IEA Solar Heating & Cooling Programme

2001 Annual Report

Edited by
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Programme

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The Solar Heating & Cooling Implementing Agreement

BACKGROUND

The International Energy Agency was established as an intergovernmental organisation in November, 1974 under the Agreement on an International Energy Program (IEP) after the oil shock of 1973/1974. The 26 Member countries of the IEA have committed themselves to take effective measures to meet any oil supply emergency and, over the long term, to reduce dependence on oil. Means to attain their objective include increased energy efficiency, conservation, and the development of coal, natural gas, nuclear power and renewable energy sources.

The IEA's policy goals of energy security, diversity within the energy sector, and environmental sustainability are addressed in part through a program of international collaboration in the research, development and demonstration of new energy technologies, under the framework of 40 Implementing Agreements.

The Solar Heating and Cooling Implementing Agreement was one of the first collaborative R&D programs to be established within the IEA, and, since 1977, its participants have been conducting a variety of joint projects in active solar, passive solar and photovoltaic technologies, primarily for building applications. The overall Programme is monitored by an Executive Committee consisting of one representative from each of the 20 member countries and the European Commission.

SHC Member Countries

Australia	Japan
Austria	Mexico
Belgium	Portugal
Canada	Netherlands
Denmark	New Zealand
European Commission	Norway
Germany	Spain
Finland	Sweden
France	Switzerland
Italy	United Kingdom
	United States

CURRENT TASKS

A total of thirty Tasks (projects) have been undertaken since the beginning of the Solar Heating and Cooling Programme. The leadership and management of the individual Tasks are the responsibility of Operating Agents. The Tasks which were active in 2001 and their respective Operating Agents are:

Task 22
Building Energy Analysis Tools
United States

Task 23
Optimization of Solar Energy Use in Large Buildings
Norway

Task 24
Solar Procurement
Sweden

Task 25
Solar Assisted Air Conditioning of Buildings
Germany

Task 26
Solar Combisystems
Austria

Task 27
Performance of Solar Facade Components
Germany

Task 28
Sustainable Solar Housing
Switzerland

Task 29
Solar Crop Drying
Canada

Task 31
Daylighting Buildings in the 21st Century
Australia

Chairman's Report: Highlights of 2001

Mr. Lex Bosselaar
Executive Committee Chairman
NOVEM, b.v., The Netherlands

OVERVIEW

In 2001, the Executive Committee of the SHC Programme continued to examine different avenues for accelerating the solar market. At the November 2001 Executive Committee meeting, a proposal for new work on Market Analysis of the Solar Heating and Cooling Markets was accepted and a Task Definition meeting will be held in March/April 2002. The Executive Committee also continued to collect data on the use of solar collectors in the Member countries.

In addition to the Executive Committee's work, three workshops were organized on the timely topics of advanced storage concepts for solar thermal domestic, heat and cold storage, and the risk of Legionnaires' disease in solar hot water heaters. And, the ninth current Task was started—Task 31, Daylighting Buildings in the 21st Century. This Task is building upon the results of the Programme's recently completed daylighting work of Task 21. The Programme also is continuing to define the work in proposed Task 30, Solar City. This Task is to be initiated in 2002. In addition to the Task work, Working Groups on PV/Thermal Systems (a joint activity with the IEA Photovoltaic Power Systems Implementing Agreement) and Solar Gain and Statistics are underway.

The Executive Committee took time this year to reflect on its work and explore new areas of possible work. A special strategic planning session was held at the November 2001 Executive Committee meeting. During this one-day session, the Executive Committee and Operating Agents reviewed the current Strategic Plan and then discussed national priorities and new opportunities and barriers. This session demonstrated that the majority of issues listed in the Strategic Plan are being addressed in the current Tasks. The top three areas of work that were proposed were renovation, process heat, and solar district heating. As a result of this session, a workshop on Solar Heat for Industrial Processes is planned for March 2002 in Austria. The members also took time to review management issues.

Participation in the Programme remains strong with 20 Member countries and the European Union actively participating in the work. This year an arrangement was made with Egypt for their participation in the Implementing Agreement and an invitation to join the Programme was extended to Hong Kong. Other countries that the Executive Committee has invited to join the Programme and is facilitating their possible participation are Argentina, Brazil, China, Cyprus, Greece, Israel, Republic of South Korea, South Africa and Turkey. The Executive Committee was pleased to have a representative from Turkey attend the November 2001 Executive Committee meeting.

HIGHLIGHTS OF THE TASKS AND WORKING GROUP

Notable achievements of the Programme's work during 2001 are presented below. The details of these and many other accomplishments are covered in the individual Task summaries later in this report.

Task 22: Building Energy Analysis Tools
Task results are being used as prenormative information in the establishment of national building energy codes and standards. The Task's IEA BESTEST cases were developed by ASHRAE into a standard for energy standard compliance tool certification. Also, the U.S. National Association of State Energy Officials has referenced IEA BESTEST for certification of home energy rating software. A number of other countries, such as the Netherlands, have used or are considering IEA BESTEST as a standard method of testing building energy analysis tools for their national energy codes.

Task 23: Optimization of Solar Energy Use in Large Buildings
Work on case studies was completed and a technical report, "Examples of Integrated Design," was published which presents five of the buildings that used the "whole building approach." The particular processes used in the design of the buildings and their performance were evaluated and documented.

Task 24: Solar Procurement
National procurements and competitions have been launched in Canada, Denmark, the Netherlands, and Sweden. Each country has experienced successful results and has plans for a second round of procurements in 2002. A new country, Belgium, decided to join the Task this year.

Task 25: Solar Assisted Air Conditioning of Buildings
A survey of 28 existing solar assisted air conditioning systems was conducted. The survey information was entered into a database that includes short reports on national R&D activities on solar assisted air conditioning in the participating countries. It is available on the SHC website.

Task 26: Solar Combisystems
Two industry workshops were held in the Netherlands and Switzerland. The topics addressed were the market, systems and components, drainback systems, legionella, architectural integration of solar collectors, and stagnation and overheating. The Task's work on a test method for solar combisystems has the interest of the CEN TC 312, who is now considering a new work item to standardize this test method.

Task 27: Performance of Solar Facade Components
Materials for durability and reliability assessment of static solar materials were identified and investigated in the framework of the following case studies 1) anti-reflective and polymeric glazing materials, 2) reflectors, and 3) solar facade absorbers. Initial risk analysis was performed, the samples were exposed at outdoor test facilities in different locations, and accelerated screening tests were started for all the case studies.

Task 28/ECBCS Annex 38: Sustainable Solar Housing
Forty experts from Australia, Austria, Belgium, Brazil, Canada, Finland, Germany, Italy, Japan Switzerland, the Netherlands, Norway, Sweden and the UK are sharing in the work of the Task. Results from this year's effort include a Task brochure describing the work, an international workshop on market analyses and strategies, and a databank on the characteristics of built exemplary projects.

Task 29: Solar Crop Drying
The flagship project this year was the installation of a solar system on a new coffee drying plant in Panama. The success of this project lies not only with the installation of the solar system but also with the close cooperation between Task participants and the plant owners. The major objective of the solar system is to reduce the amount of wood fuel needed for the furnace.

Working Group on Advanced Solar Low-Energy Dwellings
The Working Group has ended and the monitoring results collected and analyzed from buildings of SHC Task 13, *Advanced Solar Low Energy Buildings*, will be published in a new 2002 edition of the popular book, "Solar Energy Houses: Strategies, Technologies, Examples."

Working Group on PV/Thermal Solar Systems
The objectives of this Working Group are to exchange information, to prepare a "road map" by identifying the necessary international steps needed to develop various markets for PV/Thermal Solar Systems, and to advise the IEA on further work in this field. The Working Group is a collaborative effort with the IEA Photovoltaic Power Systems Programme.

Working Group on Solar Gain
This Working Group is collecting and compiling passive solar data from the Member countries.

NEW ACTIVITIES

Task 30: Solar City

This Task is in the Task Definition Phase. It was initiated in cooperation with the International Solar Energy Society (ISES) and the IEA Energy Conservation in Buildings and Community Systems Programme. Currently, the experts involved are in the process of structuring the new work and arranging the funding. The objective of this Task is to increase the understanding and application of solar technologies in cities. The overall goal of this effort is to reduce emissions in the targeted cities to an environmentally sustainable level.

Market Analysis of Solar Heating and Cooling Market

The Executive Committee agreed to the Task Definition Phase for this new work. A workshop is planned for March/April 2002.

MANAGEMENT ACTIONS

Programme and Policy Actions

The Executive Committee:

- Approved a SHC Award and established an Award Committee.
- Agreed to hold a National Program Review at its June 2002 Executive Committee meeting.
- Will celebrate its 25th Anniversary in 2002. A new Programmed slide show will be produced and the SHC exhibit will be displayed at several conferences.
- Agreed to invite Hong Kong to join the Implementing Agreement. Communication continued with the countries that have already been invited to join – Argentina, Brazil, China, Cyprus, Egypt, Greece, Israel, Republic of South Korea, South Africa and Turkey.

The Software Policy Committee continued to work on strengthening and ensuring that the policy is adhered to as new Tasks develop software.

Executive Committee Meetings

The 49th Executive Committee meeting was held in June 2001 in Bordeaux, France. During this meeting a one-day joint meeting was held with the IEA Buildings and Community Systems Programme. The 50th Executive Committee meeting was held in November 2001 in Vail, Colorado, USA.

Internet Site

The Solar Heating and Cooling Programme's website continues to be updated and new pages added as needed. The site plays an increasingly important role in the dissemination of Programme and Task information. The address for the site is: www.iea-shc.org.

Future Workshop

The Executive Committee agreed to organize a workshop in 2002 to discuss the possibility of new work in the following area.

Solar Heat for Industrial Processes
This workshop will be held March 2002 in Gleisdorf, Austria. The objectives are to show the state of the art of investigations on solar process heat, discuss experiences made with pilot projects, explore the R&D requirements for industrial applications, explore the long-term (>10 years) potential for solar process heat, and discuss the need for international cooperation. The workshop is being organized by members of the EU funded OPET-Network and by Member countries in the SHC Programme (Austria, Germany, Greece, Turkey, Spain and Portugal).

COORDINATION WITH OTHER IEA IMPLEMENTING WORKING PARTIES/AGREEMENTS AND NON-IEA ORGANIZATIONS

The Renewable Energy Working Party (REWP) increased its activities that are coordinated between the renewable energy Implementing Agreements. The SHC Programme discussed the market acceleration initiative with a representative from the IEA Secretariat at a meeting in France and provided the necessary input.

The SHC Programme participates in the Sustainable Buildings Task Force of the End Use Working Party because sustainable building is a key element of the SHC Strategic Plan.

The IEA Energy Conservation in Buildings and Community Systems Programme is collaborating in two SHC Programme Tasks—*Performance of Solar Facade Components* and *Sustainable Solar Housing.* A joint meeting was held in June 2002 in France. Possible overlaps between the Programmes' work was discussed and a link was made between the work of ECBCS Annex 33, *Local Energy Planning* and the proposed SHC Task 30, *Solar City*. The next joint Executive Committee meeting is planned for June 2003 in Germany to facilitate the continued collaborative work between the Programmes.

The Buildings Coordination Group had no activities in 2001, but is planning a meeting in early 2002 with all the buildings related Implementing Agreements.

The IEA Photovoltaic Power Systems Programme is working with the SHC Programme in the PV/Thermal Systems Working Group as well as keeping the SHC Programme abreast of activities in the PVPS Task 7, *PV in the Built Environment*.

The IEA Energy Storage Programme expressed interest in holding a joint meeting in November 2002.

The International Solar Energy Society continues to collaborate with the SHC Programme on proposed Task 30, *Solar City*.

PUBLICATIONS

The following IEA Solar Heating and Cooling reports were printed in 2001 and are not listed elsewhere in this annual report.

Task 21: Daylight in Buildings

These reports are available either from the SHC website www.iea-shc.org/task21 or from the SHC Executive Secretary pmurphy@MorseAssociatesInc.com.

Application Guide for Daylight Responsive Lighting Control

Electric lighting and daylight have to cooperate in order to achieve the goals of energy efficiency and good visual comfort. Therefore the layout of the electric lighting has to be designed in such a way that suitable zones are created and daylight is supplemented in each zone. The daylight responsive control system of the electric lighting has to take care of this. There are quite a variety of daylight responsive control systems for artificial lighting on the market. The main objective of this guide is to support the user in selection, installation and maintenance of such a system.

Applicability of Daylight Computer Modeling in Real Case Studies: Comparison between Measured & Simulated Daylight Availability & Lighting Consumption

This report investigates the accuracy and limitations of the Adeline 1.0 lighting software in simulating the illuminance distribution from daylighting and the electrical lighting energy savings of an existing atrium building. The purpose of the study was to compare the Superlite, Superlink and Radiance computed outputs against data collected in a real building.

Measurement of Luminous Characteristics of Daylighting Materials

This report covers measurement characteristics and principles, plus light transmittance and bi-directional measurements and references. It also includes specific performance data.

Post Occupancy Evaluation of Daylight Buildings

A method to study user reactions to indoor environment, especially daylighting, has been developed. It is based on a questionnaire that includes attitudes to daylight and windows as well as to the physical environment. This report describes how to use the questionnaire, which was first used in the EU Joule II Project Daylight Europe and then used more extensively in SHC Task 21, *Daylight in Buildings*.

Daylighting Design Tools

This report summarizes a survey of a cross-section of various simple daylighting design tools and their different applications. The survey included tools based on analytical solutions, tables, nomograms, diagrams, so-called protractors, simple computer tools, typological studies and scale models. Several new designs tools also are included. To allow for problem sensitive selection, the report includes a table to characterize the reviewed tools.

Validation of Daylighting Computer Programs

This report summarizes the comparison of simulation results as well as comparisons with data obtained from measurements in scale models located in artificial skies for the following daylighting software—Radiance, Superlite, Genelux, Adeline and LESO-Dial.

FEATURE ARTICLE

Each year our annual report includes a feature article on some aspect of solar technologies for buildings. This year's article is on solar combisystems, which is a promising technology. Thanks to Mr. Werner Weiss of AEE INTEC, Austria for contributing this overview.

