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Newsletter of the International Energy Agency Solar Heating and Cooling Programme

Solar+Conservation

Renovating houses to meet high energy standards

There are hundreds of exemplary renovation projects, but few have been systematically analyzed, and are at best only known about locally. With buildings accounting for up to 35% of the total energy consumption in many IEA countries, and housing being the largest energy consumer in the building sector, how energy is used is a critical factor for the builder, owner and occupant.

Experts in *SHC Task 37, Advanced Housing Renovation with Solar & Conservation* have worked for the past three years to develop a solid knowledge base on how to renovate houses to a very high energy standard and to develop strategies that support their market penetration. To draw attention to this work, a brochure series of exemplary buildings are being produced. Each brochure highlights the design and performance of the renovation project and describes the benefits, process and motivation for the renovation. Below are excerpts from two of the newest brochures. To view the full set of brochures go to http://www.iea-shc.org/publications/task.aspx?Task=37#67. Below are two new brochures highlighting buildings near Zurich.

Erlenweg Apartment Building in Volketswil, Switzerland

Located in the suburbs of Zurich, this apartment building was renovated to achieve higher energy efficiency, improve the façade's insulation, and add solar collectors on the roof and a ventilation system while meeting the owner's specific budget.

The Renovation

- Insulated facade, roof, basement ceilings, and heat and hot water pipes.
- Enlarged balconies on the east side.
- Installed new sun blinds on the south façade and insulated shutter boxes all around the building.
- Added glazed entrance and small wooden bicycle depot.
- Replaced roof and added solar vacuum collectors.
- Met Minergie Certification.

Energy Performance

Space + water heating (primary energy)

Before: 180 kWh/m²	After: 79 kWh/m² (Minergie Standard)	Reduction: 62%

Central gas heating is supplemented by new solar vacuum collectors with a solar storage capacity of 3,000 liters – 70% of the hot water production and 6% of the space heating is produced by the solar thermal collectors.

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In This Issue

Task Scope

- Single-family, duplex and row (terrace) housing; apartment buildings; and housing neighborhoods.
- Energy strategies to create a mix of cost effective 1) conservation measures, 2) renewable energy use, and 3) efficient back-up heating as part of non-energy related renovations.
- Strategies for increased market penetration of housing renovation in selected housing segments.
- Targeted primary energy uses include space heating, water heating and electricity for building technical systems.
- Occupant comfort: winter and summer thermal comfort, air quality and daylighting.

"The IEA report, *Energy Technology Perspective 2008*, presented a scenario to achieve a 50% reduction of CO_2 emissions by 2050, which is necessary to limit the global temperature increase to 2.4 degrees. In 2050, more than half of the existing building stock will still be standing so if this goal is to be achieved then 200 million residential buildings in the OECD countries will need to be renovated to a passive house standard by 2050. This is why SHC Task 37 is so important."

Fritjof Salvesen, *SHC Task 37 Operating Agent*

Segantinistr Apartment Building in Zürich, Switzerland

In a residential neighborhood of Zurich, this typical 1950s apartment building was renovated to replace and update specific elements of the building and to expand the rentable area. A special aspect of this project was the use of a prefabricated wood façade.

The Renovation

- Maximized living space by adding a new attic apartment and expanding the ground floor apartments.
- Renovated the building envelope to meet the Minergie-P Standard and to preserve the building's architectural quality.
- Installed new building technology systems – heating system, ventilation system, sanitation, and electrical installations.
- Added renewable energy – ground source heat-pump, solar collector and PV
- Renovated kitchen and bathrooms.
- Recycled building materials.

Energy Performance

Space + water heating (primary energy)

Before: 154 kW/m^{2}a After: 30 kW/m^{2}a (Minergie Standard) Reduction: 81%

The space heating and hot water are supplied by a ground-source heat pump and vacuum solar collectors on the roof of the balcony – 75% of the hot water production and 7% of the space heating is produced by the solar thermal collectors.

More information on advanced housing renovation with solar and conservation can be found on the SHC Task 37 web page at http://www.iea-shc.org/task37/index.html or by contacting the Operating Agent, Fritjof Salvesen, fs@kanenergi.no.

