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Newsletter of the International Energy Agency Solar Heating and Cooling Programme

SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

In This Issue

Spain

Partnership of scientists and companies use solar to address energy demand in office buildings

The Spanish Ministry of Education and Science (MEC) is promoting a Singular Strategic Project called "Bioclimatic Architecture and Solar Cooling" (ARquitectura bioclimática y FRIo SOLar, in Spanish or PSE-ARFRISOL). The scientists of the Energy Efficiency of Building R&D Unit of CIEMAT are leading this investigation with the goal to reduce energy demand up to an 80% in five office buildings.

To demonstrate solar energy's potential contribution in buildings, Spain has initiated the Bioclimatic Architecture and Solar Cooling project. The project's objective is to achieve energy savings of up to 80% in five office buildings using a combination of passive solar strategies and active solar systems. Recognizing the importance of collaboration for such a project, the most prominent building companies, solar technology manufacturers and installers, and university researchers are working together. The building companies are in charge of construction, the solar manufacturers and installers are working on the solar heating and cooling systems and PV systems, and the research groups are addressing specific building issues, for example, climate resources, cooling, and monitoring and simulation.

Passive solar strategies, such as building orientation, shadowing, natural ventilation, thermal mass walls and solar gains, are being analyzed in the design phase to optimize the energy performance of each building based on their specific climatic condition. The goal is for the passive solar techniques alone to save up to 60% in the building's energy demand.

Active solar devices, such as solar thermal collectors for heating and cooling and photovoltaic panels for electricity, will be used to reduce conventional energy consumption by 10-20% of the usual consumption.

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2006 SHC Solar Award

Presented to Dr. Volker Wittwer

Dr. Volker Wittwer receives the SHC SOLAR AWARD at a ceremony during the Renewable Heating & Cooling Conference, World Energy Sustainable Days in Wels, Austria.

This year's SHC SOLAR AWARD was presented to Dr. Volker Wittwer, Deputy Director of Fraunhofer Institute for Solar Energy Systems in Freiburg, Germany at the World Energy Sustainable Days in Austria.

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.

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The office buildings that will be built are located in different regions throughout Spain so the energy solutions for each building will be different:

- CIESOL, University of Almería, is located in a Mediterranean climate.
- PSA (Plataforma Solar de Almería) is located in a desert climate.
- ED.70, CIEMAT, located in the middle of Madrid has a continental climate.
- CEDER (Centro de Desarrollo de Energías Renovables) is an existing building that will be retrofitted. It is in an extreme continental climate.
- BARREDO FOUNDATION is in an Atlantic climate.

The project began in May 2005 and will be completed at the end of 2009. Approximately 50% of the funding is from the Spanish Government's Ministry of Education and Science (MEC) with the other half from building owners and participants involved in the specific Consortium Agreement.

The expected results by the end of the project are:

- Construction of five energy efficient office buildings with an energy consumption between 80% and 90% less than existing offices. Energy use in each building will be measured, analyzed and quantified.
- Assessment and optimization of installed solar technologies, and support for their further penetration into the market.

Virtual View of CIESOL – the University of Almería building project.

- Development of "Educative Modules" by professors of the Spanish Royal Society of Physics (Real Sociedad Española de Física in Spanish, RSEF) and validation of them through their use at selected education centers.
- Development of guidelines for use by the different players involved in the project from builders to educators.

Dissemination of the project results will be critical as the over arching goal is to change people's perceptions of energy use and demonstrate alternative ways to heat and cooling buildings throughout Spain.

For more information contact the Head of Project of Energy Efficiency of Building R&D Unit of Ciemat, Mª Rosario Heras, mrosario.heras@ciemat.es.

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Dr. Wittwer is the fourth recipient of the SHC SOLAR AWARD. He was selected for his role as a pioneer in the development of solar thermal collectors, for his contributions to low energy buildings and their components, and for his commitment to SHC work from his participation as a project expert in the 1980s to his support of German participation in many SHC projects.

Under his leadership, combined with his scientific input, key innovations for solar technologies have been achieved:

- selective coatings produced with sputter technology; today this is the dominant technology for production of selective absorber coatings;
- low-e-coatings for glazings and windows;
- smart window coatings (electro-chromic, gasochromic, photo-electro-chromic, thermotropic);
- advanced insulation materials (transparent and vacuum insulation);
- anti-reflectance coatings for solar glazing; and
- micro-encapsulated phase change materials for integration into building materials.

In addition, Dr. Wittwer is one of the architects of the "European Solar Thermal Technology Platform," which is to be the key consultant to the European Commission on solar thermal research, technology and development.

