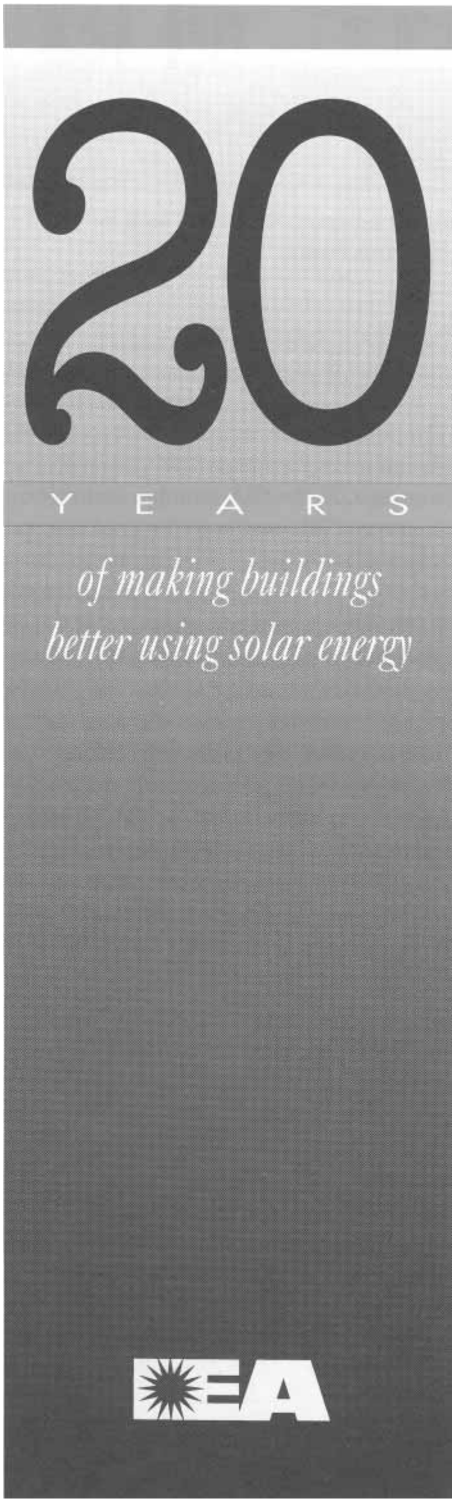
# SOLAR UPDATE

NEWSLETTER OF THE INTERNATIONAL ENERGY AGENCY SOLAR HEATING AND COOLING PROGRAMME • NO. 28 JANUARY 1997




## Letter from the Chairman

This year marks the IEA Solar Heating and Cooling Programme's 20th anniversary, and I am proud to be the Chairman during this time of celebration. After two decades of international collaboration on solar energy, the contributions of the SHC Programme participants can be seen throughout the field and in all parts of the world.

Let's take a moment and turn back the clock to 1977. The 1973 oil embargo has ended, but many oil-dependent countries remain concerned about their oil reserves and their volatile relationship with the major oil producing countries. Oil prices continue to rise, prompting countries to think about alternative energy sources. In response to these and other events occurring in the world, 21 countries agree to coordinate their energy policies and share oil supplies in the event of a severe disruption in supply. The name of this new organization is the International Energy Agency (IEA). And as part of their international initiative, the Solar Heating and Cooling (SHC) Programme is created to research and develop new solar technologies that could meet the countries' growing energy demands.

The first projects undertaken by the SHC Programme reflected the technical priorities of the mid-1970s and focused on analysis model development and validation, collector test methods, and active solar system performance data. The focus of the Programme turned to new areas as solar heating and cooling technologies became commercially available. By the mid-1980s, Programme experts were researching and developing a new generation of advanced collectors, new and improved materials, and better design tools. As this work progressed over the years, the Programme began to combine research on technologies and materials with building use and design. In the 1990s, the Programme has focused on the integration of solar technologies into buildings. The result of this international research effort is 20 years of making buildings better using solar energy.

The scope and emphasis of the Programme's collaborative work has evolved over the years to reflect changes in national programs. New areas of research and demonstration include advanced windows, daylighting, advanced solar buildings with low energy consumption, new integration techniques for PV in buildings, solar renovation, solar technology procurement, and solar crop drying.

I extend my sincere thanks to the Programme's Operating Agents who have been instrumental in the success of the many projects undertaken and to the many researchers who have made important contributions.

With the start of the new millennium on the horizon, I look forward to the growth of solar applications in buildings and the Programme's continued dedication and contributions to the field of solar energy.

