SOLARUPDATE

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Newsletter of the International Energy Agency Solar Heating and Cooling Programme

SHC Solar Award

The 2012 winner of the SHC SOLAR AWARD is Fred Morse, long time solar advocate in the United States and internationally. Dr. Morse received the award at SHC 2012, the first International Conference on Solar Heating and Cooling for Buildings and Industry in San Francisco, California.

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 SHC Programme.

Dr. Morse is the 7th recipient of the SHC SOLAR AWARD. He was selected for his decades of work in solar and his unwavering commitment to this technology long before others saw it as a viable alternative to our fossil and nuclear-based energy supply.

His influence on U.S. policy began in the late 1960s when he served as Executive Director of the White House Assessment of Solar Energy as a National Resource.

continued on page 3

▲ **SHC Solar Award recipient Fred Morse with SHC Chairman, Werner Weiss.**

IEA Solar Heating and Cooling Roadmap

The International Energy Agency's (IEA) roadmap identifies how solar thermal can supply almost 1/6th of the world's total energy use (16.5 EJ) for heating and cooling by 2050. This would save some 800 megatonnes of CO2 emissions per year.

This roadmap is part of a series on the future of key energy technologies produced at the request of the G8. The roadmaps assess the current state-of-the-art of the technology, identify barriers to growth and ways to overcome them, and try to assess the potential up to 2050. The SHC roadmap is a real first because it focuses solely on heating and cooling. It was produced by the IEA with financial support from the IEA SHC Programme as well as the European Solar Thermal Industry Federation (ESTIF), Austria's Ministry of Transport, Innovation and Technology, Canada's CanmetENERGY, Germany's Forschungszentrum Juelich GmbH, Australia's Clean Energy Council (CEC), the Australian Solar Institute, and the Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO).

continued on page 4

In This Issue

SHC Member Countries

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

SHC 2013 Conference

September 23-25 in Freiburg, Germany

SHC 2012, the first International Conference on Solar Heating and Cooling for Buildings and Industry, took place July 9-11, 2012 in San Francisco, California. A scientific committee, headed by Dr. Jane Davidson and Dr. Steven Harris, selected 200 presentations, which were held in 3 parallel slots. On each of the three conference days, invited "keynote lectures" provided an overview of key areas, with specific sessions then going into much greater depth. This design allowed experts in one field to quickly update themselves on the state-of-the-art in other fields.

The second SHC conference will move to Freiburg, the "solar capital" of Germany. Not only is the city very active in the field of solar energy, it is also home to Europe's largest solar research institute, the Fraunhofer Institute for Solar Energy Systems. Numerous solar conferences have already been held at the beautiful Konzerthaus, just opposite of Freiburg's central station (with the high-speed ICE trains, it is only 2 hours away from Germany's busiest airport, Frankfurt).

Conference Dates to Remember

April 26
Abstracts due

June 3
Notification of Acceptance

June 18
Online registration begins

September 23-25
Conference dates

For SHC 2013, the IEA Solar Heating and Cooling Programme is teaming up with the European Solar Thermal Industry Federation (ESTIF). Their own ESTEC conference is merged with SHC 2013 thus bringing together top international events from solar thermal research and the solar thermal industry.

"This is the one key thing, we want to change", says Andreas Häberle of the conference organiser PSE. "At SHC 2013 we want to see much more industry involvement. The 2012 edition was a great scientific conference and SHC 2013 will be likewise. For 2013, we want to add the industrial perspective". Thus the highly acknowledged concept of 3 conference days with keynote lectures, in-depth sessions and poster presentations will be continued and expanded with industry topics. And like in 2012, the conference proceedings will be published by Elsevier, with selected papers appearing in a special edition of the Solar Energy Journal.

For SHC 2013 a mixed conference committee was set-up, led by a scientific chair, Dr. Hans-Martin Henning of Fraunhofer ISE and an industrial chair, Xavier Noyon of ESTIF. The Call for Papers was published in early December and abstracts can be submitted until April 26, 2013.

And for people with a particular interest in solar cooling, it is worth noting that the 5th International Conference Solar Air-Conditioning takes place just after SHC 2013, on September 25 in nearby Bad Krozingen. A reduced entrance fee is offered for those participating in both events.

Up to date information, including the Call for Papers, can be found at www.shc2013.org.

Several sponsorship packages are available – please contact info@shc2013.org for more information.

2012 conference proceedings can be downloaded here.

Conference Topics

We invite all technical experts, marketing specialists, and policy makers to present their work and exchange views and ideas.

Systems and components
- Solar thermal collectors
- Thermal storage
- Other innovative components and systems
- Durability and reliability

Applications
- Water heating
- Solar heating and air-conditioning
- District heating
- Solar heat for industrial processes
- Solar refrigeration
- Solar architecture
- Building integration
- Building renovation
- Urban planning
- Solar resource assessment

Market reports and framework conditions
- Market reports (EU)
- Global markets
- Framework conditions and policies
- Innovative business models and marketing
- Standards and certification

SHC Programme & Solar Thermal Trade Associations Meeting

The annual meeting will be held in conjunction with the SHC 2013 conference in Freiburg, Germany on Wednesday, Sept. 25. The meeting will be co-organized with ESTIF and potential topics are global certification, impact of subsidies, and cost of solar domestic water heating systems.

For more information contact the Dutch SHC Executive Committee member, Lex Bosselaar of Agentschap NL, lex.bosselaar@agentschapnl.nl

SHC Solar Award *from page 1*

"Fred became involved in solar energy in the late 1960s and quickly became an international leader in promoting the development and use of renewable energy technologies. He has shaped not only the IEA Solar Heating and Cooling Programme with his bright ideas and his enthusiasm, but has been at the forefront of convincing national and international stakeholders to support R&D as well as to implement renewable energies"

WERNER WEISS
IEA SHC Chairman

In the early 1970s, he designed the U.S.'s first renewable energy program, a strategy that has guided U.S. activities over the decades.

Working in senior level positions at the US Department of Energy in the late 1970s and 1980s, Dr. Morse played a significant role in defining and managing major solar energy research, development, and commercialization programs with annual budgets of up to $250 million. During this time, the IEA SHC Programme was established and Dr. Morse served as the U.S. member of the SHC Executive Committee and as the Programme's first Chairman.

Once the federal solar budget was dramatically slashed, Dr. Morse decided to move to the private sector and founded Morse Associates, a renewable energy consulting firm that provides critical strategic planning and support services to energy companies, industry groups, government agencies, international organizations and others. In the late 1990s, as co-chair of the Western Governors' Association Solar Task Force, he helped with solar's comeback. During this time, he also served as Advisor to the SHC Executive Committee, a position he held until 2007.

Today Dr. Morse serves as the Senior Advisor of U.S. Operations for the Spanish energy company Abengoa.

Dr. Morse joins Helmut Jäger, Manuel Collares Pereira, Volker Wittwer, Jan-Olof Dalenbäck, William Beckman, and Torben Esbensen as a recipient of this award. The SHC Programme is recognizing such leaders in the field of solar energy not only for their contributions, but also to promote solar energy as a viable energy source for heating and cooling.

SHC Programme Partners with BUILD UP

The SHC Programme joinied the BUILD UP initiative as a Partner, following an invitation from the European Commission. www.buildup.eu is an interactive web portal for building professionals, public authorities and building occupants who want to share their experience on how best save energy in buildings.

The key aim of this European initiative is to reduce the energy consumption of buildings across Europe by transferring best practices to the market and fostering their uptake.

The interactive BUILD UP web portal catalyses and releases Europe's collective intelligence for an effective implementation of energy-saving measures in buildings.

