SHC TASK 32: ADVANCED STORAGE CONCEPTS FOR SOLAR AND LOW ENERGY BUILDINGS

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TASK DESCRIPTION

The main goal of this Task is to investigate new or advanced solutions for storing heat in systems providing heating or cooling for low energy buildings.

The first objective is to contribute to the development of advanced storage solutions in thermal solar systems for buildings that lead to high solar fraction up to 100% in a typical 45N latitude climate. The second objective is to propose advanced storage solutions for other heating or cooling technologies than solar, for example heat pumps or fossil boilers in order to reduce cycling and thus to reduce pollutant emissions due to partial combustion.

The ambition of the Task is not to develop new storage systems independent of a system application. The focus is on the integration of advanced storage concepts in a thermal system (solar, heat pump or boiler) for low energy housing. This provides both a framework and a goal to develop new technologies.

The Subtasks are:

- Subtask A: Evaluation and Dissemination (Subtask Leader in 2006: Switzerland)
- Subtask B: Chemical and Sorption (Subtask Leader : Chris Bales, Sweden)
- Subtask C: Phase Change Materials (Subtask Leader: Wolfgang Streicher, Austria)
- Subtask D: Water (Subtask Leader: Harald Drueck, Germany)

The teams within Subtaks B, C and D are asked to set up a TRNSYS model of their system based on experimental work in order for Subtask A to compare all the options in terms of heat and cold storage for a reference case of a one family house in 4 climates.

Duration

The Task was initiated in July 2003 and was initially planned to be completed in December 2006. The Task has been extended 12 months until December 2007 in a decision at the 58th Exco meeting in December 2005.

ACTIVITIES DURING 2006

General

In 2006, two meetings gathered 20 experts from 7 countries, with an official participation from 7

countries (CH, S, A, DK, G, SP, NL) and the input from 1 other (F).
We have had 2 new teams in the Task: a group from Kassel University in Germany and a group from TNO in the Netherlands. EMPA from Switzerland was also able to officially participate from the last quarter on.

Subtask A: evaluation method and dissemination of results

The main activity of Subtask A during 2006 has been the follow up of the sales of our "State of the art" handbook on short term heat storage. It has been sold through internet from the beginning of 2006 for a price of 35 euros + shipping. Sales went smoothly about 1 copy per week without strong promotion.

The final reference conditions and the final reference system for comparing different storage options with the same framework has been issued by the Austrian team at the end of 2006 in its final form. It has been pre-tested by some of the participants and will be intensively used during 2007 by all teams. It is an important outcome of this Task for further simulation work on solar combisystems for heating and cooling of a one family house in 4 different climates.

The Task web site www.iea-shc.org Task32, has been updated with working documents and is the Task exchange platform with more thant 230 documents, presentations at meetings and articles about heat storage.

An electronic Newsletter will be issued at the beginning of 2007.

Subtask B: Chemical and sorption storage

Six projects are being investigated. Subtask B has promising technologies for dense storage. However the task is difficult. Material caracterisation at SPF Switzerland and setting up of projects was longer than anticipated. Project TCA in Sweden is most advanced and suited for cooling applications mainly. Project Modestore in Austria came to disappointing field results for a seasonal storage with silica gel. The material appears to be not suited to this application. At SPF in Switzerland, a project aims at understanding how a zeolite or silicagel bed is behaving. The german project called Monosorp has the potential to give a seasonal storage with 8 m3 of zeolite only for a passive house. Theoretical concept is now proven and laboratory tests started in July 2006. Two new projects (thermochemical storage in NL, NaOH storage in CH) joined our Task during 2006. The work on chemical heat storage is unfortunately still in its infancy due to low budget in all countries on this topic.

Subtask C : Phase change materials

Six projects are being developped. Most of them use sodium acetate as the phase change material. Subtask C is progressing well with combisystems in focus. The danish project shows that a 10 m3 only PCM seasonal storage using supercooling effects is theoretically possible. Experimenal setup will assess some assumptions on heat transfer in a bulk PCM tank. Ithe

austrian team on PCM in tanks tried to tackle the thermal properties of sodium acetate with graphite problem and the power rating of several heat exchanger arrangements: with a 30% SA+G PCM tank, can be achieved a 1.4 to 2 density compared to water over 50-90C. Project CosyPCM in Switzerland is similar but focus on the number of cycles that can be achieved by a tank with 14% volume of PCM in the upper part in laboratory. The spanish team has shown that cost of PCM tank in a combisystem can double the price of the tank, but save 25% space in a spanish cellar. The team of the University of LLeida works also on the enhancements of the heat exchange quality for sodium acetate in aluminium bottles.