ACKNOWLEDGMENTS

In closing, I would like to thank the Operating Agents, Working Group Leaders, Executive Committee Members and our Advisor, Fred Morse, for their work. I would especially like to thank our Executive Secretary, Pamela Murphy, for her help over the past year in preparation and reporting of the meetings and numerous Programme activities as well as helping to run this active IEA Programme.

Solar Combisystems for a Sustainable Energy Future

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The increase in the use of solar collectors in recent years for domestic hot water preparation has shown that solar heating systems are a mature and reliable technology. Every day, thousands of systems worldwide demonstrate the possibilities of this ecologically harmless energy source. Motivated by the confirmed success of these systems for hot water production, an increasing number of homebuilders are considering solar energy for space heating as well.

Combining solar heating systems with short-term heat storage and high standards of thermal insulation allows the heating requirements of a single- or multi-family dwelling to be met at acceptable costs. Compared with systems using seasonal storage (the costs of which are currently not affordable for single-family houses), this combination provides a cost-effective system with high efficiency.

The demand for solar heating systems for combined domestic hot water preparation and space heating is growing rapidly in several countries. In some countries, such as Austria, Denmark, Germany and Switzerland, solar combisystems have a noteworthy share of the market.

Solar heating systems for combined domestic hot water preparation and space heating, so-called "solar combisystems" are essentially the same as solar water heaters when considering the collectors and the transport of the produced heat to the storage device. There is, however, one major difference --the installed collector area is generally larger for combisystems, as there are two different heat consumers to supply. Furthermore, in a combisystem there are at least two energy sources to supply heat to these two heat consumers -- the solar collectors and the auxiliary energy source. The auxiliary energy source can be biomass, gas, oil or electricity.

Solar combisystems are more complex than solar domestic hot water systems as there are more interactions with extra subsystems. And, these interactions profoundly affect the overall performance of the solar part of the system. The general com-

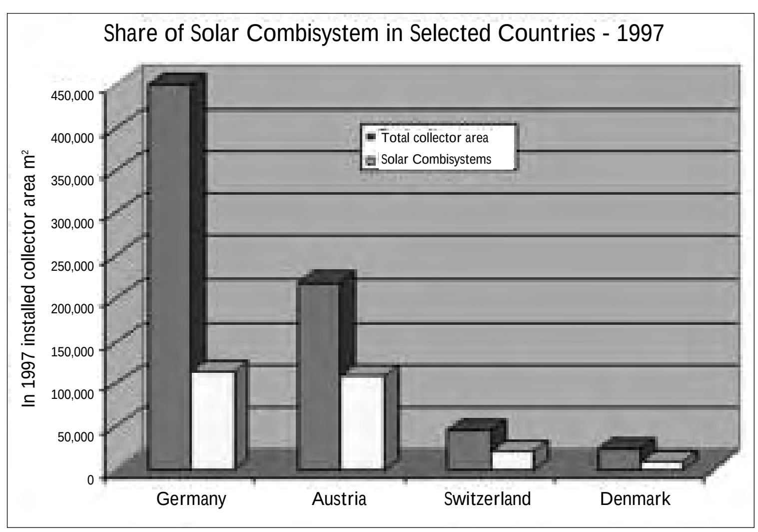

Figure 1. Installed collector areas and share of collectors for solar combisystems in selected countries for 1997.

plexity of solar combisystems has led to a large number of widely differing system designs, which do not necessarily reflect local climate or local practice. Several systems, for example, could be and soon will be sold all over Europe. Collaborative work in analyzing and optimizing combisystems is therefore an important activity. Since December 1998, 26 experts from 9 European countries and the USA and 11 solar industries, have been working together in the Solar Heating and Cooling Programme's Task 26, Solar Combisystems. The objective of this Task is to further develop and optimize solar combisystems for detached single-family houses, groups of single-family houses and multi-family houses.

Why Solar Space Heating?

The enrichment of gases inducing a greenhouse effect in the atmosphere and the potential global warming and climatic change associated with it, represent one of the greatest environmental dangers of our time. The reasons of this impending change in the climate can for the most part be attributed to the use of energy, in particular, the combustion of fossil fuels and the associated emission of CO_2.

Today, the world's energy supply is based primarily on non-renewable sources of energy -- oil, coal, natural gas and uranium - which together cover about 82% of the global primary-energy requirements. The remaining 18% are divided approximately 2/3 into biomass and 1/3 into hydropower.

The effective protection of the climate which makes provisions for the future will, according to many experts, demand at least a 50% reduction in the world-wide anthropogenic emission of greenhouse gases in the next 50 years.

As a result of the climate conferences of the last decade and the discussion about sustainable development, the European Commission has laid down its goals with respect to future development in the field of renewable sources of energy in the White Paper "Energy for the Future: Renewable Sources of Energy". In the Commission's "White Paper" the following is mentioned as a strategic goal: "... to increase the market share of renewable sources of energy to 12% by the year 2010." The yearly increase in the installed collector area named in the White Paper in the member states is estimated at 20%. Thus, solar heating systems in operation in the year 2010 would correspond to an overall installed collector area of 100 million m^2.

If the direct use of solar energy for heating purposes via solar collectors, as shown in the sustainable energy scenarios, is to make a relevant contribution to the energy supply, it is necessary that solar-heating technologies be developed and widely applied over and beyond the field of domestic hot water preparation.

A realistic approach would be to assume that in the next ten years, about 20% of the collector area yearly installed in middle and northern latitudes will be used for solar combisystems. This means that in accordance with the "White Paper" of the European Commission, in the countries of the European Union alone per year around 120,000 solar combisystems with 1.9 million m^2 of collectors need to be installed.

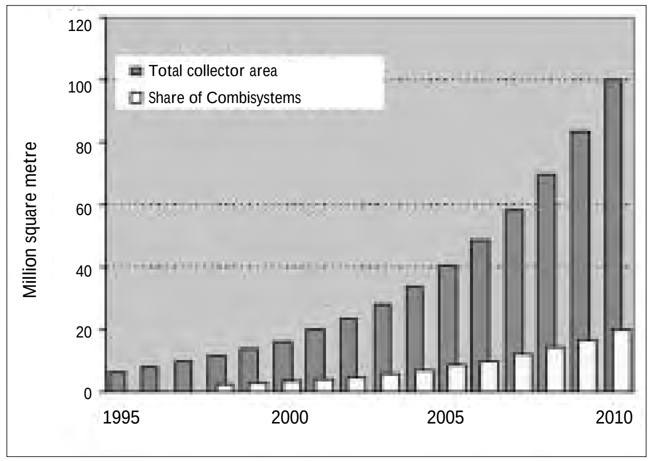

Figure 2. Objectives for the installed collector area until 2010 in the European Union's member countries.

Conditions and Pre-requisites for Solar Space Heating

Currently installed systems clearly show that solar space heating is possible even under mid- and northern climatic conditions. However, before a solar combisystem is installed, due attention must be paid to the conditions and other requirements.

Solar Energy Availability

In high latitudes, the solar energy available in summer is more than twice that available in winter. Virtually, the opposite applies to the energy demand for space heating. In comparison to hot water supply, the

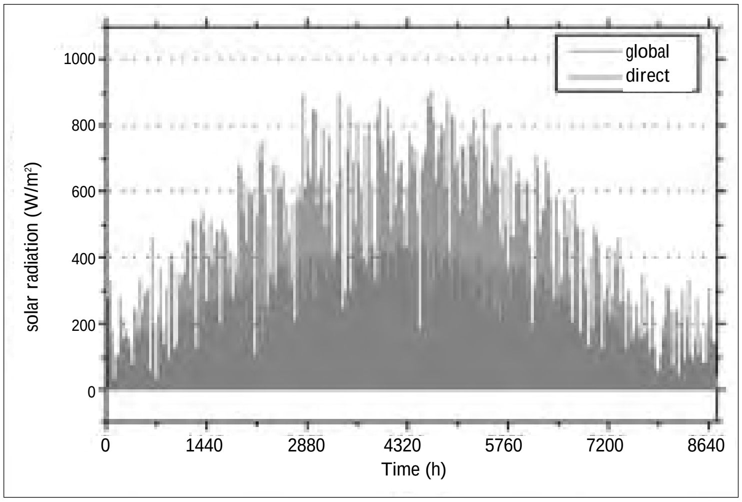

Figure 3. Solar irradiation on a horizontal plane in Zurich, Switzerland

heating load is dependent on the outside temperature. Measurements of solar irradiation and temperature in the transitional periods (September – October and March – May) clearly show that solar irradiation availability is relatively high at the beginning and end of the space-heating season. Even on winter days, energy demand and solar irradiation are partially related.

Figure 3 shows the solar irradiation on a horizontal plane at Zurich, Switzerland. It can be seen that, under this latitude, there are not only strong seasonal variations in radiation throughout the year, but solar radiation also quite widely changes on a daily, or even hourly basis.

In order to make efficient use of the available solar energy supply, it is therefore necessary to even out these fluctuations, by means of storage systems, to be able to supply hot water continuously and to guarantee a constant room temperature.

Figure 4. French house equipped with a direct solar floor system (Source: Clipsol, France)

System Designs

The solar contribution, that is, the part of the heating demand met by solar energy, varies from 10% for some systems up to 100% for others, depending on the size of the solar collector, the storage volume, the hot water consumption, the heat load of the building, and the climate.

As mentioned before, there are a large variety of system concepts on the European market. The different system concepts can partly be put down to the different conditions prevailing in the individual countries. Thus, for example, the "smallest systems" in terms of collector area and storage volume are located in those countries in which gas or electrical energy are primarily used as auxiliary energy. In the Netherlands, for example, a typical solar combisystem consist of 4-6 m^2 of solar collector and a 300 liter storage tank. The share of the heating demand met by solar energy is therefore correspondingly small.

Figure 5. Dutch solar combisystem (Source: ATAG, The Netherlands)

In countries such as Switzerland, Austria and Sweden, where solar combisystems are typically coupled with a biomass boiler, larger systems with high fractional energy savings are encountered. A typical system for a single-family house consists of 15 - 30 m^2 of collector area and a 1 - 3 m^3 of storage tank. The share of the heating demand met by solar energy is 20% - 60 %.

Figure 6. Solar combisystem for a single-family house in Germany (Source: SOLVIS, Germany)

Requirements for the Hydraulic Layout

Requirements for the hydraulic layout of solar combisystems can be summarized as follows (Streicher, 2000):

- Deliver solar energy to heat store(s) with as low heat loss as possible;
- Distribute all the heat needed to hot water and space heating demand;
- Reserve sufficient store volume for auxiliary heating taking into account minimum running time for the specific heater;
- Low investment costs;
- Low space demand; and
- Easy and failure safe installation.

Furthermore, specific properties of components influence the operation of the other components. As mentioned before, heat demand and annual and daily load distribution are of major importance for system dimensions.

Generally, the heat store is the heart of a solar combisystem. Solar heat is stored in the lower part of the store and, if applicable, auxiliary heat in the upper part. The collector hydraulics influences the height of the collector loop outlet to the store. For high-flow collectors, this connection can be quite low. On the other hand, this connection should be higher or even better variable (stratifier) for low-flow collectors and the heat store should be prepared to enhance thermal stratification.

For combisystems with indirect integrated auxiliary heating, the inlet pipe from the heater is connected at the top. The height of the outlet depends on the peak hot-water demand, the outlet pipes to the heat distribution system and the volume needed for solar energy. The minimum operation time for the heater also determines the auxiliary volume.
Requirements are stricter for wood furnaces than for gas boilers. Another factor is the type of the heat distribution system, for example, connection from high-temperature radiators to the store should be higher than from a low-temperature heat distribution system.

This indicates that system design largely depends on national building traditions, auxiliary energy source and user behavior.

Examples of System Layout

Figures 7-9 show designs from different countries and manufacturers. The system in Figure 7 is a typical early design with a large number of components. The system can be very efficient, but is also more difficult to install.

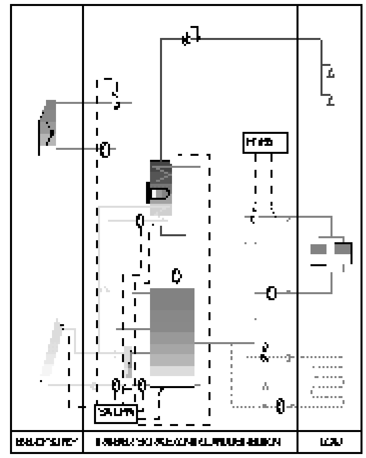

Figure 7. Two-stores combisystem with fixed-power auxiliary heater (Austria)

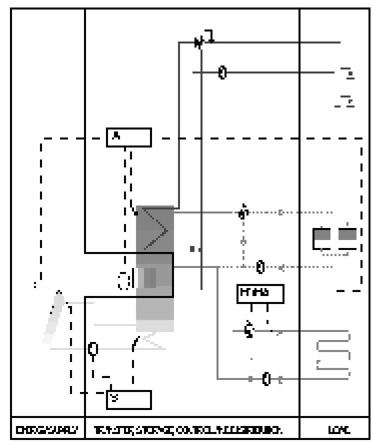

Figure 8. Solar combisystem with integrated gas or oil burner (Finland)

In the system layout presented in Figure 8, most functions have been integrated in the heat store, even the gas or oil burner. Figure 9 shows a solar combisystem with direct floor heating. The thermal mass of the floor heating system is used as heat store. Auxiliary heating is coupled in series. A special control is used for distribution of the solar heat between floor and hot water.

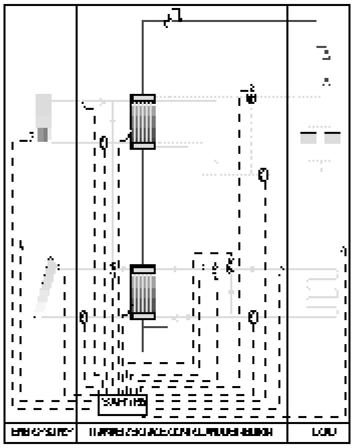

Figure 9. Direct solar floor combisystem (France)

More information on system layouts can be found in the report, "Overview of Solar Combisystems 2000" that can be found on the Task 26 homepage at www.iea-shc.org/task26.

