SOLARUPDATE VOL.60 | OCTOBER 2014

Newsletter of the International Energy Agency Solar Heating and Cooling Programme

COUNTRY HIGHLIGHT

China & the IEA Solar Heating and Cooling Programme Capitalize on Collaboration

China represents 60% of the global solar thermal share, which means China's participation in the SHC Programme brings the world's largest solar thermal market to the SHC work.

Since 2012 Chinese solar researchers, who before were not very familiar with the SHC Programme, have been collaborating with experts throughout the world. This partnership is creating a path to bring the SHC Programme's work to China.

▲ Chinese participants in Denmark at a SHC Task 45: Large Scale Solar Heating and Cooling Systems workshop in May 2012.

Over the past two years 11 Chinese organizations have joined four SHC Tasks (another name for projects) and are contributing to the work of *Task 43: Solar Rating and Certification Procedures, Task 45: Large Scale Solar Heating and Cooling Systems, Task 48: Quality Assurance & Support Measures for Solar Cooling Systems,* and *Task 49: Solar Heat Integration in Industrial Processes*. Participants in these Tasks include experts from research institutes, manufacturing, universities and testing centers.

For China, participation in the SHC Programme is bringing the Chinese solar industry onto the global stage through the collaborative work, the election of the Chinese Executive Committee member as a SHC Vice Chair, and the hosting of the SHC 2014 Conference in Beijing. In China, this collaboration has led to new ventures with European and other Asian countries as well as a new solar thermal research program and a growing cooperation with solar businesses.

Since joining the SHC Programme some changes have taken place in the Chinese solar thermal market as industry has begun to pay more attention to large-scale solar heating systems, solar cooling and solar industry process heating compared to a primary focus on solar water heating systems before joining the Programme. Solar water heating continues to be the largest share of the market, but with

◄ Chinese participants in Germany at a SHC Task 43: Rating and Certification Procedures workshop in September 2012.

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In This Issue

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China and SHC *from page 1*

the increases in building applications more and more manufacturers are shifting their focus to the split indirect solar water heating system.

This international collaboration has also opened the door for technical visits. In 2012 the Chinese solar association visited Denmark to learn first hand about solar district heating applications. And today, the development of large-scale solar district heating systems and solar cooling systems are booming in China. One example is the solar district heating system with seasonal storage system in Hebei province. The system has a 11,600m^2 collector area and over 20,000 m^3 water tanks, which can supply space heating and domestic hot water for buildings over 480,000m^2. Another example is the solar district heating and cooling system being constructed in Xinjiang province, which has a 16,000m^3 pit storage and 13,000m^2 collector area. There is also a growing market for solar cooling system applications in low energy building.

As for the future of solar in China, the trend is towards district heating and cooling; and solar thermal has a key role to play. The collaboration with the SHC Programme is bringing an international perspective to China, which no doubt will contribute to a growing passion for solar thermal throughout the world.

This article was contributed by the Chinese Executive Committee member, Mr. He Tao of the China Academy of Building Research.

▲ **Split indirect solar water heating system.**

▶ **District solar heating system with seasonal storage at Hebei University of Economics and Business in Shi Jia Zhuang City in He Bei Province.**

China Hosts SHC 2014

The largest solar thermal market in the world hosted the 3rd annual SHC Conference. The local conference host China Academy of Building Research, which sets the standards for solar thermal manufacturing and installation in China, and the SHC Programme have created a dynamic and informative platform for the exchange of expertise and knowledge at SHC 2014.

SHC conferences are a tremendous opportunity to meet leading researchers from around the world and see how solar thermal is being deployed in the market.

You can find the proceedings from past conferences in:

- SHC 2014 proceedings to be published in Elsevier's *Energy Procedia*.
- SHC 2013 proceedings published in volume 48 of Elsevier's *Energy Procedia*
- SHC 2012 proceedings published in volume 30 in Elseviers's *Energy Procedia.*
- SHC 2012 selected papers published in volume 104 of Elsevier's *Solar Energy Journal.*

Join us at SHC 2015 in Turkey!

Pioneering Municipality Wins 2014 Solar Award

On October 13th the 2014 SHC Solar Award was presented to the French city **Montmélian la Solaire**. The Mayor, Mrs. Béatrice Santais, received the award on behalf of city at the SHC Programme's International Conference on Solar Heating and Cooling for Buildings and Industry in Beijing, China. The 2014 award recognized not only the excellent results of Montmélian la Solaire, but also the pioneering spirit of the city's leaders.

This town of 4,000 residents is firmly committed to the promotion and development of solar thermal. Nearly 1,500 m2 of solar thermal collectors are installed on buildings. Of this solar collector area, 56% are installed on municipal buildings and 44% on private multifamily houses. In addition, a solar thermal feasibility study is executed for each new public building project.

The city of Montmélian la Solaire has always been in the forefront of the application of new solar technologies:

- solar heating for the city's swimming pool was installed in 1984,
- large-scale solar heating for the hospital was completed in 1991,
- solar air heating (SolarWall) for the Inter-district gym hall was installed in 2007, and
- the ambitious solar city quarter, Triangle Sud, which in 2018 will be the first solar district heating system in France with a solar fraction of 80%!

Currently, the town boasts some 370 m2 of thermal solar panels per 1,000 inhabitants, which is ten times more than the national average. As Mrs. Santais states, "We must continue tirelessly because we are on the right path, the one and only path."

To ensure continued growth, the city understands that education is key. Information panels are held to explain the operation of a solar thermal installation and the advantages compared to other heating technology. An electronic display shows the power being generated in real-time. School activities help children understand the value of renewable energy.

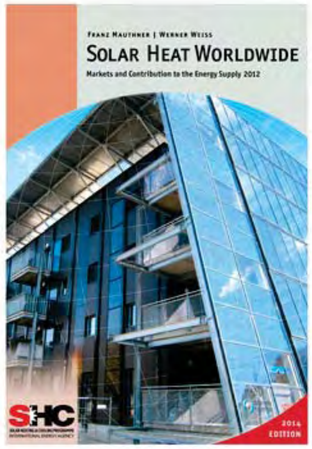
The city of Montmélian la Solaire joins the Drake Landing Company, Fred Morse, Helmut Jäger, Manuel Collares Pereira, Volker Wittwer, Jan-Olof Dalenbäck, William Beckman, and Torben Esbensen as a recipient of this award.

▲ **The city of Montmélian la Solaire's Mayor, Mrs. Béatrice Santais, and SHC Chairman, Ken Guthrie.**

"This year's SHC Solar Award recognizes a municipality with an incredible track record of leading by example," said Ken Guthrie, chairman of the SHC Programme. "The city of Montmélian la Solaire has demonstrated for 30 years how to motivate a community and stimulate the development of solar thermal energy through the systematic installation of solar thermal systems in municipal and residential buildings."

Solar Heating Saves Over 79 Million Tons of CO^2 Annually

The 2014 edition of the SHC Programme's Solar Heat Worldwide is available online.