Andre De Herde
*Chairman*

# 20 Years of Making Buildings Better

*The following is excerpted from the feature article in the Solar Heating and Cooling Programme's 1996 Annual Report.*

The International Energy Agency (IEA), understanding the importance of alternative fuel sources, has been working collabora tively on the development of new and improved energy technologies to diversify energy supplies that can sustain growth while having a minimal impact on the environment. This international undertaking of energy cooperation and research has contributed significantly to the advancement of renewable energy and technology.

> **"The most important influence is the meeting of experts from different countries** which **inevitably leads to improved knowledge and understanding and to an improved accuracy of measurement. This leads to a strengthening of the respective national programs and a greater awareness of the priorities and needs of other countries."**
>
> **Michael Hutchins**
> Task 18 Operating Agent

The progress made in solar heating and cooling over the past 20 years is due, in part, to the IEA Solar Heating and Cooling (SHC) Programme and the related work of the national programs within the IEA countries. Since 1977, the 20 member countries and the European Commission have been collaborating to develop technologies which use the sun to heat, cool, light, and power buildings. Technological areas in which the SHC Programme has made important contributions include:

*Solar Materials R&D*

- Selective absorber materials
- Collector and window glazings
- Heat transfer and thermal storage media
- Methods for durability testing

*Advanced Glazing Materials*

- High performance glazings
- Optical switching glazings
- Transparent insulating materials
- Light transport materials
- Application assessment
- Daylighting

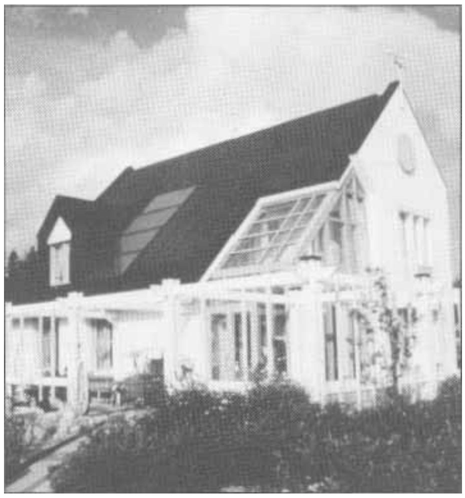
*Building Energy Analysis*

- Algorithms for atria, transparent insulation materials, and optical switching glazings
- Software such as BESTEST (Building Energy Simulation Test) and ADELINE (Advanced Daylighting and Electric Lighting Integrated New Environment)

*Solar Radiation Data*

- Measurement and estimation tech niques
- Irradiance measurements for solar collector testing
- Improved spectral radiation data for PV and advanced glazing applications
- Representative climatic design years

Based on the advances made in these fields, the SHC Programme has taken the next step and successfully applied these solar technologies to buildings. Using solar technologies to supply energy for all building applications-heating, cooling, hot water, lighting, and electricity-not only addresses the growing energy needs throughout the world, but also taps a large inexhaustible resource that benefits the environment and the economy. However, stating that solar energy is a viable resource is not enough.



**A solar low-energy single family house in Pietarsaari, Finland.**

## DEMONSTRATING THE VALUE OF SOLAR ENERGY

The potential for reducing the use of pur-chased energy in the building sector is immense. In the IEA member countries, an average 30 percent of the total energy consumed is used to provide energy for residential and non-residential buildings. Solar technologies can make a major contribution in meeting this need. The fundamental objective of the SHC Programme over the past two decades has been to make solar energy a working reality by developing technologies that are reliable, economical, adaptable by industry, and acceptable to the public.

SHC researchers have worked or are working on many solar technologies and their application to improve buildings. The Programme's most recent achievements in specific building applications are highlighted below.

### Passive Solar Commercial Buildings

In this area, the SHC Programme has explored new opportunities for using the sun's energy to heat and light commercial buildings. Researchers focused on the intensity and timing of internal gains, requirements for faster payback, and non-owner occupancy as these posed the greatest constraints on solar applications in commercial building. Under Task 11,

