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Newsletter of the International Energy Agency Solar Heating and Cooling Programme

SHC
SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

In This Issue

www.iea-shc.org

Solar Heating and Cooling in IEA Countries

The IEA Solar Heating and Cooling Programme held its 9th National Program Review workshop for member countries to exchange information on their national solar programs. These country reports and an overview chapter highlighting the main trends are now available. The report, Solar Energy Activities in IEA Countries, can be downloaded from the SHC web site.

IEA Member Countries

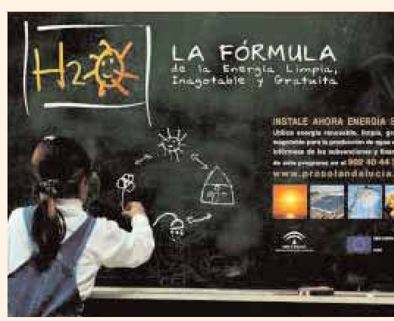
- Australia
- Austria
- Belgium
- Canada
- Denmark
- European Commission
- Finland
- France
- Germany
- Italy
- Mexico
- Netherlands
- New Zealand
- Norway
- Portugal
- Spain
- Sweden
- Switzerland
- United States

The Market

Since the workshop in 2002, the market for active solar systems has shown healthy growth with an installed capacity of 98.4 GWth or 141 million square meters of collector area at the end of 2004 and an estimated growth by the end of 2005 to 115 GWth or 164 million square meters of collector area.

The most dynamic markets for flat-plate and evacuated tube collectors worldwide are in China, Australia and New Zealand as well as in Europe. The average annual growth rate between 1999 and 2004 was 25% in China and Taiwan, 19% in Australia and New Zealand and 13% in Europe.

The market for non-glazed collectors is also growing. The USA and Canada lead in the application of this technology, which is mainly used for swimming pool heating. The non-glazed collectors form 23% of the total installed collector capacity.



In the field of solar design, the focus has shifted from maximizing solar gains to integrated design where the day light features, the solar gains and the cooling all play an important role. Several countries in Europe have introduced building codes where the total energy performance of a building (including passive gains) is rated.

Spain's information campaign on solar hot water heating, includes TV, radio and print ads.

Major Trends

The country reports in the publication, Solar Energy Activities in IEA Countries, underscore the diversity of the solar market in each country. Despite these differences, several general trends can be seen.

Building Codes

In several countries (Australia, Austria, Denmark, Germany and Netherlands), the buildings codes limit the energy use in new buildings and include

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solar energy in the calculation. In Europe, all countries will soon be obliged to introduce such a building code under the EU's Energy Performance of Buildings Directive. Some countries are even going a step further and requiring all new buildings to install solar water heating systems. For example, what started in Barcelona, Spain, is now being replicated in some form throughout all of Spain, and in Australia, Portugal, France and Mexico City.

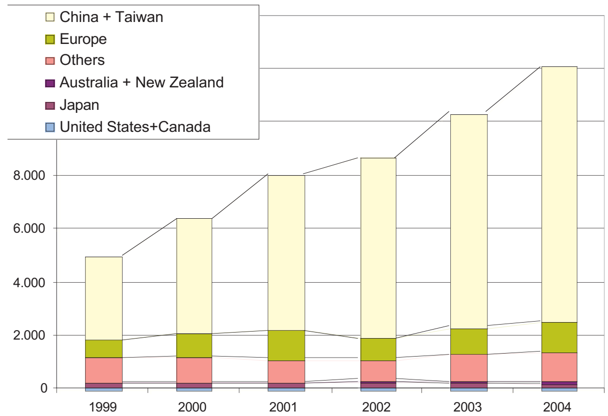
Incentive Programs

Where some countries are increasing incentives and starting new programs (e.g., Australia, Portugal and the United States), other countries have ended or reduced incentives (e.g., Netherlands and Switzerland). One trend that has emerged is countries that have had a stable incentive program for several years (e.g., Austria, Germany and France) also have a strong and growing solar market. China is an exception because the market continues to grow with no government incentives. Another trend is the shift in incentives provided by national governments to incentives provided by regions (e.g., Italy, Switzerland, Spain and the United States).

Standards and Labels

In several countries (Australia, France, New Zealand, Canada and Portugal), the incentive programs require a certain level of system performance or a quality certificate for the installation work. In Europe, an international certificate, the Solar Keymark, has been introduced for solar heating systems. The Solar Keymark is based on the CEN-standards and it is replacing local certificates.