SHC Solar Roadmap *from page 1*

Four expert workshops, held on three different continents throughout 2011, provided much of the input to Milou Beerepoot, the IEA's lead author. The final document is a superb overview of solar heating and cooling technologies today and their potential in the future. It explains simple concepts such as flat-plate vs. vacuum tube collectors and also delves into more complex topics such as different types of advanced heat storages.

The potential and the deployment over time do not show a "maxium" scenario, but fit with the assumptions of the IEA's own 2-degree-scenario as well as the other technology roadmaps. The SHC Programme has a much more ambitious goal, which could be accomplished if all the right framework conditions were put in place, not 1/6th but half of the total final energy demand for low temperature heating and cooling could be covered with solar thermal technologies.

The IEA forecasts that solar water heating will remain the main application for some more time to come. However, for the medium-term solar industrial process heat will become the single largest solar thermal application.

As solar hot water and space heating will continue to be such an important application, it is worth looking at where the systems will be used. The roadmap clearly shows that today, China is the biggest user of solar thermal for hot water and space heating. However, other regions will grow much faster before 2050. Amongst the fastest growing markets will be Africa and the Middle East as well as the other developing countries in Asia.

In terms of current barriers, the report identifies the technological, economic, and non-economic barriers, explains them, and tries to outline solutions for how to overcome them. Actions to support the development and deployment of solar heating and cooling solutions are categorized by three stakeholder groups: governments, solar heating and cooling industry, and universities/research institutes.

Universities and research institutes are charged with the research and development of the technology to increase the use of solar energy in more applications, to increase the temperature ranges handled by the applications, and to develop lower cost, high quality applications. R&D topics include:

- Develop integration of solar collectors in building surfaces.
- Research alternative materials, technologies and manufacturing techniques to reduce system cost and improve performance.
- Expand development of collectors that cover temperature gap between 100°C and 250°C.
- Continue developing promising materials for compact thermal energy storage, particularly phase change materials, sorption and thermochemical materials.

The solar heating and cooling industry is tasked with developing products, based on the research of the research institutes. Furthermore, they should:

- Develop quality assurance methods, certification and standards at system level, to be included in support mechanisms, ensuring an acceptable quality of solar heating and cooling products is achieved.
- Introduce training and education in solar heating and cooling technology for architects, engineers, designers, owners, facility managers, consultants and installers.
- Seek synergies between solar heating and cooling industry and conventional heating, cooling and air conditioning industry.
- Expand international R&D collaboration, making best use of national competencies.

Governments should, amongst others:

- Set medium-term targets for (nearly) mature solar heating and cooling technologies (solar low-temperature heat) and long-term targets for advanced technologies (high-temperature heat and solar cooling).
- Make economic incentive schemes consistent over a period to allow time for industry to plan and develop with certainty. Avoid "stop-and-go" policies by separating funding for support schemes from annual state budgets.
- Consider regulatory approaches such as solar obligations or building regulations.
- Increase R&D funding in the short term and ensure sustained RD&D funding in the long term through private-public partnerships.

To read and download the full report go to http://www.iea-shc.org/roadmap.

Figure 10: Roadmap vision for solar heating and cooling (Exajoule/yr)

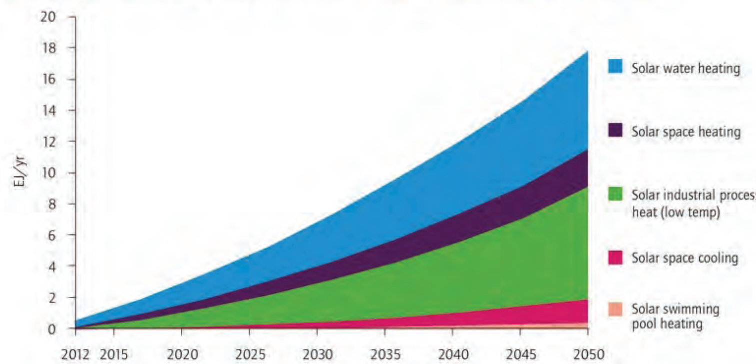
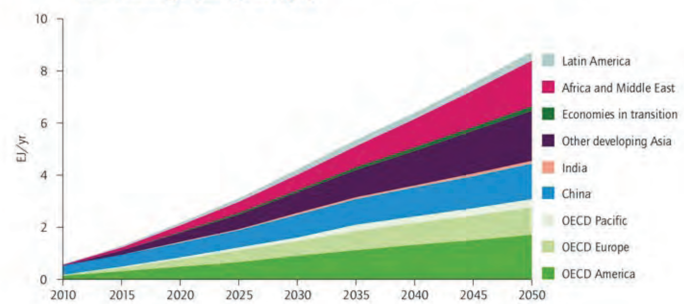


Figure 11: Roadmap vision for solar hot water and space heating in buildings (Exajoule/yr)



Tackling Solar's Architectural Barriers

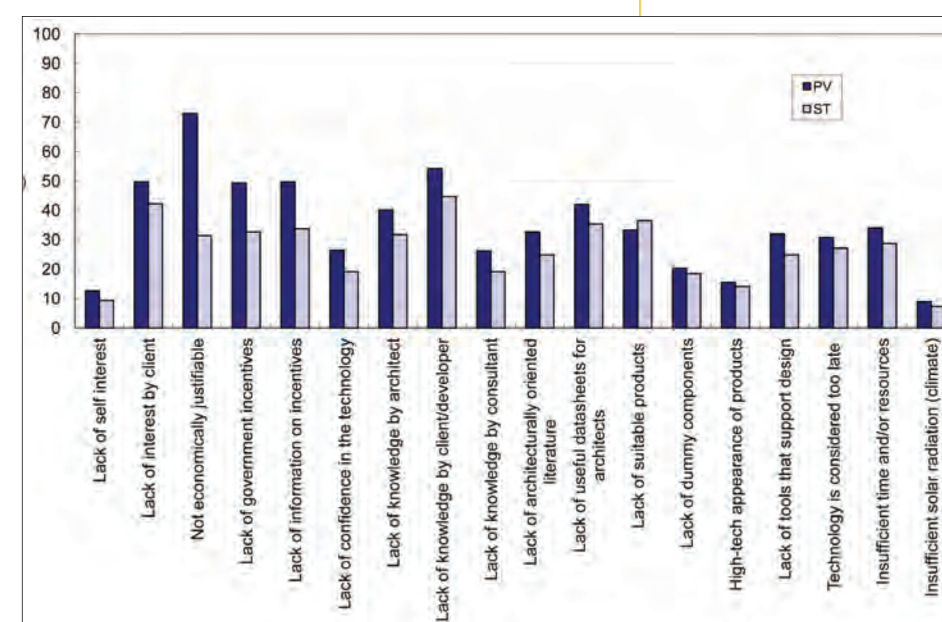
Task 41

Among the solutions to the global energy crisis, the exploitation of solar energy is certainly one of the most promising ecological avenues. Given this, it is surprising to find that solar energy systems are not more widely spread into the general building practice. Traditionally, the economical issue has been dominant in this debate. However, as costs for renewables-based energy systems decline while the price of oil and gas continue to fluctuate, the economical issue is slowly losing its rationale. Some other factors seem to deserve consideration, for instance a general lack of awareness and knowledge of the different technologies among building professionals, a general reluctance to use "new" technologies and finally, last but not least, limitations stemming from architectural and aesthetic considerations in relation to the integration of solar systems.

To address these important issues related to architectural barriers, *SHC Task 41: Solar Energy and Architecture* was carried out as a three-year project. Task 41 involved professional architects, researchers and educators from 14 countries: Australia, Austria, Belgium, Canada, Denmark, Germany, Italy, Norway, Portugal, South Korea, Singapore, Spain, Sweden and Switzerland.