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 RESOURCE KNOWLEDGE MANAGEMENT

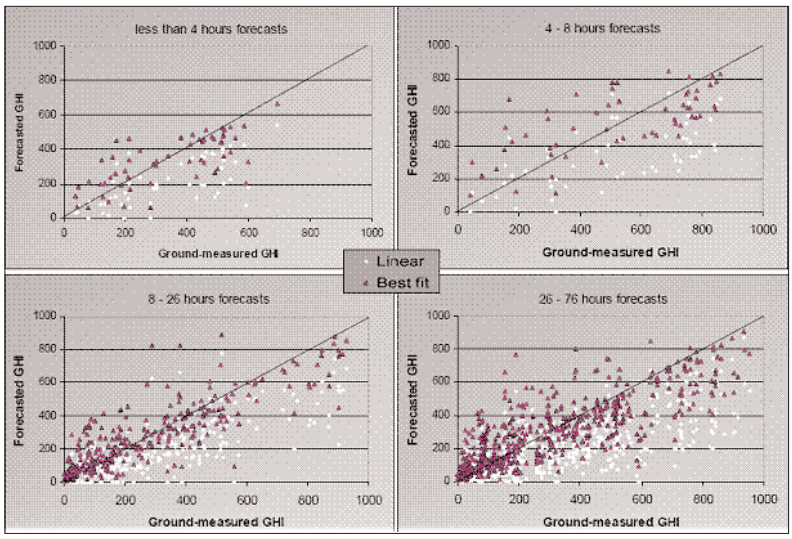
Work on SHC Task 36, *Solar Resource Knowledge Management*, started in July 2005. Six countries (Canada, France, Germany, Spain, Switzerland, and the United States) and the European Union are officially participating in the Task. The goal of SHC Task 36 is to provide the solar energy industry, the electricity sector, governments, and renewable energy organizations and institutions with the most suitable and accurate information on solar radiation resources at the Earth's surface in easily accessible formats and understandable quality metrics. The scope of solar resource assessment information includes historic data sets and current data products derived using satellite imagery and other means.

There are three main objectives of this Task to achieve this goal:

- To provide further standardization and benchmarking of international solar resource data sets;
- To provide improved data reliability, availability and accessibility in formats that address specific user needs;
- To integrate improved spatial and temporal coverage with customized solar resource products, including reliable short-term solar radiation forecasts and scenarios on the future availability of solar resources in a changing climate.

Achieving these objectives would reduce the cost of planning and deploying solar energy systems, improve the efficiency of solar energy systems through more accurate and complete solar resource information, and increase the value of the solar energy produced by solar systems. Because the Task is collaborating with the IEA Photovoltaic Power Systems (PVPS) and the IEA Solar Power and Chemical Energy Systems (SolarPACES) Programmes, the products coming out of SHC Task 36 will have considerable value to all solar technologies. For example, in IEA PVPS Task 2, *Performance Database*, the SHC Task 36 procedures will be used to qualify the IEA PVPS Task 2 database. In turn, IEA PVPS Task 2 outputs will serve as a means for testing, benchmarking, and quality assessing the satellite-derived databases.

Another strength of this LC Project is that many of the participants were involved in the United Nations Environment Programmes's (UNEP's) now completed Solar and Wind Energy Resource Assessment (SWERA) project, which included the development of high-resolution site-time specific solar resource maps and data for 13 countries around the world.



Example of solar resource forecasting results
(Source: R. Perez, SUNY/Albany New York, U.S.)

SHC Task 36 has a coordinated work plan that encompasses three subtasks:

- Subtask A: Standardize and Benchmark Solar Resource Products to Ensure Worldwide Intercomparability and Acceptance
- Subtask B: Develop Common Structure for Archiving and Accessing Data Products
- Subtask C: Improve Techniques for Solar Resource Characterization and Forecasts *(An example of the type of solar resource forecasting results proposed for this Task is shown in the figure below)*.

Since the start of SHC Task 36, several informal meetings among various Task participants have taken place, including a side meeting during the Solar World Congress in Orlando in August 2005. The Second Experts Meeting will be held in Denver, Colorado, USA on July 6-7, 2006 in advance of the Solar 2006 Conference. Recently, a questionnaire was developed on how solar resource data are used and what types of products are required by all solar technologies and solar-related research programs. The questionnaire will be posted on the Task web site in May 2006 with results available three to four months later.

For more information please contact the Operating Agent, David Renné, david_renne@nrel.gov.

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ADVANCED HOUSING RENOVATION BY SOLAR & CONSERVATION

Buildings are responsible for up to 35% of the total energy consumption in many of the IEA countries, and housing accounts for the greatest part of the energy use in this sector. Therefore, renovating existing housing offers an enormous energy saving potential.

