and the impact on energy use could be significant as the industrial sector is the largest consumer of energy compared to the transportation, household and service sectors in OECD countries. This report gives an overview and some background information on the present state of process heat collector development carried out in the framework of the IEA SHC Task 33/SolarPACES IV.

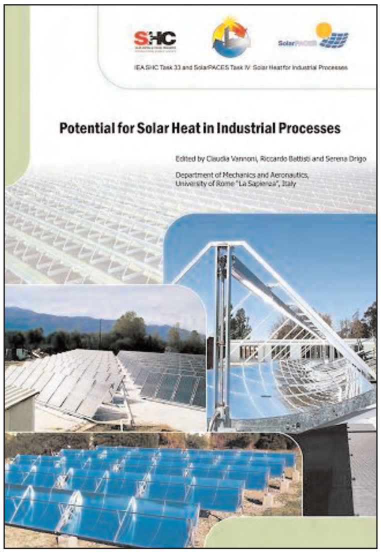
Download your copy at http://www.iea-shc.org/publications/downloads/task33-Process_Heat_Collectors.pdf.



Potential for Solar Heat in Industrial Processes

The goal of this report is to highlight the potential use of solar thermal plants to provide heat for industrial applications. In order to fulfil this aim, several national potential studies were surveyed and compared with a focus on the key results and the methodologies applied.

Download your copy at http://www.iea-shc.org/publications/downloads/task33-Potential_for_Solar_Heat_in_Industrial_Processes.pdf.



new projects

NZEB & Thermal Storage

> "This new work aims to support the evolution of Net Zero Energy Buildings from a radical concept into marketplace reality by engaging IEA countries in developing a common understanding and methodology, tools, innovative solutions and guidelines to enable industry adoption."
> *Mark Riley, Task 40 Operating Agent*

NET ZERO ENERGY SOLAR BUILDINGS

Given the global challenges related to climate change and resource shortages, much more is required than incremental increases in energy efficiency. Currently, a prominent vision proposes so called "net zero energy", "net zero carbon" or "EQuilibrium" buildings. Although these terms have different meanings and are poorly understood, several IEA countries have adopted this vision as a long-term goal of their building energy policies.

What is missing is a clear definition and international agreement on the measures of building performance that could inform "zero energy" building policies, programs and industry adoption.

The Task

Working with the IEA's Energy Conservation in Buildings and Community System's Program (ECBCS), this new Task, *Net Zero Energy Solar Buildings*, will study current net-zero, near net-zero and very low energy buildings and will develop a common understanding, a methodology, tools, innovative solutions and industry guidelines. The planned outcome of the Task is to support the conversion of the net zero energy building (NZEB) concept from an idea and a "slogan" into practical reality in the marketplace. A source book and data sets developed during the Task will provide realistic case studies of how NZEBs can be achieved.

The scope of the work will include major building types (residential and non-residential, existing and new) in the climatic zones represented by the participating countries. Participants will link the Task work to their national activities and will focus on individual buildings, clusters of buildings and small settlements. By analyzing existing examples, innovative solutions will be developed and incorporated into the Task's demonstration buildings.

SHC Task 40/ECBCS Annex 52 is a five-year collaborative project that will begin in October 2008 and end in September 2013.

Expected Results

The Task's results will be targeted to and designed for the building industry (building manufacturers, manufacturers of components and systems), housing companies and building developers, architects, building engineers and utilities.

Specific results will include:

- Technical reports on a harmonized methodology and definition and guidelines for monitoring and verification of NZEBs and on the market potential of NZEBs including impacts on grids.
- Overview of market available and near market NZEB components and systems for different building types and climates.
- Suite of NZEB tools including a data base and user manual.
- NZEB source book covering the methodology, technologies, tools, case studies and demonstration projects.
- Solution sets and designs for national demonstration projects.

For more information contact the SHC Operating Agent, Mark Riley of Natural Resources Canada, NetZeroBuildings@nrcan.gc.ca.

Ecoterra Equilibrium near-net-Zero Home of Alouette Homes in Quebec, Canada

COMPACT THERMAL ENERGY STORAGE

Greenstone Low Energy building in Whitehorse, Yukon, Canada

By improving the effectiveness of thermal storage, the effectiveness of all renewable energy technologies that supply heat can be improved. For solar thermal systems, it is necessary to store heat (or cold) efficiently for long periods of time in order to reach high solar fractions, and at this time, cost-effective compact storage technologies are not available.

What is needed is a way to bring together the ongoing work on materials and applications. Current activities are either limited to specific applications or to specific materials and are not sufficiently linked.