One of the founding arguments for initiating Task 41 was the consideration that solar technologies for building use have an important impact on the building's architecture. Due to the large size of solar systems in relation to the scale of the building envelope, the quality of their integration has a major impact on the final architectural quality of the building. Furthermore, experts in this field have observed that a poor architectural quality of the integration into the building envelope may hinder the acceptance and spread of solar technologies.

Participants in Task 41 focused on architectural factors with the main aim to accelerate the development of high quality architecture for buildings integrating solar energy systems. A secondary objective was to improve the qualifications of architects regarding solar energy systems and technologies. The scope of the work included residential and non-residential, as well as new and existing buildings.



▲ **Figure 1. Barriers for widespread integration of photovoltaic (PV) and solar thermal (ST) systems in architecture – based on survey of 439 respondents in 14 countries.**

Criteria for Architectural Integration of Active Solar Products and Systems

To begin, an international survey was carried out to identify barriers that architects are facing when using active solar technologies. The results showed on the one hand, an overwhelming interest in solar technologies and active solar design solutions (80% ranking these issues as important), and on the other hand very low use in actual practice (less than 10% for photovoltaics and less than 20% for solar thermal)! Passive and daylighting strategies are still more commonly used (69% for passive and 79% for daylighting) than active systems.

The results showed that economic issues are the main barriers, both for solar thermal and

continued on page 6

photovoltaics, followed by a lack of architects' knowledge and lack of targeted information on solar systems, with similar impact (Fig. 1). Concerning the products, the survey highlighted a difference between solar thermal and photovoltaics: for solar thermal, product availability is one of the main barriers, while only ranking a 9th place for PV. This confirmed the necessity to develop innovative solar thermal products, designed from the start for building integration.

Having no direct ability to impact the economical issues, the Task concentrated on removing the two other major barriers: architects' knowledge and lack of suitable products. To support architects, comprehensive guidelines were developed, focusing on integration issues brought by solar thermal and PV systems. Solar Energy Systems in Architecture: Integration Criteria and Guidelines summarizes the knowledge needed to integrate active solar technologies into buildings, handling at the same time architectural integration issues and energy production requirements. The report offers technical information about each technology, constructive/functional integration possibilities, system sizing and positioning criteria, and formal flexibility offered by standard products. Good examples of integration are presented, showing ways to make the best use of available products in the architecture. In addition, innovative market products specially adapted to building integration are presented. The guidelines conclude with a short section on the differences and similarities between solar thermal and photovoltaic systems, which should help architects to optimize the energy use and architectural aspects of the solar exposed surfaces of their buildings.

To address the lack of good products for building integration, the Task has developed criteria and guidelines for manufacturers of solar components and systems and they will be available on the Task website in early 2013. Finally, the lack of knowledge on adapted products for building integration has been addressed using a website of Innovative Solar Products.

Tools and Methods for Solar Design

A successful integration of passive strategies and active solar technologies can only be achieved if it is considered at the earliest stages of the design process. Do architects have the right tools to perform this integration of solar strategies and systems? The Task participants examined this central question.

The first step of this process consisted of an inventory of software tools, State-of-the-Art of Digital Tools Used by Architects for Solar Design. In general, the inventory showed that most tools are better suited for the detailed design stage rather than for the early design phase (EDP), and that the majority of tools have limited features regarding various aspects of solar design. In particular, it was shown that tools are generally too systemic (not allowing to address a single solar system such as solar thermal) and do not allow a realistic visualization of the results at the EDP, which is key to selling the solar concept to the client.

Results from an international web-based survey showed that challenges regarding digital tools include poor skills using solar or energy simulation tools and commonly held perceptions that these tools are too complex, too expensive, time-consuming, not well integrated into CAAD software, or simply not suitable for the EDP. Only 2% of the respondents were satisfied with the existing tools. Additionally, the results showed that tools need to be simpler to use, that the interoperability between software needs to be improved, that tools should provide key data about solar energy aspects as well as explicit feedback to the architect. Finally, tools need improved visualization capacity, especially for active solar energy systems, since visualization is one of the key elements contributing to convincing clients and client's advisors to use active solar systems in the project. The research yielded important insights about how to improve digital tools for architects to make it easier to integrate solar systems into building designs.

Based on the survey results, 19 CAAD and building performance simulation (BPS) tools for solar design (active, passive and daylighting) were selected and further documented in a report to architects. This report, Solar Design of Buildings for Architects: Review of Solar Design Tools, shows typical output and possible results obtained by using the selected CAAD tools, in order to provide inspiration and incentive for using the tool(s). In addition, the second part of the report presents three exemplary case stories conveying valuable experiences and describing different design approaches (which tools were used and how the use of solar design tools influenced the design process and final architectural design).

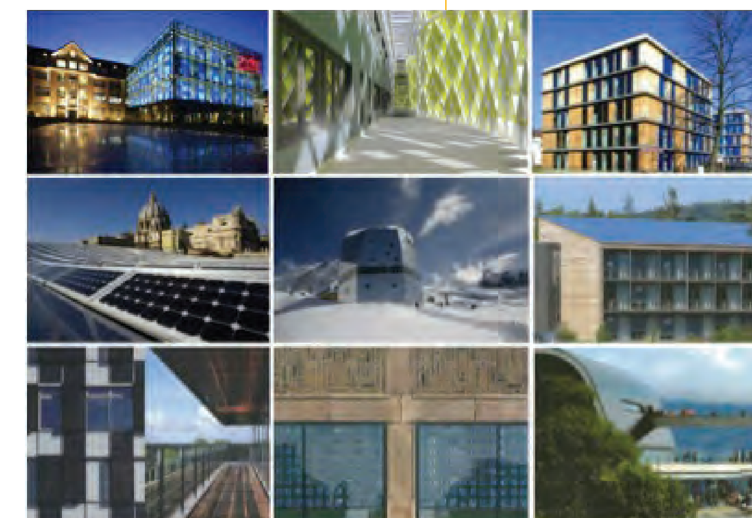
Another outcome of this work is a set of 3D parametric CAAD objects that are compatible with both Graphisoft ArchiCAD and Autodesk AutoCAD. The main goals of this work were to accelerate the rendering process when integrating PV systems in building design, to facilitate and stimulate the use of BiPV (Building integrated Photovoltaic) systems by architects and designers, and to improve the architectural quality of BiPV systems. Hopefully, showing the usability of such objects will inspire many manufacturers of solar thermal and PV components to develop their own CAAD objects so that a whole database of solar objects on the market can soon be available for architects. This will also support their communication with clients. Finally, a dialogue with digital tool developers was initiated with the intention to clarify the needs regarding digital tools expressed by architects.

Case Studies and Communication Guidelines

The evaluation of more than 250 case studies resulted in the selection of around 65 projects from 11 countries as inspiring examples of solar architecture. These were further documented and most of them included in the Collection of Case Studies, which will be posted on the Task 41 website in early 2013. The selected case studies represent different types of new and renovated buildings, using active and/or passive solar strategies and show that already today

appealing and energy-efficient architecture can be achieved using solar energy in buildings, see Figure 2.

Since one barrier for the architect is to convince the client at an early design stage to use solar energy, a guideline was developed to support architects during this phase. This Communication Guideline is designed to support architects in their communication process with clients, authorities, and contractors. Today, the energy performance of solar solutions is well documented and well known, especially in the "technical environment," however, this knowledge needs to be communicated in a convincing way to the decision makers if there is to be a broad implementation of sustainable solar solutions in future building design. The Communication Guideline includes convincing arguments and facts supporting the implementation of solar-based design solutions.