The systems described above are designed for single- or two-family houses. But there are also systems in operation that are designed for multi-family houses and terraced houses. These systems also have shown promising results during the last years.

In Gleisdorf, Austria a system was installed in 1998 for an office building and 6 terraced houses. The collectors – spread on three construction parts – with an extension of 230 m^2 were integrated into the roofs of the winter gardens and cover 80% of the hot water and 60% of the space heating demand of the whole year. A biomass boiler provides the remaining energy. A local heating network connects the individual houses to the central 14 m^3 storage tank. The temperature level of the heat release also determines the efficiency of a solar heating system. For this reason the buildings were equipped with special low-temperature wall heating systems. The medium fluid temperature of low-temperature wall heating system is 35° C during the heating period.

Figure 10. 60% of the space heating demand of these terraced houses are covered by solar energy (Source: AEE INTEC, Austria)

Support for System Development

Both mathematical models and test methods support the assessment and optimization of solar combisystems.

Computer Programs

There are several computer programs on the market for the thermal performance calculation of solar combisystems: Polysun, TSOL and SHWwin. All are transient simulation programs with time steps of a few minutes and feature database support for components and systems. Heat loads can also be defined in great detail. Possible system layouts are, however, restricted and differ from one program to the other. More information on these programs can be found in (Streicher, 2000).

A more general computer program is TRNSYS. Solar combisystems can be composed from TRNSYS modules. Within SHC Task 26, about half of the solar combisystems from the 2000 overview are being modeled using TRNSYS so that optimization of these system concepts can be calculated.

For solar combisystems with a relatively small collector area (2-5 kW heat load), optimum heat store volume appears to be 50-200 liters per kW heat load. The optimum tilt angle is between 30° and 75°. Orientation is best between 30° east and 45° west.

Test methods

Emphasis in solar combisystem test method development is now in the so-called "Direct Characterisation" (DC) test procedure where a 6 days test simulates the system operation during summer, winter and spring/autumn. Performance indicator from testing is processed in a simple way to deliver annual performance prediction, but only for the conditions during the test, being average values for the whole year. Extrapolation into other climates and heat demands than used in the test is not possible.

The CTSS (Component Testing – System Simulation) method, available from European Standardisation of solar hot water systems, is more complex. Components are tested separately in this method and component models are used to determine component specifications. Combination of component models into a numerical model for the whole system gives the annual performance and enables extrapolation. The DC method is under investigation in Task 26. CTSS serves for comparison. There is a liaison between SHC Task 26 and CEN Technical Committee 312 'Solar Energy'.

Conclusions

The attention that is being given to solar combisystems is justified, as these products will certainly hold a sound share of the market in the future. In recent years, combisystems have changed from complex designs into compact products. And, although there are still many different system designs to choose from, the computer programs being used to optimise system designs and the test methods being used to assess and compare products are supporting the market development of reliable systems.

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For more information visit: www.iea-shc.org

TASK 22:

Building Energy Analysis Tools

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TASK DESCRIPTION

The overall goal of Task 22 is to establish a sound technical basis for analyzing solar, low-energy buildings with available and emerging building energy analysis tools. This goal will be pursued by accomplishing the following objectives:

- Assess the accuracy of available building energy analysis tools in predicting the performance of widely used solar and low-energy concepts.
- Collect and document engineering models of widely used solar and low-energy concepts for use in the next generation building energy analysis tools.
- Assess and document the impact (value) of improved building energy analysis tools in analyzing solar, low-energy buildings, and widely disseminate research results to tool users, industry associations and government agencies.

Task 22 will investigate the availability and accuracy of building energy analysis tools and engineering models to evaluate the performance of solar and low-energy buildings. The scope of the Task is limited to whole-building energy analysis tools, including emerging modular type tools, and to widely used solar and low-energy design concepts. To accomplish the stated goal and objectives, the Participants carried out research in the framework of two Subtasks during the initial phase of the Task:

- Subtask A: Tool Evaluation
- Subtask B: Model Documentation

During a Task Extension Phase, the Participants will focus on two new Subtasks:

- Subtask C: Comparative Evaluation
- Subtask D: Empirical Validation

Tool evaluation activities will include analytical, comparative and empirical methods, with emphasis given to "blind" comparative evaluation using carefully designed test cases and "blind" empirical validation using measured data from test rooms or full scale buildings. Documentation of engineering models will use existing standard reporting formats and procedures.

The audience for the results of the Task is building energy analysis tool developers. However, tool users, such as architects, engineers, energy consultants, product manufacturers, and building owners and managers, are the ultimate beneficiaries of the research, and will be informed through targeted reports and articles.

Duration

The Task was initiated in January 1996, and with the approved 24-month extension, is planned for completion in December 2002.

ACTIVITIES DURING 2001

A summary of Subtask research activities completed during 2001 is presented below.

Subtask A: Tool Evaluation

This Subtask is concerned with assessing the accuracy of available building energy analysis tools in predicting the performance of widely used solar and low-energy concepts. Three Tool evaluation methodologies are being employed:

1) Analytical Tests
2) Comparative Tests
3) Empirical Validation Tests

Work accomplished during 2001 on each of these tool evaluation efforts is summarized below.

Analytical Tests: All planned activities have been completed. However, continued interest and collaboration in analytical test methods continues through ASHRAE SPC-140 and CEN, prEN13791 and pr EN13792. The Subtask A Leader and the Operating Agent have written a letter to the CEN project leader expressing concerns about the CEN-sponsored approach to energy analysis tool evaluation and to propose collaboration between Task 22 and CEN in the area of building energy analysis tool evaluation methods.

Comparative Tests: The HVAC BESTEST suite of test cases – series E100 – E200 – was approved by the Executive Committee, distributed to Task Experts and other building energy analysis tool developers, and made available on the IEA Solar Heating and Cooling Program web site.

Empirical Validation Tests: The Final Report of three empirical validation tests conducted at the Iowa Energy Center's Energy Resource Station (ERS) was approved by the Executive Committee, and was posted on the SHC Programme website.

Parameter Estimation/Identification Technique: A draft final report of this innovative building energy analysis tool validation method was prepared by the author, and is being readied for Executive Committee approval and distribution through the SHC Programme website during 2002.

Subtask C: Comparative Evaluation
This Subtask is concerned with developing a number of comparative tests on basic energy modeling capabilities. During 2001, Task Experts developed test case specifications for the following energy modeling issues:

- Radiant Floor
- Gas-Fired Furnaces
- Multi-Zone Loads
- HVAC BESTEST – Cases E300-E520
- Ground Coupling

A first round of results for the ground coupling test cases was completed by several Task Experts, with results for the other test cases to be completed in early 2002.

Subtask D: Empirical Validation
This Subtask is concerned with validating building energy analysis tool energy predictions with performance data from a highly controlled commercial test facility. The following energy systems will be tested in the Iowa Energy Resource Station Test Facility, the performance data used in the validation of building energy analysis tools:

- Heat Recovery
- Daylighting/HVAC Interaction
- Economizer Control

A second round of data collection was completed on the Daylighting/HVAC information empirical validation energy tests. Experimental Plans for the other empirical validation topics were developed and are being readied for implementation.

WORK PLANNED FOR 2002
Planned Task activities for 2002 are presented below.

Subtask C: Comparative Tests
Complete several rounds of analyses on the HVAC BESTEST (E300-E520), radiant floor, ground coupling, and gas-fired furnace comparative test cases, and prepare draft final reports on each comparative test case.

Subtask D: Empirical Validation
Conduct experiments at the Iowa Energy Research Station to create data sets for empirical validation of simulation tools. Three sets of test will be undertaken – heat recovery, economizer control, and daylighting/HVAC interaction. Complete several rounds of validation analyses, and prepare draft final reports on each validation test case.

LINKS WITH INDUSTRY
Because of the nature of the Task – tool evaluation and emerging tool research – links with industry take a somewhat different form than other SHC Programme Tasks. The primary audience for Task 22 research is building energy analysis tool authors. A secondary audience is building energy codes and standards writing organizations. For tool authors, a number of links have been estab-

lished. The Analytical Solutions Working Document was distributed for their use and comment, and a number of tool authors are participating in the HVAC BESTEST and ERS tool evaluation exercises. These activities keep Task 22 research effectively linked to the needs and recommendations of the world's leading building energy analysis tool developers.

The results of Task 22 research are used as prenormative information in the establishment of national building energy codes and standards. For example, the IEA BESTEST cases were developed by ASHRAE into a standard for energy standard compliance tool certification. Also, the U.S. National Association of State Energy Officials has referenced IEA BESTEST for certification of home energy rating software. A number of other countries, such as The Netherlands, have used or are considering BESTEST as a standard method of testing building energy analysis tools for their national energy codes.

Through these kinds of industry links, the participants of Task 22 ensure the valuable use of its research results.

REPORTS PUBLISHED IN 2001

BESTEST specifications for comparative test of cooling equipment (series E300-E520 test cases), residential gas-fired heating equipment, and radiant floors.

ERS data sets and test specifications for the daylighting – HVAC interaction empirical validation exercises.

REPORTS PLANNED FOR 2002

Parameter Estimation/Identification Technique for Modeling Error Diagnostics, GISE/ENPC, France.

International Energy Agency Building Energy Simulation Test and Diagnostic Method for HVAC Equipment Models (HVAC BESTEST) Volume 2: Cases E300-E500, National Renewable Energy Laboratory.

International Energy Agency Building Energy Simulation Test and Diagnostic Method for Radiant floor Models (RADTEST), Technikum Luzen.

International Energy Agency Building Energy Simulation Test and Diagnostic Method for Gas-Fired Furnaces (GASTEST), National Resources Canada.

MEETINGS IN 2001

Eleventh Experts Meeting
March 8-9
Lucerne, Switzerland

MEETINGS PLANNED FOR 2002

Twelfth Experts Meeting
Feburary 6-8
Ottawa, Canada

Thirteenth Experts Meeting
June 2002
To Be Determined

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TASK 23:

Optimization of Solar Energy Use In Large Buildings

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TASK DESCRIPTION

The main objectives of Task 23 are to ensure the most appropriate use of solar energy in each specific building- project for the purpose of optimizing the use of solar energy and to promote an increased use of solar energy in the building sector.

This is achieved by enabling the building designers to carry out trade-off analyses between the need for and potential use of energy con-servation, daylighting, passive solar, active solar, and photo-voltaic tech-nologies in systematic design processes.

In addition, the objective of the Task is to ensure that the buildings promote sustainable development. This is done by including considerations of other resource use and of local and global environmental impact in the trade-off analyses to be carried out.

Scope

The work primarily focuses on commercial and institution-al buildings, as these types of buildings clearly need several types of systems. In particular, office buildings and educational buildings are addressed. The same issues are relevant for many ---other commercial and institutional buildings. However, some of these, such as for -instance hospitals, require rather specialized design teams and would broaden the scope of the Task tremendously. They are therefore excluded from the Task in order to ensure concentration and focus in the work carried out.

Means

The work in the Task is divided in four Subtasks:

- Subtask A: Case stories (Lead Country: Denmark)
- Subtask B: Design process guidelines (Lead Country: Switzerland)
- Subtask C: Methods and tools for trade-off analysis (Lead country: USA)
- Subtask D: Dissemination and demonstration (Lead country: Netherlands)

Subtask A provides the knowledge base to be used in the development of guidelines, methods, and tools in Subtasks B and C, while Subtask D ensures that the results of the work are disseminated to the appropriate audiences.

Duration

The Task was initiated in June 1997 and will be completed in June 2002.

ACTIVITIES DURING 2001

Subtask A: Case Stories

The main objective of Subtask A is to provide the knowledge needed in the development of the guidelines, methods, and tools that are being developed in Subtasks B and C. This has been done by evaluating and documenting a set of buildings designed using the "whole building approach". Both the particular processes used in the design of the buildings and the resulting building performances have been evaluated.

The work in the Subtask has been completed this year, and a technical report has been published. This report, called "Examples of

Integrated Design," presents five of the cases studied.

Subtask B: Design Process Guidelines

The main objective of Subtask B is to develop design process guidelines suitable for the early stages of design, as the integrated design approach is particularly important in these stages. The guidelines deal both with the make up of and the interaction between members of the design team, with the information required by the team, and with the ways of designing the building as a system, where the different low energy and solar technologies to be used are integral parts of the whole.

The Subtask B working group has developed an electronic, multidimensional information space that serves as a guide through the design process. This guide, called the *Navigator*, is based on the design process activities and dynamically links related issues, actors, and methods and tools relevant for a specific context. Basically, the *Navigator* is a tool that will be developed over time using experience gained. I.e. it is an environment for developing design processes for different contexts, and both national, company, and project versions may be developed. The Task 23 version is completed, however, and a user/developer manual is now being produced.

A first complete draft of a design process guidelines booklet is also developed. This is a document intended for wider distribution than the *Navigator*. It describes the need for an integrated design process when designing solar low energy buildings and discusses the key, more universal issues that need to be considered during such a process.

The first Task 23 demonstration project: Kvarterhuset community center in Kolding, Denmark, which is under construction.

Subtask C: Methods and Tools for Trade-off Analysis

The main objective of Subtask C is to develop methods and tools to be used by the designers when doing trade-off analyses between different low energy and solar technologies. As designers, builders, and owners optimise against a large number of criteria, such as energy use, comfort, cost, aesthetics, environmental impact, etc., it is assumed that there is a need for both a computer-based tool that can optimise against a relatively limited set of criteria and a more complex, multi criteria decision making method. that will enable the designers to do more general and, therefore, less detailed optimisations.

The Subtask C working group has developed a method that structures the discussions of which criteria to use and that facilitates multi criteria decision making. It has also developed a computer program to be used with the method. The method, called *MCDM-23*, is basically a formalised step-by-step procedure to aid in the discussion- and decision-making process. The software automates many tasks involved in using the method and produces worksheets, bar charts, and star diagrams.

There are two situations where *MCDM-23* is useful:
In the process of designing a building: when selecting and prioritising among design criteria and when evaluating alternative design solutions.

In a design competition: when developing the program and when selecting the best design from among several submissions.

A final draft of the *MCDM-23* booklet, which describes the method, has been distributed and is presently being reviewed. It will eventually contain a CD with the computer program. The program is essentially complete, and the program electronic help, as well as computer presentations of both the method and the program, are in final draft stage.

