SHC 2012 CONFERENCE JULY 9-11 SAN FRANCISCO
International Conference on Solar Heating and Cooling for Buildings and Industry

SOLARUPDATE

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Newsletter of the International Energy Agency Solar Heating and Cooling Programme

SHC INTERNATIONAL ENERGY AGENCY Solar Heating & Cooling Programme

Solar Heat Worldwide Reaches 196 GW_{th}

The 2012 edition of the SHC Programme's Solar Heat Worldwide is now available online.

The solar thermal market grew 14% in 2010 despite the economic crisis -- reaching 196 GWth of installed capacity and generating 162 TWh. As a result, 53 million tons of CO2 emissions were avoided.

Solar Heat Worldwide reports on data from 55 countries representing more than 60% of the world's population and over 90% of the global solar thermal market.

The vast majority of the total 2010 capacity was in China (117.6 GWth) followed by Europe (36.0 GWth), which together accounted for 78.5% of the total capacity.

With 162 TWh produced in 2010, solar heating and cooling is second only to wind amongst the 'new' renewables. And while China continues to lead in total installations, Australia and Israel added more capacity per capita than any other country.

Of the existing systems, domestic hot water systems continue to dominate the market (95%), but in several countries combisystems (systems that provide water heating and space hearing) are becomng major market players. Other solar thermal applications experiencing a growth are industrial processes, district heating and air conditioning. Taken together, combisystems and applications other than domestic hot water reached 10% of the newly installed systems in 2010.

On the technology side, thermosiphon (natural flow) systems are the clear market leader, accounting for 89% of the newly installed capacity in 2010, compared with 11% of forced circulation systems.

A preview of the 2011 stats shows the total capacity for solar thermal collectors reaching 245 GWth – the equivalent of 350 million square meters.

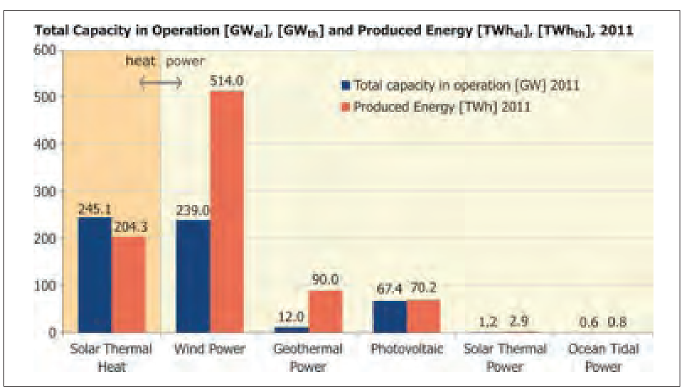


Figure 1. Total capacity in operation [GWel], [GWth] and annual energy generated [TWhel], [TWhth] in 2011. Sources: EPIA, EGEC, Earth Policy Institute, IEA SHC 2011, WWEA

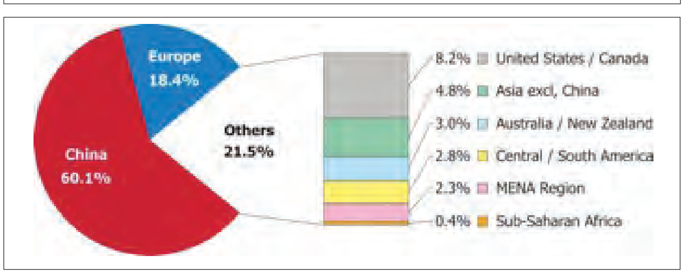


Figure 2. Share of the total installed capacity in operation (glazed and unglazed water and air collectors) by economic regions at the end of 2010.

SHC Member Countries

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

In This Issue

Building Renovations Strive for NZEB Standards

Task 47

Buildings – residential, commercial, and public – account for one-third of the globe's total final energy consumption and existing buildings represent the lion's share. It is a know fact that buildings are large energy consumers. In most IEA countries, buildings are responsible for up to 40% of the primary energy consumption, and for the SHC Programme existing buildings are as important as new buildings.

Many renovation projects have demonstrated that total primary energy consumption can be drastically reduced while also improving buildings' indoor climate. However, the experiences gained from many of these projects have not been systematically analyzed to make them a reliable resource for planners. Because most property owners are not even aware that such savings are possible, they set energy targets that are too conservative. And, buildings renovated to mediocre performance standards can be a lost opportunity for decades, therefore, it is essential that building owners be aware of the successes and set ambitious targets.

For this reason, the SHC Programme started *Task 47: Renovation of Non-residential Buildings Towards Sustainable Solutions*, as follow-on work to *Task 37: Solar Housing Renovation with Solar and Conservation*, which ended in December 2010. Over 20 experts representing Australia, Austria, Belgium, Denmark, Germany, Italy and Norway are participating in the new work.