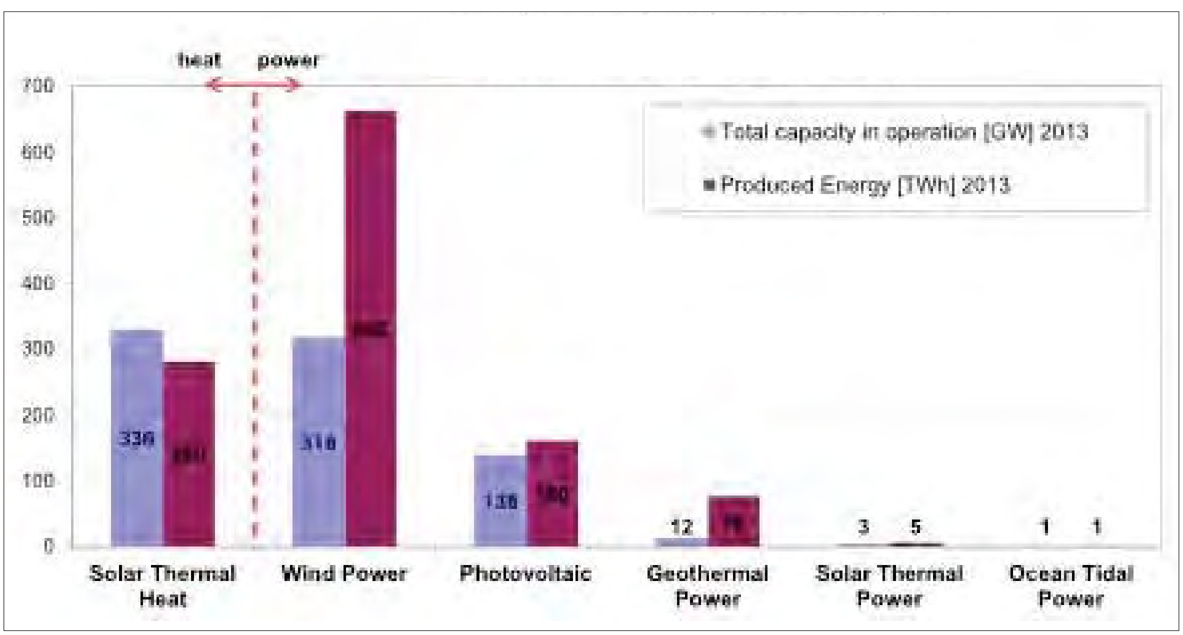
This year's edition reports a 9.4% growth in the market in 2012, with the installed solar collector capacity reaching 269 GWth. The collectors provided 228 TWh of solar thermal energy, thus saving over 79 million tons of CO2 emissions.

Solar Heat Worldwide provides data from 58 countries representing more than 63% of the world's population and over 95% of the global solar thermal market.

The vast majority of the total capacity in operation was installed in China (180.4 GWth) and Europe (42.8 GWth), which together accounted for 83% of the total capacity. The remaining installed capacity was shared between the United States and Canada (17.2 GWth), Asia excluding China (10.3 GWth), Latin America (7.4 GWth), Australia and New Zealand (5.4 GWth), the MENA2 countries Israel, Jordan, Lebanon, Morocco and Tunisia (4.9 GWth) and the Sub-Sahara African countries Mozambique, Namibia, South Africa and Zimbabwe (1.0 GWth).

Most of the existing systems provide domestic hot water (87%), but in some countries combisystems (systems that provide water heating and space heating) have become major market players. Industrial applications, district heating, and air conditioning

"It is often forgotten that 47% of the world's energy demand is for heating", reminds Ken Guthrie, SHC Chairman. "Solar heating and cooling offer a renewable supply of thermal energy and can be applied anywhere in the world. In many regions, solar has been cost-competitive for years. People use it because it works and it is relatively inexpensive".



◄ **Total capacity in operation [GWel], [GWth] 2013 and annual energy generated [TWhel], [TWhth].** (Sources: AEE INTEC, GWEC, EPIA, IEA PVPS, Navigant Research, Ocean Energy Systems, REN21, U.S. Geothermal Energy Association)

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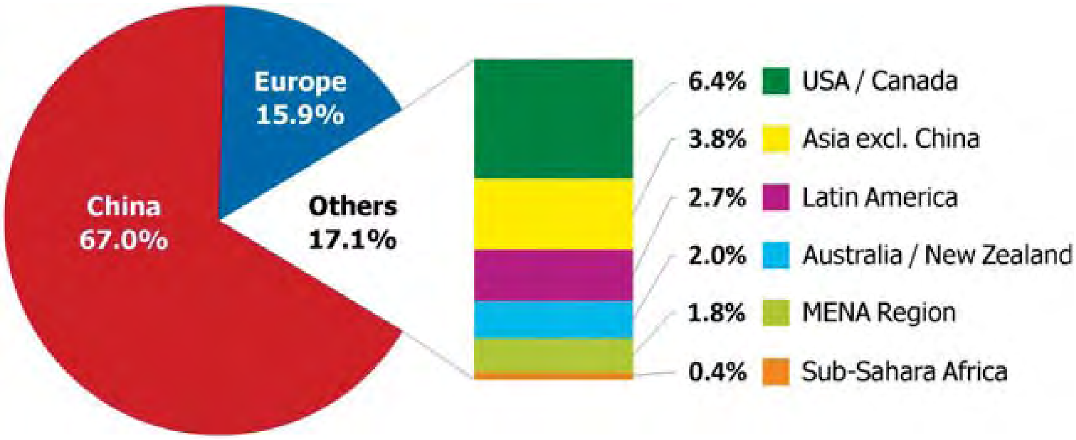
Solar Heat *from page 4*



Sub-Sahara Africa: Mozambique, Namibia, South Africa, Zimbabwe
Asia excluding China: India, Japan, Korea South, Taiwan, Thailand
Latin America: Brazil, Chile, Mexico, Uruguay
Europe: EU 28, Albania, Macedonia, Norway, Switzerland, Russia, Turkey
MENA Region: Israel, Jordan, Lebanon, Morocco, Tunisia

▲ **Share of the total installed capacity in operation (glazed and unglazed water and air collectors) by economic region at the end of 2012.**

are also growing solar thermal applications. Taken together, combisystems and applications other than domestic hot water reached 13% of the newly installed systems in 2012.

On the technology side, evacuated tube collectors are the clear market leader accounting for 82% of the newly installed capacity in 2012. This is driven by the dominance of the Chinese market. In China, 86% of all new installations are evacuated tube collectors while in Europe it is the opposite with 86% being flat plate collectors.

A preview of the 2013 stats shows a total capacity for solar thermal collectors reaching 330 GWth – the equivalent of 471 million square meters.

TOP 10

markets for glazed flat plate collectors and evacuated tube collectors in 2012

China 44,730 MW_{th}

Turkey 1,137 MW_{th}

India 1,015 MW_{th}

Brazil 806 MW_{th}

Germany 805 MW_{th}

USA 699 MW_{th}

Australia 644 MW_{th}

Italy 231 MW_{th}

Israel 218 MW_{th}

Poland 211 MW_{th}

New Members

Regional Center for Renewable Energy and Energy Efficiency

Gulf Organisation for Research & Development

The SHC Programme welcomes the Regional Center for Renewable Energy and Energy Efficiency (RCREEE) and the Gulf Organization of Research and Development (GORD). This is an exciting development as the Programme looks forward to new collaborations in Arab states.

About RCREEE

The Regional Center for Renewable Energy and Energy Efficiency (RCREEE) is an independent not-for-profit regional organization that aims to enable and increase the adoption of renewable energy and energy efficiency practices in the Arab region. RCREEE teams with regional governments and global organizations to initiate and lead clean energy policy dialogues, strategies, technologies and capacity development in order to increase Arab states' share of tomorrow's energy.

RCREEE is a membership-based organization with thirteen Arab countries among its members. Through its solid alliance with the League of Arab States, RCREEE tackles each country's specific needs and objectives through collaborating with Arab policy makers, businesses, international organizations and academic communities in key work areas: capacity development and learning, policies and regulations, research and statistics, and technical assistance. The center is also involved in various local and regional projects and initiatives that are tailored to specific objectives.

RCREEE strives to lead renewable energy and energy efficiency initiatives and expertise in all Arab states based on five core strategic impact areas: facts and figures, policies, people, institutions, and finance.

RCREEE was set up based on the Cairo Declaration, which was signed in June 2008 by government representatives from ten Arab countries. RCREEE acquired its legal status in August 2010 as an independent not-for-profit international organization through a Host Country Agreement with the government of Egypt.

RCREEE is financed through its member state contributions, government grants provided by Germany through the German Development Cooperation (GIZ), Denmark through the Danish International Development Agency (DANIDA), and Egypt through the New and Renewable Energy Authority (NREA). RCREEE is also financed through selected fee-for-service contracts.

RCREEE
Regional Center for Renewable Energy and Energy Efficiency
المركز الإقليمي للطاقة المتجددة وكفاءة الطاقة

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New Members *from page 6*

Organizational Structure

RCREEE is governed by a Board of Trustees, which consists of governmental representatives from member states and a 5-member Executive Committee consisting of the governmental and private sectors.