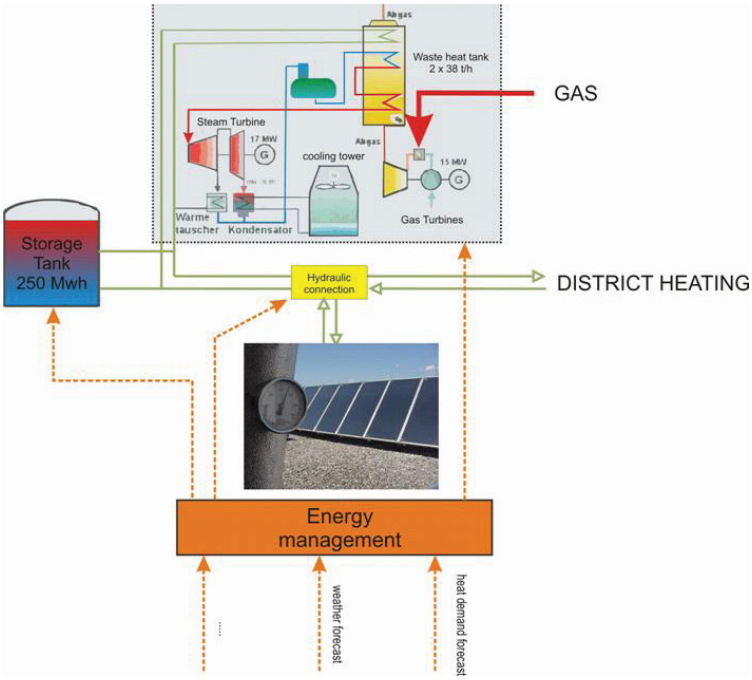
Solar Forecasting to Support District Heating in Austria

task 36

Energy management is relatively straightforward until thermal storage is introduced, and then energy management becomes a predictive operation and solar forecasts of several parameters are needed to operate the overall system in the most efficient way.

In Wels, Austria, an existing district heating grid, consisting of a gas-fired main heat source and a thermal storage tank, will be extended with a solar thermal feed-in. The existing system supplies approximately 72MW of thermal power to meet a heating demand of 156 GWh. With the addition of the solar thermal plant, it will be necessary to build in 'load management' as a fundamental component to coordinate the energy distribution, which will include optimization methods and the forecast of solar radiation ambient temperature.

The Austria Solar Innovation Center (ASiC), in cooperation with BlueSky Wetteranalysen, Elektrizitatswerke Wels AG, Wels Strom GmbH and the University of Linz, is working to support this project. They are researching the types of solar forecasts available and which of these will be needed for the optimal operation of the system. BlueSky Wetteranalyses and ASiC are working within IEA *SHC Task 36, Solar Resource Knowledge Management*, to test various solar forecasting schemes that are either in use or under development by several SHC Task 36 participants.



A schematic of the solar assisted district heating grid in Wels. The solar collector field is envisioned to be about 3,600 m². A storage tank with a capacity of approximately 250MWh is used to store the excess heat of the solar thermal plant.

The use of several energy sources and an energy storage unit requires a coordinated energy flow system. This system determines at every time instant the amount of energy coming from all of the energy sources. To operate the system most efficiently, one has to know which part of the needed heat can be covered by the solar thermal plant over the next few hours and days. SHC Task 36 is contributing to this analysis by investigating solar resource forecasting capabilities and determining their applicability to the Wels district heating system operations once the solar thermal panels and storage system are installed and implemented.

The reason for using such a system is to optimize the system's financial performance with minimum input. The optimization process involves a 3-step procedure: 1) to examine existing data on temperature, heat demand and solar radiation over the course of a year to establish a "precalculated" operating strategy, 2) to improve on this strategy on a daily basis by introducing solar forecast information, and 3) to further improve on system performance based on corrections to the system management by human operators according to actual conditions.

This plant is not yet in operation, but should start in a few months. Currently, a simulation of the operating environment is under development along with new optimizing algorithms. And, an assessment of forecast uncertainty is being performed by SHC Task 36.

This article was contributed by Gerald Steinmaurer of ASiC, steinmaurer.gerald@asic.at and Dave Renné, Task 36 Operating Agent, David_Renne@nrel.gov.

country spotlight

solar thermal in france

The French solar thermal system market has grown steadily since 2007 as the French authorities have been resolute in their efforts to promote the solar sector.