Included in Subtask C is also work on the *Energy-10* program. This program incorporates many attributes deemed important to the task of evaluating tradeoffs during the process of optimising solar energy and energy efficiency strategies during building design. Most of the countries participating in the Task have used *Energy-10* and have provided valuable feedback to the program developers.

The development of a new version of the program is taking this feedback into account. One upgrade for which programming is complete, is the ability to incorporate a set of user defined libraries of building materials and constructions practices. Library sets for the Task 23 countries will thus be distributed in future releases, making *Energy-10* more usable on an international level. Another improvement in the program is the ability to perform a concurrent simulation of the performance of a building and a grid-connected photovoltaic system. This program version has been released for beta-testing.

Subtask D: Dissemination and Demonstration

The main objective of Subtask D is to disseminate the results of the work in the Task to the building community. The Task 23 "package" of products will consist of the following:

- The guideline for integrated design processes (a booklet)
- The electronic guide through the design process - the *Navigator*
- The multi criteria discussion and decision making method - the *MCDM-23* (a booklet containing a description of the method and a CD with the software)
- Descriptions of selected case stories (a booklet)
- Technical reports on case stories
- Descriptions of demonstration projects (a booklet)

The most important activity in Subtask D at present is the work on demonstration buildings. The Danish project is, as shown in the photo, well on its way, and construction should be completed by the end of the year. The building, a Community Center in Kolding, features building integrated photovoltaics, passive solar technologies, daylighting, natural ventilation, and the use of environmentally friendly materials and reduced water consumption. The knowledge and tools developed in the Task have been used in the design process, and the experience with using them is being reported.

Some other countries are now also in the demonstration phase: Norway has at least one project, an office and information center, and the Netherlands has three projects, an office building for a bank, an office building for the Dutch Army, and a facade renovation for a hospital. Still other countries are considering including demonstration projects, but their plans are not yet finalised.

Demonstration buildings are only one way of disseminating the results of the Task, however. Several of the participating countries are very active in disseminating the results in other ways. For instance, Austria are using the ideas behind and the results obtained in Task 23 in a new national project aimed at development and dissemination in the local context. Denmark has organised seminars for local architects and produced an article for a local journal. Germany has already produced German versions of the products from Subtasks B and C and is using them in local workshops. Norway is working with the Directorate of Public Works to integrate the results of B and C in their building programming, and Switzerland has adapted the results of B for use in the local context and is implementing it in real design projects.

In general, these local dissemination activities may be the more effective way of disseminating the results of the Task, as architects mainly use information they get (and need) in real design situations. Such activities should therefore, possibly be emphasised more in future plans.

WORK PLANNED FOR 2002

As 2002 is the last year of the Task, the main activities will mainly consist of finalising the products developed, and of publishing and distributing them. In addition, of course, the work on demonstration buildings will continue at full speed.

Subtask B: Design Process Guidelines

The electronic guide through the design process (the *Navigator*) and a user/developer manual will be distributed. The design process guidelines booklet will also be completed and distributed.

Subtask C: Methods and Tools for Trade-off Analysis

The Task 23 multi criteria decision-making method (*MCDM-23*) will be further tested and used, and the booklet presenting the method and the software will be produced and distributed. A new version of *Energy-10*, with libraries for some of the Task 23 countries, will also be released.

Subtask D: Dissemination and Demonstration

Work on the demonstration building projects will continue, and publication of the set of Task 23 products as a package will be arranged.

REPORTS PUBLISHED IN 2001

Computer Tools for the Implementation of Solar and Low Energy Measures in the Early Design Phase
Andresen, I., Proceedings of the ISES Summer Academy on Solar Architecture, Freiburg, Germany.

Examples of Integrated Solar Design: Five Low Energy Buildings Created Through Integrated Design
Van Cruchten, G. (editor).

IEA Task 23: Optimization of Solar Energy Use in Large Buildings,
Hestnes, A.G., Esbensen, T., Jaboyedoff, P., Balcomb, J.D., and Poel, B., Proceedings of ISES Solar World Congress, Adelaide, Australia.

The New Solar Buildings
Hestnes, A.G, Proceedings of North Sun 2001, Leiden, The Netherlands.

Examples of Solar Architecture
Hestnes, A.G., Proceedings of the ISES Summer Academy on Solar Architecture, Freiburg, Germany.

Guiding Tools – Guidelines on Integral Planning
Löhnert, G. and Jaboyedoff, P., Proceedings of the Intelligent Building Design Symposium, Stuttgart, Germany.

In addition, a large number of reports have been published by the individual Task participants in their own countries.

MEETINGS IN 2001

Eighth Experts Meeting
March 14-16
Lund, Sweden

Ninth Experts Meeting
November 12-13
Stuttgart, Germany

MEETINGS PLANNED FOR 2002

Tenth Experts Meeting
March 6-8
Yokohama, Japan

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TASK 24:

Solar Procurement

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TASK DESCRIPTION

The main objective of Task 24 is to create a sustainable, larger market for active solar water heating systems (mainly domestic systems). This objective will be achieved through major cost and price reductions for all cost elements, including marketing and installation, as well as performance improvements and joint national and international purchasing.

Subtasks

The work in Task 24 is divided into two Subtasks, each co-ordinated by a lead country:

- Subtask A: Procurement and Marketing (Lead Country: the Netherlands)
- Subtask B: Creation of Tools (Lead Country: Denmark)

The objectives of Subtask A are:

- To raise interest in active solar thermal solutions
- To form buyer groups to purchase state-of-the-art and innovative systems

The procurement activities will consist of two rounds: the first with smaller national projects and a low degree of joint international collaboration, and the second with larger projects and a higher degree of collaboration.

The objectives of Subtask B are:

- To collect, analyse and summarise experience
- To create tools to facilitate the creation of buyer groups and the realisation of projects and procurements. These tools will be included in a manual: "Book of Tools"
- To define a process for prototype testing and evaluation, using existing methods

Participation

Five countries take part in the Task – Canada, Denmark, Netherlands, Sweden and Switzerland. During the year, Belgium has taken part as an Observer and has now decided to join the Task. The formal participation process is ongoing.

Duration

The Task was initiated on April 1, 1998 and will be completed on March 31, 2003.

ACTIVITIES DURING 2001

- The First Round of Task 24 is now ending. Intensive work has been spent on analysing the market situation in the countries, identifying buyers, and forming national buyer groups (con-sisting of municipalities, utilities, housing corporations, construction companies, NGOs and other organisations). Specifications and competition documents have been drawn up and national procurements and competitions have been launched.

- The Canadian activities have focussed on projects with utility partners in Ontario. The plan is to install approximately 10,000 systems over the next three years. The systems were tested at the National Testing Laboratory during the year.

- In Denmark, the "Sun over Thy and Mors" campaign and contacts with the Danish association of plumbers have continued. Intensive work has been spent during the year on building up the organisation of the new Danish procurement buyer group project on the Internet: *"www.soltilbud.dk"*. The twelve tenders received were judged by a committee and the best in three categories were pronounced winners by the judging committee. A 20% price reduction was achieved, and one supplier formed a consortium of instal-lers all over Denmark. The winning systems are described and marketed on the website. There are four fixed installation prices depending on the type of the house.

- In the Netherlands, several activities have been ongoing during the year, for domestic systems (in existing dwellings and in new housing development) and for medium-size systems. The Sol*id, ASN Bank and WWF projects for domestic systems for existing dwellings, launched in 1999, have now been integrated into the "Call the Sun" campaign. This project is described on the website: www.beldezon.nl. The "Solhas" survey project – also for domestic systems for existing dwellings – was started this year together with the umbrella organisation of all housing associations in the Netherlands and counterparts in nine other European countries. The aim is to form an international buyer group of housing associations for the Second Round of Task 24.

  Among the projects for domestic systems for new houses in the Netherlands is the project called "Solar Energy in the Essent Supply Region." It has been running since 2000 with the goal of installing 1,200 systems. Phase 1 of the medium-sized system project "Space for Solar" was launched with a turnkey tender for 10,000 m^2 in December 2000 with February 2001 as the deadline for submitting tenders. The buyer group consists of a foundation of 59 housing associations. The project will continue with Phase 2 in 2002. Information is supplied at: www.ruimtevoorzon.nl.

- In Sweden, two projects were launched in 2000 – a competition for small systems (5,000 – 10,000 m^2) and a procurement for medium sized systems (10,000 m^2). The calls for tender were published both nationally and internationally via the EU Official Journal. All information about the projects, including competition documents (in Swedish and English), is available on the website http://solupphandling.bfr.se. About a dozen entries (including 3-4 international ones) were received in both projects.

  Eight prototypes for the small-systems project were tested at a Swedish independent testing laboratory. The winning system, Figure 1, offered a new lightweight, corrosion-free construction of which the large parts can be made of recycled plastic. Five pilot systems were installed in 2001. The project has been somewhat delayed since problems emerged on the plastic material in some of the pilot systems as a result of the very hot summer in Sweden. This means that, before starting the series production, the prototype has to be upgraded with improved material, which is now being tested in Australia. The tests are expected to be completed in March 2002 at the latest and deliveries are planned to take place throughout 2002.

  In the large-systems project the aim of the procurement was to accumulate orders totalling 10,000 m^2 of collector area. This target was not reached. Instead of selecting a winner, the jury has decided to describe five of the entries judged which best meet the specifications. Investigations will be made to find out whether the project can be merged with the "Space for Solar" project to gain synergy.

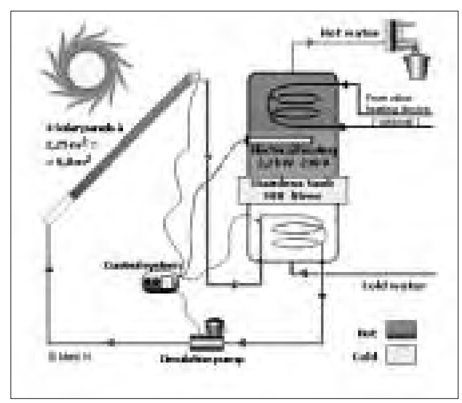

Figure 1. An outline of the winning solar heated tap water system in the Swedish competition.

- The work in Switzerland was very much influenced by the referendum in 2000, which was not in favour of a solar project follow-up. The "50 Solar roofs in the city of Zug" project was ended in the summer of 2001, and additional installation and service is offered.

For the "SSES virtual buyer group (on the Internet)" initiative, aimed at private homeowners, the intention is to form a local project team with PR specialist, Internet expert, suppliers, contractors and the Swiss Task 24 representatives. A website will soon be opened: www.solarpooler.ch.

The Swiss Manual for Buyer Groups was completed in 2001. It is based on literature research, analysis of earlier projects, interviews with actors in the market and the finding from a workshop held earlier this year. It consists of instructions and checklists for the formation of buyer groups, including a description of the process for preparations.

- Information material, brochures and articles were produced and published in all the participating countries, and papers were presented at different solar conferences.

- The evaluation of the First Round of the Task 24 procurements was finalised and two Mid-term Evaluation Reports were prepared.

- Belgium participated in Task 24 as an observer for part of the year.

WORK PLANNED FOR 2002

- In 2002 intensive efforts will be made to prepare for the Second Round of Procurements, which will include, to a larger degree, international coordination on specifications and principles for evaluation. The Task experts have identified concrete areas for further joint work, see Figure 2. It includes international procurement for national groups as well as for international groups. With the Netherlands as coordinator, some are countries preparing for collaborative work under the "Solhas Initiative," which involves housing associations in Europe. Eleven European countries have expressed interest. Other countries will work on the creation of buyer groups, using Internet mechanisms, as has been the case in Sweden.

	Canada	Denmark	Finland	Netherlands	Switzerland	Sweden
Small systems	■	■		■		■
Medium sized systems				■		■
Company		■			■	
Internet buyer group		■			■	
Web-site	■	■				
Tender documents	■	■		■	■	■
Buyer tool	■	■		■	■	■
Manual		■			■	

Figure 2. Areas where countries have initiated collaborative work on procurement documents or models.

- In the First Round, national experiences from using Internet tools for procurement and marketing to buyer groups were gathered in four of the participating countries (Denmark, The Netherlands, Sweden and Switzerland). The following websites have been used and will be used during the Second Round:

Denmark:
http://www.soltilbud.dk
Netherlands:
http://www.beldezon.nl
Sweden:
http://solupphandling.bfr.se
Switzerland:
http://www.solarpooler.ch

For the Second Round it is planned to deepen the exchange of web-site experiences with the final goal to develop an internationally accessible set of Internet tools that support procurement and marketing, and to link the Internet-based campaigns to each other, for example, under the umbrella of the "Soltherm Europe Initiative."

- The "Soltherm Europe Initiative," which was initiated by the Netherlands in 2001, aims to accelerate the European solar thermal market. The goal is to realise 15 million m2 in 2004, among other things by creating co-operation between sales and installation companies and through information campaigns. Much synergy can be gained from the collaboration with existing initiatives, such as Task 24. Eleven countries will be involved in the project, among them Belgium with the Walloon Region and Brussels. A first call for tender is expected to be launched in 2002. For this initiative, a SAVE/Altener funding proposal was submitted and accepted in 2001. Further information about the project can be found on www.soltherm.org.

- There are also plans for an internationally accessible Internet database with qualified international product information, which would be very effective in lowering the thresholds for international procurement ("B2B" information). In order to create a truly international market for solar thermal systems, international product information should be readily available. The database could be the catalyst in this process. This has been discussed with ASTIG and a format has been agreed upon, based on the CEN Standards. Further develop-ment will be done in co-operation with ASTIG and Solar Key-mark.

- The web-based "Business Tools" will be further updated to include an international context with experiences from completed projects.

- The work on model processes and contract documents, the "Guide for Tender" will continue to be reviewed internationally and suggestions requested from suppliers.

- The Swiss projects will continue in collaboration with some cities, for instance Lucerne and Burgdorf.

- Different organisations will be approached regarding solar projects, as for example the World Wildlife Foundation in the Netherlands and Denmark, and Greenpeace in Denmark.