The goals of this Task are two-fold:

- Develop a solid knowledge base on how to renovate non-residential buildings towards the NZEB standards (Net Zero Energy Buildings) in a sustainable and cost efficient way.
- Identify the most important market and policy issues as well as marketing strategies for such renovations.

The scope of the work covers a variety of non-residential buildings, including historic buildings, office buildings, educational buildings, nursing homes, and hotels.

Initial work has focused on the collection of information on select exemplary buildings in the participating countries. This information will be the basis for more detailed analysis during the Task. To ensure not only a cross section of buildings but also buildings with ambitious energy targets, the participants applied the following criteria:

BUILDING TYPE

- Office buildings, educational buildings, cultural buildings and hotels, including historic/protected buildings

ENERGY

- Building objective is towards a NZEB building
- Optimized building envelope and technical installation using the best available technologies/products on the market

▲ **Example of a SHC Task 47 exemplary project summary.**

Work Areas

Advanced Exemplary Projects - Information Collection & Brief Analysis

On September 7th a seminar will be held in Louvain la Neuve, Belgium to present several exemplary projects from the participation countries will be presented.

Market and Policy issues and Marketing Strategies

Assessment of Technical Solutions and Operational Management

Environmental and Health Impact Assessment

continued on page 3

Don't Miss It!

Register now at www.shc2012.org

SHC 2012 CONFERENCE JULY 9-11 SAN FRANCISCO

International Conference on Solar Heating and Cooling for Buildings and Industry

Conference Topics

- **Solar thermal collectors**
- **Thermal storage**
- **Innovative components**
- **Solar heating and air-conditioning of buildings**
- **Solar heat for industrial processes**
- **District heating**
- **Solar cooling and refrigeration**
- **Building integration**
- **Solar building renovation**
- **Solar architecture**
- **Solar resource assessment**
- **Rating and certification**
- **Market strategies**
- **Policy issues**

Join other solar professionals for 3 days of scientific presentations & posters at SHC 2012. This will be a conference nobody in the solar heating and cooling industry can afford to miss, explains IEA SHC Chairman Werner Weiss.

SHC 2012 offers participants the opportunity to discuss the latest advancements in solar heating and cooling technologies with an international audience. The conference papers and posters were selected by a Scientific Committee, headed by Professor Jane Davidson of the University of Minnesota, USA and Dr. Stephen Harrison of Queen's University, Canada.

This year's conference is sponsored by the *California Solar Initiative – Thermal Program* and *Industrial Solar Thermal Solutions* and supported by *California Solar Energy Industries Association (CALSEIA), CanSIA, International Solar Energy Society (ISES), European Solar Thermal Industry Federation (ESTIF),* and *IEA Energy Conservation through Energy Storage (IEA ECES).*

SHC 2012 is the same week as Intersolar North America to create a multidimensional experience for participants.

SHC 2012 Conference Proceedings

ELSEVIER will publish the SHC 2012 Conference proceedings in Energy Procedia. All papers published in Energy Procedia will also be covered by Scopus and accessible on sciencedirect.com.

SHC 2012 Conference Papers

A selection of high quality papers from the SHC 2012 proceedings will be published in Elsevier's peer reviewed Solar Energy Journal, the official journal of the International Solar Energy Society.

Building Renovation *from page 2*

- Within the given constraints of the individual building (e.g., for protected / historic buildings)
- At least 60% reduction in the primary energy demand (heating, cooling, ventilation, lighting, DHW and pumps) (according to the calculation rules given by the EPBD standard or other similar standards)
- Renovated standard should be better than the national standard building code for new buildings
- Embodied energy strategies to be considered

ECONOMICS

- Marketable solutions

MARKET POTENTIAL

- Replicable building concepts

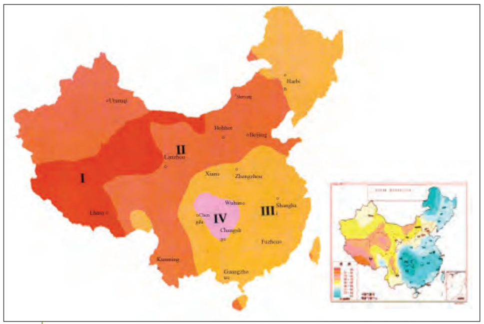
The Exemplary Building summaries will be posted on the SHC Task 47 website. The first two projects will be posted this July.

For more information contact Fritjof Salvesen, Task 47 Operating Agent, Fritjof.Salvesen@asplanviak.no or visit the SHC Task 47 website.

China
Largest Solar Thermal Market in the World

According to the SHC Programme's 2012 edition of Solar Heat Worldwide, China is the largest solar thermal market in the world, holding 60.1% share of the total installed capacity in operation.