French Energy Policy

In France, the energy policy is driven by two main government initiatives:

- The POPE law of July 2005, which deals with Energy strategy in connection with the country's long-term "factor 4" objective (reducing the greenhouse emissions by a factor of 4 from 2005 to 2050). The goal of this law is to produce an additional 50% of renewable heat energy (15 MToe per year versus 10 MToe in 2003).
- The "Grenelle Environment Round Table" is a process aimed to define the key points of government policy on ecological and sustainable development issues. The "Grenelle Environment" was a debate organised during the summer of 2007 between the French government and representatives of the public sector (including professional associations, and citizen and environmental advocacy organisations).

The Golf Hotel in Saint-Raphaël (100 km from Nice) uses solar thermal collectors for their DHW needs and heating the swimming pool. The 90 m² of collectors cover 61% of the hotel's hot water demand, saving 37,400 kWh/year. The collectors also save 20,600 kWh/year in swimming pool heating.

Solar thermal is supported by the Government through financial incentives. These incentives are designed to support the production of 100,000 Toe each year until 2020, which represents the installation of 15 to 20 million cumulated m².

Financial Incentives for Solar Thermal

Two forms of financial support exist. One is for individual houses and the other for apartment and service sector buildings.

HEATING & DOMESTIC HOT WATER PRODUCTION IN FRANCE

	2004	2005	2006	2007	2008
DHW individual houses (m²)			150 000	165 000	193 000 (est.)
Heating individual houses (m²)			51 500	48 000	66 000 (est.)
DHW apartment buildings (m²)			22 000	40 000	57 000
Total *	55 340	121 500	223 000	253 000	313 000
Percentage change		+120%	+84%	+14%	+24%

* mainland France, without the overseas departments and territories

Homeowners tax credit

This financial measure is a tax credit for homeowners and not a reduction of the tax. Therefore, people who do not pay taxes can still receive a payment. The amount of the subsidy is half of the equipment price before taxes and does not include installation. The tax credit is applicable for heating and hot water solar systems with CSTBat or Solar keymark certified collectors.

In 2007, 153,850 m² of collectors were installed for both heating and hot water in individual residences. Unfortunately, monitoring is not required and so the heat production from this initiative is not measured and recorded.

Fond chaleur "heat funding"

This financial measure supports the production of hot water in apartments, office buildings, hotels and swimming pools. A minimum of 50 m² of collectors is required to be eligible, and heating and cooling solar system are not eligible for the "fond chaleur".

This subsidy is proportional to the heat production and the location of the building within the country. A certain amount of the subsidy is granted for monitoring so that energy performance can be measured for a ten year period.

The collectors must be CSTBat or Solar keymark certified and the building must comply with the French thermal heating regulation.

Contrary to the tax credit, this subsidy scheme provides a financial incentive to measure the solar heat production.

Solar Today

In 2008, France's solar thermal market experienced a significant growth of 24% from 2007. This growth is due to the financial incentives paid by the French government.

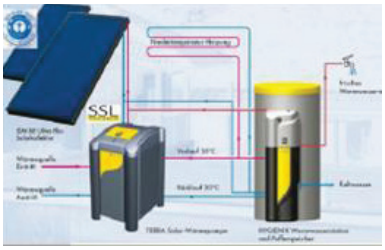
The heat produced from solar thermal systems is estimated to be 92,000 Toe.

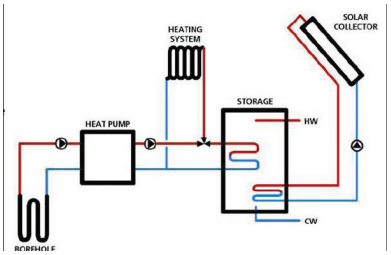
This article was contributed by the French Executive Committee member, Céline Coulaud of ADEME,

Solar + Heat Pumps

Be a part of this new work

HP + SOLAR





One system among 10. Is this good enough or can we do better?

Over the past few years, systems that combine solar thermal technology and heat pumps have been marketed to heat houses and produce domestic hot water. This new combination of technologies is a welcome advancement, but standards and norms are still required for its long term commercial success.

At this time, most manufacturers are developing systems without a clear framework of the best possible combination of the two technologies, and customers are lacking comparable approaches. Today, systems entering the market are far from being optimized and sometimes are too complicated to guarantee a lifetime free of problems or to operate efficiently.