"Thermal energy storage technologies are needed for 1) matching the intermittent supply of renewable heat and 2) optimizing thermal system performance. Present thermal energy storage technologies, which are water based, perform well, but on a relatively low level of efficiency. These systems can only be improved marginally, and so new materials and systems are needed for a breakthrough in this area.

Past IEA SHC and ECES work concluded that a broad and basic research and development initiative is needed to find and improve compact thermal energy storage materials. This joint SHC Task 42/ECES Annex 24 will bring together experts from both the materials development field and the systems integration fields. In four years, the Task aims to finish the first steps towards a new generation of thermal storage technologies."

Wim van Helden
Task 42 Operating Agent

The Task

Working with the IEA's Energy Conservation through Energy Storage Program, this new Task, *Compact Thermal Energy Storage: Material Development for System Integration*, will develop advanced materials and systems for the compact storage of thermal energy and will create an active and effective research network for the collaboration of researchers and industry working in the field.

The scope of the work will cover advanced materials for latent and chemical thermal energy storage (TES), excluding materials related to sensible heat storage. Seasonal solar thermal storage will be a primary focus, but as there are many more relevant applications for TES and materials research can not be limited to only one application, the Task will focus on multiple application areas. Other applications to be included are cogeneration and tri-generation and heat pumps, building cooling, district heating, industrial waste heat, and concentrated solar power.

SHC Task 42/ECES Annex 24 is a four-year collaborative project that will begin in January 2009 and end in December 2012.

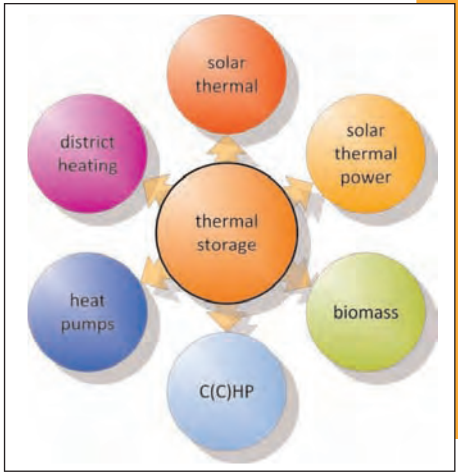
Expected Results

The Task's results will be targeted to and designed for experts and organizations in the materials and applications sectors. For the materials sector, the results will provide a better understanding of existing and new materials for thermal energy storage, new methods and procedures for material and system performance improvement, and a comprehensive overview of the possible applications for this class of materials. For the applications sector, the results will provide a better understanding of the potential and barriers of compact thermal energy storage materials and systems for their application.

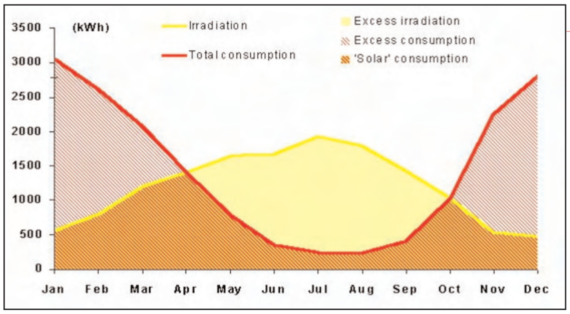
Specific results will include:

- Materials database with material properties and relations, materials safety data sheets, and samples of new materials for material testing.
- Inventory of production technologies and materials pricing datasheets.
- Long-term stability test protocols for several classes of material.
- Test procedures for model validation and validated numerical models for all applications.
- System testing methods.
- Case studies and a field test of a least one application.

For more information contact the SHC Operating Agent, Wim van Helden of the Energy Research Center of the Netherlands, vanhelden@ecn.nl.



Thermal energy storage is essential for a 100% solar house.
(Source: ESTIF)



With seasonal storage, the summer's solar heat can be used to meet heating demand in winter.

SHC Programme

adopts bold new vision

Solar thermal energy systems will provide up to 50% of low temperature heating and cooling demand by 2030.

Turning solar thermal into a major energy resource by 2030 is an ambitious, but realistic goal. It is achievable – provided that the right mix of research & development, industrial growth and consistent market deployment measures are applied. The SHC Programme is not alone in this vision, the European Commission's European Solar Thermal Technology Platform shares this vision, and other organizations, companies and local governments are committed to solar and other renewables.

The energy sector, as we know it today, will be vastly different in 20 years as demands on traditional energy sources are pushed to their limits. Solar thermal already is making a contribution in the growing demand for heating and cooling in buildings. And, as buildings become more energy efficient, solar thermal energy will become the most important energy source for heating and cooling in new and existing building stocks by 2030.