As China adjusts its energy structure and works towards developing society in a more sustainable way, renewable energy applications continue to receive heightened attention. For solar, China has strong resource conditions and huge application potential. Based on the radiation quantity, there are four solar resource areas, as shown in Figure 1. More than two thirds of the area's radiation exceeds 5000 MJ/ (m^2•a).



▲ **Figure 1. China radiation resource map**

Areas	**Global irradiation**
very rich area	>6700 MJ/(m2·a)
rich area	5400 6700 MJ/(m2·a)
normal area	4200 5700 MJ/(m2·a)
poor area	<4200 MJ/(m2·a)

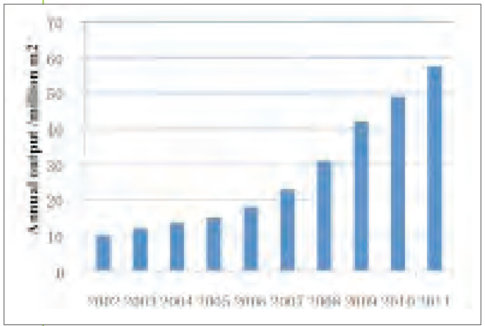
'In the future, China will strengthen the communication and cooperation with the other partners in the IEA SHC Programme. And, we hope that the experiences and exchanges will benefit both China and the other member countries.'

PROF. HE TAO
Chinese Executive Committee Member

The Solar Thermal Industry

China's solar thermal industry covers a broad spectrum, including solar water heaters, solar passive houses, solar cookers, solar drying, and solar cooling. Of these applications, the solar water heater is the most widely used, and has experienced the most rapid development. The annual output of solar water heaters in 2011 was 57.6 million m^2, almost six times the output in 2002 (see Figure 2). The installed capacity at the end of 2011 was 193.6 million m^2 (see Figure 3), and it is expected to reach 400 million m^2 by the end of 2015 and 800 million m^2 at the end of 2020.

There are about 2,800 solar thermal manufacturers in China. Most of the manufacturers are located in the eastern part of China with 50% concentrated in three provinces— Zhejiang, Shandong and Jiangsu. The main product being produced is the vacuum tube compact solar water heater (SWH), which dominates 87% of the water heating market shares. The reasons for this are because of the application's high heat gain and low price. A typical SWH's heat gain, under the daily irradiation of 17 MJ/m^2, is more than 7.5 MJ/m^2 and it costs about 3,000 - 5,000 RMB (400 - 600 euro).

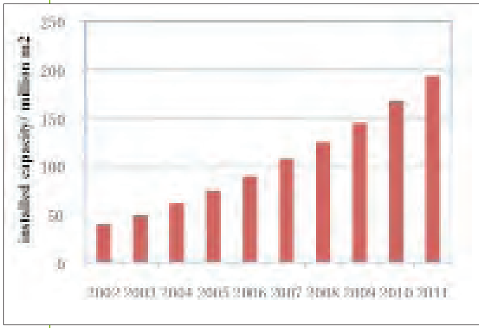


▲ **Figure 3. Total installed capacity of Solar Water Heater**

Policy and Application

From 2006 to 2008, there were 359 renewable energy application projects receiving financial support from the central Government, 41% of them were solar heating projects, which received 50 to 100 RMB/m^2 (construction area) for each project.

In 2009, the Ministry of Finance and the Ministry of Construction decided to support renewable energy building demonstration cities. From 2009 to 2011, there was a total of 72 cities and 146 counties that passed the national selection process to became demonstration cities. With this designation, a city received 50 million to 80 million RMB in subsidies.



▲ **Figure 2. Annual output of Solar Water Heater**

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China *from page 4*

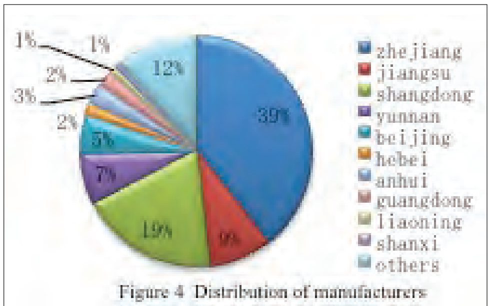


Figure 4 Distribution of manufacturers

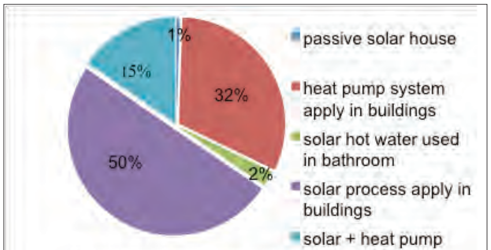


Figure 5. Distribution of renewable energy applications

Due to the financial and policy support by the government, renewable energy applications experienced a rapid growth over these years, and solar thermal applications accounted for half of this growth.