Located in Cairo, the RCREEE Secretariat maintains communication and interaction with relevant agencies and public institutions in member states and coordinates joint actions with cooperation partners. The Secretariat also implements the center's strategic and annual work plans with the help of RCREEE national focal points.

More information can be found at www.rcreee.org.

About GORD

The Gulf Organisation for Research & Development (GORD) is an official governmental body empowered with the authority to propagate the knowledge on sustainability as well as to promote healthy, energy & resource efficient, and environmentally responsible practices in Qatar and the MENA region.

GORD provides the framework by which Qatar will achieve its sustainable development aims, as it also supports the global efforts to meet the needs of the present without compromising the rights of future generations.

In today's challenge, GORD plays a pioneering role in the research and development of improving the sustainable building technology and techniques that aims to form a green shield through which it defends the strikes of the climate change phenomenon, as well as to structure a green weapon that combats pollution, carbon emissions and resource depletion.

GORD proudly supports the Qatar National Vision 2030 by addressing each of the four interconnected pillars of human, social, economic and environmental development in its plans and policies by:

- **Human Impact**
  Facilitating a better, more comfortable indoor environment, which in turn increases the quality of human life and increases productivity to sustain a prosperous society.
- **Social Impact**
  Setting the stage for a low-carbon future for the world's future generations. Since 2008 GORD Academy has graduated more than 1500 engineers in green building techniques.
- **Economic Impact**
  Helping to minimize the use of water and energy resources as well as reducing waste generation and carbon emissions.
- **Environmental Impact**
  Transforming the way builders and planners approach sustainable building, by developing harmony between economic growth, social development and environmental protection.

According to its holistic approach to sustainable built environment, GORD has launched a standard for excellence on sustainability also known as the Global Sustainability Assessment System (GSAS). This unique system is the most comprehensive sustainability rating system for the built environment amongst other systems around the world.

GORD is set to direct and supervise the implementation of the performance-based rating system, GSAS, which has been engineered to minimize the environmental footprint for most of the mega-government projects in Qatar (i.e., Lusail City, Ashghal Projects (PWA), Qatar Rail, Supreme Committee for Delivery and Legacy (FIFA 2022)) and many more.

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New Members *from page 7*

GORD has developed three centres of excellence: GSAS Trust, GORD Academy, & GORD Institute. These centres of excellence aim to support GORD's mission to create a sustainable, smart and healthy environment for living. The centres of excellence are:

- **GSAS Trust**

The centre is responsible for the development of sustainable building standards, and certifications for developments during the design, construction, operation phases, and all other future certification schemes.

- **GORD Academy**

The centre is responsible for offering memberships and certifications programs, which are designed to meet the educational needs of the professionals and practitioners working in the construction industry.

- **GORD Institute**

GORD Institute is the research hub of the organisation, established to advance human knowledge and investigate new approaches to achieve enhanced sustainability in the built environment. The centre runs scientific research programs unilaterally as well as in partnerships with local and international organizations.

The institute promotes collaborative interdisciplinary research across various interconnected fields of study such as architecture, civil engineering and construction, electrical engineering, material science, interior design, environmental psychology and behavioral science.

Dozens of new research projects are in the pipeline at GORD Institute. The research spans both academic and applied realms and is being funded by the government, Qatar Science and Technology Park (QSTP), Qatar National Research Funds (QNRF) as well as through joint ventures with other institutes. In 2011, the total budget of the institute was in excess of USD 15 million.

A building needs to be designed and built from the start with the environment in mind. Problems of energy efficiency and high consumption are nearly impossible to fix even with the best technology after the building has been built. That's why GORD Institute is focused on maximising efficiencies by bringing cutting-edge design and technology to every stage of construction. The institute also aims to tackle a variety of renewable energy challenges that exhibit strong potential for application in the local environment. Owing to the abundance of sunlight in the region all year round, several of the projects are focused on harnessing solar energy to achieve various ends. Research is also being conducted in wind energy, photovoltaic cells, bioclimatic architecture and network integration of renewable energies. Equipped with state of the art scientific infrastructure and world-class laboratories, the institute is in charge of these research projects throughout their life cycle, from testing the theory to building working prototypes.

More information can be found at www.gord.qa/

GORD

GORD Institute's built environment researches are distributed as followings:

- GORD's Intellectual Property
  - Solar hydrogen production
  - Fuel cells
  - The hybrid eco-car
  - Solar smart dynamic panels
  - Solar cooling
  - Solar power generation
  - Organic Thermoelectric Materials for Waste heat utilization
- Inter-Disciplinary Research
  - Low carbon concrete
  - Photovoltaic and thermoelectric hybrid system
  - Potential native plants for urban landscapes
- Research Demonstration Hub
  - Eco villa
- Knowledge Dissemination
  - The International Journal of Sustainable Built Environment (IJSBE)

SHC Takes on New Generation Solar Cooling

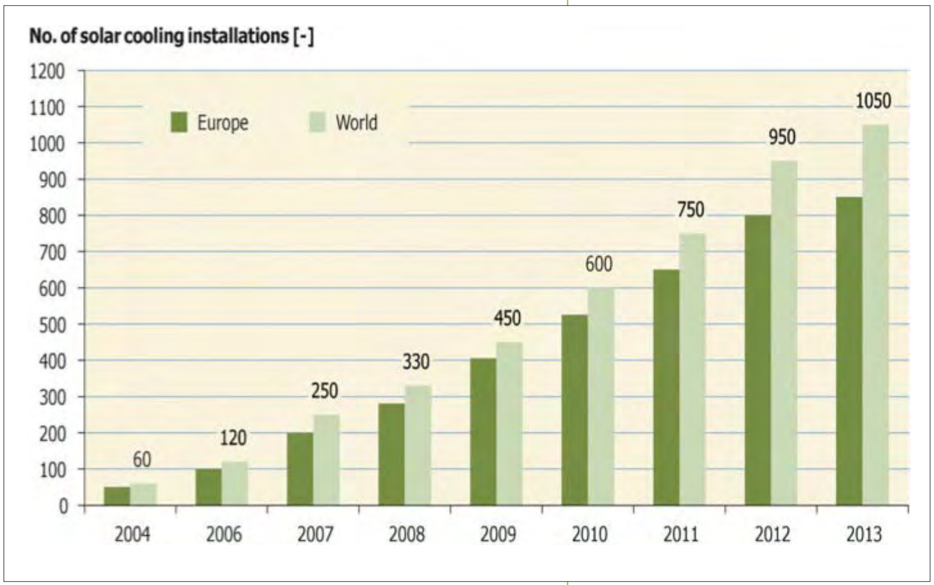
Task 48 & Task 53

Solar cooling technology is faced with a very exciting challenge as the air conditioning market continues its steady growth, especially in sunny and developing countries. Part of this challenge is to create a strong and sustainable market for new generation solar cooling systems.

Solar cooling is such an important topic for the SHC Programme that there are two cooling projects underway – *Task 48: Quality Assurance and Support Measures for Solar Cooling,* which is developing a set of tools, procedures and documents to improve the quality of the existing solar cooling technology, especially in the range of cooling power beyond 30 kWcooling and the new *Task 53: New Generation Solar Heating and Cooling*, which started its three and half year run in March 2014 to complement the work concluding in SHC Task 48.

Cooling 2014

Most cooling and refrigeration systems are still powered by electricity, and thermally driven cooling technologies are largely used in combination with waste heat, district heat or co-generation units and occasionally with solar thermal technology. Over the last decade, about 1,000 installations have been realized, mostly within the framework of research and demonstration programs. Several years ago, a commercial market began to emerge in the residential sector in Mediterranean countries (e.g., Spain) and in the commercial building sector in Asia (e.g., India, Singapore, China). Solar cooling technology has not grown as fast or as extensively as expected, but the technology has reached a level of early market development. The components are mature and available, a significant number of reference installations have been realized worldwide, and the technology has shown that significant energy savings are possible, but the financial risk for parties involved in the solar cooling business is still not clear.