What is needed is a systematic analysis of the different possible systems and their potential for application in different climates and under different boundary conditions. To begin to tackle this, the SHC Programme has initiated *Task 44, Systems using solar thermal energy in combination with heat pumps (HP+Solar).*

The scope of this new Task, which will begin in 2010, includes the following items:

- Small-scale residential heating and hot water systems that use heat pumps and any type of solar thermal collectors as the main components.
- Systems offered as one product from a system supplier/manufacturer and that are installed by an installer.
- Electrically driven heat pumps, but during the development of performance assessment methods thermally driven heat pumps will not be excluded.
- Market available solutions and advanced solutions (produced during the course of the Task).

To better focus on the current market demand, large scale systems (i.e., systems using any type of district network or systems for large buildings) are not included, nor are systems solely for cooling buildings. However, a heat pump that is used for both heating and cooling will be included in the performance assessment methodology as this "optional" feature should not be forgotten.

Task participants are thinking to divide their work into four Subtasks:

- Overview of solutions (existing, new) and generic systems
- Performance figures and performance assessment
- Modeling and simulation
- Dissemination and market supporting measures

Why Participate?

- The combination heat pump and solar will represent a large market share in future decades. In some regions, systems are already installed in 80% of new homes!
- An IEA framework provides a unique opportunity to meet and share with the experts from universities and industries working on thermal solar and heat pumps.
- We are attracting top engineers and manufacturers to the Task!
- Future systems will be sketched and new ideas will emerge from the exchange of practice, knowledge and experience.
- The prenormative work will produce materials to assess performance of combined systems, the definition of which is currently lacking.

For more information on this new work contact the Operating Agent, Jean-Christophe Hadorn, jchadorn@baseconsultants.com representing the Swiss Federal Office of Energy.

New Work

Harmonization of Testing Standards and Certification Requirements

The testing and characterization of solar thermal collectors and systems have been investigated from the inception of the IEA Solar Heating & Cooling Programme. Performance test procedures and characterization equations were originally developed for typical solar collector types under well-defined standard test conditions. Short-term tests also were developed to predict the long-term durability of standard collectors and systems.

Today, national and international certification bodies in many IEA participant countries still use these test procedures and characterization equations to determine a solar thermal product's performance and compliance with required safety and reliability standards. And, this poses a problem for the new and advanced solar thermal products continually being introduced to the marketplace and submitted to national certification bodies as the existing testing and characterization procedures can not always accommodate these new products or allow them to be evaluated in a reasonable and consistent manner.

"An example of why this SHC Task is needed is the current backlog in the US, which was partially a side effect of only two labs being certified to test to SRCC standards. What is needed is more consistency in the standards and testing and the mechanisms for the certifying bodies to work together."

KEVIN DEGROAT, Task Manager

The first official meeting of *Task 43, Advanced Solar Thermal Testing and Characterization for Certification of Collectors and Systems,* was held this month in South Africa in conjunction with ISO/TC180. This Task is unique in that it is bringing together testing laboratories, researchers, industry and representatives from certification bodies from around the world to identify gaps and shortcomings in solar collector and system testing procedures, to develop improved methods or approaches where they are needed, and to share best practices and methods. By coordinating and sharing research results and test procedures the Task encourages the adoption of consistent test standards and harmonization of certification and testing requirements to make it easier for manufacturers to have the tests applied to their products recognized and accepted in different countries.