The Future

China is in its 12th five-year plan, and solar energy is a primary focus of the renewable energy applications. It is expected that solar thermal technology will represent 16% of renewable energy use, and 2% of the total energy consumption use by the end of 2020. With this growth, China's solar thermal industry will concentrate more on application markets, particularly in the areas of space heating and cooling, industrial and agricultural production, expansion from low temperature to middle-high temperature, and testing and certification of applications, which complements the work of the SHC Programme. As the newest member of the SHC Programme, China and the other member countries see many opportunities for collaboration.

This article was contributed by Prof. He Tao, Deputy Director for National Center for Quality Supervision and Testing of Solar Heating Systems at the China Academy of Building Research and the Chinese representative on the SHC Executive Committee, iac@vip.sina.com.

China becomes 21st member of the SHC Programme

The SHC members welcome China and the Executive Committee members Prof. He Tao and Mr. Zhang Xinyu to the Programme. *"China is not only the largest market for solar thermal, but also a center for RD&D in solar heating and cooling technologies,"* says SHC Chairman Werner Weiss. *"Our collaboration will help speed up development and deployment of solar thermal worldwide."*

▲ **Top to bottom: Solar combisystem in a Beijng suburb. Solar cooling system in Hannan Province. Solar industry process heat at a print & dye factory in Jiangsu Province. Solar district heating system in Inner Mongolia autonomous region.**

Singapore

World's Largest Solar Cooling System Up and Running

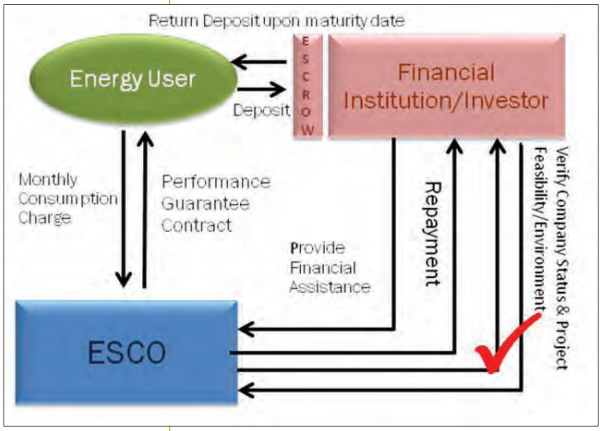
The United World College South East Asia (UWCSEA) East-campus in Tampines, with an area of 76,000 m² and equipped with state-of-the art facilities, received the Green Mark Platinum award from the Singapore Building Construction Authority. This is the highest "green building" award available in Singapore, and means that UWCSEA has achieved an environment friendly, energy efficient, sustainable green building campus. By taking a holistic life cycle design approach during the planning phase and incorporating energy efficient features, UWCSEA has reduced by 40% its reduction of overall water and energy saving.

To take advantage of Singapore's geographical location in the tropical Sunbelt, an energy efficient solar thermal system for air conditioning and hot water was installed. Solar cooling is a technology with huge potential, particularly in a tropical climate region like Singapore, in stabilizing electric grids and converting conventional energy to renewable. Currently, air conditioning systems are responsible for 50-70% of all electricity usage in hot climates thus creating power peaks that are responsible for most brownouts and blackouts. A "Solar Thermal Technology Roadmap," once developed, could pave the way for more innovative, high performing solar cooling applications that minimize their impact on future energy systems.

▲ **Figure 1. Overview of UWCSEA solar thermal system**

UWCSEA has collaborated with SOLID Asia/SOLID Austria to deliver, install and operate a solar water heating and space cooling installation. The solar cooling plant is the largest system in world. With a collector area of 3,900m² (HT gluatmugl collectors), this system will generate approximately 1,750 megawatt hours a year, and provide 100% of the school's hot water demand and 30-40% of the air-conditioning demand (see Figure 1).

The entire investment of around EUR 4.5 million is financed by Raiffeisen-Landesbank of Steiermark (RLB-Stmk) and Oesterreichische Kontrollbank OeKB using the unique business model of Energy Service Company (ESCO) financing and UWCSEA-EAST with an energy consumption guarantee for 20 years via an Escrow deposit (see Figure 2).



▲ **Figure 2. Business model applied for the UWCSEA solar thermal system**

The above table of stipulated values demonstrates that the energy efficiency of the Solar Cooling System power requirement is approximately 60% lower than the baseline practiced in Singapore.

Commissioned at the end of 2011, the Solar Thermal System at UWCSEA-EAST is currently

Singapore *from page 6*

UWCSEA's adsorption chiller

UWCSEA's hot water system

Solar Cooling System (Based on 420Tref)		**Conventional Cooling System** (Based on SS530)	
Description	**kW/ton**	**Description**	**kW/ton**
Pump 1- Solar	0.0276	Chiller	0.577
Pump 2- Heat	0.055	CHWP	0.117
Pump 3- CHW	0.0402	CWP	0.088
Pump 4- CWP	0.1166	Cooling Tower	0.055
Chiller	0.03		
Cooling Tower	0.071		
Total	0.340	Total	0.837

▲ **Table 1. System efficiency for the solar cooling system**

being optimized via a remote monitoring and control system from SOLID in Austria (see Figure 3). Currently, the representative performance values are being interfered with by the impact of the El Niño event in the region, which is causing disruption in the normal weather patterns. Therefore, exact data from the optimized solar thermal plant will be available in the next few months.