▲ **Solar cooling systems in operation.** (SHC Solar Heat Worldwide 2014 Sources: EURAC, Fraunhofer ISE, ROCOCO, Solem Consulting, Green Chiller, TecSo)l

SHC Work

The main objective of SHC Task 53 is to assist with strong and sustainable market development of a new generation of solar cooling systems. This will be achieved by focusing on packaged solutions, pre-engineered systems with small capacities for the following building types: single family houses, small multi-family buildings, offices, shops, commercial centers, factories, hotels. All of these buildings can be grid connected or off grid in the case of photovoltaic (PV) cooling and heating.

The main scope of the Task is the direct coupling between solar and a cold production machine. However, special configurations and control strategies will be considered in certain

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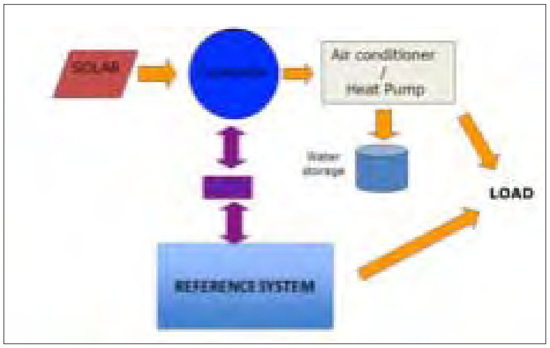
Solar Cooling *from page 9*

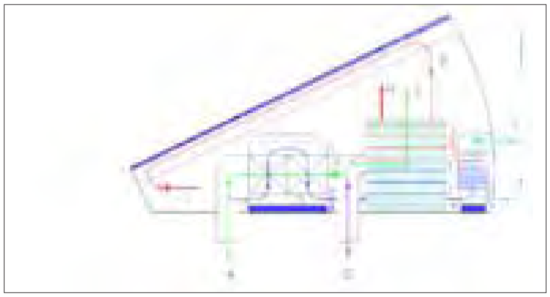
countries, for example in Central Europe, to allow for the maximized use of PV power direct for heating/cooling even without direct coupling. The cooling and heating power range to be covered is from 1 kWcooling/heating to several tens of kWcooling/heating.

The Task is structured to create a logical follow up on earlier SHC work (Task 38, Task 48) by trying to find solutions to make the solar driven heating and cooling systems cost competitive. This major goal will be reached through the five levels of activities:

1. Investigation of new small to medium size PV & solar thermal driven cooling and heating systems
2. Proof of cost effectiveness of the solar cooling & heating systems
3. Investigation of life cycle performances on energy and environmental terms (LCA)
4. Assistance with market deployment of new solar cooling and heating systems for buildings worldwide
5. Increasing energy supply safety and influencing the virtuous demand side management behaviors.



Principle scheme for a PV cooling concept. (Source: TECSOL)



Concept for compact solar thermal air conditioner based on fixed & cooled adsorption beds. (Source: SolarInvent)

State of the Art

At the end of 2014, Task experts will report on the state-of-the-art new generation solar cooling and heating systems commercially available or close to entering the market.

Several manufacturers including in Switzerland (Cosseco), France (Freecold), US (Lennox) and China (Midea) are marketing systems that directly couple PV and heat pumps. In addition, Sweden (Climatewell) and Italy (Solarinvent) are close to introducing to the market very innovative solar thermal cooling systems with the clear ambition to reach cost competitiveness.

A complete chart presenting these products with their features, performances (PER savings, electrical efficiency) and costs will be available to show a clear picture of this revolutionary, young and raising market.

SHC Task 48

Quality Assurance and Support Measures for Solar Cooling

Duration
October 2011 - March 2015

Operating Agent
Daniel Mugnier
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Webpage
http://task48.iea-shc.org/

Participating Countries
Australia
Austria
Canada
China
France
Germany
Italy
United States

SHC Task 53

New Generation Solar Heating and Cooling

Duration
March 2014 - June 2017

Operating Agent
Daniel Mugnier
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Webpage
http://task53.iea-shc.org/

Participating Countries
Australia
Austria
China
France
Germany
Italy
Spain
Sweden
Switzerland

Solar Energy in Urban Planning

Task 51

The built environment accounts for over 40% of the world's total primary energy use and 24% of greenhouse gas emissions. A combination of making buildings (refurbishing and new developments) more energy-efficient and using a larger fraction of renewable energy is therefore a key issue in reducing the non-renewable energy use and greenhouse gas emissions. More solar energy is one important part of this development, where the urban fabric uses ***passive solar*** *gains and daylight to reduce the energy use in buildings and for lighting outdoor environments, as well as to improve the inhabitants' comfort indoors and in urban outdoor areas and* ***active solar*** *energy systems are integrated into the renewable energy supply to reach sustainable solutions.*

SHC Task 51: Solar Energy in Urban Planning is one of two SHC projects on this topic. The objective of this Task is to support urban planners, authorities and architects as they develop urban areas, and eventually whole cities, with architecturally integrated solar energy solutions (active and passive). To achieve this objective, experts from 10 countries are collaborating to develop processes, methods and tools capable of assisting cities in developing long-term urban energy strategies that also include heritage and aesthetic issues. A valuable outcome of this work will be to strengthen solar energy in urban planning education at universities by testing and developing teaching material for architecture, architectural engineering and/or urban planning programs. This material will also be pertinent for postgraduate and continuing professional development courses.

The scope of the Task includes solar energy issues related to new and existing urban area development and sensitive/protected landscapes (solar fields). In order to achieve a substantial contribution to the increased use of solar energy, SHC Task 51 is focused on how to improve and accelerate the integration of solar energy in urban planning that respects the quality of the urban context. The main work is on active solar strategies due to the great need for development in this area as it relates to urban planning. The Task is organized in four main activities:

Subtask A: Legal framework, barriers and opportunities
(Leader: Mark Snow of UNSW, Australia)

Subtask B: Processes, methods and tools
(Leader: Marja Lundgren & Johan Dahlberg of White Arkitekter, Sweden)

Subtask C: Case studies and action research
(Leader: Annemie Wyckmans & Carmel Lindkvist of NTNU, Norway)

Subtask D: Education and dissemination
(Leader: Tanja Siems & Katharina Simon of BUW, Germany)

Subtasks A through C reflect different stages in the urban planning process. Subtask A sets the current boundary conditions for solar integration, deals with the assessment of available potential and elucidates opportunities. Subtask B deals with processes, methods and tools and developments for the applied phase related to specific situations (new development areas, existing urban areas, landscapes). Subtask C focuses on implementation issues: tests of processes, methods and tools, tests of concepts (e.g., NZEB/NZEC) through case stories and showing good examples as case studies. Finally, Subtask D covers dissemination focused on tertiary education and continuing professional development (CPD).

The following are examples of activities from Subtasks B and C.

SHC Task 51

Solar Energy and Urban Planning

Duration
May 2013 - May 2017

Operating Agent
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Webpage
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Participating Countries
Australia
Austria
Canada
Denmark
France
Germany
Italy
Norway
Sweden
Switzerland

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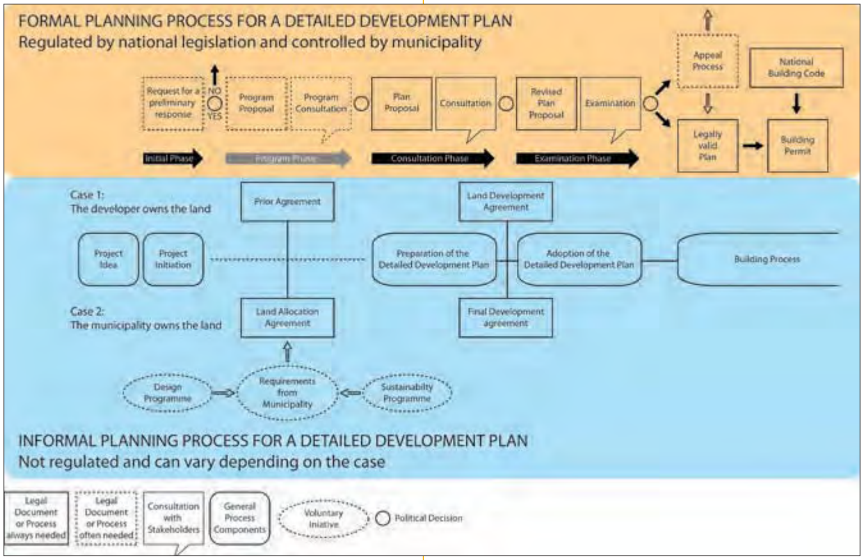
Subtask B: Processes, Methods and Tools

Sutask B aims to develop processes, approaches, methods and tools capable of assisting urban planners, authorities and architects in developing a long term urban energy strategy. There is an urgent need for different professional backgrounds to evaluate the relevant aspects of active solar in an urban planning process complementing optimal solar potential studies.