Yearly Installed Capacity of Glazed and Evacuated Tube Collectors [MW/a]



Europe: EU 25 plus Luxemburg, Switzerland, Norway
Others: Barbados, Brazil, India, Israel, Mexico, South Africa, Turkey
Source: Solar Heating Worldwide, www.iea-shc.org.)

Government Funding

In general, funding for active and passive solar has decreased and remains small compared to funding for other renewables, such as wind and bio energy. But there is hope—new programs focused on reducing the energy use of the whole building are beginning to fill these funding gaps. A table on government funding of renewables is included in the report.

The complete report, *Solar Energy Activities in IEA Countries – 2006*, and an annual overview of the world's solar thermal market, *Solar Heating Worldwide*, can be downloaded from www.iea-shc.org.

A 200 MW solar simulator used at Canada's National Solar Test Facility.

Germany's new Federal Office on Environment or Dessau is energy efficient and uses renewables including solar collectors and daylighting.

The Prova Collettori Solari facility at Italy's ENEA Casaccia Research Centre.

A French home with a roof integrated solar water collector.

solar drying

a viable alternative

Working with commercial crop growers and processor industry associations, the participants in the SHC Programme's solar drying project have overcome three key barriers to the application of solar drying technology—a lack of awareness of the cost-effectiveness of solar drying systems, a lack of good technical information and a lack of good local practical experience—to demonstrate its commercial use and viability.

One of the most obvious and promising applications for active solar heating worldwide is the drying of agricultural products, especially in developing countries. In a recent study, which led to IEA SHC Task 29, the potential amount of energy that could be displaced using solar in this market was estimated to be between 300 PJ and 900 PJ annually, primarily in fuel-fired dryers for crops that are dried at temperatures less than 50°C. The study further found that the use of solar energy for these markets is largely undeveloped. At this time, wood and conventional fossil fuels are primarily used for drying, although they are being replaced by more expensive diesel and propane fuels as the traditional resources become scarce.

To capitalize on the large potential of solar technologies for crop drying, SHC Task 29 participants teamed with a variety of commercial crop drying companies to integrate solar technology in their facilities. Installations were made in China to dry jujubes and moyu, in Costa Rica and Panama to dry coffee and in India to dry coir pith, which is part of coconut shells.

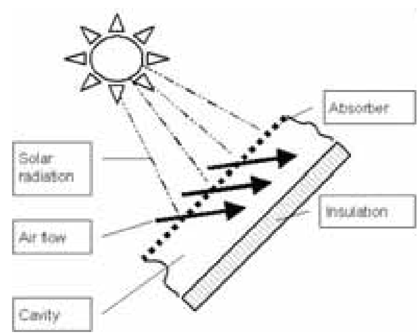
Solar perforated air heating collectors were installed on the roofs of the drying buildings. Ducts were then installed to connect the collectors to the furnace air handling systems. When sunlight shines on the black painted steel the air above the panels is heated. The heated air is drawn by fans through the small perforations in the panels and then through the ducts to the furnace. The preheated air reduces the amount of fuel required by the furnace to heat the air to the

Metal "hats" hold perforated solar panel of roof and form the air space from which the solar heated air is drawn.

Panama coffee drying facility shows collectors installed on the lower and upper roofs.

temperature required by the dryers.

This type of solar system is most appropriate for widespread use due to the simple design and technology, the use of readily available materials, the ability to be installed by local labor, the ease of retrofit, and the simple operation.



In addition to learning a great deal about integrating solar systems with well-established drying methods, Task participants found that greater system efficiency could be reached by improving the design and construction of the furnace, more carefully installing the duct work, improving the design and installation of the air handling equipment, using automated controls systems and providing additional training for the operators.

Monitored data from the Task projects demonstrated that solar air preheat systems, in combination with the efficiency improvements, can provide a cost effective solution to rising fuel costs and/or depleting fuel supplies. Mr. Doug Lorriman, the SHC Task 29 project leader, emphasizes that "To fully realize the potential of solar drying in developing countries a commitment is needed from the engineers, manufacturers and installers as well as the customers.
The results and experiences of SHC Task 29 provides an excellent resource for replicating the application of this technology"

A report will be published in early 2007 summarizing the experiences and information from each project. The report will be available on the SHC web site, iea-shc.org.