▲ **Figure 2. The Collection of Case Studies shows a wide range of projects demonstrating solar energy in architecture.**

Conclusions and Outlook

Good examples of solar components and architecturally appealing solar buildings exist, but further developments of products, tools, and skills are needed. More products are needed with improved flexibility in size, surface texture and color, jointing, etc. as well as dummy elements (with the same appearance as active elements) that can be used on parts of facades and roofs not suitable for active elements. On the other hand, thanks to the growing interest of architects in solar, manufacturers are becoming increasingly aware of the need for new products specially adapted to architectural integration, or at least for increased flexibility in their existing products, leading to novel development activities even in the less developed field of solar thermal integration.

Many digital tools can handle solar energy issues, but are mainly suitable for engineers and for the advanced design phase. Tools for the Early Design Phase, when key formal building decisions are taken, are still limited and not integrated in the normal workflow of architects. Such tools are needed to support the architects in their work and also to support their communication with the client, the municipality for building permits, consultants, etc. Tool developments as well as development of CAAD objects for solar components are urgently needed.

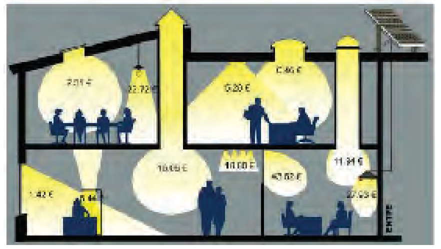
Architecturally inspiring solar buildings exist, and this is encouraging since good examples of buildings and architecturally integrated solar systems are important to convince architects and clients and to make buildings welcome in the built environment. However, architecturally inspiring examples of energy-efficient building renovation with solar are few and need to be encouraged further. Our vision – and the opportunity – is to make architectural design a driving force for the use of solar energy!

Good examples of urban areas with a conscious planning of solar energy use and energy-efficient buildings were originally planned to be part of Task 41. However, only a few good examples of solar energy in urban planning exist today and vast development of regarding strategies, methods, tools, and case studies on the urban level is needed, which could not be accomplished within scope of Task 41. The good news is that it is the topic for new SHC work, *Task 51: Solar Energy in Uurban Planning* starting in May 2013.

This article was contributed by Maria Wall of Lund University, Sweden and Operating Agent for Task 41 and Task 51, maria.wall@ebd.lth.se. To learn more and find all the results of Task 41 visit the SHC Task 41 web page.

TASKS STARTING IN 2013

Advanced Lighting Solutions for Retrofitting Buildings



Participants in this new Task will work to accelerate retrofitting of daylighting and electric lighting solutions in the non-domestic sector using cost effective, best practice approaches that can be used on a wide range of existing buildings. Work will focus on:

- Developing a sound view of the lighting retrofit market.
- Triggering discussion, and initiating revisions and enhancements of local and national regulations, certifications and loan programs.
- Increasing robustness of daylight and electric lighting retrofit approaches technically, ecologically, and economically.
- Increasing understanding of lighting retrofit processes by providing adequate tools for different stakeholders.
- Demonstrating state of the art lighting retrofits.
- Developing an electronic interactive source book, including design inspirations, design advice, decision tools, and design tools relying on the results of the different Task activities.

The Task will run from January 2013 to December 2015. The kickoff meeting is planned for March 20-22 in Lund, Sweden.

For more information contact the Operating Agent, Jan de Boer of Fraunhofer Institute for Building Physics, Germany, jdb@ibp.fraunhofer.de

Solar Energy in Urban Planning

This Task will support the work of urban planners, authorities, and architects to develop urban areas, and eventually whole cities, with architecturally integrated solar energy solutions (active and passive). Work will include developing processes, methods, and tools to assist cities in developing a long-term urban energy strategy. Another component of the Task is to test and develop teaching materials on solar energy in urban planning. A key to the Task's success will be open dialogue and cooperation with municipalities in each of the participating countries.

The Task will run from May 2013 to December 2015. The kickoff meeting is planned for May 28-30, 2013 in Bonn, Germany in connection with the 4th Global Forum on Urban Resilience and Adaptation also in Bonn on May 31-June 2.

For more information contact the Operating Agent, Maria Wall of Lund University, Sweden, maria.wall@ebd.lth.se.

TASKS UNDER DEVELOPMENT

New Generation Solar Cooling Systems

This proposed Task will continue the SHC Programme's work in the field of solar cooling. The main objectives are twofold: 1) to analyze the interest of new generation solar cooling & heating concepts systems for buildings in all climates and select best solutions for highly reliable, durable, efficient and robust solar cooling and heating (ambient + DHW) systems, and 2) to contribute to market entry of the technology and identify most promising market areas in terms of cost competitiveness and value of electricity. The solar driven systems for cooling to be covered are solar thermal driven innovative compact cooling + heating systems and PV + air conditioning system (compression air conditioning/heat pump if heating as well).

The proposal is for a 4-year Task beginning the 4th quarter of 2013. A meeting to further define the work is planned for March 21-22 in Paris, France.

For more information contact Daniel Mugnier of TECSOL SA, France, daniel.mugnier@tecsol.fr or Jean-Christoph Hadorn of BASE Consultants, Switzerland, jchadorn@baseconsultants.com.

Low-Cost Innovative Solar Water Heating Systems

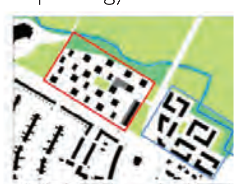
This proposed Task will research and develop innovative designs and materials for residential solar water heating systems that have the potential to reduce the installed SWH system cost by a factor of three to five, while maintaining existing performance and durability. The Task's scope includes systems analysis and design, materials testing, prototype development, performance testing and characterization, qualification testing, numerical and analytical modeling, and information dissemination.

The proposal is for a 5-year Task beginning in December 2013. A meeting to further define the work will be held before June 2013.

For more information contact Kate Hudon of NREL, United States, Kate.Hudon@nrel.gov.

Solar Thermal & Energy Economics in Urban Environments

The objective of this proposed work is to build upon the work of other SHC Tasks to help energy consultants, utilities and urban planners better understand the role of solar thermal systems in energy supply systems of urban environments. This includes the development of long-term scenarios for energy supply systems integration in fluctuating electric and heat sources and sinks. This Task will require that all participating countries provide at least one demonstration project of an existing or newly developed city quarter, which fits to the Task concept, to be used for documentation and monitoring.



The proposal is for a 4-year Task beginning in late 2013. The first Task Definition Meeting will be held February 26-27, 2013 in Copenhagen, Denmark.

For more information contact Sebastian Herkel of Fraunhofer Institute for Solar Thermal Energy Systems, Germany, sebastian.herkel@ise.fraunhofer.de

ECREEE Joins the SHC Programme

The **Economic Community of West African States (ECOWAS)** is a regional group of fifteen West African countries (Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, Togo). Founded on May 28, 1975 with the signing of the Treaty of Lagos, its mission is to promote economic integration across the region and to increase political co-operation.

Considered one of the pillars of the African Economic Community, the organization was founded in order to achieve "collective self-sufficiency" for its member states by creating a single large trading block through an economic and trading union. It also serves as a peacekeeping force in the region. The organization operates in three official languages: English, French, and Portuguese.

The revised treaty of 1993, which was to extend economic and political co-operation among member states, designates the achievement of a common market and a single currency as economic objectives, while in the political sphere it provides for a West African parliament, an economic and social council, and an ECOWAS court of justice to replace the existing Tribunal and enforce Community decisions. The treaty also formally assigned the Community with the responsibility of preventing and settling regional conflicts.