▲ **Figure 1. Example of planning process in Sweden.**

The work within Subtask B can be divided into three parts:

1. To identify aspects among existing planning processes, approaches, methods and tools that enable integration of solar energy in urban planning, and to elucidate needs for development.
2. To develop and/or improve urban planning processes in order to facilitate passive and active solar strategies in urban structures.
3. To develop new and/or improved tools, methods and knowledge.

The expected outcomes are:

- A review of the current status of solar energy in urban planning, including legislation and planning processes
- New or improved approaches, methods and tools
- A synthesis, in the form of guidelines, to integrate solar energy through the urban planning process

Some of the on-going work is to describe and compare legislation and planning processes in different countries and in local contexts. One task is for each participating country to describe their planning process through an illustration (see example in Figure 1). The initial findings are that both legislation and planning processes can be vastly different. To be able to reach the overall objective, a generic process model that can be used to describe urban planning in all participating countries needs to be developed. It has also become clear that tools in very early design stages need to be simple and user friendly while tools and methods in later stages can be more complex.

▲ **Figure 2. Illustration of a future section of the Stockholm Royal Seaport. The seaport is a case story in SHC Task 51. A more detailed architectural design will be developed through a competition that will use the Sunscape Index to evaluate solar aspects.** (Illustration: Aaro Designsystem)

Another finding is that the planning processes may not be comparable between different environments: new urban areas, existing urban areas and landscapes. Issues relating to solar energy integration are also very different between environments. In new areas there are a multitude of solar potential tools available today but there are few multi-criteria tools that also consider other aspects such as economics. In existing urban areas, cultural heritage and urban densification are two common issues that need to be dealt with. Here, there are examples of on-going work where solar potentials have been combined with, for example, zoning maps (cultural heritage). With landscapes, one of the issues raised is to find double functions for solar fields.

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Urban Planning *from page 12*

Example of Action Research in Stockholm, Sweden

During the 2nd quarter of 2014 work on strategies for assessing active solar in urban planning competitions was carried out on a Case Story (action research) of the Stockholm Royal Seaport in collaboration between the Swedish team of SHC Task 51 and the City of Stockholm (Figure 2). Stockholm Royal Seaport is one of Stockholm's environmental profiled areas and has set targets for solar energy in all new developments. The assessment criteria for solar in new buildings beyond the solar potential are load matching, economy and architectural aspects.

An assessment tool developed in earlier applied research was adjusted in a pilot version for city competition processes in the Swedish context. Aspects that are necessary to assess in the competition stage for land development in Stockholm are architectural and economical aspects, as well as load matching between the solar energy production and energy use in a cluster of buildings. During the 2nd quarter of 2014, the assessment tool Sunscape Index was developed for the competition phases and tested in a competition in the Royal Seaport arranged by the City of Stockholm. The easily used tool is Excel-based and evaluates load matching, economy and relates to the architectural expression (Figure 3). The goal is a simple user-friendly process tool for competition teams that can be used for evaluation, together with the many other aspects in urban planning competitions. The aim is to test the possibility to connect the tool to the traditional methods and tools used by architects and urban planners today, such as traditional solar shading studies. Aspects included in the pilot process using Sunscape Index for competitions are:

- Assessing the correlation between traditional solar shading studies made in urban planning and appreciation of relevant active solar areas to test in the Sunscape Index tool, where the irradiation data from PVGIS is used. The correlation is studied through a comparative study of SketchUp and Virtual Environment of three competition entries.
- Development of a user friendly Excel-tool (Sunscape Index) to assess load matching of PV and energy use together with relevant architectural aspects as orientation, inclination of façade and roof areas.

The idea is to develop approaches, tools and methods from the end-users' perspective, (i.e., urban planners and architects) so that they can incorporate them in their existing day-to-day work.

Subtask C: Case Studies and Action Research

The main objective of Subtask C is to facilitate replicability of successful practices. So far, a diverse set of cases are located in Australia, Austria, Canada, Denmark, France, Germany, Italy, Norway, Sweden and Switzerland. The cases will be actively used during the Task to learn about the approach to solar energy in urban planning in the different countries as well as to test and evaluate new strategies and methods.

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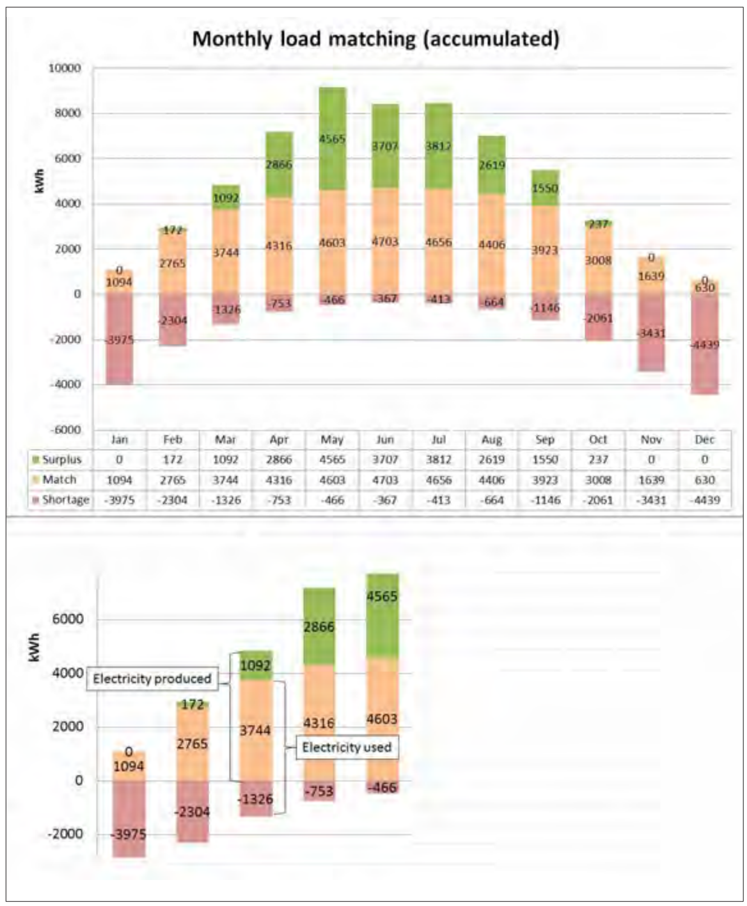


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Surplus	0	172	1092	2866	4565	3707	3812	2619	1550	237	0	0
Match	1094	2765	3744	4316	4603	4703	4656	4406	3923	3008	1639	630
Shortage	-3975	-2304	-1326	-753	-466	-367	-413	-664	-1146	-2061	-3431	-4439

▲ **Figure 3. The Sunscape Index tool is used during the early urban planning phase. It shows the outcome for the tested surfaces in terms of load matching: Green is the production of electricity beyond the need, Beige is the matched production, Pink is the lack of electricity. The user adds the profile of the building, the amount of square meters of useable area and surfaces at a certain angle and orientation. As seen in Figure 3, March to October are the primary months for solar energy production in Sweden.**