A new SHC Task dealing with energy efficient housing renovation is being finalized. This Task is scheduled to begin in July/August 2006 and be completed in December 2009. The Task's objectives are to develop a solid knowledge base on how to renovate houses to a very high energy standard and to develop strategies that support the market penetration of these renovations.

SHC Task 37, *Advanced Housing Renovation by Solar & Conservation*, will address both technical R&D and market implementation. To accomplish this the work will be divided into four areas:

- Subtask A: Marketing and Communication Strategies
- Subtask B: Advanced Projects Analyses
- Subtask C: Concepts Development
- Subtask D: Environmental Impact Assessment

The first activity will be to analyze the building stock to identify building segments with the greatest numbers and energy saving potential. Examples of building segments are year of construction, type of building, type of envelope and components. Within these segments, important topics for discussions are ownership and decision structures, inhabitants and their characteristics, and retrofit market players. In parallel, analysis of exemplary renovation projects achieving substantial primary energy savings while creating superior living quality will be conducted. Drawing on this package of experiences and the most up to date research, new and innovative concepts and components will be developed.

Insights from this international collaboration will be shared with national end users in a deliberate strategy to increase the market penetration of advanced housing renovations.

For more information please contact the Operating Agent, Mr. Fritjof Salvesen, fs@kanenergi.no.

Solar Assisted Cooling Systems

This Task will get underway in 2006. The objectives of the work are 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.

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

Polymeric Materials for Solar Thermal Applications

The economic viability of solar collector systems for domestic hot water (DHW) generation is strongly linked to the cost of such systems. An attractive approach to cost reduction is to replace glass and metal parts with less expensive, lighter weight polymeric components. To investigate this, a new Task is under development to assess the applications and the potential reduction in costs when use polymeric materials in solar collectors. The Task will focus on the two core components of a solar thermal system—the collector and storage components.

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

Thanks To…

Fritjof Salvesen of KanEnergi AS, who served as the Norwegian Executive Committee member for 24 years. The Executive Committee thanks him for his dedication to the goals of the Programme, he not only served as Committee member, but also as Chairman. The Committee looks forward to working with him in his new role as Operating Agent for the new Task on Advanced Housing Renovation with Solar and Conservation.

Pietro Menna, who served as the European Commission's Executive Committee member. The Committee thanks him for working to facilitate the collaboration between the EC and the SHC Programme.

Welcome To…

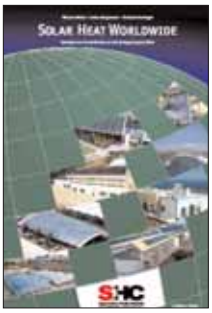
Anne Gunnarshaug Lien of Enova SF, who is the new Executive Committee representative for Norway.

Jose Riesgo who is the new Executive Committee representative for the European Commission.

publications

new SHC publications

SOLAR HEAT STATISTICS



Solar Heat Worldwide – 2006 Edition
Werner Weiss, Irene Bergmann, Gerhard Faninger

Solar thermal energy's contribution to the energy supply is documented in this annual report. 2004 data show continued growth in the market with an installed capacity of 98.4 GWth or 141 million square meters of collector area.

Download your copy from www.iea-shc.org

SUSTAINABLE SOLAR HOUSING

Business Opportunities in Sustainable Housing: A Marketing Guide Based on Houses in 10 Countries
Elisabeth Synnove, Trond Haavik, Edward Prendergast

Sustainable housing is a growing part of the housing industry, making it a business opportunity waiting to be explored. To help in this exploration, the report presents experiences on how sustainable housing was introduced into the market in different countries.

Sustainable Solar Housing–2 volumes
Edited by Robert Hastings and Maria Wall; Hardback, £112.50, ISBN 1844073270

This two-volume set examines potential strategies for designing low-energy buildings and provides detailed analysis of exemplary buildings.

Vol. 1: Strategies and Solutions
Paperback, £49.50, ISBN 1844073254
Volume 1 presents strategies and solutions for assessing environmental and economic concerns in sustainable housing projects. It also offers guidance for implementing the most appropriate course of action in a variety of contexts.

Vol. 2: Exemplary Buildings and Technologies
Paperback, £49.50, ISBN 1844073270
Volume 2 provides detailed analysis of exemplary buildings in different European countries and examines the technologies used. Illustrations throughout the book offer invaluable insights into the application of these technologies.

Available September 2006. Pre-order your copy at http://shop.earthscan.co.uk

Bioclimatic Housing: Innovative Designs for Warm Climates
Edited by Richard Hyde; Hardback £49.95, ISBN 1844072843

This book addresses sustainable architecture in warmer climates and addresses the relationship between nature and design. It explores case studies from the Middle East, Asia, Europe and Australia to form an overview of strategies and to show how these strategies can be developed into practice by architects, designers and engineers.