Article contributed by Peter Jurgen Husnik, CEO SOLID Asia Energy Services Pte Ltd Singapore with additional reporting by Zelia Tay, Building Construction Authority, Singapore. Singapore is a member of the IEA Solar Heating & Cooling Programme, for more information contact the Executive Committee member, Kian Seng Ang, ang_kian_seng@bca.gov.sg.

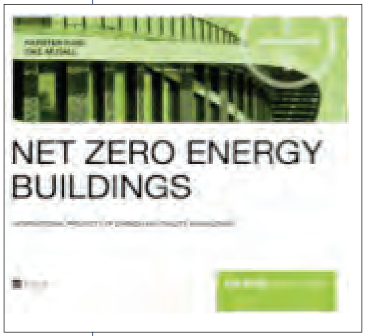
▲ **Figure 3. SOLID's telemonitoring system**

Agreeing on an International Definition

Task 40

While the concept of zero energy buildings is generally understood, an internationally agreed upon definition is still lacking. What is missing is a formal, comprehensive and consistent framework that considers all the relevant aspects characterizing Net ZEBs and that allows each country to define a consistent (and comparable with others) Net ZEB definition in accordance with the country's political targets and specific conditions.

To drive this work, the IEA SHC Programme is collaborating with the IEA Energy Conservation in Buildings and Community Systems (ECBCS) Programme on SHC Task 40/ECBCS Annex 52: Towards Net Zero Energy Solar Buildings to arrive at a common definition that is based on scientific analysis.



Currently, there is a conceptual understanding of a ZEB as an energy efficient building able to generate electricity, or other energy carriers, from renewable sources in order to compensate for its energy demand. Therefore, it is implicit that there is a focus on buildings that are connected to an energy infrastructure and not on autonomous buildings. To this respect, the term Net ZEB can be used to refer to buildings that are connected to the energy infrastructure, while the term ZEB is more general and may as well include autonomous buildings. The wording 'Net' underlines the fact that there is a balance between energy taken from and supplied back to the energy grids over a period of time, nominally a year.

The common denominator for the different possible Net ZEB definitions is the balance between weighted demand and supply. The balance may be calculated in different ways, depending on the quantities that are of interest and available. An *import/export balance* focuses on the energy flows exchanged between the building and the grids; it applies in monitoring or in design when estimates of self-consumption are available. A simpler *load/generation balance* focuses on the gross load and generation quantities disregarding their interplay; it applies in design when estimates of self-consumption are not available. A third type of balance is the *monthly net balance* that can be seen as a combination of the other two; monthly generation and load (for each energy carrier) are assumed to balance each other off and only the monthly residuals are summed up to form the annual totals.

The choice of a proper balance metrics and weighting system should depend on targets in the political agenda and not being driven solely by feasibility of Net ZEB projects or minimization of investment cost – even though this may be a major target itself. However, it is important that authorities and competent national bodies and legislators are fully aware of the effect of the weighting factors when deciding upon the metrics to adopt for the Net ZEB definition they want to set in place.

Important aspects in the framework are the criteria on energy efficiency and energy supply. While the pathway to a Net ZEB is set by the balance of the two actions – energy efficiency and energy supply – experience from a large number of already existing Net ZEBs underlines the priority of energy efficiency as the path to success . Minimum energy efficiency requirements may be enforced in a Net ZEB definition. Likewise, a hierarchy of energy supply options may also be enforced.

Net ZEBs are characterized by more than the mere weighted balance over a period of time. In the article, "Net Zero Energy Buildings: A Consistent Definition Framework" in the international journal *Energy and Buildings*, Vol. 48, May 2012, the authors propose a characterization based on two aspects of temporal energy match: *load matching*, the ability to match the building's own load, and *grid interaction*, the ability to work beneficially with respect to the needs of the local grid infrastructure. These aspects are evaluated separately per each energy carrier exchanged with the grids; no weighting is applied. For load matching, an

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Net Zero Buildings *from page 8*

indicator is proposed, the load match index, which is able to express the seasonal unbalance of energy exchanged with a grid. For grid interaction, the concept of flexibility is introduced, which may be estimated in the design phase by simulating different strategies for the control of load, generation and storage systems. These indicators address the topics, but need further development. For example, work is needed on the time resolution of hours in order to account for energy price fluctuations and grid peak load. To this respect, building designers need information on end users' temporal consumption patterns, preferably from normative data, and the support of advanced dynamic simulations tools.