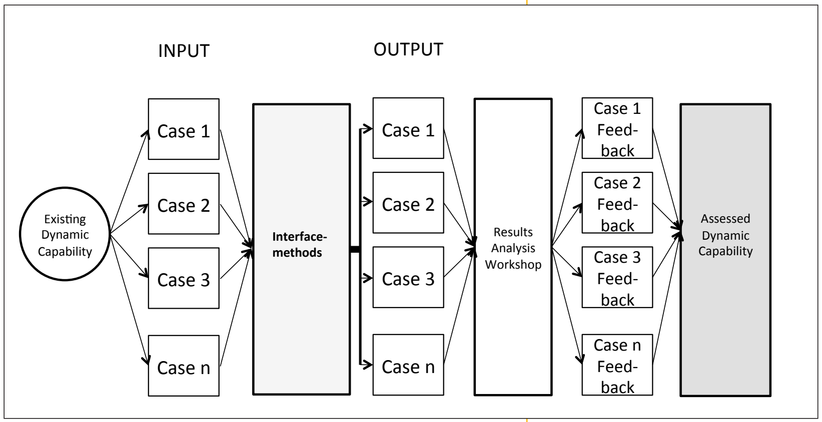
The expected outcomes are:

- Database of best practices
- Documentation of activities supporting the creation and management of action research in each participating country (exhibitions, public hearings, quality pro-grammes, jury work, presentations to decision makers, interviews, legislation work, creation of incentives etc.)
- Documentation reports on testing of supportive instruments in partner cities (preparation, implementation and assessment of results and linked to Subtask B, see above)

To be able to compare such a diverse set of projects, a versatile yet comprehensive tool is needed. Du Plessis and Cole (2011) propose a paradigm shift in sustainable building that incorporates an approach that is dynamic in nature in terms of accepting the unpredictable and constantly changing, complex and adaptive nature of projects and allows for an iterative process. A dynamic capability approach is taken. Here, dynamic capabilities are considered as a collective activity of stakeholders embedded within a social and physical context where projects continuously adapt to changing environments in pursuit of improved effectiveness. The approach comes from the acknowledgement that construction projects work in a context of uncertain environments, with long time horizons and contain a diverse range of projects. The different projects involved in Subtask C share theses characteristics.

Long Time Horizons

Construction projects tend to have long time horizons and deadlines are often stretched due to unforeseen changes in design, policy and technological development, etc. This is particularly true for the SHC Task 51 cases as solar energy technologies are still trying to be understood in the urban environment where approaches and processes are in a mode of change. How projects react to these changes over time is a necessary consideration during the project phase and how it feeds into decision-making.



▲ **Figure 4. The dynamic capability evaluation framework.**

Uncertain Environments

Construction projects are temporary organisations incorporating diverse groups that are transient, unfamiliar with each other, required to work together within tight time schedules and costs (Lindkvist, 2005). Therefore, people change during the process of the projects and there are different emphasises on goals at different stages of the project, which are also influenced by deadlines and budgets. The urban environment is particularly uncertain. Not only is the planning of individual buildings are open to change, but solar access is often dependent on the planning decisions of surrounding buildings.

Diverse Stakeholders

Teams are interdisciplinary and fragmented, which creates a challenging environment in establishing practices to re-configure knowledge for effective cross-project knowledge transfer (Bresnen et al., 2005). When considering strategy for construction projects, it is important to acknowledge that it is a collective endeavour enacted by a loosely defined group of individual actors (Green et al., 2008). The stakeholders involved in solar energy in urban planning are diverse with differing experiences, priorities and expertise. They include municipalities, building owners, solar energy experts, construction contractors, architects, etc.

The SHC Task 51 evaluation framework designed for the case examples accounts for all these

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Urban Planning *from page 14*

characteristics. An action research approach is being taken to reflect the dynamic context because evaluation that comes at the end of a project seldom achieves real benefit for the project itself. More value can be provided from evaluation up front, as the possibilities of influencing the process are greater the earlier they are contemplated (Samset, 2010). The proposed framework is to be used in the early, middle and late stages of the projects, which provides an integrative capacity within an iterative process where the individual experience as well as the collective arenas of knowledge can be articulated and codified. There is a two-step process:

1. Interface methods, such as interviews with stakeholder, participant observation/secondment, testing of tools/approaches and document analysis are used to coordinate tacit and explicit knowledge.
2. Feedback accumulated from the research teams in the different countries will be discussed with project stakeholders. The result of this meeting is the decision by the project to build on capabilities or change capabilities captured during the evaluation process.

The above process, outlined in Figure 4, illustrates how project capabilities are identified, evaluated and (if necessary) changed to react to the environment of the project. This highlights the enactment of dynamic capabilities in projects. Through the developed evaluation framework, we attempt to identify how dynamic capabilities are enacted in practice providing an integrated knowledge approach to ongoing projects and informing projects when change is necessary which is as important as the act of change. Therefore, developing lessons learnt within projects and across projects helps build and replicate successful practice.

Understanding that renewables are key to the success of any sustainable urban environment, the SHC Programme has initiated two projects dedicated to solar and cities. *SHC Task 51: Solar Energy in Urban Planning* is focused on architecturally integrated solar energy solutions (active and passive) for urban areas and *SHC Task 52: Solar Heat and Energy Economics in Urban Environments* is focused on the analysis of the future role of solar thermal in energy supply systems in urban environments. To learn more about these projects visit *SHC Task 51: Solar Energy and Urban Planning*, and *Task 52: Solar Heat & Energy Economics*. A related completed project is *SHC Task 41: Solar Energy and Architecture*.

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A valuable outcome will be strengthening the solar energy curriculum in urban planning education at universities by testing and developing teaching material for architecture, architectural engineering and urban planning programs.

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Global Solar Certification Network Established

On March 13th, 2014 the Global Solar Certification Network (GSC-NW) was officially established at Las Palmas de Gran Canaria on the Canarias Islands in Spain.

The main goal of the Global Solar Certification Network is to harmonize the certification and testing procedures of solar thermal components and systems all around the globe. For this purpose, representatives from industry, product certification organisations, solar thermal test laboratories and the major existing certification schemes, such as Solar Keymark, SRCC, IAPMO and Golden Sun, are working together. The network's first collaborative action will be to develop a global certification scheme for solar thermal collectors.

▲ **Members attending the constitutional assembly of the Global Solar Certification Network (GSC-NW) held March 13, 2014 at ITC (Instituto Tecnológico de Canarias) in Las Palmas de Gran Canaria, Spain.**

At its constitutional assembly held at the ITC (Instituto Tecnológico de Canarias) the Global Solar Certification Network approved its first version of the working rules and established a board with members representing the key sectors – industry, certifiers and test laboratories. The elected officers are:

Chairman: Dr. Harald Drück, Head of the Research and Testing Centre for Thermal Solar Systems (TZS) at ITW, University of Stuttgart, Germany and chairman of the Solar Keymark network

Vice Chairman: Les Nelson, Vice President of IAPMO's Solar Heating & Cooling Programs, USA

Treasurer: Eileen Prado, Executive Director of Solar Rating & Certification Corporation (SRCC), USA

Secretary: Peter Markart, Director of Research and Development at GREENoneTEC, Austria

Manager: Jan Erik Nielsen, SolarKey International, Denmark and secretary of the Solar Keymark Network

The activities leading to the establishment of the Global Solar Certification Network were performed within the framework of *SHC Task 43: Solar Rating and Certification*

The next meeting of the Global Solar Certification Network will take place on October 8-9, 2014 in Beijing, China.

If you would like more information on the activities of the Global Solar Certification Network (GSC-NW) please contact the SHC Task 43 Operating Agent and GSC-NW manager, Jan Erik Nielsen manager@gsc-nw.org.