On November 2007 during the ECOWAS Conference on Peace and Security in Ougadougou, Burkina Faso, the Heard of States signed the Ougadougou Declaration, highlighting the need for a regional cooperation in various sectors namely in the energy sector. The declaration articulated the need to establish the ECOWAS Centre for Renewable Energy and Energy Efficiency.

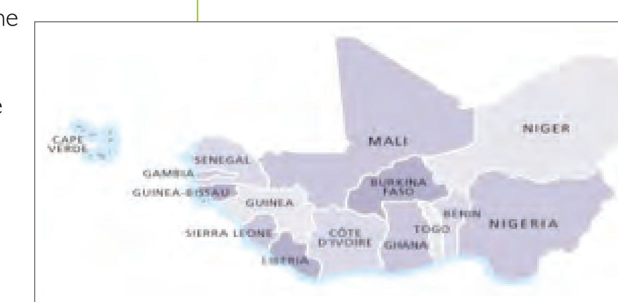
The foundation of the **ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE)** was laid by the ECOWAS Council of Ministries on November 2008 and on December 2009 the ECOWAS Commission established the Centre, with the support of Austrian Cooperation, UNIDO, and the Government of Cape Verde, and in 2010, Spain became a major partner. The official inauguration took place on July 6, 2010.

Solar's potential in the ECOWAS region is significant – an annual average solar radition of 5-6 kWh/m2. And, the use of solar systems for heating and cooling presents a huge potential still untapped. Solar heating systems for hotels and industrial processes can contribute significantly to reducing the huge energy deficit in the region. Recent technology developments in solar cooling, associated with the growing need to improve the indoor thermal comfort, particularly in offices, also points to a very important potential.

JANSENIO DELGADO
ECREEE'S SHC Executive Committee Member

ECREEE's Governance Structure

The ECREEE Secretariat is based in Praia, Cape Verde and operates in all three ECOWAS languages (English, French, Portuguese) And an Executive Director heads the small multinational team of West African and international full-time staff.



ECREEE uses a network of National Focal Institutions (NFIs) to interlink the Secretariat with all the ECOWAS Member States, and Centre activities are executed in cooperation with the NFIs or other entities of the public and private sectors.

The Centre is governed by an Executive Board (EB) and a Technical Committee (TC), which meet usually twice a year. The EB is the highest decision-making body and provides strategic guidance and approves the annual work plans, progress reports, and financial statements of the Centre. The TC

continued on page 10

provides technical guidance and is responsible for reviewing major technical documents and reports for submission to the EB. If necessary, the TC reviews projects to be funded by ECREEE and recommends their approval by the EB.

▲ **ECREEE Headquarter in Praia, Cape Verde.**

ECREEE Objectives

ECREEE is a specialized agency of ECOWAS with a public mandate to promote regional renewable energy (RE) and energy efficiency (EE) markets. It acts as an independent body, but within the legal, administrative, and financial framework of ECOWAS.

ECREEE objectives are to:

- promote sustainable development in West Africa by improving access to modern energy services, energy security and climate change mitigation through the use of RE&EE and
- create an enabling environment for regional RE&EE markets by mitigating various barriers for the dissemination of green energy technologies and services.

Through its activities, ECREEE contributes to:

- the improvement of energy security, energy access and mitigation of negative environmental externalities of the energy system in the ECOWAS region,
- the UN Goals on Sustainable Energy For ALL (SE4ALL), which aims to achieve three interlinked targets by 2030: universal access to modern, affordable and reliable energy services; doubling the rate of improvement in energy efficiency; doubling the share of renewable energy in the global energy mix,
- the WAPP Master Plan Scenario, which aims to double the regional electric generation capacity by 2025, and
- the ECOWAS White Paper on energy access, which foresees that at least 20% of new investments in rural electrification should originate from locally available renewable resources.

ECOWAS RE&EE Potentials

West Africa can rely on a wide range of untapped RE&EE potentials in various sectors. So far, West African countries do not take advantage of their RE&EE potentials due to various technical, financial, economic, institutional, legal, and capacity related barriers.

Important renewable energy resources already identified in the ECOWAS region include:

- 23, 000 MW of hydropower, of which only 16% has been exploited;
- High potential for all forms of bioenergy;
- Considerable wind, tidal, ocean thermal, and wave energy resources available;
- Vast solar energy potential, with a very high radiation average of 5 to 6 KWh/m2 throughout the year.

What ECREEE wants to achieve

The Renewable Energy Policy and the Energy Efficiency Policy of ECOWAS approved by the Council of Ministers of Energy at the Accra High Level Forum on 29 of October 2012 defined the following 2020 and 2030 targets for RE & EE:

As a specialized agency of ECOWAS with the mandate to promote renewable energy and energy efficiency in the region, ECREEE is pleased to be a Sponsor of the IEA SHC Programme. We look forward to participating in the R&D activities and offering R&D demonstration projects from West Africa.

JANSENIO DELGADO
ECREEE'S SHC Executive Committee Member

Grid-Connected Renewable Energy Targets	**2020**	**2030**
RE share in total ECOWAS generation capacity (incl. large hydro)	35%	48%
RE share in total ECOWAS generation capacity (excl. large hydro)	10%	
2.425 MW	19%	
7.606 MW		
Rural Renewable Energy Targets	**2020**	**2030**
Rural population supplied by mini-grids and stand-alone systems	22%	25%
Mini-grids to be installed (includes hybrid systems)	60,000	
3,600 MW	128,000	
7,680 MW		
RE Stand-alone or micro-systems		450,000 per year
Rural population served with improved stoves	100%	100%
Rural population with access to LPG	17%	32%
Other Targets	**2020**	**2030**
Electricity savings through demand side and supply side EE measures	equivalent to 40 power plants with a capacity of 2000 MW	Doubling of annual improvements in energy efficiency
Ethanol share in gasoline consumption; biodiesel share in diesel/ fuel oil consumption	5%	10%
Use of solar thermal hot water systems	25% of health centers; 10% of hotels; 10% of agro-food industries using hot water;	50% of health centers; 25% of hotels; 25% of agro-food industries using hot water;
Portion of installed RE&EE equipment locally manufactured	7%	20%

Scope of activities and services of ECREEE

The Centre undertakes activities in four main thematic programs, which aim to mitigate barriers for the deployment and application of RE&EE technologies and services in the region:

- Tailored policy, legal and regulatory framework
- Capacity development and training
- Knowledge management, awareness raising, advocacy and networks
- Business and investment promotion

The activities are implemented in cooperation with the private and public sector, civil society and other national and international institutions, in cooperation with the National Focal Institutions (NFIs).