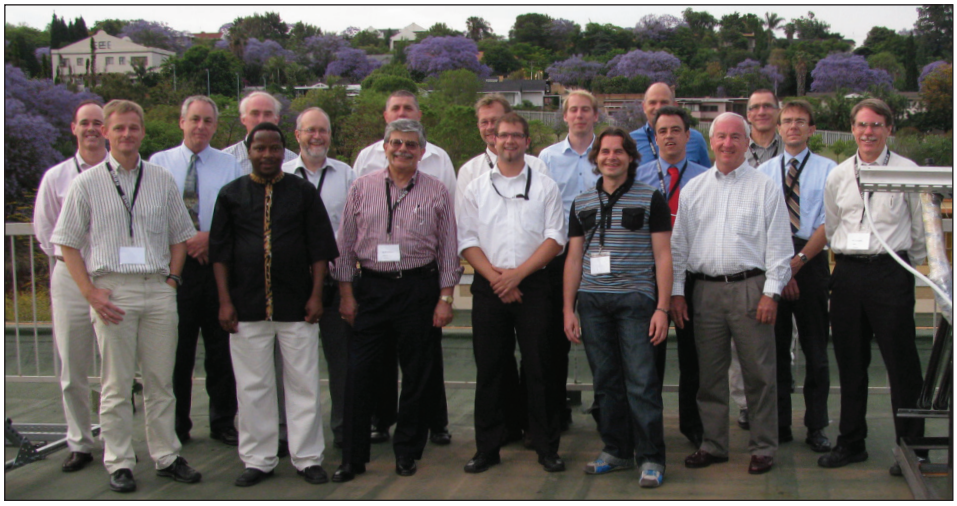
The Task work will revolve around research and round-robin testing coordinated between the QAiST project in Europe and programs in North America and Australia. The October Task meeting was an important first step in establishing a good working relationship with the ISO/TC180 group and its efforts in developing international standards. During this meeting, a strategy for engaging certification bodies in the Task and creating a framework for cooperation among international certification bodies responsible for solar energy was discussed by the participants. This will be a major topic for future work.

A second Task meeting is planned for February 8-10, 2010 in Stuttgart, Germany, with plans to include a half-day workshop for industry to become acquainted with testing and certification issues. More details will be posted on the Task 43 website, www.iea-shc.org/task43/index.html, once the agenda is completed.

In other news, since its official start there has been interest from India, China, Brazil and South Africa in the Task. We are encouraging those that are eligible to formally join the IEA SHC Programme and participate in the Task. Others will be kept informed of new developments and encouraged to join in efforts to harmonize testing standards and certification requirements as they develop.

Expected Results

Results of this work will be for industry, testing laboratories and certification bodies to use in improving and harmonizing testing and certification processes. The improvements that are made will then benefit consumers and policy makers by providing better information on the performance and benefits of solar thermal technologies.



Participants in Task 43 meet with members of ISO/TC 180 at the South African Bureau of Standards (SABS) in Pretoria, SA to begin work on the collector and system testing and certification work authorized under the new task. The group toured SABS' collector and system testing facilities during the meeting – this is a view from the lab roof where outdoor tests are performed.

- A road map of solar thermal testing and certification issues for collectors, approaches to improve existing systems and harmonize standards and certification.
- State of the art white papers on testing, measurement and certification issues specific to flat-plate collectors, evacuated tube collectors, air heating collectors, concentrating collectors for medium to high temperatures.
- Round-robin tests for flat-plate collectors, evacuated tube collectors, air heating collectors, and concentrating collectors for medium to high temperatures.
- If deemed appropriate, draft recommendations for revising performance test standards, qualification and safety test standards for specific collectors.
- Joint meetings with Solar Keymark, ISO, and other standards groups to discuss testing and certification issues and promote harmonization.
- A report on norms for systems testing and characterization that addresses system boundaries and definitions.
- A report on qualification and safety testing that identifies inconsistencies, gaps and problems and recommends actions to resolve key issues.
- A white paper on simulation and modeling tools that identify strengths, weaknesses, gaps in their capabilities, and inconsistencies in their application or interpretation.
- A white paper detailing research results on research on the effects of component/material substitution and extrapolating size have on actual system performance versus predictions and recommendations on how tests and standards for systems need to be adapted.
- A report examining the relation between test and characterization information and user experience – for example, testing and measurement as it relates to occupant comfort in space conditioning – with recommendations for improvements or new approaches.
- A report examining the connection between solar thermal system testing and measurement and measures of the public benefits of solar thermal systems, with recommendations for making testing, measurement and certification more effective as a foundation for benefits estimates.

For more information contact the Operating Agents, Les Nelson, lnelson@westernrenewables.com, Jan Erik Neilson, jan@solarkey.dk, or the Task Manager, Kevin DeGroat, kdegroat@antares.org.

IEA SHC programme

The International Energy Agency was formed in 1974 within the framework of the Organization for Economic Cooperation and Development (OECD) to implement a program of international energy cooperation among its member countries, including collaborative research, development and demonstration projects in new energy technologies. The members of the IEA Solar Heating and Cooling Agreement have initiated a total of 44 R&D projects (known as Tasks) to advance solar technologies for buildings. The overall Programme is managed by an Executive Committee while the individual Tasks are led by Operating Agents.

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SOLARUPDATE

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