Solar + Heat Pump Systems Final Results

Task 44

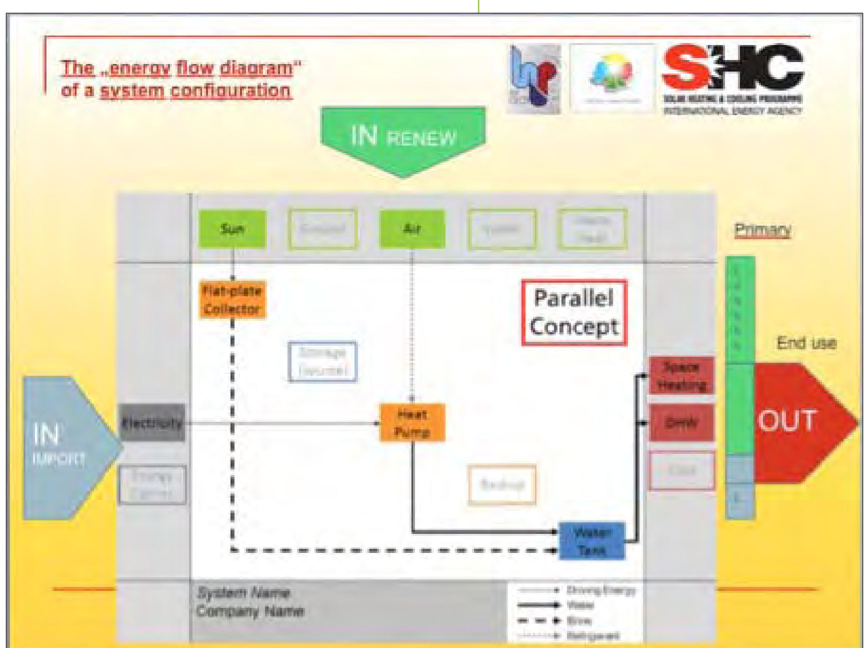
SHC Task 44 on solar and heat pump systems wrapped up its work at the end of 2013. The participants have been hard at work compiling the results for dissemination at workshops, in journals, on the web, etc. The culminating document will be a Solar and Heat Pumps Handbook that will be published Wiley-VCH later this year.

SOLAR + HEAT PUMP

Task participants from the SHC Programme and the IEA's Heat Pump Programme collaborated for the past four years to assess the performance and suitability of combined systems using solar thermal collectors and heat pumps. The main conclusions from this international project are summarized below.

Systems Analysis

- More than 80 manufacturers from eleven countries provided information on their systems available on the market from 2010-2012.
- The survey showed that the concept of combining solar heating and heat pumps (SHP) is a fascinating idea for the HVAC industry since a clear market aim is to supply complete systems rather than components, and the SHP combination can deliver both heating and domestic hot water all year long.
- A great variety of combinations of solar collectors and heat pump were found to be present on the market.
- The work of Task 44 has brought some order and clarification to the systems by establishing a clear classification of solutions – Parallel, Serial, Regenerative, and More Complex systems (P, S, R and C).
- Task participants also established a way to represent any combination in a systematic energy flow chart diagram that simplifies understanding of a system without losing information. This chart is available as a simple Excel tool from the SHC website. Figure 1 shows and example of the parallel concept of a SHP system.
- Surveys showed that there is a need for test methods and performance factor definitions since a combination of solar heating and heat pumps is still considered a complex system.



▲ **Figure 1. A parallel concept of SHP described with the Task 44 system.**

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Solar + Heat Pump *from page 17*

Systems Monitored In-situ

- Participants provided 1-2 years of monitored results from 50 different systems in seven countries, covering not only the variety of systems on the market, but also prototype systems. The variance of performances, however, was however to be large. Seasonal performance factors (SPF) from as low as 1.5 to a very good 6 were measured.

- Reasons for the variety of results were analysed and are explained in the Subtask A reports as well as in the Handbook to published later this year.

- Although Parallel systems are the most common and the simplest to operate, high performing systems were found in all 4 identified categories (P/S/R/C), and good integration of all components was shown to be possible. Some best practice examples have been reported and will appear in the Handbook.

Simulation Work

- Task 44 has shown that basic models for simulating components in solar and heat pump systems are available. Features have been analysed, reported on, and recommendations for choosing an adequate model have been formulated in Subtask C reports.

- Simulations and field monitoring have shown the great importance of storage in a combined system and also of storage stratification for improved performance.

- There is a need of data for modelling variable-capacity or variable-speed heat pumps and special heat pumps based on advanced concepts. Models are not currently available for these complex machines and thus reduces our capacity of finding optimal combinations.

- There is a lack of simulation models for the complex effects that were shown to appear in water storage tanks, namely, the mixing of heated water and the loss of exergy due to high velocities of incoming flow or some poor introduction geometry. CFD (Computational Fluid Dynamics) 3D software can be used for design purposes, but not for system optimization.

- Task participants set up a framework for simulating SHP systems in different climates and for different loads. The framework is an international collaborative work and will be very useful for national work as well. All relevant documents for this framework are available on the SHC website.

- Task participants simulated more than 20 different system concepts using the common tools.

- Simulation results show that the solar benefit contribution to a SHP system can be substantial when optimal arrangement and a good control strategy are considered.

- Design recommendations were formulated based on simulation results for industry engineers.

Performance Assessment

- In terms of reporting performance of an installation, Task participants showed that there is a need for different performance figures for different purposes, such as energy evaluation, environmental analysis or economic aspects. These various performance factors were derived in a Subtask B report.

- There is a need to take all components into account in any performance calculation (pumps, controllers, displays, fans, valve actuators, etc.) as this can make the difference between a good system and an unacceptable one, (i.e., with too low a seasonal

SHC Task 44

Solar and Heat Pump Systems

Duration
January 2012 - December 2013

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http://task44.iea-shc.org/

Participating Countries
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Denmark
Finland
France
Germany
Italy
Portugal
Spain
Sweden
Switzerland
United States

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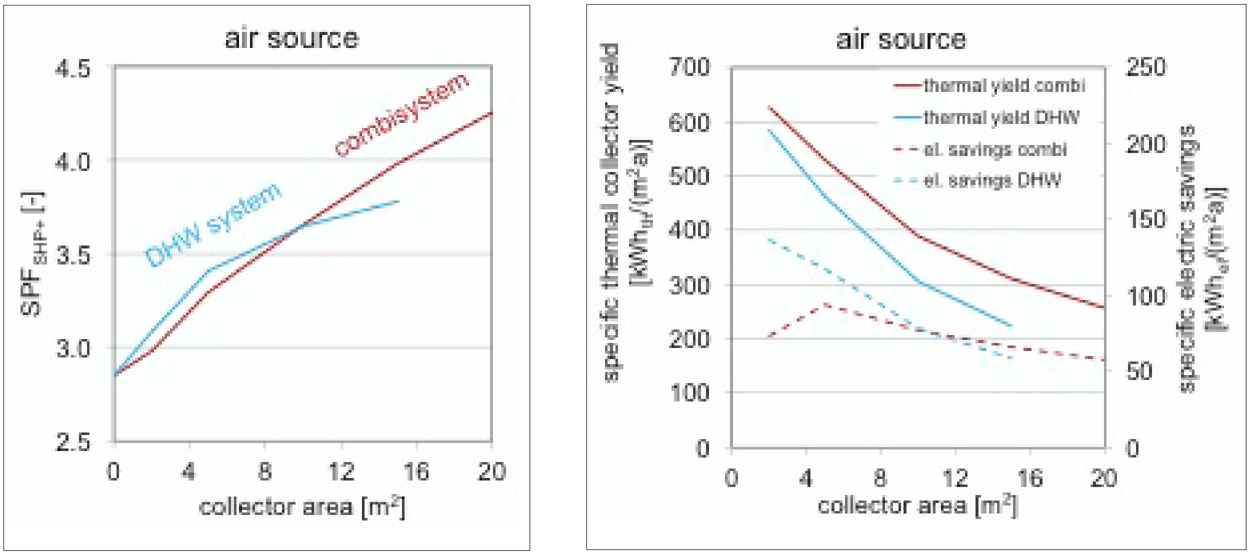
Solar + Heat Pump *from page 18*



▲ **Figure 2. What does solar heating add to the whole? Performance of air source solar and heat pump systems, where solar heating is used for DHW only or for a combine system with combined storage. (These are from simulations of SPF in reference conditions.) For more results refer to the Handbook to be published April 2015.**

performance factor (SPF) when auxiliary electricity is considered). And auxiliary electricity should be considered in all cases.