This article was contributed by ECREEE's SHC Executive Committee, Jansenio Delgado, JDelgado@ecreee.org. To learn more about ECREEE visit their website at http://www.ecreee.org

Today's Solar Cooling Market

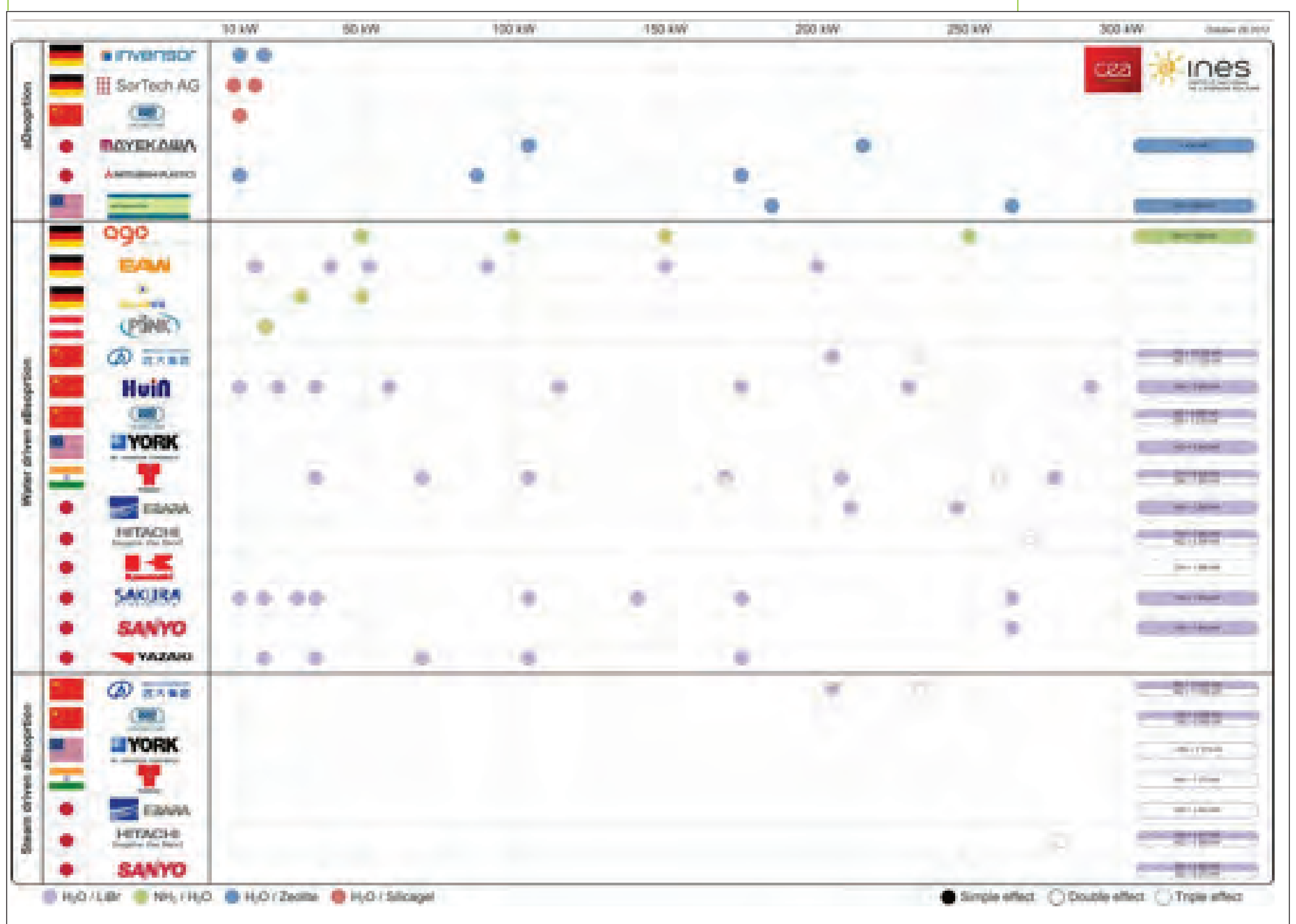
Task 48

IEA SHC Programme's work on Quality Assurance and Support Measures for Solar Cooling conducted a survey of components and systems related to solar cooling. As part of this work, detailed lists of the solar cooling chillers and DEC systems available on the market have been produced.

Market Available Chillers For Solar Cooling

CEA INES, the French R&D institute, lead the work on chillers with the strong collaboration from other *SHC Task 48: Quality Assurance and Support Measures for Solar Cooling* experts. The work had one simple goal: to list with maximum completeness the existing chillers compatible with solar thermal energy as the driver.

▼ **Table 1. Market overview of available chillers compatible with solar thermal energy.**



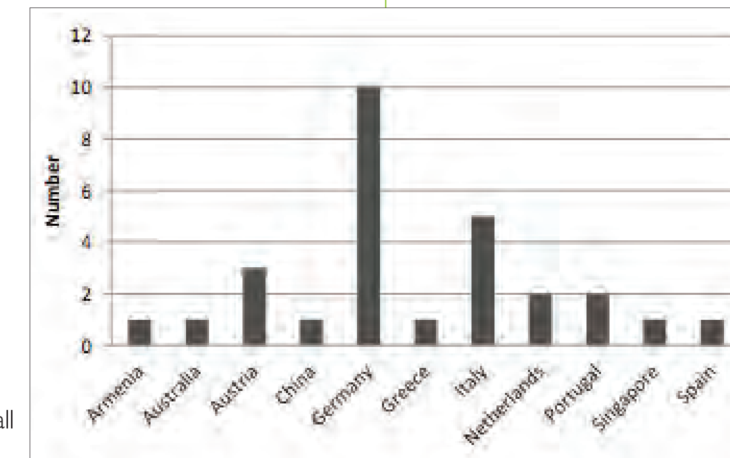
continued on page 13

Solar Cooling Market *from page 12*

In addition to simply listing them, the result include relevant information, such as:
- country and manufacturer
- nominal cooling capacity
- sorption technology (steam and hot water absorption/adsorption)
- working pair (H2O/LiBr, NH3/H2O, etc.)
- sorption technology (single, double, triple effect)

Table 1 gives an overview on the available solar cooling chillers on the market in 2012.

This table shows that a very large range of cooling capacity is possible from 8 kW to more than 10 MW cooling. Asia dominates this market, but Europe is also quite active particularly in the area of small to medium power chillers. It should also be noted that the majority of systems are single effect absorption H2O/ LiBr chillers.



▲ **Figure 1. Identified SDEC systems per country.**

When reviewing this table if you notice that a chiller is missing please contact the *Task 48: Quality Assurance and Support Measures for Solar Cooling* Operating Agent, Daniel Mugnier, daniel.mugnier@tecsol.fr

Solar Desiccant Evaporative Cooling Market Survey

The work of SHC Task 48 primarily addresses quality issues of small and large-scale thermally driven sorption chillers. However, work is also being conducted on open sorption cycle system - namely desiccant evaporative cooling (DEC). The advantage of a solar heat driven DEC system is that it fulfils all the essential requirements of air-conditioning (i.e., control of fresh air temperature, humidity and volume flow). The objective of this Task work is to provide good practice examples of solar DEC system design and installation. This work will also conduct ongoing screening to identify new DEC technology R&D, for example the application of new sorption materials or new system configurations and control strategies.

According to the market survey conducted in *SHC Task 38: Solar Air-Conditioning and Refrigeration* solar heat driven DEC systems have a low market share of the Solar Air-Conditioning (SAC) market in comparison to absorption and adsorption chillers. Out of 113 SAC systems, only 18 open cycle systems identified were equipped with DEC technology. Solid sorption materials are clearly dominating the applied DEC technology; only two DEC systems have been indentified that operate with liquid sorption material.

In the second quarter of 2012, a new successive market screening was carried out by SHC Task 48 experts. Twenty-eight operating solar DEC (SDEC) system were identified. In terms of numbers, Germany, Italy and Austria cover two-thirds of all the identified SDEC installations. Based on the available information, only two SDEC systems operate using liquid sorption material; all the other SDEC systems use solid sorption material coating rotating matrixes or fix beds. As part of the SHC Task 38, experts will continue to collect data to fill the gaps in the technical SDEC system data.