## COMPLETED TASKS

**Task 1** Investigation of the Performance of Solar Heating and Cooling Systems

**Task 2** Coordination of Solar Heating and Cooling R&D

**Task 3** Performance Testing of Solar Collectors

**Task 4** Development of an Insolation Handbook and Instrument Package

**Task 5** Use of Existing Meteorological Information for Solar Energy Application

**Task 6** Performance of Solar Systems Using Evacuated Collectors

**Task 7** Central Solar Heating Plants with Seasonal Storage

**Task 8** Passive and Hybrid Solar Low-Energy Buildings

**Task 9** Solar Radiation and Pyranometry Studies

**Task 10** Solar Materials R&D

**Task 11** Passive and Hybrid Solar Commercial Buildings

**Task 12** Building Energy Analysis and Design Tools for Solar Applications

**Task 13** Advance Solar Low-Energy Buildings

**Task 14** Advance Active Solar Energy Systems

**Task 16** Photovoltaics in Buildings

**Task 17** Measuring and Modeling Spectral Radiation

## CURRENT TASKS & WORKING GROUPS

**Task 18** Advanced Glazing and Associated Materials for Solar Applications

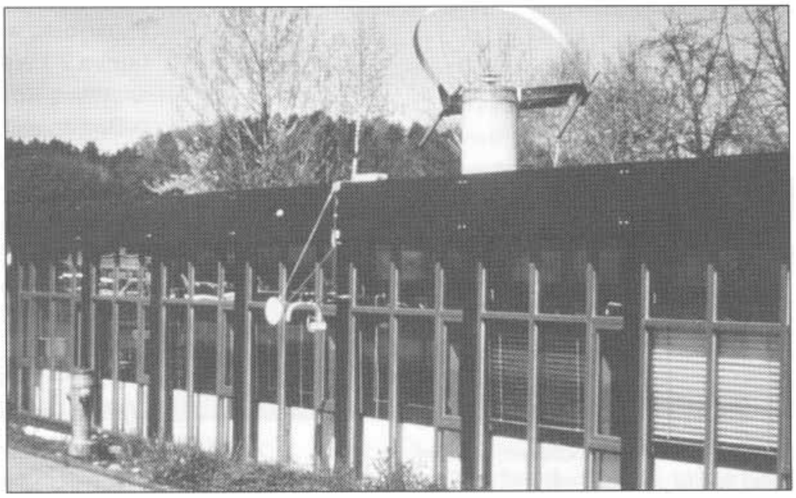
**Task 19** Solar Air Systems

**Task 20** Solar Energy in Building Renovation

**Task 21** Daylight in Buildings

**Task 22** Solar Building Energy Analysis Tools

**Working Group** Materials in Solar Thermal Collectors



The office of Haas & Partners in Jona, Switzerland uses passive solar technologies.

experts assessed the potential of various solar concepts and the influence of the constraints by surveying, monitoring, and computer modeling 43 existing and planned buildings in 12 countries. The detailed monitoring conducted by Task experts provided much needed information on the integration of solar and mechanical systems, optimization of control systems, and interaction between people and systems. And, the development of two computer algorithms, SUPERLINK and DAYLINK, which linked daylighting models with thermal models, thereby facilitating the necessary paramet- ric studies conducted.

The Haas & Partners office building in Switzerland is one of more than 20 examples of successful solar applications monitored under Task 11. Through the application of solar technologies. the annual purchased energy requirements for the building were reduced to 34 kWh/m2, one of the lowest auxiliary heating requirements for any office building in Switzerland. Integrating the following passive solar features into the building reached this impressive energy saving: window and facade air collectors connected to a subfloor rock bed; earth sheltered construction on the north and west facades for natural cooling; movable absorber and insulation panels for indirect thermal gain; and direct daylighting.

"International research collaboration is important to Task 20's work because solar renovation concepts and design solutions vary from country to country and Task experts benefit from the sharing of work, experiences and lessons learned."

**Arne Elmroth**

*Task 20 Operating Agent*

**Advanced Solar Low-Energy Buildings**

Advancing solar building technologies to the point where the use of purchased energy in residential buildings can be reduced or even eliminated was the goal of the Programme's work in this area. Task 13 achieved this goal through the identification, development, and testing of new and inno- vative concepts using passive and active solar, photovoltaics, and advanced energy conservation technologies.