Duct work for the solar panels mounted under the roof at the moyu drying plant in China.

netherlands

solar heating: an integrated approach

The Dutch market for solar heating has not grown over the last years, but new policies will stimulate the further use of energy saving measures and solar technologies in both existing and new buildings.

The Situation Today

The Dutch policy on renewable energy has shifted over the past years to support electricity producing technologies and the most cost-effective technologies. The technologies that fall into these categories are bio-energy (as co-firing in coal power stations) and wind energy. The elections in November 2006 will probably result in a change in the current policy as most political parties now favor stronger support of solar technologies and climate policies.

Solar Water Heating

The market for solar water heaters has decreased slightly over the last years, after a steady increase in the 1990s. The main reason for this decrease was the end of the subsidy scheme. Although the market for solar water heaters on new houses is reasonably stable, the market for systems on existing homes has decreased considerably. Despite this drop in the market, most solar companies are still active, but have a very small budget for promotion. At this time, there are five Dutch manufactures producing their own systems and several companies importing systems. To support their industry many have joined the trade organization, Holland Solar. Holland Solar, in turn, is one of nine trade organizations that signed a Memorandum of Understanding with the IEA Solar Heating and Cooling (SHC) Programme.

Solar Buildings

In the field of solar buildings, the focus is on Trias Energica, which is a general policy for energy projects. The first step in the Trias Energica is energy saving, the second step is the use of renewable energy and the third is the effective use of fossil fuels. This policy was introduced in the Netherlands by Erik Lysen, the former Dutch Executive Committee member of the SHC Programme, and has become part of the climate policy in many cities. It also is the basis of the book "Toolkit for Sustainable Building," in which the Trias Energica is applied in the design of buildings. This book was written by a builder with the help of several leading renewable energy experts and with the financial support of the government. The toolkit, based on experiences from the construction of full-scale buildings, presents concepts for constructing buildings with an energy performance of 10%–50% below current regulations.

One of the buildings used is The Urban Villa, a building constructed as part of the SHC Programme's Task on advanced solar low energy buildings.

The outlook for solar buildings is becoming brighter with the introduction of the European Union's Energy Performance of Buildings Directive as it should have a positive effect on the use of energy saving measures, especially in the renovation sector.

The "Toolkit for Sustainable Building" is available in Dutch at www.toolkitonline.nl.

What the Future Holds

The Netherlands is continuing to support energy research. Goals of the energy research subsidy that started in 2005 are energy neutral new houses and a 50% reduction in the energy consumption of existing houses. Also, several long-term research and demonstration projects are underway.

Another important development is the formation of transition platforms in which key actors form a market co-operation with the government to reach long-term goals in an energy field. One of these platforms is devoted to energy in the built environment. By the end of 2006, this platform will have developed concrete proposals for reducing energy use in the built environment. These proposals will help simulate the increased use of energy saving measures and solar technologies.

A housing development designed using the "Toolkit for Sustainable Building."

Policies such as these will stimulate the further use of energy saving measures and solar technologies in both existing and new buildings in the Netherlands.

This article was contributed by Mr. Lex Bosselaar, the Dutch representative on the Solar Heating and Cooling Programme's Executive Committee.

Typical installation of solar collectors on new buildings in the Netherlands.

PV/T collectors

technologies combine to increase output

Solar collectors that combine PV panels and solar thermal collectors to produce both solar thermal and electric energy are called PV/thermal solar collectors. By combining these two technologies, PV/thermal systems are able to generate more energy per unit surface area than side by side photovoltaic panels and solar thermal collectors. Calculations made by ECN in the Netherlands show that by using PV/T collectors instead of side by side systems it is possible to reduce the collector area by 40% and still generate the same amount of energy.

To support the development and market introduction of high quality and commercially competitive PV/Thermal Solar Systems, the SHC Programme initiated SHC Task 35 on PV/thermal solar systems in January 2005 as a collaborative program with the IEA Photovoltaic Power Systems Programme. In addition to catalyzing the market for PV/T systems, participants are working to increase the general understanding of the systems and to contribute to internationally accepted standards on the performance, testing, monitoring and commercial characteristics of PV/Thermal Solar Systems in the building sector.

The Task is organised into 5 subtasks on 1) the market and commercialization, 2) energy analysis and modelling 3) product and system development, test and evaluation, 4) demonstration projects, and 5) dissemination of results. The countries participating in this work are Canada, Denmark, Israel, The Netherlands, and Sweden with input from experts in Greece, Hong Kong and Italy.