Finally, it is argued that only a measured rating would enable the verification of claimed Net ZEBs, the effectiveness and robustness of the design solutions applied, and at last the actual achievement of the energy policy targets. Therefore, a measurement and verification (M&V) process is required and its completeness and complexity will depend on the options selected for the definition criteria. It should be stressed that for an easily verifiable Net ZEB definition it is preferable to include all operational energy uses in the balance boundary. Specification of other boundary conditions, such as reference climate, comfort, functionality and space effectiveness, are also necessary in order assess possible deviations from the calculated to the measured balance.

[1] Voss, K. and Musall, E. (2011) Net Zero Energy Buildings- International Projects on Carbon Neutrality in Buildings, DETAIL, ISBN-978-3-0346-0780-3, Munich.

This article is based on the Energy and Buildings article, "Net Zero Energy Buildings: A Consistent Definition Framework" in the international journal Energy and Buildings, Vol. 48, May 2012, pp: 220-232 by Igor Sartori of SINTEF Building and Infrastructure, Oslo, Norway, ,Assunta Napolitano of EURAC, Bolzano, Italy, and Karsten Voss of the University of Wuppertal, Germany. For more information on SHC Task 40 contact the Operating Agent, Josef Ayoub jayoub@encs.concordia.ca.

Net Zero Energy Building: Living and Working with an Equalised Energy Balance

This book details the strategies and experiences from the perspective of planners and users. Net zero energy buildings, equilibrium buildings or carbon neutral cities – depending on location and the reasons for making the calculation, the numbers are run differently. The variety of terms in use indicates that a scientific method is still lacking – which is a problem not just for international communication, but also for planning processes. The clarification and meaning of the most important terms in use is extremely important.

The results of the IEA SHC/ECBCS collaborative work on analyzing exemplary buildings that are near a zero-energy balance in order to develop methods and tools for the planning, design and operation of such buildings are documented in this publication. This book is not just an architectural showcase for projects, but rather focuses on relaying knowledge and experience gained by planners and builders.

This book is printed in English and German. To order go to http://shop.detail.de/eu_e/net-zero-energy-buildings.html

New SHC Publications

Solar Rating and Certification Procedures

Roadmap of Collector Testing and Certification Issues

This new reference document describes the existing collector testing procedures, how tests and standards are applied and how they relate to certification, identifying gaps, inconsistencies and weaknesses along with approaches to addressing problems. The report also outlines actions for specific procedures.

Solar Energy and Architecture

New SHC Task 41 publications coming soon.

June Publications

- *Building Integration of Solar Thermal and Photovoltaics – Barriers, Needs and Strategies*
- *Solar Design of Buildings for Architects: Review of Solar Design Tools*
- *Needs of Architects Regarding Digital Tools for Solar Building Design*

July Publications

- *Solar Energy Systems in Architecture - Integration Criteria and Guidelines.*
- *Designing Solar Systems for Architectural Integration. Criteria and Guidelines for PV*
- *Communication Guideline*

Website: Innovative Solar Products for Architectural Integration

August Publications

- *Designing solar systems for Architectural Integration. Criteria and Guidelines for Solar Thermal.*

Website: Collection of Case Studies of Architecturally Attractive Solar Buildings

EU Gives Boost to Compact Thermal Energy Storage R&D

This year, four large R&D projects started with the financial support of over 17 M from the European Union. All the projects are aimed at setting the next steps in the development of compact thermal energy storage technologies. Three projects will work on developing systems, while one will work on material development. Most of the project partners also contribute to the SHC Programme's Task 42: Compact Thermal Energy Storage Materials Development for System Integration.

Material Development Project

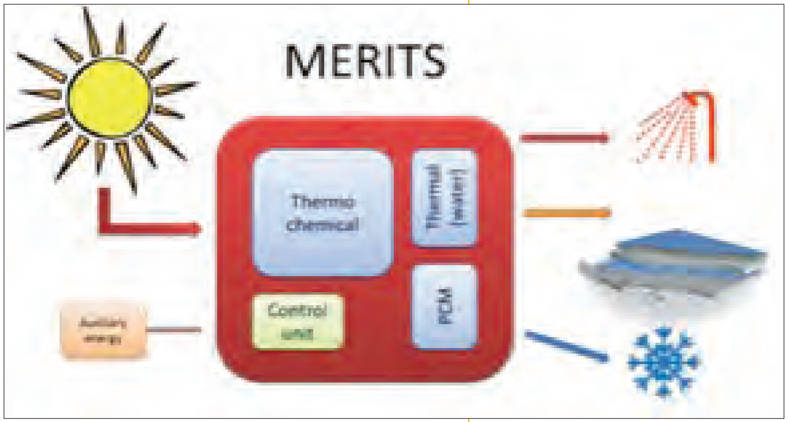
The SAM.SSA project is the materials development project. It is lead by the University of Bordeaux, France, and is focused on developing new phase change materials (PCM) for thermal energy seasonal storage applications (STES) in the medium temperature range. The development boundary conditions for the materials are low cost, environmentally sound and safe, easy adjustment of the melting point for optimal "tuning" to the required applications, energy densities greater than 200 kWh/m3 for compact storage, long-term storage with significant reduction of thermal losses, and storage heat release at "high" temperature with reduced discharge power requirements.