- New countries will actively be consulted regarding participation in Task 24. For example, countries wanting to develop their market for solar water heaters for housing associations will be given the opportunity of participating in the "Solhas" initiative. Countries planning to start up web-site sales or a market for medium size systems can participate in the "Space for Solar" initiative.

- Belgium has decided to become a participating country and is expected to be a full Task 24 member in 2002.

- Information activities will continue in all the participating countries. The Task 24 newsletter will be updated and published on the Task 24 home page (www.ieatask24.org) and presentations will be made at different solar conferences.

LINKS WITH INDUSTRY

Ongoing contacts with the European supplier organisations ASTIG and ESIF were made in 2001, and the draft tender documents were sent to them for comments. Comments were received from ASTIG. ASTIG is now working with European-based quality systems and quality certification for installers. New rules for membership are being prepared for the European organisations, which will make collaboration between these two organisations easier in the future.

Contacts and meetings with manufacturers took place, for example in connection with the Experts meeting in the Netherlands in September. A dialogue was started and there has been a valuable exchange of ideas regarding tenders, solar system components, transportation, training, etc.

Contacts have been taken with different industrial organisations regarding possible solar projects. For example, a project is planned in Switzerland with an insulation company. It is aimed at the employees and will start mid-2002. Involvement of retailers and customers is planned.

REPORTS PUBLISHED IN 2000

The second edition of the Task 24 report "Book of Tools"—produced on the web—with the majority of the original content in the section "Business Tools" was published in 2001. The report is available from the Task home page (www.ieatask24.org).

A draft Guide for Tender was compiled and published on the homepage. So far, it contains two draft example tender documents—for solar heating systems for single-family houses and for collector subsystems for large solar heating systems.

REPORTS PLANNED FOR 2002

An updated version of the "Book of Tools" will be available on the Task 24 website.

MEETINGS IN 2001

Seventh Experts Meeting
March 21-23
Sweden

Eighth Experts Meeting
September 26-28
Netherlands

MEETINGS PLANNED FOR 2002

Ninth Experts Meeting
March 20-22
Denmark

Tenth Experts Meeting
September 16-18
Belgium

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TASK 25:

Solar Assisted Air Conditioning of Buildings

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TASK DESCRIPTION

The main objective of Task 25 is to improve conditions for the market introduction of solar assisted air conditioning systems in order to promote a reduction of primary energy consumption and electricity peak loads due to air conditioning of buildings. Therefore the project aims on:

- Definition of the performance criteria for solar assisted cooling systems considering energy, economy and environmental aspects,
- Identification and further development of promising solar assisted cooling technologies,
- Optimization of the integration of solar assisted cooling systems into the building and the HVAC system focusing on an optimized primary energy saving - cost performance, and
- Creation of design tools and design guidelines for planners and HVAC engineers.

The work in Task 25 is carried out in the framework of four Subtasks.

Subtask A: Survey of Solar Assisted Cooling

The objective of Subtask A was to provide a picture of the state-of-the-art of solar assisted cooling. This includes the evaluation of projects realized in the past.

Subtask B: Design Tools and Simulation Programs

The objective of Subtask B is to develop design tools and detailed simulation models for system layout, system optimization and development of advanced control strategies of solar assisted air conditioning systems. Main result will be an easy-to-handle design tool for solar assisted cooling systems dedicated to planners, manufacturers of HVAC systems and building engineers.

Subtask C: Technology, Market Aspects and Environmental Benefits

The objectives of Subtask C are to provide an overview on the market availability of equipment suitable for solar assisted air conditioning and to support the development and market introduction of new and advanced systems. Design-guidelines for solar assisted air conditioning systems will be developed.

Subtask D: Solar Assisted Cooling Demonstration Projects

Several demonstration projects will be carried out and evaluated in the framework of Task 25. The objectives are to achieve practical experience with solar assisted cooling in real projects and to make data for the validation of the simulation tools available. Aim is to study the suitability of the design and control concepts and to achieve reliable results about the overall performance of solar assisted air conditioning in practice.

Duration

The Task was initiated in June 1999 and will be completed in May 2004.

ACTIVITIES DURING 2001

A summary of Subtask research activities carried out during 2001 is presented below.

Subtask A: Survey of Solar Assisted Cooling

A survey of existing solar assisted air conditioning systems has been carried out and information about 28 installations has been gained. A database was prepared for this purpose. Short reports about national R&D activities on solar assisted air conditioning in participating countries have been produced. The results of Subtask A were summarized in a webpage with access to the database.

Subtask B: Design Tools and Simulation Programs

Mathematical models for most of the key components of solar assisted air conditioning systems have been developed: single-effect absorption chiller, adsorption chiller, desiccant wheel, solar collectors, storage tank, backup gas heater, standard air handling equipment components. Most of the component models have been implemented in the design tool; some of them (e.g. thermal driven chillers) have also been written as component models for TRNSYS. An executable version of the WINDOWS design tool is available which is able to simulate solar assisted ventilation systems. Three typical building loads were defined (office building, hotel, lecture room) and 6 climatic areas which cover the whole spectrum from warm-humid to moderate climates (Tropical, Mediterranean/Coastal, Mediterranean/Inland, Central European/South, Central European/Moderate and Central European/North). The production of the reference load files for all those climates is ongoing.

September 2001 Task Experts Meeting in Lisbon, Portugal.

Subtask C: Technology, Market Aspects and Environmental Benefits

A survey of market available equipment for solar assisted air conditioning has been carried out. The survey aimed to achieve a market overview about absorption chillers, adsorption chillers and desiccant wheels.

A survey about finished and ongoing national R&D work on new components has been carried out as well. Aim was to identify promising new approaches which are feasible for solar assisted A/C systems.

An approach to measure overall performance of solar assisted air conditioning systems with relation on energy, economy and environmental issues has been developed. This approach will be included into the design tool (Subtask B) in order to allow an easy comparison of different system options and to support design decisions.

Subtask D: Solar assisted cooling demonstration projects

Two levels of monitoring have been defined for demonstration systems: global monitoring aims on measuring of daily energy balances and detailed monitoring aims to achieve time series of many system parameters in order to study component performance and control issues.

Monitoring has been started at 6 projects. In 2 installations commissioning is ongoing and 4 systems are being manufactured and will start operation in 2002.

WORK PLANNED FOR 2002

Subtask A has been finalized. Subtask B and C were extended until the end of 2002. Subtask D will continue until May 2004. A proposal for a follow-up of Subtask B has to be prepared in order to allow a comparison of the models with measured results of the demonstration projects. The following activities are planned for 2002.

Trade Fair Participation

Task 25 will present Solar Assisted Air Conditioning of Buildings on the International Trade Fair AirConTec on April 14-17, 2002 in Frankfurt, Germany. The topic will be presented by different means such as posters, a slide show, a solar desiccant system model with interactive poster, a computer with projector to show the design process using the computer design-tool and a Workshop to be held on April 14.

Subtask B: Design Tools and Simulation Programs

It is planned to have a first complete version of the design tool available in April 2002 in order to present it during a trade fair (see above). This includes final production of reference load files (18 load files: 6 climates, 3 reference buildings). Missing component models shall be implemented such as a model for a cooling tower and eventually a model of a double-effect absorption chiller.

Subtask C: Technology, Market Aspects and Environmental Benefits

The survey about market available equipment will be finished and documented. The survey about new developments of low temperature heat driven cooling equipment and solar collector developments feasible for solar assisted A/C will be finished and a technical report about this topic has to be completed. Based on application of the design-tool design examples will be produced and design guidelines shall be developed.

Subtask D: Solar Assisted Cooling Demonstration Projects

Monitoring of systems in operation will continue and some new systems will be commissioned and start operation in 2002. The evaluation process will start and be used to achieve draft results about operation experiences and energy performance.

REPORTS PUBLISHED IN 2001

A webpage about national activities in solar assisted air conditioning R&D and about existing systems in participating countries was produced. This webpage is not yet available to the public.

REPORTS PLANNED FOR 2002

Technical report about new developments (Subtask C).

Solar assisted air conditioning handbook (Subtask B and C). This handbook is one of the major outputs of the Task and will summarize the work of Subtask C and parts of Subtask B. The target audiences of the handbook are planners, manufacturers of A/C systems and building engineers.

MEETINGS IN 2001

Fourth Expert Meeting
January 29-30
Sophia Antipolis, France

Fifth Expert Meeting
September 27-28
Lisbon, Portugal

MEETINGS PLANNED FOR 2002

Sixth Expert Meeting
April 18-19
Freiburg, Germany

Seventh Experts Meeting
To be determined
probably Graz, Austria

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TASK 26:

Solar Combisystems

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TASK DESCRIPTION

Solar heating systems for combined domestic hot water preparation and space heating, so called solar combisystems are increasing their market share in several countries. Much is already known about solar domestic hot water systems, but solar combisystems are more complex and have interaction with extra subsystems. These interactions profoundly affect the overall performance of the solar part of the system. The general complexity of solar combisystems has led to a large number of widely differing system designs, many only very recently introduced onto the market. After the first period of the use of combisystems (1975-1985), when design of non-standard and complex systems by engineers was the rule, a new period has been opened since 1990. Now the design is done essentially by solar companies trying to sell systems, which are less complex and cheaper. But current designs result mainly from field experiences and they have not yet been carefully optimized. Substantial potential for cost reduction, performance improvement and increase in reliability exists and that needs to be scientifically addressed.

Scope and Main Activities

Task 26 is reviewing, analyzing, testing, comparing, optimizing and improving designs and solutions of solar combisystems for:

- detached single-family houses,
- groups of single-family houses, and
- multi-family houses or equivalent in load with their own heating installations.

This Task does not refer to solar district heating systems, systems with seasonal storage and central solar heating plants with seasonal storage.

To accomplish the objectives of the Task, the Participants are carrying out research and development in the framework of the following three Subtasks:

- Subtask A: Solar Combisystems Survey and Dissemination of Task Results (Lead Country: Switzerland)
- Subtask B: Development of Performance Test Methods and Numerical Models for Combisystems and their Components (Lead Country: The Nether-lands)
- Subtask C: Optimization of Combisystems for the Market (Lead Country: Austria)

Besides 32 experts from 10 countries, 16 companies from almost all participating countries are taking part in the work. Their contributions will make the results of the Task more relevant to the solar heating industry.

Duration

The Task was initiated in December 1998 and will be completed in December 2002.

ACTIVITIES DURING 2001

A summary of Subtask research activities during 2001 is presented below.

Subtask A: Solar Combisystems Survey and Dissemination of Task Results

Progress in Subtask A is reported in

the field of combisystem characterization. A French participant entered a major contribution to this subject at the Delft Experts' Meeting. The new mathematical function introduced by him to describe the annual combisystem performance leads to a drastic reduction in the data point scatter in the efficiency diagram. The main idea is the exclusion of the potential excess heat (observed at summer time) from the calculation of the performance function. He presented more results based on simulation data from Subtask C at the following meeting at Rapperswil. Although more work has to be done with further data, the potential of the method has been confirmed. The suggested mathematical representation leads to a simple correlation with a high degree of confidence. It is expected to enable a more accurate and objective comparison of different generic combisystems than previous approaches.

The Norwegian combisystem was added to the classification published in the coloured booklet "Overview of combisystems 2000." Norway, who joined Task 26 late, prepared a full description of its system. It has been decided to consider it as a variation of generic system #9. The inclusion will be done on the web site only (no renewed printing of the booklet).

In order to supplement the data available to the Task, Subtask collected information on space requirements for each generic combisystem (storage tank(s), pump/hydraulics, external boiler, external heat exchanger). More information is desired on generic system costs. Accurate cost data has been published in the coloured booklet, therefore data from the parallel running EU Altener project, when data will be used when it is available. Under the Altener project, about 140 combisystems will be installed in the participating countries with the aim to boost the market based on improved and optimized systems. The costs of these systems will be monitored. Due to the fact that most Altener project participants are also involved in Task 26 the cost data transfer is straightforward.

Subtask A regularly gets extensive reports on architectural integration of combisystems from its Austrian and Norwegian participants. In both countries, national projects are currently running on this topic. The emphasis is on façade and roof integration of collectors. Facade integrated collectors are an interesting new field for architects which is expected to open a new market segment to solar thermal systems. The condition is that aesthetics of the products integrated into the façade is carefully considered. In Austria the temperature and humidity profile in the wall with an integrated collector without backside ventilation has been monitored in two buildings (light weight and massive constructions respectively). So far, no risk of significant water vapour condensation in the wall has been encountered. However, before a definitive conclusion the measurements from the winter of 2001/2002 will be analyzed.

Subtask A is performing a compilation of resource documents on solar combisystems available in the participating countries. A bibliographic database is being created.

Further steps towards the Task 26 final deliverable have been taken. The preferred concept is a book published by a technical or scientific publisher and a CD-ROM sold together with the book. In the book, basic information and results will be published. The CD-ROM will include more details on all topics addressed by Task 26. For the moment, the book's table of contents is being discussed with potential publishers. Working out the book and the CD-ROM texts will be a major activity for Subtask A in 2002, in co-operation with Subtasks B and C.

Task 26 improved its website by creating a sub site operated by the Danish Technological Institute in addition to the main site managed in New Zealand. The main site presents basic information like the coloured booklet 'Overview of Solar Combisystems' published in 2000. On the sub site, more rapidly changing information is available, in particular a number of pdf files which can be downloaded.

The second issue of the annual Industry Newsletter was prepared and edited. It was also translated in German (with two editions for Austria and Germany respectively), French, and Danish. All versions are available as pdf files from the Task 26 web site. The topics addressed in the second issue were industry's participation in the Task, a completed German project on solar combisystems, the Altener project on solar combisystems, heat losses from storage tanks, stagnation behaviour of thermal solar systems, and controller integration.

The two Industry Workshops in Delft, the Netherlands and Rapperswil, Switzerland were well attended. The addressed topics were:

- market, systems and components
- drain-back systems
- legionella, architectural integration of solar collectors, stagnation and overheating. Especially the last subject (Influence of hydraulics on thermal stress of components including the heat transfer fluid / Long-term stability of heat transfer fluids, experience of producers / Use of glycol-water mixtures in solar heating systems from the point of view of the manufacturer) initiated an intense debate among the workshop participants.

Subtask B: Development of Performance Test Methods and Numerical Models for Combisystems and their Components.