At this stage of the Task, tests of different PV/T collectors are being carried out in a number of countries. The aim of these tests is to achieve a better understanding of the performance of existing systems and to define standard methods for testing the characteristics and durability of PV/T systems. Methodologies being used are based on the experiences from the participating laboratories and the most recent international standardisation of testing procedures for solar systems.

- Tests of a flat plate liquid PV/T collector from the Dutch manufacturer PVTWINS, see Figure 1, were completed in September 2006 by the Danish Technological Institute. The same collector will now be tested at the University of Padova in Italy.
- A transpired air PV/T collector from Conserval Engineering in Canada is currently being tested at the National Solar Test Facility in Canada, see Figure 3. Tests of the same collector type are in preparation at the Danish Technological Institute.
- Tests of other types of PV/T collectors will also be carried out in Sweden and Italy.

Other results in this project will include articles based on market survey interviews and a revised roadmap for the commercialization of PV/T systems, a downloadable overview of PV/T components and projects, downloadable packages of PV/T simulation models and design tools, and a published summary on the experiences gained from working PV/T systems. A significant activity will be new demonstration projects. The Task will begin advertising for these projects soon.

By using PV/T collectors instead of side by side systems it is possible to reduce the collector area by 40%.

The liquid PV/T collector (PVTWIN 422 from PVTWINS of The Netherlands) tested at the Danish Technological Institute, Denmark

Preparation of the test stand for the air PV/T collector at the National Solar Test Facility in Canada.

For more information on this Task please contact the Operating Agent, Henrik Sørensen, h.soerensen@esbensen.dk or the Project Manager, Jan Hansen, j.hansen@esbensen.dk.

SHC new work

The Solar Heating and Cooling Programme initiates new work that is proposed by participating countries and fulfills the Programme's strategic plan.

Solar Air Conditioning and Refrigeration

Work on SHC Task 38, *Solar Air Conditioning and Refrigeration*, started in September 2006. Eight countries (Austria, Canada, Germany, Italy, Mexico, Portugal, Spain and Switzerland) are participating in the Task with other countries expressing interest to join.

The goal of Task 38 is to improve conditions for the market introduction of solar assisted air-conditioning systems for residential and small commercial buildings, to develop concepts and create tools for the proper implementation of solar cooling (air-conditioning and refrigeration) in large scale applications (e.g., large office and residential buildings, hotels, industry, etc), and to facilitate the development of new systems and concepts through research activities.

The specific objectives of the collaborative work are to:

- Improve conditions for the market introduction of solar assisted air-conditioning systems devoted to the residential and small commercial sectors. The aim is to achieve the development of standardized small capacity systems with strong involvement of the industry (solar thermal systems, manufacturer of heat driven cooling devices). The pre-engineered systems are to be ready for installation without the need for further planning.
- Develop concepts and create tools for the proper implementation of solar cooling (air-conditioning and refrigeration) in large scale applications (e.g., large office and residential buildings, hotels, industry, etc). The scope is to work out a complete set of instruments for a correct pre-design, planning, installation and commissioning of systems by collecting previous experiences and results of current research. The objective is to remove one of the main barriers to the market for large scale applications.
- Facilitate the development of novel solar cooling concepts by improving the technology in response to the needs of targeted sectors through collaborative research activities. The work will focus on analysis of new and advanced system not yet ready for installation and market introduction.

To reach these objectives, the Task is organized into four subtasks:

- Subtask A: Pre-engineered systems for residential and small commercial applications
- Subtask B: Custom-made systems for large non-residential buildings and industrial applications
- Subtask C: Modeling and fundamental analysis
- Subtask D: Market transfer activities

Results from this work will be designed for the solar industry (manufacturers of components and systems and system sales companies), the air conditioning industry (manufacturers of components and systems) and professionals such as HVAC engineers, civil engineers, planners, and architects.

Since the start of SHC Task 38:

- The 1st international conference on "Solar Air-Conditioning" was held this past October in Italy.
- Task experts will actively contribute again to the 2nd international conference to be held October 2007 in Tarragona, Spain.
- Fifteen small systems (solar-combi-plus-systems) have been identified for further development and monitoring.
- Ten large systems in non-residential buildings have been identified for further study.