- System boundaries were defined in order to calculate all relevant performance indicators. The method was derived from the energy flow diagram describing all flows in a system that can be applied to any kind of energy system (solar cooling for instance), and not only to solar and heat pump systems.

- Task participants derived the correct definitions for System Performance Factors that take the overall system into account. Engineers and manufacturers can refer to the Task work to specify the SPF within common boundaries. This is a necessary basis for any system comparison.

Laboratory Testing

- Laboratory testing is important because SHP is a complex system with complex dynamic interactions. System testing is fundamental to the process of developing SHP systems and can provide relevant information for performances, failures, default behaviour, etc. in a short time period. Test sequences over twelve days were used to test several types of systems in different European laboratories.

- There are different methods of testing SHP in laboratories over this predefined cycle of twelve days. Task participants have described the main ones used in the four participating laboratories.

SHC Task 44 has delivered valuable information on the design and the performance of combined solar and heat pump systems. Participants have developed tools to simulate any type of system combination, as well as performance indicators that should be calculated for fair comparisons between systems. Comprehensively monitored systems have shown that high SPF values can be delivered if design and commissioning are carefully carried out.

Solar heating can be a good heat source for heat pumps as an alternative or a complement to air and ground sources.

Reports, including the publication announcement of the Handbook in April 2015 can be found on the SHC Task 44 webpage. Also, a Solar and Heat Pump Position Paper is available, http://www.iea-shc.org/position-papers

SHC Publications

Don't miss reading, using and referencing these important SHC publications and databases.

Solar Cooling

Solar Cooling Handbook - A Guide to Solar Assisted Cooling and Dehumidification Processes

This is "the" reference book on the subject of solar thermal air conditioning. With over 350 pages covering details on components, systems and design, economic analysis of technology and field experience for both small and large systems. All sorption technologies are discussed by scientists from 20 countries.

The book was published as part of SHC Task 48: Quality Assurance & Support Measures for Solar Cooling Systems

Price: France: 75, Other: 82

Industrial Process Heat

Overheating Prevention And Stagnation Handling In Solar Process Heat Applications

This overview of stagnation and overheating in solar assisted process heat applications focuses on the following topics:

· Definition of terms
· Introduction to stagnation and overheating of collectors and collector fields
· Overheating prevention and control measures for solar process heat applications
- Measures for solar process heat applications with non-concentrating collectors
- Special challenges for concentrating and tracked collectors
· Best practice examples of implemented measures
· References to related literature

Net Zero Solar Energy Buildings

Solution Sets and Net Zero Energy Buildings: A Review of 30 Net ZEBs Case Studies Worldwide

Thirty fully documented Net ZEB case studies cover technical and non-technical information. The projects are classified by building type (residential/non residential) and by climate type (cooling dominated, heating and cooling dominated, heating dominated). Each case study also includes project contact.

Net ZEB Evaluation Tool

This excel-based tool can assess balance, operating costs and load match index for predefined Net ZEB definitions. The tool supports the evaluation of solutions adopted in new building design with respect to different Net ZEB definitions balance in monitored buildings (for energy managers), implementation processes of Net ZEBs within the national normative framework (for decision makers).

Solar and Heat Pump Systems

System Performance Calculation

This free education material addresses the definition of several performance indicators developed within SHC Task 44/HPPAnnex 38. This presentation is designed to be used when teaching on the topic of olar plus Hehat pump systems. The presentation guides you through the process of SHP analysis using a clear format and clarifying text and graphs.

Solar and Heat Pump Position Paper

This Position Paper presents an overview of Solar + Heat Pump technology, its potential, current barriers and actions needed. It provides an inside view on why and how solar and heat pump systems should be supported and promoted.
Will get link soon

Compact Thermal Energy Storage

Development of Space Heating and Domestic Hot Water Systems with Compact Thermal Energy Storage

Long-term, compact thermal energy storage (TES) is essential to the development of cost-effective solar and passive building-integrated space heating systems and may enhance the annual technical and economic performance of solar domestic hot water (DHW) systems. This report summarizes the work on the development of system concepts and the technical evaluation of proposed systems and the storage components of these systems through predictive modeling and laboratory testing.

MarketPlace

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

SHIP Database

Solar Heat for Industrial Processes (SHIP) is at the early stages of development, however, it is regarded to be one of the solar thermal applications with the highest potential. Currently there are 120 operating solar thermal systems for process heat, with a total capacity of about 88 MWth (125,000 m^2). The potential for market and technological developments are great as 28% of the overall energy demand in the EU27 countries originates in the industrial sector and the majority of this is heat below 250°C.

The SHIP database contains information on existing solar thermal plants that provide thermal energy for production processes in different industry sectors. Each plant description contains information on the size of the collector field, collector technology, integration point in the production process, etc. The data was collected through a survey sent to different solar companies. A key function of the database is that the user can created his own statistics, such as share of collector technologies, size of collector field per country or industry sector and cost per square meter from all the solar thermal plants in the database.

This free online database was developed within the framework of *SHC Task 49/SolarPaces Task IV: Solar Heat Integration in Industrial Processes*, and is designed to be a living platform with new information continuously being added.

To use the database or learn more about SHC Task 49 visit the SHC Task 49 webpage http://task49.iea-shc.org or contact the Task Operating Agent, Christophe Brunner, c.brunner@aee.at

New Software Tool for Solar Cooling, Heating and Hot Water Pre-Installations

PISTACHE (Pre-sizing tool for solar cooling, heating and domestic hot water production systems) is a software tool to pre-size and evaluate the performances of solar installations for cooling, heating and domestic hot water preparation, with or without an energy back-up system.

PISTACHE provides a quick and easy calculation of a solar installation to help the user pre-size the installation and obtain the energy balance and annual performance indicators.

The tool's user interface allows the user to upload an input file, fill the parameters and choose the main component characteristics. The tool also includes calculation tables, material databases and a step-by-step help file.

To use PISTACHE you will need the annual hourly data with meteorological data for the site, the cooling and heating loads and the net domestic hot water demand. The data must be provided in a text file in the specified format given in the step-by-step help file.

PISTACHE is a free tool developed within the framework of *IEA SHC Task 48: Quality Assurance and Support Measures for Solar Cooling* by TECSOL and the CEA at INES in the MeGaPICS project, and partly financed by the Agence Nationale de la Recherche (ANR) in the framework of the HABISOL program.

For more information on this and other projects visit the SHC Task 48 webpage or contact the Task Operating Agent, Daniel Mugnier, daniel.mugnier@tecsol.fr

New Partnership with Solarthermalworld.org

Solarthermalworld.org, the global knowledge-based web portal, now has a dedicated IEA SHC section to publicize key IEA SHC publications: http://gstec.stg.o-a.be/iea-shc/iea-shc.

This collaboration connects the SHC Programme's work in the field of research, development, demonstration (RD&D) and test methods for solar thermal energy and solar buildings with Solarthermalworld.org's leading website for solar thermal energy professionals. This new resource is a top "go to" site for researchers, policy makers, industry, utility and business representatives, builders, architects and teachers, and the list goes on.

Solarthermalworld.org is your link to news and scientific research items on the international solar thermal industry. The website gathers over 3,800 news articles and scientific papers with the latest updates, background information and research on the development of the solar thermal sector. After seven years of activity, the website has a monthly average of 9,000 visitors. The monthly Newsletter is circulated to a list of over 5,400 contacts worldwide and over 25,000 people are reached via our active social media presence.

IEA programme SHC

The International Energy Agency was formed in 1974 within the framework of the Organization for Economic Cooperation and Development (OECD) to implement a program of international energy cooperation among its member countries, including collaborative research, development and demonstration projects in new energy technologies. The members of the IEA Solar Heating and Cooling Agreement have initiated a total of 50 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

S●LARUPDATE

The Newsletter of the IEA Solar Heating and Cooling Programme

Vol.60, October 2014

Prepared for the IEA Solar Heating and Cooling Executive Committee

by

KMGroup, USA

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