Test method development for solar combisystems includes both thermal and hot water performance. Model development supports definition of test procedures and evaluation of tests in Subtask B as well as optimization of solar combisystems in Subtask C.

For test method development the financial status of the Subtask has improved a lot: for 2001, budget was available not only for SPF-Switzerland and SP-Sweden, but also for ITW-Germany and TNO-the Netherlands. Moreover, problems with the lack of time have decreased for SP and SPF. Moreover, CSTB-France showed interest in working on test method development.

Thermal Performance Test Method

Emphasis in solar combisystem test method development is now on the so-called Direct Characterisation (DC) test procedure. A preliminary second version of the test method was drafted, distributed and thoroughly discussed. With this document at hand, participants discussed a desirable and realistic end product of Subtask B considering following possibilities:

1. The performance indicator is a direct result from testing. There is no processing into annual performance prediction. Hence, this involves direct comparison of test results if more systems are tested.
2. Performance indicator from testing is processed in a simple way to deliver annual performance prediction, but only for the conditions during the test, being average values for the whole year. Extrapolation into other climates and heat demands than used in the test is not possible.
3. Test results are processed with a numerical solar combisystem model revealing annual performance predictions for all climates and loads possible.

Option 3 is favourable with respect to its expected accuracy. However, test sequences might be more extensive in order to determine all necessary parameters accurately enough. If no model is available, data processing also requires additional modelling work. This all makes the test more expensive. On the other hand, the test is considered to be cheaper than CTSS testing (Component Testing followed by System Simulation, ENV 12977-2), and probably also more accurate with respect to annual performance prediction due of measuring the whole system, i.e. including system control. Currently, option 1 is considered as a too limited result. Without investigation of accuracy of the annual performance prediction, it is difficult to estimate how accurate the method is for the large variety of solar combisystems. Hence, that leaves option 2 as the most realistic way to further develop the DC test method at this moment.

The conclusion is that the main focus will be on option 2 with description of the method in a draft procedure and preliminary evaluation of the test procedure by investigation of simulated test data and real testing. A few participants will explore option 3 at a lower level.

Discussion on details of the test procedure among others revealed:

- The final energy used by the auxiliary heating as major performance indicator of the solar combisystem. This implies that the solar combisystem shall always be tested in combination with the auxiliary heater. This feature is considered as favourable as many problems in system operation appear to be due to improper control strategy of combination of solar and auxiliary part of the system. Hence, the test method forces manufacturers to think about the integral system design.

- Determination of annual final energy used is only possible for annual conditions that correspond more or less with the test conditions. It is decided that the performance indicator is to be derived for the combination of one out of three climate zones, one out of three space heating loads and one domestic hot water demand, following definitions in Subtasks A and C. This approach reduces threshold for export, as there is no need for translation into specific national conditions with respect to climate and load.

Hot Water Performance Test Method
A separate test method for determination of hot water performance has successfully been tried out on three heat stores. The test conditions used are the outcome of discussions with German manufacturers. On the way to European standardisation in future, more general test conditions can be expected for a wider range of also national dependent solar combistores. A combination of hot water performance test and DC test sequence was discussed before. A combination is only favourable if an additional advantage for solar can be indicated, i.e. the increase in utilised hot water volume.

Discussion on Use of Water/Glycol Mixtures
Special item for discussion on testing was the unambiguous use of water/glycol mixtures in collector loops. Use of different fluids leads to different efficiencies for the solar collector and heat exchanger(s). Correction of efficiencies from one fluid to the other might be difficult in some designs. This may cause problems in mutual acceptance of test results. It was concluded that the water/glycol discussion is considered not to be an aspect only related to solar combisystems. The Solar Keymark project is a better forum for further elaboration of this item. It is agreed to feed the discussion by the following investigations:

- Calculation of the influence of variations in the water/glycol mixture on annual performance of solar combisystems.
- Determination of variations in the water/glycol mixture on the pump power.

For the time being, it is decided that the manufacturer should deliver the water/glycol mixture. This recommendation will be built into the test procedure description.

Test Facility Building and Thermal Performance Testing
Further work has been carried out in building test facilities. Use of the solar collector emulator has been described and construction work has been carried out. New player in this field is DTU (Denmark). Test facility at SPF is most ready and has been tried out on a solar combisystem. At the end, there will be test facilities in Denmark, Germany, the Netherlands, Sweden and Switzerland. Contacts with manufacturers have been made for testing solar combisystems.

Model Development
Model development has mainly taken place in conjunction with system optimization in Subtask C. Specific model development was carried out for investigation of simulated test data.

Subtask C: Optimization of Combisystems for the Market
The objective of this Subtask is to enhance existing solar combisystem designs by optimization based on simulation of the systems and to help industry to propose new system designs being able to match demand with better thermal and economical performance than before. Ten of the 21 system designs chosen by Subtask A are modelled. The optimization of the models will be finalized in the beginning of 2002.

Reference Conditions
The reference conditions for simulation runs are defined in Milestone Report C0.2 and approved by the participants. They are based on four reference buildings (single family house with 30, 60 and 100 kWh/m^2a space heat demand), three climates (Stockholm, Zurich, Carpentras), conventional reference systems and many fixed parameters.

Optimization Procedure
The optimization procedure was approved at the Rapperwil Meeting (7-10 October 2001). It is now possible to optimize the system, with its specific collector area and store volume, because a new comparison method was developed in 2001. The following steps are performed during the system optimization.

- Model the system in TRNSYS for the relevant climate (preferably

Zurich) and the 60-kWh/m^{2}a building with collector area and store volumes set by the participant.
- Do a sensitivity analysis (and may be optimization) with this model. The parameters that should be varied are given in Milestone Report C3.1. Of course participants can do a sensitivity analysis with more than the mandatory parameters. The model can also be changed, if it is found, that it is far away from the optimum.
- Optimize the system using the specified target functions (by hand and automatically). If available, cost functions can be included in the optimization.

The target functions for the analysis are based on fractional energy savings. Three functions have been defined basing on:

- Final energy for burner (fuel demand),
- Final energy for burner (fuel demand) including electricity consumption of pumps and boilers,
- Final energy for burner (fuel demand) including electricity consumption of pumps and boilers as well as penalty functions for not fulfilling the comfort criteria of domestic hot water (DHW) and room temperatures as they are defined for the reference conditions.

Comparison of Systems

The procedure for the comparison of the systems was tested by the participants and gives very encouraging results. With this method it is possible to compare systems in different ranges of fractional energy savings ('large' solar plants against 'small' solar plants) basing on the efficiency of the system (maximum possible solar energy yield for the used collector area against actual yield). By mid-2002 the comparison of all optimized systems should be completed.

As result of this analysis recommendations and general guidelines for advanced solar combisystems can be drawn and elements of 'dream' combisystems will be defined in the last half-year of Task 26.

WORK PLANNED FOR 2002

A summary of planned activities for each of the Subtasks is presented below.

Subtask A: Solar Combisystems Survey and Dissemination of Task Results

- Complete the characterization combisystem as well as of work on architectural integration, collection of resource documents, etc.
- Produce of the third and last issue of the Industry Newsletter
- Organize two Industry Workshops. The Industry Workshops will be held in conjunction with the upcoming Task 26 meetings in Norway and Austria.

Subtask B: Development of Performance Test Methods and Numerical Models for Combisystems and their Components

- Prepare description of the Direct Characterisation Test Method including test facilities.
- Further investigate the test conditions for the DC test method (Option 2) using simulated test data. Test sequences will be simulated for a variety of solar combisystems. Special attention will be paid to extrapolation of annual performance for different climates and loads as well as for slightly different system sizes.
- Further design and build/finish test rigs for AC/DC testing. Special attention will be paid on design of the solar collector emulator.
- Conduct real solar combisystems testing according to the AC/DC test method and comparison with the outcome with CTSS test results.

Subtask C: Optimization of Combisystems for the Market

- Finalize the sensitivity analysis and optimization for various parameters including control strategies with respect to all reference conditions, parameters and target functions chosen by Subtask A and C.
- Compare the different optimized systems
- Analyze each optimized system on behalf of the comparison
- Report on all systems (system description, modelling, sensitivity, optimization, comparison)
- Collect and report on the material demand of all systems
- Develop general guidelines for the design of advanced solar combisystems and elements of a 'dream' system.

LINKS WITH INDUSTRY

Sixteen companies from almost all participating countries are taking part in Task 26. The Industry Workshops have received a positive response from industry, especially from industry in the country hosting the Experts' Meeting. Between 11 and 50 representatives of the industry attended the workshops.

LINKS WITH CEN TC 312

Liaison status has been granted to Task 26 with CEN/TC 312 "Thermal solar systems and components," by Resolution 7/99. The duration of this liaison is three years and will be reviewed accordingly on 2002-10-27. CMC (CEN Management Center) has recorded as permanent interface between the CEN/TC 312 and Task 26: Dr. Jean-Marc Suter of Switzerland and Mr. Huib Visser of the Netherlands.

CEN/TC 312 has interest in the work of IEA SH&C - Task 26 and decides that in due time standards will be required on solar combisystems.

NEN will prepare a formal proposal for a new work item on solar combisystems before end of 2002.

[Note: NEN is the Dutch member body of CEN/TC 312.]

REPORTS PUBLISHED IN 2001

Second Industry Newsletter with the following three extensive annexes published on the Task 26 homepage (pdf files to be downloaded) as scientific articles:

- *Heat Losses from Storage Tanks - Up to 5 times higher than calculated!*
  Jean-Marc Suter, Suter Consulting, CH-3000 Berne 16, Switzerland

- *Stagnation Behaviour of Thermal Solar Systems*
  Robert Hausner and Christian Fink, AEE INTEC, A-8200 Gleisdorf, Austria

- *Controller Integration*
  Stefan Larsson, Vattenfall Utveckling, S-81426 Alvkarleby, Sweden

Proceedings of Delft and Rapperswil Industry Workshops

The Industry Newsletters as well as the Task 26 Industry Workshop Proceedings are all available from the Task 26 homepage http://www.solenergi.dk/task26/downloads.html.

REPORTS PLANNED FOR 2002

Third Industry Newsletter

Proceedings of the last two Industry Workshops

2001 EXPERTS MEETINGS

Fifth Experts Meeting
April 1 – 4
Delft, The Netherlands

Sixth Experts Meeting
October 7 – 10
Rapperswil, Switzerland

2002 EXPERTS MEETINGS

Seventh Experts Meeting
April 7-10
Oslo, Norway

Eigth Experts Meeting
September 22-25
Austria

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TASK 27:

Performance of Solar Facade Components

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TASK DESCRIPTION

The objectives of this Task are to determine the solar visual and thermal performance of materials and components, such as advanced glazing, for use in more energy efficient, comfortable, sustainable buildings, on the basis of an application oriented energy performance assessment methodology; and to promote increased confidence in the use of these products by developing and applying appropriate methods for assessment of durability, reliability and environmental impact.

Scope

The work will focus on solar facade materials and components selected from the following:

- Coated glass products
- Edge sealed glazings, windows and solar façade elements
- Dynamic glazing (i.e., electrochromic, gasochromic and thermochromic devices, thermotropic and other dispersed media)
- Antireflective glazing
- Light diffusing glazing
- Vacuum glazing
- Transparent insulation materials
- Daylighting products
- Solar protection devices (e.g., blinds)
- PV windows
- Solar collector materials, including polymeric glazing, facade absorbers and reflectors.

Means

The work in Task 27 is carried out in the framework of three subtasks.

- Subtask A: Performance (Lead Country: Netherlands)
- Subtask B: Durability (Lead Country: Sweden)
- Subtask C: Sustainability (Lead Country: France)

Main Deliverables

Subtask A: Performance

- Further developed coherent energy performance assessment methodology to enable comparison and selection of different products and to provide guidance for their assembly and integration into building envelope elements.
- Structured a database of components and façade elements to present data in a consistent and harmonised form, suitable for product comparison and selection and for simulation of performance in specific applications.
- Recommended calculation and test methods for solar and thermal performance parameters in support of international standards development.

Subtask B: Durability

- Validated methodology for durability assessment of advanced solar building materials.
- Estimated the service lifetime based on degradation of performance for selected materials tested.
- Recommended standard test procedures for service life testing of selected materials and components.

Subtask C: Sustainability

- Reviewed of international knowledge base, tools, actions and requirements related to glazing, windows and solar components.
- Conducted an overview of the FMEA tool capabilities, adaptation

to the field of glazing, windows and solar components, and guidelines for using it in the assessment of possible shortening/reduction of the service life.

Duration
The Task was initiated in January 2000 and is planned for completion in December 2003.

ACTIVITIES DURING 2001
In general, good progress was made in the main issues of performance, durability and sustainability.

Subtask A: Performance
The extended report on performance indicators and terminology will be finished in May 2002.

The energy performance assessment methodology for A2, A3, B1 has been split into building and component performance indicators and the work will begin in April 2002.
Work on modelling and control strategies began during the second half of 2001. The work carried out in Uppsala, Sweden was presented in November 2001 in a PhD Thesis. Measurements and simulations of electrochromic windows, in combination with mechanical reflecting shading devices at Solar-Institut Jülich, will contribute as well. Work is in progress to define control strategies, monitoring and evaluation procedures.

Links to other projects outside the Task and organisations are important and need to be intensified. The European projects SWIFT (on switchable facade technology) and WINDAT (on glazing and window database development) have been established. The outcome of the project and discussions may be useful for standards organisations. Links to CEN TC33 (WG on shading products) are established as well. Also a new heating energy performance standard for non-domestic buildings is being developed, and an exchange of information has been promised by the project leader with the convenor of the group.

Subtask B: Durability
The general methodology for durability assessment has been defined and applied to various subjects.

The adaptation of durability assessment methodology to specific chromogenic requirements has also been carried out. The accelerated ageing testing could not be started in time due to delays in the supply of the test samples.
The inquiry on electrochromic samples availability for durability studies has been made among the industrial partners of Task 27, commitments to provide samples to the Task 27 research have been made with Flabeg, Interpane and AFG Gentex, Asahi, St Gobain will probably be able to provide data on durability.
Outdoor testing at ISE and CSTB were started in October 2001.Electrochromic samples will be distributed by Flabeg and gasochromic samples will be distributed by Interpane. Accelerated tests on electrochromic samples will start in mid-2002.