Market Trends

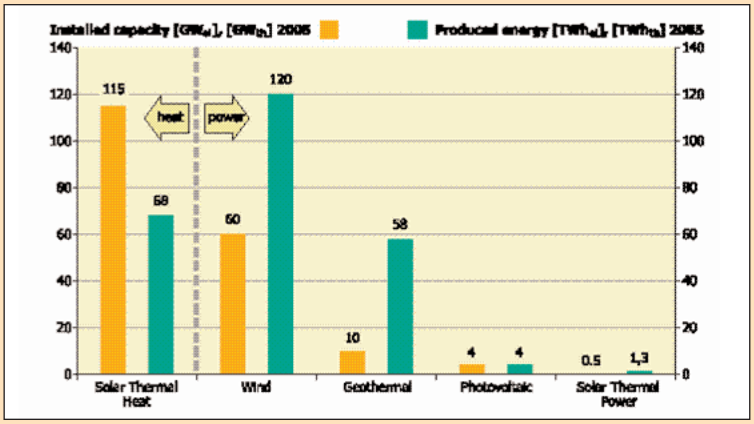
Since the beginning of the 1990s, the solar thermal market has grown steadily. At the end of 2006, a total of 127.8 GWth corresponding to 182.5 million square meters of collector area were installed in 48 countries. These 48 countries represent 3.87 billion people, about 60% of the world's population. And, the collector area installed in these countries represents 85-90% of the world's solar thermal market.

Compared with forms of renewable energy, solar thermal's contribution in meeting global demand is, besides the traditional renewables like biomass and hydropower, second only to wind.

The market for hot water and space heating using flat plate and evacuated tube collectors grew a remarkable 22% from 2005 to 2006. The most dynamic markets worldwide were in China and Europe as well as Australia and New Zealand.

Solar's Impact

In 2006, the annual collector yield of all solar thermal systems installed was 76,959 GWth (more than 277,054 TJ). This is an oil equivalent of 12.5 billion liters, and represents an annual avoidance of 34.1 million tons of CO_2.

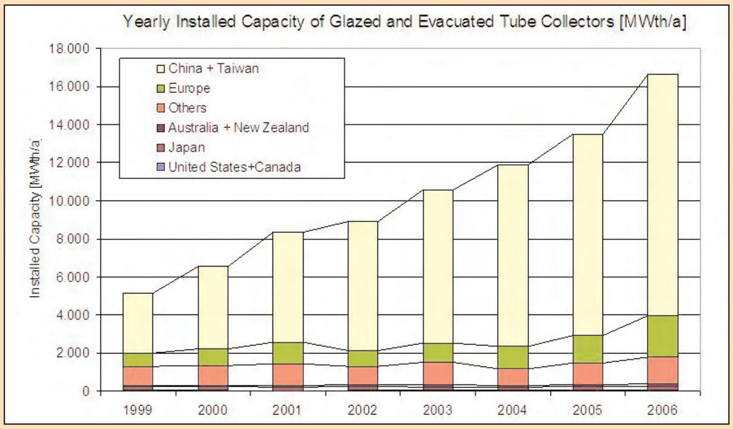


Total capacity in operation.
(Source: IEA SHC Programme, Solar Heat Worldwide 2008 report)

Solar's Future

Solar technologies can supply energy for all building applications—heating, cooling, hot water, light and electricity—without the harmful effects of greenhouse gas emissions created by conventional energy sources.

Solar technologies are appropriate for all building types—single-family homes, multi-family residences, office and industrial buildings, schools, hospitals, and other public buildings—and applicable anywhere in the world.



Annual installations by region.
(Source: IEA SHC Programme, Solar Heat Worldwide 2008 report)

Active solar technologies can be used for agricultural and industrial process heat applications.

The SHC Programme, driven by our vision, is committed to increasing the use of solar designs and technologies in the built environment, and for agricultural and industrial process heat.

To learn more about the SHC Programme's work visit www.iea-shc.org.

IEA SHC programme

The International Energy Agency was formed in 1974 within the framework of the Organization for Economic Cooperation and Development (OECD) to implement a program of international energy cooperation among its member countries, including collaborative research, development and demonstration projects in new energy technologies. The members of the IEA Solar Heating and Cooling Agreement have initiated a total of 41 R&D projects (known as Tasks) to advance solar technologies for buildings. The overall Programme is managed by an Executive Committee while the individual Tasks are led by Operating Agents.

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