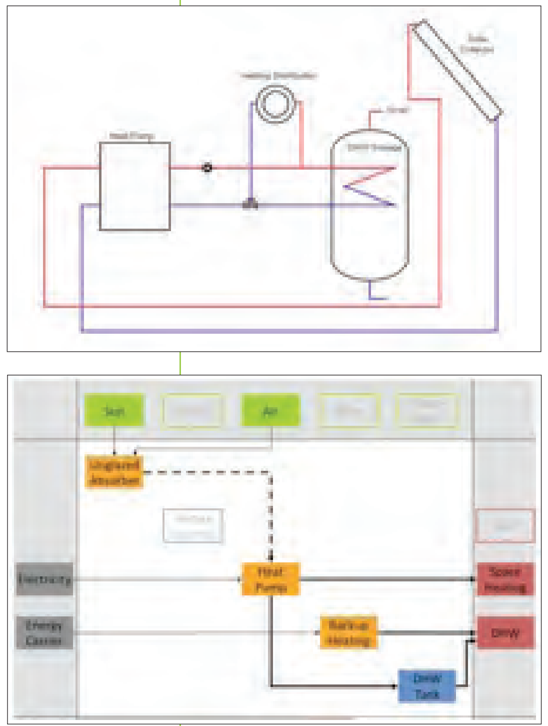
This article was contributed by SHC Task 48 expert Tim Selke of the Austrian Institute of Technology, tim.selke@ait.ac.at; and SHC Task 48 Operating Agent Daniel Mugnier of TECSOL, France, daniel.mugnier@tecsol.fr. For more information go to the SHC Task 48 website http://task48.iea-shc.org/

Solar + Heat Pump Systems

Task 44

A welcome advancement is the combination of solar thermal technology and heat pumps to heat houses and produce domestic hot water. And, the market for these S+HP systems is booming in countries like Switzerland, Austria and Germany where favorable conditions exist, such as CO2 reduction promotion programs, renewable obligations for domestic hot water production, high electricity peak costs, and incentives. However, to ensure this technology's long-term commercial success, standards and norms are required.

To support this technology, the IEA Solar Heating and Cooling Programme is collaborating with the IEA Heat Pump Programme to assess the performance and relevance of S+HP systems, to provide a common definition of performances of such systems, and to contribute to the successful market penetration of these new promising combinations of renewable technologies. The main target market is the small system, in the range of 5 to 20 kW, that uses any type of solar collector and any heat source for the heat pump.



▲ **Figure 1: A solar energy roof and its description using the Task 44 "square view".**

Recent Results

2013 marks the conclusion of this work and much has been accomplished.

100 Systems Surveyed

More than 100 systems have been surveyed and classified into four new categories: parallel, serial, regenerative, and complex concept. Task participants developed a special tool called the "square view" to describe the systems in a standard format.

Results from the survey show that 70% of the systems are parallel systems, 7% serial systems, 21% complex systems, and very few are regenerative systems. The number of air and ground heat sources is comparable and only a few systems used just a solar collector as the heat source for the evaporator while the majority of systems used "multi sources". A report presenting the survey results will be available in early 2013.

In addition, about 20 different systems have been monitored in real conditions and the results will be reported on during later this year 2013. The monitoring of the field tests show various results with some very attractive seasonal performance factors as well as some with disappointing values.

Criteria	Indicator 1	Indicator 2
Energy performances	Seasonal Performance factor	Primary Energy ratio
Grid impact	Max electrical power asked from grid	Summer / Winter ratio
Renewable energy performances	Renewable energy fraction	Solar savings fraction
CO2 emissions	Annual emissions g/kWh	On site / Globally
Climate performance	Productivity of solar kWh/m2 or kWh/kW	Heating / Cooling
Cost performances	Investment/kW	Cost/kWh

▲ **Table 1: Criteria and performance indicators considered in Task 44 to evaluate S+HP combinations.**

continued on page 15

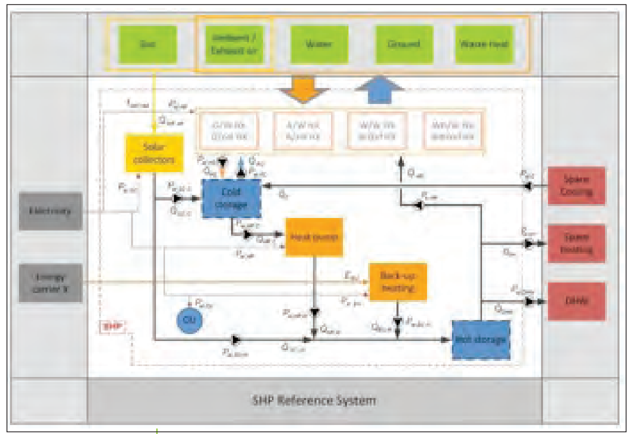
Solar + Heat Pump Systems *from page 14*

Performance Indicators Defined

Task participants agreed upon a set of performance indicators, which proved to be more difficult than anticipated, to compare systems. The performance indicators include system and component efficiency, primary energy, and CO2 emissions or savings.

One important question when dealing with hybrid systems such as S+HP systems is how to calculate the benefit of the combination "solar and heat pump". Table 1 is what this Task is working with.

A number of institutes participating in Task 44 are already testing S+HP systems and system components on stands. A common procedure of testing however is still being discussed, as there are no standards at this time.



▲ **Figure 2. Defining boundaries to evaluate S+HP systems performance including the electricity for auxiliary.**

◄ **Figure 3. Frost on a selective uncovered collector when used below the dew point (SPF, Switzerland).**

Simulation Work Continues

To compare systems it is necessary to simulate them with the same "case". A common framework has been defined based on a reference building with a defined heating and cooling load. To learn more on this work download the report Review of Component Models for the Simulation of Combined Solar and Heat Pump Heating Systems. As part of this work, the Task's common boundary conditions will be implemented on different simulation platforms, as not all participants want to use TRNSYS.

Simulation models of components are essential for simulating systems and therefore four working groups have surveyed existing models of solar collectors, ground heat exchangers, heat pumps, and heat storage. And, a new Heat Pump Model (Type 877) for TRNSYS has been developed and once it is has been validated it can be used for optimisation purposes.

Modelling the frost conditions and water condensation heat exchange on solar absorbers for night operating conditions is well advanced thanks to the prior work of the Task's Swedish experts. The model was tested on laboratory results in Switzerland and proved to be adequate. Condensation, however, is not very important in the annual balance of heat supplied as solar radiation and air exchange dominate.

Several systems show good correlations with monitored data for some important S+HP configurations. Comparison of systems (serial, parallel, and others) and optimization will happen during 2013.

Where to Find Results

The Task website is a resource for teaching material on S+HP combinations, including descriptions of more than 80 S+HP combinations, and for publications, including the Task newsletter.

The final product of the Task will be a S+HP handbook covering all aspects of S+HP: practical experience, performance indicators definition, standard testing, component modelling, system simulations, and comparison and guidelines for planning good systems.

This article was contributed by Jean-Christophe Hadorn of Base consultants SA, Switzerland and Task 44 Operating Agent, jchadorn@baseconsultants.com.

Countries Participating

Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Spain, Sweden, Switzerland, United States

Deliverables to Come

- Technical reports on existing and monitored systems from national experts
- Map of generic systems with pros and cons
- New set of performance indicators
- Procedure to test combined solar and heat pump systems – pre normative work
- Technical reports on systems tested in laboratory with this procedure from national experts
- New reference framework for simulating solar and heat pumps systems
- New components models or compiled existing ones
- Website with all major reports and papers
- Educational material on the website
- Support to national workshops about the topic "solar and heat pump"

Cheese Maker Turns to the Sun

One of the most promising industry sectors for solar process heat identified in *SHC Task 49/IV: Solar Heat for Production and Advanced Application* is the food sector. New developments by concentrated solar collector producers have increased the temperature range up to 400° C for solar applications in the food industry, which has meant more options for the industry.