Candidate materials for durability and reliability assessment of static solar materials were identified and investigated in the framework of the following case studies:

- Anti-reflective and polymeric glazing materials
- Reflectors
- Solar facade absorbers

Initial risk analysis was performed, samples were exposed on outdoor test facilities at different locations, and accelerated screening tests started for all case studies.

Subtask C: Sustainability
A first attempt of data processing was completed concerning the report about examples performed on reference products. The methodology report (nominal service life prediction and anticipation of premature termination, application to an example) has to be revised to a final and referenced report for publication as well as the terminology report.

A selection of application examples to be carried out by the group is in process.

The state of the art report will be completed in January 2002 and the reports on the case studies (Edge Sealed Glazing Units, Breathing Units and TIM-Elements) will be completed the end of 2002.

The involvement of the subtask members in networks, working groups and events gives an access to information issued from:

- EIPC Conference (Brussels, May 2001) on Environmental Product Declaration (EPD) harmonisation in Europe(deliverables to be circulated)

- Report of the "SETAC – LCA in Building" group, available on the SETAC web site
- Active participation to the CRISP, PRESCO network, the sustainable construction WG in ISO TC59/SC3, the application to the CEN (DG Enterprise) call for tenders
- National projects progress (projects on windows in Denmark, Finland, Italy, Norway and the USA and projects on declaration formats in France and the USA)

WORK PLANNED FOR 2002

Subtask A: Performance

- Complete the extended report on performance indicators and terminology.
- Preliminary energy performance assessment methodology for A2, A3, B1 for components and buildings.
- Improved energy performance assessment methodology for components and buildings
- Definition of appropriate conditions for testing and calculation
- Sensitivity studies report
- Performance data report
- Results of testing and modelling

Subtask B: Durability

- General methodology for durability assessment validated by testing glazing materials and comparison with results of outdoor testing
- Completion of first series of accelerated ageing testing of chromogenic glazings
- Completion of second series of accelerated ageing tests for static solar materials

Subtask C: Sustainability

- State of the art report
- Reports of the Case Studies on Edge Sealed Glazing Units and Breathing Units and TIM-Elements
- Yearly evaluation of collected data
- Report of accelerated cyclic tests on "Edge Sealed Glazing Units" and "Assemble of Windows/Wall"

LINKS WITH INDUSTRY

Nine companies from seven countries are participating in Task 27. Through these industry links, the participants of Task 27 can ensure the valuable use of its research results. See the list of Task 27 national contact persons for further details.

MEETINGS IN 2001

Third Experts Meeting
April, 27-30
Berkeley, California, USA

Fourth Experts Meeting
October, 8-11
Rome, Italy

MEETINGS PLANNED FOR 2002

Fifth Experts Meeting
April, 9-12
Copenhagen, Denmark
Partly joint with Task 31 plus a "Window Rating" workshop.

Sixth Experts Meeting
September 30 - October 3
Ottawa, Canada
To include a workshop with Canadian colleagues and industry.

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TASK 28 / BCS ANNEX 38:

Sustainable Solar Housing

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TASK DESCRIPTION

The goal of this Task is to help achieve significant penetration of sustainable solar housing in the markets of participating countries starting in the year 2005 by providing home builders and institutional real estate investors with:

- Website network illustrating solar sustainable housing which are exemplary in design, living quality, energy use and environmental impact.
- Book: Marketable Sustainable Solar Housing: Photos, Plans and Performance describing recently built housing to help planers learn from built experience
- Book: Marketable Sustainable Solar Housing: A Design Guide with planning advice supported by graphs and tables from building monitoring, lab testing and computer modeling.
- Demonstration Buildings with press kits for articles and brochures in local languages to increase the multiplication effect beyond the local region.
- Workshops after the Task conclusion presenting the Task results.

The work in Task 25 is carried out in the framework of four Subtasks:

- Subtask A: Market-Assessment and Communication (Lead countries: Netherlands and Norway)
- Subtask B: Design and Analysis (Lead countries: Sweden and Switzerland)
- Subtask C: Demonstration (Lead country: Australia)
- Subtask D: Monitoring and Evaluation (Lead country: Germany)

Duration

The Task was initiated in April 2000 and is planned for completion in April 2005.

ACTIVITIES DURING 2001

40 Experts from Australia, Austria, Belgium, Brazil, Canada, Finland, Germany, Italy, Japan Switzerland, Netherlands, Norway, Sweden and the UK are sharing in the work of the Task. Tangible results from this year's efforts include:

- Brochure describing the Task
- International workshop on market analyses and strategies,
- Working document comparing the different building codes using three reference budings which will serve as a basis to analyze the effectiveness of design strategies a detailed outline for the handbook, Marketable Sustainable Solar Housing: Photos, Plans and Performance, and drafts of 10 chapters,
- Draft manuscript on the design brief process,
- Data bank on the characteristics of built exemplary projects, and
- Articles in national professional journals or conference proceedings

Subtask A: Market-Assessment and Communication

Task Communication

An Internet website provides information on the Task www.iea-shc.org/task28/) and 4,000 Task brochures were printed. Copies are available from the IEA SHC Secretariat.

Market Assessment

Experts reviewed national marketing

situations for sustainable housing and discussed strategies to increase market share at an international workshop held in Bregenz, Austria in September 2001.

Finish researchers from VTT investigated what builders think of environmental issues. Seven page questionnaires were sent to 784 purchasers of house lots in the six major urban areas. From the 239 replies it was notable that homebuyers highly rate low energy consumption. By contrast, advice from salesmen was rated very low as seen in Figure 1.

In Austria market factors for sustainable housing were empirically analyzed from questionnaires to 212 residents of conventional housing, and 100 interviews with occupants from innovative housing projects as well as with component producers

Barriers identified were:

- the remarkably little knowledge among planners, builders, contractors and residents regarding energy, and resource-efficient buildings. Lack of home buyers' awareness causes low demand.
- high transaction-costs (including design) and uncertain risks for builders and buyers alike, and
- the builders and buyers reluctance to "experiment" with new technical systems.

Paths to overcome the barriers can be to:

- encourage ecologically motivated individuals, groups of architects, builders,
- address buyers' expectations for a comfortable and healthy environment, positive feelings about the house and themselves and something special to show the outer world, and
- strengthen buyer identification with the house by involving them during planning.

From national surveys, the lesson for the Task, demonstration projects and design handbook are that the construction must be as maintenance-free as possible, aesthetics are decisive and that energy cost savings are indeed a selling point.

Subtask B: Design and Analysis

Energy Analysis Group

Reference buildings have been defined per national construction codes and energy loads calculated with a PC-version of the European Code: EN 832 prepared for the Task by the University of Siegen. Internal gains were defined by a working group The bars of Figure 2 above the centerline show transmission and ventilation heat losses; bars below the center line are the supply of useable internal and solar gains and auxiliary heating. Sun-poor, northern countries benefit most from solar gains to offset heating losses. The range of remaining heating demand across climates is small because U-Values in practice are inversely proportional to latitude.

Life Cycle Ecology

This group is striving to find common insights from the application of different LCA methodologies including a detailed LCA method used in Switzerland and Germany, a holistic approach currently under develop-

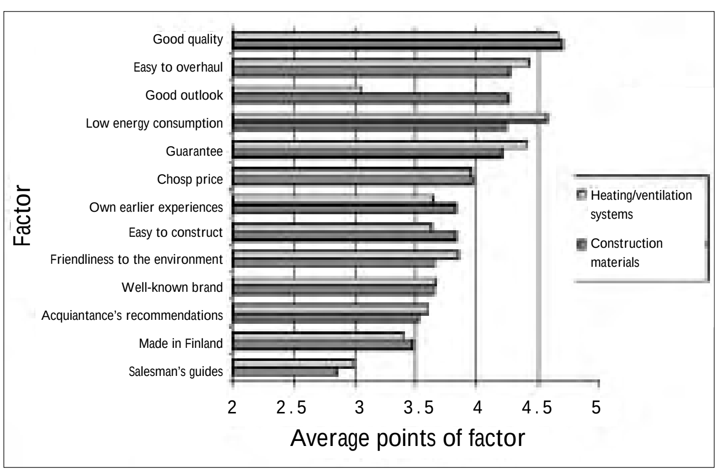

Figure 1. Importance of different factors in the decision making-process of homebuyers.

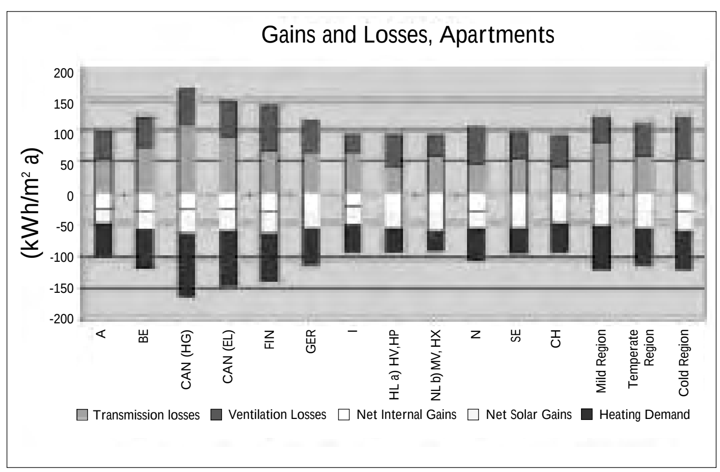

Figure 2. Energy losses and gains of the reference building by country.

ment in Belgium, and checklist methods used in Norway and the Netherlands.

Subtask C: Demonstration
A draft report on developing design briefs has been completed and discussed at the Bregenz expert meeting. The documentation is structured in three blocks:

- Functional requirements (how the building/spaces will be used)
- Environmental requirements (including low water usage)
- Eco-Efficiency Cost Plan (achieving the most ecological benefit for a given investment)

Several demonstration projects have already been constructed. Of particular interest is the Swedish housing estate without heating completed this year and the experiences of the new homeowners. A demonstration project in Scotland, shown if Figure3, has achieved very impressive energy performance at less than conventional housing costs, thanks to innovative building envelope construction].

Subtask D: Monitoring and Evaluation
Data sets have been compiled for 53 building as a basis for a book on exemplary buildings. The selection represents a very instructive range of conditions and design responses:

- The projects are heated by fossil fuel, biomass, district heating, heat pump and direct electric heaters
- Active solar systems include domestic hot water, combi (space + dhw), solar air systems and photovoltaic panels.

Figure 3: The 'Zero-Heating' Home at Peterculter, Aberdeen, Scotland

- Ventilation is provided through natural / windows, exhaust only, heat recovery and ground heat exchangers.
- Occupancy density average 44 m^2 net floor area / person with a range from 25 - 40

Cooling Working Group
Sustainable solar housing is also an important topic for hot climates.
In response, the Cooling Group is:

- defining strategies, typical solution sets and technologies, i.e. shading, ventilation, insulation, and solar dhw., using the guidebook structure of the Heating Group.
- analyzing the effectiveness of strategies using the Olgyay comfort charts and diagramming method (monthly with diurnal ranges) as proposed by Japan.

WORK PLANNED FOR 2002

- Task web site will be expanded and (depending on resources) restructured.
- Experts will continue improving methods to assess national housing markets and developing strategies, do & don'ts and tips to increase market penetration.
- Typical design solution sets will be selected and computer modeling begun. Additional technology chapters for the handbook will be drafted.
- Guide for writing an effective design brief will be completed to help improve the quality and survival of sustainability concepts throughout planning and construction.
- First draft of the exemplary buildings documentation will be completed, selecting from completed data sets and project profiles of 50 projects.
- Subtask D structure for summarizing monitored data will be to make cross comparisons and generate design advise for the Guidebook.
- Concept for reporting "Innovative Components under Development" will be tested on a few components and presented to the experts at the next meeting.
- Built examples of sustainable housing for hot climates will be examined, typical solution sets identified and design advice critically reviewed. The prototype sustainable housing project in Brazil will be further developed and additional projects sought.

LINKS WITH INDUSTRY
Many Task experts represent specific industries, for example, the Norwegian State Housing Bank, ABB, Swiss and Canadian construction firms and others.

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Towards Zero-heating: Affordable Models for Environmentally Friendly Housing in Scotland
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Breaking the Heating Barrier: Learning from the First Houses without Conventional Heating
Hastings R.: CISBAT 2001, Switzerland, September 2001.

Low Energy Housing in Ticino
Pahud, Daniel, et.al. Switzerland, December 2001.

Internal Gains. Assumptions for Simulations. A Multi-family Row and Single-family Detached House.
Working Document, Smeds, J. & Wall, M., September 2001.

A Comparison of Energy Regulations in 12 Countries Using IEA 28/38 Reference Houses
Smeds, J. & Wall, M, Lund University, Sweden, 2001.

REPORTS PLANNED FOR 2002

The Pathways to Sustainable Solar Design in Housing, for The Environmental Brief.

MEETINGS IN 2001

Third Experts Meeting
April 2-4
Amersfoort, Netherlands

Market Analysis Workshop
September 25
Bregenz, Austria

Fourth Experts Meeting
September 26-28
Bregenz, Austria

MEETINGS PLANNED FOR 2002

Fifth Experts Meeting
April 17-19
Rome, Italy

Sixth Experts Meeting
September 18-20
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TASK 29:

Solar Crop Drying

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TASK DESCRIPTION

One of the most promising applications for active solar heating worldwide is the drying of agricultural products. In a recent study, the potential amount of energy that could be displaced using solar in this market was estimated to be between 300 PJ and 900 PJ annually, primarily in displacing fuel-fired dryers for crops that are dried at temperatures less than 50∞C.The use of solar energy for these markets is largely undeveloped. Wood and conventional fossil fuels are used extensively at present. In many countries, more expensive diesel and propane fuels are replacing wood. Three key barriers to increased use of solar crop drying are the lack of awareness of the cost-effectiveness of solar drying systems, the lack of good technical information and the lack of good local practical experience.

The objective of the Task is to address the three barriers above by providing technical and commercial information and experience gained from the design, construction and operation of full-scale, commercially viable solar drying systems for a variety of crops and a number of geographical regions where solar is expected to have the greatest potential. Crop grower and processor industry associations will be key partners in dissemination of the results.