In total, 11 organisations, including two industries, are collaborating in this project to develop molecular alloys based on sugar alcohols (MASA). These molecular alloys allow for adjustments in the melting point and lead to significantly increased energy density. Another important area of work is to increase thermal conductivity, which is low for PCMs. One way to overcome this problem is to increase the thermal conductivity using low-cost, tailor-made carbon porous structures and to increase the specific area of heat exchange through macro- or micro-encapsulation with organic, inorganic and hybrid shells.

System Development Projects

All the system development projects are aimed at designing, building and measuring prototypes of a compact, seasonal thermal storage system.

The MERITS project (More Effective use of Renewables Including compact seasonal Thermal energy Storage) is led by TNO, The Netherlands. The team will work with novel high-density materials that can supply required heating, cooling and DHW for a dwelling with up to 100% renewable energy sources. The main development issues are 1) the delivery of heat on different dedicated temperature levels, 2) the tailoring to the size of individual dwellings, 3) the design and development of a dedicated solar collector, and 4) the integrated design for the different components and enhanced thermo chemical materials including the control system.



▲ **Figure 1. The MERITS principle**

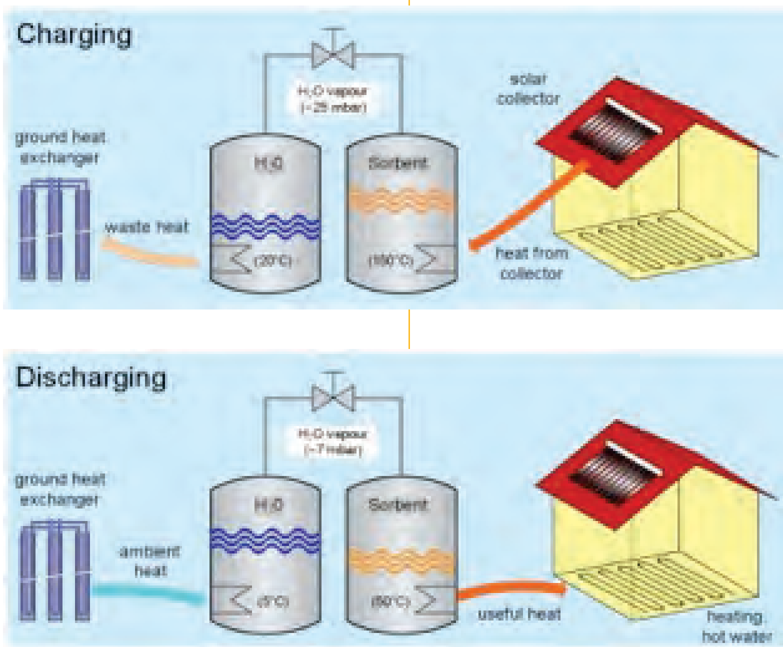
The first proof-of-concept systems will be evaluated in 2012. They will contain an optimized reactor volume, optimized heat exchangers for ad- and desorption, and an optimized evaporator/condenser. Simultaneously, field tests and concepts of building integration of a modular thermochemical seasonal storage system will be prepared.

Prototypes of the system (for three different climate zones) will be demonstrated and evaluated in a field test. Partners in the project are four research institutes (TNO, VITO, Tecnalia, Fraunhofer), two

continued on page11

universities (Ulster University, University of Lleida) two SMEs (De Beijer RTB, Zonne-energie Nederland BV), and three industries (Voestalpine, Mostostal, Glen Dimplex Heating). With this combination of partners, project results will be brought to the market at a faster pace..

The SoTherCo project will be developing an innovative modular, compact and seasonal thermo-chemical solar heat-storage system. The modular design, based on the proper arrangement of ~1000L heat-storage modules, is intended to offer the needed flexibility and adaptation to answer the space heating demand of low-energy buildings, from a single family dwelling up to communities and district heating. Two demonstration projects will be performed semi-virtually over long periods of time and at two different locations (Arlon, Belgium and Bourget-du-Lac, France) for regional climatic particularities.



▲ **Figure 2. Working principles of liquid sorption heat storage**

The storage material used will be chosen from at least three thermo-chemical working pairs (Salt-in-Matrix composites + water-vapor). The prototypes will be up scaled from mini-modules to real-scale modules, each with a different storage material, to understand their complete behavior in terms of power response and energy balance. The project is collaboration between three research institutes (University de Liege, CEA-INES, AIT) and two SMEs (ESE, Regulus).