For more information please contact the Operating Agent, Hans-Martin Henning, hans-martin.henning@ise.fraunhofer.de

Polymeric Materials

SHC Task 39, Polymeric Materials for Solar Thermal Applications, started in October 2006. Six countries (Austria, Germany, Norway, Portugal, Sweden and Switzerland) are participating in the work and other countries have expressed interest in joining.

The objectives of the Task are to:

- Assess the applicability and the cost-reduction potential of polymeric materials and polymer-based novel designs in solar thermal systems, and
- Promote increased consumer confidence in these products by developing and applying appropriate methods to assessment their durability and reliability.

To reach these objectives, the Task is divided into three subtasks:

- Subtask A: Information
- Subtask B: Collectors
- Subtask C: Materials

Information about the application of polymeric materials in solar thermal systems, particularly in terms of cost/performance ratios for an acceptable lifetime, is key if sound applications are to move into the market. It is for this reason that the Task has devoted a subtask specific to information.

Work in Subtask B will be to analyze the state-of-the-art in polymer based solar collectors and to derive and define the requirements for collectors in given applications. It will also include the development of concepts for polymer based collectors that are easy to handle, can be mass produced, and are cost competitive.

An important aspect of all research activities in Subtask C will be the strong focus

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solar marketplace

The Solar Heating and Cooling Programme is not only making strides in R&D, but also impacting the building sector. This section of the newsletter highlights solar technologies that have been developed or conceptualized in a SHC Task and are now being commercially manufactured, marketed or used.

SHC Testing and Validation Work is Applied Throughout the World

Canada & United States

The American National Standards Institute (ANSI) and the American Society of Heating, Refrigeration, and Air Conditioning (ASHRAE) published Standard 140-2004 a revised version of the original Standard 140-2001. This new standard includes:

- the original IEA BESTEST, a suite of test cases primarily related to building thermal fabric heat transfer developed in the US in SHC Task 12, Solar Building Analysis Tools,
- HVAC BESTEST, a suite of test cases related to space cooling mechanical equipment developed in the US in SHC Task 22, and
- additions in 2007 that will include:
  - – Furnace BESTEST – developed in Canada under SHC Task 22
  - – HVAC BESTEST Volume 2 – developed under SHC Task 22

In June 2006, the US Internal Revenue Service issued a notice that cites Standard 140-2004 to certify software used for commercial building energy efficiency tax credits in the U.S.

United Kingdom

The UK's Charted Institute of Building Services Engineers (CIBSE) is compiling tests (CIBSE TM33) for software accreditation and verification. The tests address "a need for UK regulators to have a mechanism for the technical accreditation of detailed thermal models as part of their formal approval for use in the [UK] National Calculation Methodology." CIBSE notes that the TM33 tests are primarily meant to instill confidence in users rather than to provide comprehensive validation of a program. For those intending more detailed program validation, CIBSE TM33 cites tests and benchmarks available from ASHRAE Standard 140, IEA, ASHRAE Research and CEN.

Japan

A Japanese-language translation of HVAC BESTEST Volume 1 has recently been completed. Japan's translation team includes members from both universities and industry. This translation and an earlier translation of IEA BESTEST have been distributed to about 25 researchers and engineers in Japan, and several published papers already refer to these BESTEST translations. The translation of HVAC BESTEST Volume 2 is now in progress.

new work continued

on the performance, functionality and durability of polymer products with respect to the application in solar thermal systems. As with other materials, final product performance, functionality, durability and costs not only depend on the type of the polymeric material used, but also on many other factors related to product design, processing and production. Work in Subtask C will include:

- the identification of appropriate products for existing commercial and novel polymeric materials that have high potential and can meet sustainability, durability and performance criteria;
- the development, investigation and establishment of a structure/property-correlation for both, functional polymeric materials and polymer surfaces for solar thermal applications as well as performance defined structural polymeric materials for solar thermal applications; and
- the evaluation of polymer processing methods for the prototype production and cost-efficient mass production for solar thermal components.

For more information please contact the Operating Agent, Michael Köhl, michael.koehl@ise.fraunhofer.de

IEA programme SHC

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 39 R&D projects (known as Tasks) to advance solar technologies for buildings. The overall program is managed by an Executive Committee while the individual Tasks are led by Operating Agents.

Current Tasks and Operating Agents

Advanced Storage Concepts for Solar and Low Energy Buildings
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