Duration

The Task was initiated in January 2000 and is planned for completion in December 2002.

ACTIVITIES DURING 2001

Panama – Coffee Drying

The flagship project for the year was the installation of a solar system on a new coffee drying plant in Panama. The project was constructed and the solar system installed during the year and it is anticipated that the system will be commissioned before the end of the year and be ready to operate during the upcoming harvest season. The success of this project lies not only with the installation of the solar system but also with the close cooperation between Task participants and the plant owners. The major objective of the solar system is to reduce the amount of wood fuel needed for the furnace. With this in mind, all aspects of the project were reviewed by team members, which resulted in modifications in the furnace and system designs that will ultimately improve the process. Task members facilitated and participated in meetings between the owners and specialists in other fields to develop novel design solutions, which may not have otherwise been incorporated.

India – Coir Peat Drying

The Coir Peat drying facility in India has been designed and the panels have been shipped to India. It is expected that the panels will be installed at the facility in early 2002.

India – Cardamon Drying

A new dryer design has been proposed for this facility and the project awaits approval from the owners before continuing.

China – Biomass Drying

Task involvement in this project has

now greatly exceeded the provision of a solar system to the drying process. This is a new facility and there was no mechanical drying planned originally. Therefore, in addition to the solar system, Task members have designed the full mechanical drying system. This has necessitated a number of iterations as a full appreciation of the limitations and challenges were appreciated. The facility owners are currently reviewing the most recent design proposals.

China – Jujube Drying
This project has also evolved into the design and construction of a whole new drying facility to replace the highly outdated and inefficient systems currently in use. Task members have been involved in researching and designing a new dryer based on a design originally produced by the agriculture department at the University of California – Davis. The whole project now includes the new dryer and a structure to enclose it, which will incorporate the solar panels. The foundation for the facility has been constructed and the design drawings for the rest of the project are being translated.

Zimbabwe – Tobacco Drying
A prototype solar system was installed at the Tobacco Research Institute in Zimbabwe to supply heat to two different types of drying barns. Monitoring was carried out during the year and first results are expected soon.

Challenges
The excellent progress reported above falls short of meeting the milestones set at the beginning of the year but was accomplished in spite of numerous challenges facing the Task participants. The principal challenges included:

- Low commodity prices worldwide, which impaired the ability of many growers and processing plant owners to undertake capital projects.
- The ability of users to secure appropriate financing for new capital projects.
- The broadening of project scope beyond the solar component, requiring the Task participants to find and coordinate additional expertise.
- The lack of technical expertise on the part of some users, thereby requiring a large general education component to the work.
- Communications difficulties caused by language and distance.
- Shipping and customs logistics for various countries.

Abandoned Projects
Unfortunately, due to business and/or other reasons, the Task did not proceed with the following projects that were reported as prospects in the last annual report:

Viet Nam – Rice Drying
Guatemala – Coffee Drying
Brazil – Coffee Drying
Columbia – Coffee Drying
Uganda – Coffee Drying
India – Tea Drying

ACTIVITIES PLANNED FOR 2002
The following activities are expected to be completed in 2002:

LINKS WITH INDUSTRY
The Task continues to maintain excellent links with industry as summarized below:

- The Panamanian project is installed on a facility owned by the largest coffee producer in the country. Based on favorable results of this project, the owner will consider installing solar systems on their other facilities. They are also prepared to have this first installation serve as a showcase of the applications of solar technology for this use.
- The owner of the Chinese jujube drying facility is one of the largest

Solar system on a coffee drying plant in Panama. The system preheats air before it goes into the furnace. In this case, the objective is to reduce the amount of firewood used, but the system can also be used on other plants in the country,

Project	Status
Panama – Coffee Drying	system commissioned and monitored
India – Coir Peat Drying	system commissioned and monitored
India – Cardamon Drying	system design completed solar system installed monitoring installed
China – Jujube Drying	facility constructed system commissioned monitoring installed
China – Biomass Drying	facility completed solar system installed
Zimbabwe – Tobacco Drying	monitoring results
Costa Rica – Coffee Drying	project identified feasibility study completed design completed
Mexico – Coffee Drying	project identified design completed solar system installed
USA – Grain Drying	project identified feasibility study completed design completed solar system installed
USA – Fruit Drying	project identified feasibility study completed design completed solar system installed

operators in a region where there are many such operations. The owner is prepared to use the Task designed facility as a showcase for other producers.

- The Indian projects are being coordinated by the Solarwall® distributor in India. One of the design proposals also incorporates other products produced by that company which enhances the project value for both the distributor and the customer.
- Two Task participants attended a coffee industry trade show in Costa Rica where the solar drying was introduced to many of the delegates, and may result in a new Task project in that country.
- A Mexican coffee producer who attended the Task workshop implemented many of the recommendations contained in the feasibility study on his facility.
- The Dutch participant continues to work with the Tobacco Research Institute in Zimbabwe to provide local industry connections for their work.
- A new testing program for the Solarwall® has been initiated as a result of work done by the Task.
- As a result of talking to food processors in California while researching a new dryer for the Chinese jujube project, a new Task project opportunity has been identified in that state.

REPORTS PUBLISHED IN 2001

No official reports were published in 2001, however, a newsletter was produced and widely distributed by e-mail and posted on the SHC website.

REPORTS PLANNED FOR 2002

The Task plans to publish another newsletter in 2002 to provide updated information on the active projects.

MEETINGS IN 2001

Third Experts Meeting
June 1
Toronto, Canada

The fourth experts meeting was planned for Panama in conjunction with the opening of the project in that country. When start up was changed to late 2001 or early 2002, it was decided to postpone that meeting until the system is operational.

MEETINGS PLANNED FOR 2002

The meetings have yet to be confirmed. Plans are as follows:

Fourth Experts Meeting
January/February
Panama

Fifth Experts Meeting
October/November
China or India

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TASK 31:

Daylighting Buildings in the 21st Century

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TASK DESCRIPTION

Daylighting and the impact of daylighting strategies on the lighting, heating and cooling of buildings, are vital issues for building owners, design professions, and for building occupants due to energy use and associated carbon emissions. Despite potential energy savings benefits, only a tiny fraction is actually captured in buildings today. Not only are there engineering and scientific challenges, but occupant response is also a critical element and the integration of occupant acceptance, daylighting systems and electric lighting controls is vital to provide a successful daylighting design.

Daylighting systems research in SHC Task 21, Daylighting in Buildings, was concentrated on the performance of single design elements and the associated energy savings. This research showed the potential of new daylighting technologies, but the interdependencies between the different systems and the impact of the user were not fully explored. Without integrated systems research the synergistic result may be less than desired, particularly if the user has not been factored in.

The intent of Task 31 is to balance innovation and practicality by creating integrated daylighting solutions that are technically feasible taking into account electric lighting and shading controls. As designers embrace new advanced technologies, and the complexity of integration, it is also essential that research provides a constructive optimisation model that accounts for human factor issues.

Scope and Main Activities

Task 31 will integrate this new research and disseminate the results to architects, engineers and lighting designers by performance tracking networks and material for local/regional support groups. The integration issues will include lighting, heating and cooling of buildings, the integration of daylighting, solar shading and electric lighting and the design processes associated with them taking into account user acceptance.

The Task will focus on commercial and school buildings both new and existing and on those user needs and systems integration that are not currently addressed. A related approach to express the goal of addressing cutting edge solutions will be to apply these tools and techniques to "transparent buildings" with virtually all glass facades, as these represent one of the greatest challenges to designers of modern buildings.

To accomplish the objectives of the Task, the Participants are carrying out research and development within the framework of the following four Subtasks:

- Subtask A: User Perspectives and Requirements (Lead Country: Denmark)
- Subtask B: Integration and Optimisation of Daylighting Systems (Lead Country USA)
- Subtask C: Daylighting Design Tools (Lead Country: Germany)
- Subtask D: Daylight Performance Tracking Network and Design Support (Lead Country: France)

Duration
The Task was initiated in September 2001and will be completed in September 2005.

ACTIVITIES DURING 2001
Subtask A: User Perspectives and Requirements
There are five project areas in Subtask A:

- A1: Literature survey
- A2: Review of assessment methods for visual comfort
- A3: Application of assessment methods for visual comfort
- A4: Modelling
- A5: Guidelines

The emphasis to date has been on defining literature survey headings for the literature review, and the submission of 10 descriptions per participant for the database of the web site. The initial key words for each entry in the literature survey to categorize the entries are being determined. The categories are:

- Category 1: Health effects, energy consumption, assessment methods, user acceptance, user preferences, user response, VDU-work and lighting, glare luminance distribution, exterior view, productivity, behavioural models and patterns
- Category 2: Type of study
- Category 3: Type of data

Subtask B: Integration and Optimisation of Daylighting Systems
There are four project areas in Subtask B:

- B1: State of the art review
- B2: Design solutions roadmap
- B3: Optimisation and development of smart lighting control systems
- B4: Field tests

This work will commence with a state of the art review. A questionnaire will be prepared and the survey information will be collated to produce a report. There is to be a survey from each country to include metrics, targets, building standards, CIE research in this area, IES design guides and EURO norms. Performance metrics have been listed as-lighting energy use, illuminance and luminance levels, lighting power density, installed performance, occupancy and visual comfort and performance (with input from Subtask A). Also the typical best practice design parameters commonly used by practitioner such as minimum window size. This will demonstrate what is needed and what is available. There will also be feedback from Subtask A. Development and optimisation will follow.

Subtask C: Daylighting Design Tools
There are four project areas in Subtask C:

- C1: User Interactions
- C2: Algorithms and plug-ins
- C3: Tools and Engines
- C4: Validation

A workshop was held to determine practitioners' needs. A survey strategy and questionnaire are being drafted. From the results of the workshop, selected tools will be developed with improved interfaces.

Subtask D: Performance Tracking Network and Design Support Groups
There are four project areas in Subtask D:

- D1: Development of a web server structure
- D2: Data Base 1- Benefits of daylighting techniques
- D3: Database 2: Noteworthy examples
- D4: Material for design support groups

A structure for the database was proposed. The database deals with occupant impact in a building and with examples of noteworthy buildings worldwide. Products from Subtask A will be included in database 1, e.g. effects on health and productivity with convincing arguments for industry. Database 2 will include case studies carried out during technical visits at the experts meetings. Access to the web site will be restricted to members (Participants) and Task sponsors, for example, industry prior to the publication of results at the end of the Task.

Each participant in Subtask A provided 10 items on the following topics: the financial benefits of investing in daylighting systems, the cost of daylighting portions in comparison with other options, reduction in specified illuminances due to good daylighting systems, electric energy saved by the use of daylighting systems or on daylighting and well being and daylighting and productivity. The overall intent is to produce 200 items relating to the benefits of daylighting techniques in the four-year period.

Technical Visits
At the first Experts Meeting in Berlin, Germany in October 2001,

Interior view of the BerlinTechnical Museum.

technical visits were made to the Berlin Technical Museum, Reichstag (Architect Foster), Pariser Place buildings (Architects: Kleihus, Winking, GMP, Kollhoff, Wilford, Behnisch, Gehry, Moore), GSW office tower (Architect Sauerbruch), and the Zumtobel building. Shown below are images from the Berlin Technical Museum.

WORK PLANNED FOR 2002

A summary of planned activities for each of the Subtasks is presented below.

Subtask A: User Perspectives and Requirements

In Subtask A the conclusions of the literature survey will be annotated in a generic template according to experienced problems. Appropriate methods to assess visual and indoor environment comfort will be refined and the first pilot studies on selected methods will be conducted. Algorithms will be selected from available literature and there will be a survey of architects needs in daylit buildings.

Subtask B: Integration and Optimisation of Daylighting Systems

The results from the state-of-the-art review will be reviewed by means of a teleconference and the first draft of the summary will be submitted for publication. A roadmap methodology will be completed and a test draft of performance criteria from simulations. The first guidelines for the calibration and commissioning of controls will be presented and there will be a workshop presentation of advanced controls at the Frankfurt Fair on Light and Buildings. Pilot studies with test cell will be carried out and protocols drafted for building measurements.

Subtask C: Daylighting Design Tools

In Subtask C, user preferences for software will form a working document and there will be working documents on approaches to describe daylighting behaviour of complex fenestration systems. Algorithms will be implemented in stand-alone modules or plug-ins. Improved tools will be released over three years

Subtask D: Performance Tracking Network and Design Support Groups

The data base structure will be completed and there will be further input of data. Materials for the design support groups will be defined.

LINKS WITH INDUSTRY

Representatives from industry have participated in Task 31 experts meetings or supported the Task in the following countries:

- Australia: Skylights Industry Association Inc., Public Works, Queensland Government, and CLIPSAL
- Belgiun: St Gobain Glass
- Denmark: A reference group from industry and the professions
- France: HEXCEL Fabrics, TECHNAL, and INGELUX
- Germany: LichtVision Industries who will be participating in 2002 include PHILIPS Lighting BV and ETAP lighting BV of the Netherlands.

LIAISON WITH CIE DIVISION 3: INTERIOR ENVIRONMENT AND LIGHTING DESIGN

The Director of Division 3 is also the Task 31 Subtask D Leader. Research results from Technical committees in Division 3 namely- TC 3.15: Sky

Luminance Models, TC 3-29: Computer Procedures for Lighting Metrics and Visualisation, TC 3.33: Test Cases for Assessment of Accuracy of Interior Lighting Computer Programs, T3-34: Protocols for Describing Lighting, TC 3-37: Guide for the Application of the CIE General Sky, and T3-38: Tubular Daylight Guidance Systems are to be referenced in Task 31.

REPORTS PUBLISHED IN 2001

International Daylighting R D & A
Issues 2 and 3

REPORTS PLANNED FOR 2002

State-of-the-art review summary report

Test protocol combining lighting, energy and occupant metrics

Working document on user preferences

Working document on Radiance integration based on SDF

Working document on functional integration of LCP and MLGS system

MEETINGS IN 2001

First Experts Meeting
October 1-4
Berlin, Germany

MEETINGS PLANNED FOR 2002

Second Experts Meeting
April 8-12
Roskilde, Denmark

Third Experts Meeting
October 1-4
Ottawa, Canada

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