The COMTES project is a collaboration of seven research institutes (AEE INTEC, TU Graz, University of Stuttgart, TH Wildau, EMPA, SPF, DTU) and four industries (Vaillant, Kingspan, Velux, Nilan) and is working parallel on three technology development lines.

One line will use grain-like storage material (composite of zeolite with a salt hydrate) in a system that probably will have a separate reactor through which the active material is transported and charged/discharged. The second line is working on a system using sodium lye as the active medium. As this is liquid, the design of the reactor for this system is much different and other problems have to be solved, such as preventing the formation of crystals in the solution. The third line is employing a phase change material that is super cooled. Here, the material is below its solidification temperature but still liquid. When it is triggered, it solidifies and a lot of heat is generated. The development challenges for this line are the proper separation of the liquid in manageable modules and the controlled triggering of the solidification process. Next to the specific development items for every line, there are many common development activities for these three lines. The project partners will share as much of these activities as possible in the group while taking into account the intellectual property aspects. After two and a half years, the developed prototypes will be installed on demonstration or field test sites and monitored for one year.

With the EU's R&D projects and the SHC Programme's work on compact thermal energy storage, the future looks bright for commercially viable, cost-effective compact storage technologies. One of the biggest winners will be solar thermal as these technologies will allow the efficient storage of heat or cold for long periods of time.

This article was contributed by Emilie Courbon (University of Mons, Belgium), Elena Palomo (University of Bordeaux, France), Ruud Cuypers (TNO, The Netherlands) and Wim van Helden (Renewable Heat B.V., The Netherlands) who is also the SHC Task 42 Operating Agent. For more information visit the SHC Task 42 website.

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Current Tasks and Operating Agents

Polymeric Materials for Solar Thermal Applications
Mr. Michael Köhl
Fraunhofer Institute for Solar Energy Sytems
Heidenhofstr. 2
D-79 110 Freiburg
GERMANY
michael.koehl@ise.fraunhofer.de

Toward Net Zero Energy Solar Buildings
Mr. Josef Ayoub
CanmetENERGY
Natural Resources Canada
1615, boul. Lionel-Boulet
Varennes, Quebec J3X 1S6
CANADA
Josef.Ayoub@rncan-nrcan.gc.ca
jayoub@encs.concordia.ca

Solar Energy and Architecture
Ms. Maria Wall
Lund University
P.O. Box 118
SE-221 00 Lund
SWEDEN
maria.wall@ebd.lth.se

Compact Thermal Energy Storage
Mr. Wim van Helden
Renewable Heat B.V.
Oosterstraat 15
1741 GH Schagen
NETHERLANDS
wim@wimvanhelden.com

Solar Rating and Certification Procedures
IAPMO Solar Heating & Cooling Programs
5001 E. Philadelphia Street
Ontario, CA 91761
les.nelson@iapmo.org

Mr. Jan Erik Nielsen
PlanEnergi
Aggerupvej 1
DK-4330 Hvalsö
DENMARK
jen@solarkey.dk

Solar and Heat Pump Systems
Mr. Jean-Christophe Hadorn
BASE Consultants
8 rue du Nant - CP 6268
CH - 1211 Genève 6
SWITZERLAND
jchadorn@baseconsultants.com

Large Systems: Large Solar Heating/ Cooling Systems, Seasonal Storage, Heat Pumps
Mr. Jan Erik Nielsen
PlanEnergi
Aggerupvej 1
DK-4330 Hvalsö
DENMARK
jen@solarkey.dk

Solar Resource Assessment and Forecasting
Dr. David Renné
2385 Panorama Ave.
Boulder, CO 80304
UNITED STATES
drenne@mac.com

Solar Renovation of Non-Residential Buildings
Mr. Fritjof Salvesen
Asplan Viak AS
P.O.Box 24, 1300 Sandvika
NORWAY
fritjof.salvesen@asplanviak.no

Quality Assurance and Support Measures for Solar Cooling
Mr. Daniel Mugnier
TECSOL SA
105 av Alfred Kastler - BP 90434
66 004 Perpigan Cedex
FRANCE
daniel.mugnier@tecsol.fr

Solar Process Heat for Production and Advanced Applications
Mr. Christoph Brunner
AEE INTEC
Feldgasse 19, A-8200 Gleisdorf
AUSTRIA
c.brunner@aee.at

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 49 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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CHAIRMAN
Mr. Werner Weiss
AEE - Institute for Sustainable Technologies
Feldgasse 19
A-8200 Gleisdorf
AUSTRIA
Tel: +43/3112 5886 17
e-mail: w.weiss@aee.at

SHC SECRETARIAT
Ms. Pamela Murphy
KMGroup
9131 S. Lake Shore Dr.
Cedar, MI 49621
USA
Tel: +1/231/620-0634
e-mail: secretariat@iea-shc.org