Subtask D: Water tanks

Six projects are under investigation. Subtask D is focusing on improving tank storage and regular combisystems. ITW has already done a lot of work in this area and will contribute more toTask 32. The danish project is well advanced in comparing several devices to enhance stratification effects and several ways to produce tap water from the storage tank. The SPF team in Switzerland is studying a drain back - pressureless tank – variable flow distribution by simulation. New Trnsys types are being developped for flue gas for example since we want to have accurate CO2 emission calculations for combisystems. Two new projects from NL and Germany started recently only. In Spain, a theoretical project showed interesting results in dimensionless numbers analysis to evaluation stratification effects, a lack in the scientifical litterature.

WORKED PLANNED FOR 2007

The work is progressing slowly due to the difficulty of the tasks. Validation of storage models is on the way but there will be as good as the quality of the laboratory testing for which all the teams are committed.
We plan to have at least 10 different cases simulated and compared. This is ambitious. There will be in any case a lot of information on new systems and materials that can be used for further work. Subtask B and C have already experienced difficulties in some technologies that has brought new light and experience to the scientific community.
We are onserving that more and more interest in new heat storage solutions are shown in different countries and R&D programms. Task 32 initiated in 2003 will have helped to this situation.

LINKS WITH INDUSTRY

An industry day on November 14^{h}, 2006 at the technical university of Denamrk was attended by participants from the danish industry of storage (about 30 attendees plus 15 from Task 32). Task 32 work was presented by several speakers.

Wihtin a EU Project called Preheat, a workshop organised in Lyon, France in July 2006 where Task 32 status was presented by JC Hadorn (about 25 attendees from engineering companies, utilities, muicipalities and heat storage industry).

REPORTS and PAPERS PUBLISHED IN 2006

- Report B3 Laboratory prototypes of storage units (December 2006)

- Wien March 17th 2006, National Austrian Innovative Storage conference, Task 32 presentation (in German), JC Hadorn
- Ecostock June 2006, USA: Task 32 status, JC Hadorn
- Ecostock June 2006, USA: 10 scientific papers from 17 participants in IEA SHC Task 32 are available in the proceedings of this international conference

REPORTS PLANNED FOR 2007

- Report A2 Boundary conditions and reference conditions. Revised final version
- Report A3 Method of comparison and criteria – revised final version
- Report A4: Criteria assesment for advanced combisystem with new storage designs
- Final task management report

- Report B1 Identifications and selection of projects. Revised final version
- Report B4: as an update of B3 on Laboratory prototypes of storage units
- Report B5: Simulation models
- Report B6: Systems simulations with ref conditions
- Report B7: Improved designs
- Report B8: Subtask report.

- Report C3 Laboratory prototypes of storage units. Revised final version
- Report C4 Lab tests. Will be an update of C3.
- Report C5 Simulation models.
- Report C6 System simulations.
- Report C7 Improved design.
- Report C8: Subtask report.

- Report D1 Review of advanced concepts and dream systems for tank storage. Revised final version
- Report D2 Laboratory testing of advanced or new devices.
- Report D4: Lab tests of water tank stores
- Report D5 Development of simulation models.
- Report D6 System simulation with reference conditions.
- Report D8: next generation design. will be combined with D1.
- Report D9: Subtask report.

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Within a subtask, some reports might be combined depending on the number of teams that will be able to complete the full simulation work.

MEETINGS IN 2006

7th Experts Meeting
May 29-30, in conjunction with the international Ecostock'06 conference
Stockton, NJ, USA

8th Experts Meeting
November 15-17 in conjunction with a national danish industry day on heat storage
Lyngby, Denmark

MEETINGS PLANNED FOR 2007

9th Experts Meeting
April 18-20, in conjunction with a german industry day on April 17th
Stuttgart, Germany

10th Experts Meeting
October 3-4-5
Dübendorf, Switzerland

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