Available August 2006. Pre-order your copy at http://shop.earthscan.co.uk

The Environmental Brief: Pathways for Green Design
Richard Hyde; Hardcover $120, paperback $54.95, ISBN: 0415290449

This book explains how the use of an environment brief can drive building design to produce high environmental performance. The book is divided into three parts: theoretical issues of environmental briefing; the briefing method and process; and a series of international case studies.

Available in May 2006. Pre-order your copy at www.amazon.com

ADVANCED STORAGE CONCEPTS FOR SOLAR AND LOW ENERGY BUILDINGS

Thermal Energy Storage for Solar and Low Energy Buildings–State of the Art
Edited by Jean-Christophe Hadorn; Hardback £35 ISBN 84-8409-877-X

The first book published on thermal heat storage in 10 years. Fifteen international experts report on storage in building structures, storage in water, phase change material storage, and sorption and chemical storage.

Order your copy from www.iea-shc.org or http://www.6faces.com/product. php?productid=176

SOLAR HEAT FOR INDUSTRIAL PROCESSES

Medium Temperature Collectors: State of the Art
Werner Weiss and Matthias Rommel

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 medium temperature collectors.

Download your copy from http://www.iea-shc.org/task33/index.html

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.

Australian Manufacturers Adopt SHC Low-Flow Design

In response to Australia's Mandatory Renewable Energy Scheme to increase the amount of electricity generated from renewable energy sources, sales of solar water heaters have increased. This scheme requires electricity generators to produce up to 2% of their output from renewable sources or to buy renewable energy credits (1 credit = 1MWh of renewable electricity) from other renewable electricity generators or from products such as solar water heaters that displace electricity.

Under the Renewable Energy Scheme, solar water heaters receive a performance based subsidy. The value of the subsidy depends on the market trading of the credits and has ranged from AU$25 to AU$35 per credit or AU$800 to AU$1200 per solar water heater. To maxamize credits, most manufacturers have developed in-house capability for designing solar water heaters using the software, TRNSYS. The widespread use of TRNSYS has resulted in most Australian manufacturers adopting the optimum design principles evaluated under IEA SHC Task 14, Advanced Active Solar Systems.

The SHC advanced solar domestic hot water project (or "Dream System" project) was initiated to advance the state-of-the-art in active solar energy system design. One of the major outcomes of this work was the practical demonstration of the "low flow"concept for pumped designs. Specific recommendations also were made, including:

- The flow in the collector loop should be approximately 2 to 4 g/s-m^2.
- Flow into the solar storage or integral heat exchanger design should be such that optimal stratification is maintained.
- Total flow volume through the collector for an average day should be matched to the volume supplied to the load for an average day.
- The collector and load flow rates should be optimally matched.

Although the concept of "low flow"design was well established before IEA SHC Task 14, the SHC work provided the practical demonstration of the concept in a wide range of product configurations. The adoption of Task 14 results by manufacturers, however, has been a slow process.

Most of the thermal designers in the Australian solar water heater industry were reluctant to move from the text book rule that the "faster the flow the better the heat transfer." The Renewable Energy credits scheme, which is based on demonstrated performance, is changing this as there is a significant financial advantage manufacturers can gain by optimizing system designs. Today, the design features of low-flow and stratification optimization demonstrated in IEA SHC Task 14 have now been adopted by most manufacturers in Australia.

For more information contact Graham Morrison, University of New South Wales, Sydney Australia, g.morrison@unsw.edu.au or visit the IEA SHC web site, www.iea-shc.org.

SHC in brief

New Method For Measuring PCMs In Solar Applications

A new method for measuring phase change materials (PCMs) as a storage material for solar systems has been defined by experts in IEA SHC Task 32, Advanced Storage Concepts for Solar and Low Energy Buildings. This improved method combines two existing methods, the T-history method and Differential Scanning Calorimetry (DSC), making it easier for laboratories to compare results.

To characterize a PCM for its suitability in solar applications, its thermal properties are of major importance. In the past, DSC was used but this process was complicated by the size of PCM samples and the dependence of the results on the heating or cooling rates. As a result, a simple but effective method for characterizing PCMs, the T-history method, was developed and continues to be further developed in IEA SHC Task 32.

This IEA SHC work is pre-normative as there are no international standards at this time. Several German companies are also continuing to work on new methods and SHC experts are in close contact with them.

For more information contact the IEA SHC Task 32 Operating Agent, Jean-Christophe Hadorn, jchadorn@baseconsultants.com

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 36 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

Performance of Solar Facade Components
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