One system at work is NEP Solar's process heat system "On Sun" at the Tête de Moine Cheese Factory in Saignelégier, Switzerland. This plant features the latest development of the PolyTrough collector, which is installed on the rooftop of the dairy factory extension of Emmi Group's Fromagerie de Saignelégier AG where the famous Tête de Moine AOC cheese is produced.

The plant consists of seventeen PolyTrough 1800 collectors with a total collector area of 627 m². At full sun the solar field produces 360 kW of renewable process heat. Water circulates through the collectors to supply high temperature heat through a plate heat exchanger to the factory's hot water circuit and storage tank. The solar thermal system was integrated into the existing equipment with minimal adaption and process disruption.

The project is a milestone for NEP Solar in that it is the first commercial project utilizing the new PolyTrough 1800 collectors. These collectors were developed in conjunction with the Institute for Solar Technology SPF in Rapperswil, Switzerland (www.solarenergy.ch). The development and industrialization of NEP Solar's new PolyTrough 1800 collector is supported by the Swiss Climate Foundation (Klimastiftung Schweiz, www.klimastiftung.ch) and CTI (www.kti.admin.ch).

With this project Emmi and NEP Solar are pioneering the integration of solar thermal technologies to deliver high temperature process heat for industrial applications, an emerging market with huge potential.

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With this project Emmi and NEP Solar are pioneering the integration of solar thermal technologies to deliver high temperature process heat for industrial applications, an emerging market with huge potential.

For more information contact NEP Solar AG, news@nep-solar.com or visit the SHC Task 49 webpage.

▲ On Sun: NEP Solar collector field on the rooftop of the Tête de Moine cheese factory in Saignelégier, Switzerland.

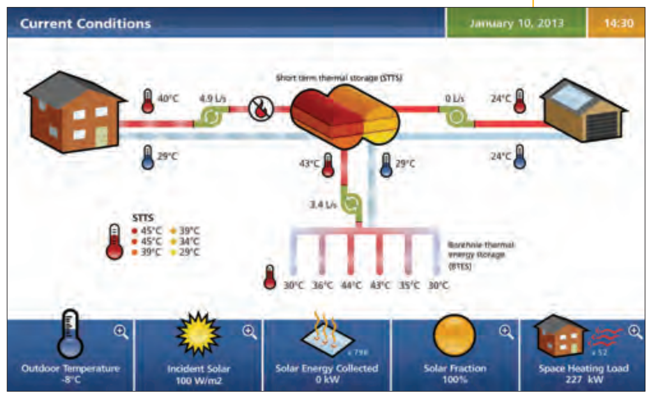
"For the Fromagerie de Saignelégier it was important to not only think, but also act sustainably," says Mr. Jean-Philippe Brahier, Chef d'Exploitation of the Fromagerie de Saignelégier. "The NEP Solar collector field allows us to reduce our fossil fuel consumption by 30,000 liters per year and thereby save 79 tons of CO2 emissions."

Solar Community Tops World Record

The Drake Landing Solar Community reached 97 percent of its home heating needs through solar energy. This 52-house subdivision is North America's first large-scale seasonal storage solar heating system. It provides space heating by collecting solar thermal energy throughout the summer and storing it underground in a borehole thermal energy system (BTES) to use to heat the homes during the winter.

"To achieve and do better than what we originally designed helps in this technology being promoted not only within Canada, but around the world" says Doug McClenahan, Canada's SHC Executive Committee member.

Track the "Systems Current Conditions Dashboard on the Drake Landing website or using the mobile app for iOS, Android and Blackberry 10.



POLYMERIC MATERIALS

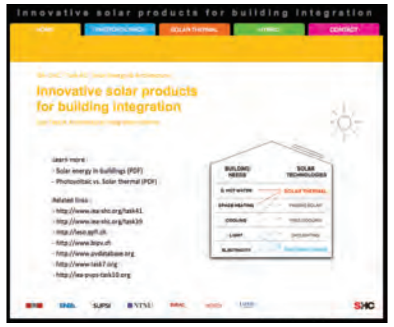
Polymeric Materials for Solar Thermal Applications

The first in the IEA SHC Programme's Solar Heating and Cooling book series being published by Wiley publishers. And, the first book devoted to polymers for solar thermal applications.

This book, a summation of the work conducted in *SHC Task 39: Polymeric Materials for Solar Thermal Applications*, describes the state-of-the-art of 'polymers in solar thermal systems' comprehensively and provides an introduction to solar thermal technologies and the polymer properties and processing. It concludes with examples of successful component and system designs for inexpensive mass-produced polymeric solar thermal systems. With its emphasis on applications, this book is relevant for researchers at universities and developers in commercial labs.

SOLAR AND ARCHITECTURE

Innovative Solar Products for Building Integration Website



This website showcases the innovative/inspiring solar products for building integration on the market. It is designed so that architects can easily see products for photovoltaic, solar thermal, and hybrid systems. The user simply chooses a specific technology and integration approach (roof integration, façade integration, balcony, etc.) and then is provided with a selection of appropriate products in "virtual sheets". These sheets include detailed product information, contact details, and pictures of the stand-alone product and its application on buildings.

Solar Energy Systems in Architecture - Integration Criteria and Guidelines

This clear and practical report summarizes the knowledge needed to integrate active solar technologies (solar thermal and photovoltaics) into buildings, handling at the same time architectural integration issues and energy production requirements. The manual ends with a short section on the differences and similarities between solar thermal and photovoltaic systems to help architects optimize the energy and architectural aspects of the sun exposed surfaces on their buildings.

Product Developments and Dissemination Activities

This document shows product developments and dissemination activities carried out within the framework of, or in close relation to Task 41: Solar Energy and Architecture. The report is not a complete list of activities, but shows the different types of activities to help spread the findings of Task 41 and to initiate product developments in participating countries.

Building Integration of Solar Thermal and Photovoltaics – Barriers, Needs and Strategies

This first report describes the results of an international survey on the reasons why architects do not use or rarely use solar technologies, and offers strategies for overcoming these barriers.

Solar components 3D parametric CAAD objects

This new tool is to help speed up the rendering procedure when integrating PV systems in building design, to facilitate and stimulate the use of BiPV (Building integrated Photovoltaic) systems by architects and designers, and to improve the architectural quality of BiPV systems. It was developed by the Institute for Applied Sustainability to the Built Environment (ISAAC) in collaboration with IDC AG, the Swiss national Graphisoft distributor (responsible for CAD object programming).The modules are available for free downloads.

The Communication Process

This Communication Guideline is a tool to support architects in their communication process with clients, authorities, and contractors. The energy performance of solar solutions needs to be communicated in a convincing way to decision makers. These guidelines provide convincing arguments and facts to support the implementation of solar-based design solutions.

SOLAR RENOVATION IN NON-RESIDENTIAL BUILDINGS

A set of Exemplary Renovation Projects demonstrating that total primary energy consumption can be drastically reduced while also improving the building's indoor climate is available online. These projects have been systematically analyzed to make them a reliable resource for planners. Projects will continue to be added to this collection.

Façade facing playground - Before renovation

Façade facing garden - After renovation

NEWSLETTERS

Two Tasks publish newsletters-- Task 44: Solar and Heat Pump Systems publishes an annual newsletter and Task 39: Polymeric Materials for Solar Thermal Applications publishes a semi-annual newsletter.

IEA SHC programme

Current Tasks and Operating Agents

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.

Follow IEA SHC on

SOLARUPDATE

The Newsletter of the IEA Solar Heating and Cooling Programme

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Prepared for the IEA Solar Heating and Cooling Executive Committee

by

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