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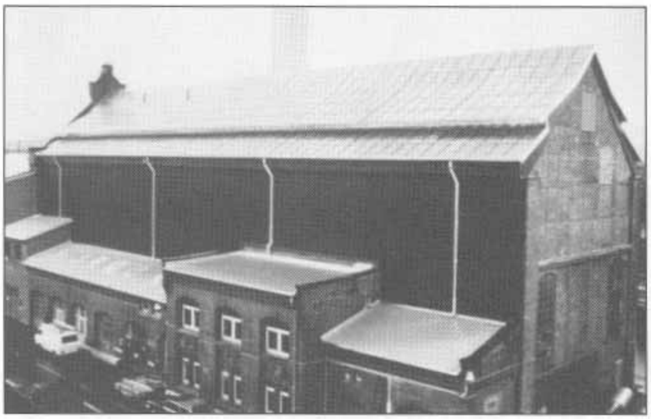


**This co-generation plant in Gottingen, Germany, installed the first perforated solarwall in Europe.**

The most promising and effective concepts were incorporated into the design of 14 experimental houses. These houses were designed as "total systems" addressing all energy uses. For example, a house might install solar technologies as well as energy efficient appliances and lighting, high performance windows, and super insulation. Building monitoring revealed that this work successfully integrated technologies to achieve an average total energy consumption of 44 kWh/m$^2$ per year of heated floor area

> The Task 13 buildings were in part designed during special sessions at Task meetings. Each design therefore benefited from the knowledge and experience of the group as a whole."
>
> **Anne Grete Hestnes**
> *Task* 13 Operating Agent

compared to 172 kWh/m$^2$ for the typical house, a 75 percent reduction.

The total solar contribution to these houses averages 37 kWh/m$^2$ which includes passive solar gains, active solar, and photovoltaics.

The houses built under Task 13 reflect diverse cultures in their design and construction, and represent extremes in climate, ranging from very cold, in Scandinavia and Canada, to quite warm, in parts of the United States and Italy. An example is the house built in Finland, on a beautiful lakefront site in Pietarsaari, which features a 2 kWp photovoltaic system, solar thermal collector, and a ground- coupled heat pump. This house achieved one of the lowest purchased energy consumption levels in the Task, 27 kWh/m2.

## Advanced Active Solar Energy Systems

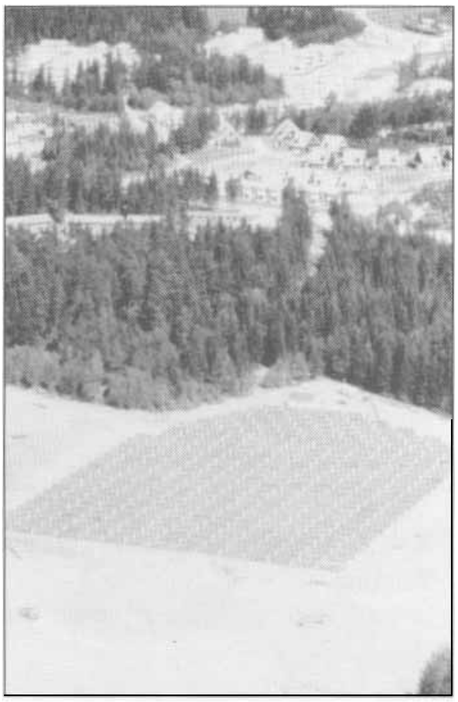
Programme experts have been examining state-of-the-art active solar energy systems through computer simulation models, development and testing of new components and systems, and the design, construction and monitoring of operating systems. The solar system applications researched and developed include solar domestic hot water, ventilation air and space heating for commercial buildings, and large-scale heating below 200°C. The results obtained have not only improved these technologies, but also promoted their application in buildings. For example, six countries participating in Task 14 developed solar domestic hot water "dream systems," three countries commercialized their systems as leading edge systems, and other countries marketed a variety of improved components and systems. Overall, this work developed technologies which have realized cost/performance improvements of up to 50 percent.

Another area significantly impacted by the Programme's work is solarwall air heating. Task 14 spearheaded much of the research conducted on the innovative perforated absorber. In fact, the perforated absorber was a direct product of bringing experts and industry representatives from various countries together at an IEA workshop. Task 14 experts also monitored the first perforated solarwall in Europe which was installed on a renovated co-generation plant in Gottingen, Germany. The solarwall preheats combustion air used by the boilers in the gas- fired plant operated by the local utility. Since the installation of the solarwall, boiler efficiency has increased by 1-1.5 percent, providing an annual energy sav-ings of 130 Mwh.

> "In addition to the excellent technical achievements, the best outcome of Task 14 was the establishment of an interna-tional network of experts which will have continuing value long after the Task is completed."
>
> Doug Lorriman
> Task 14 Operating Agent

## Central Solar Heating Plants with Storage

Programme collaboration in this field bas brought CSHPSS technology from what was once considered an impractical idea to the market and bolstered its wide- spread use. Several projects undertaken were in northern countries where solar heating of buildings seemed to be an unrealistic proposition-in the winter- time, when heat is most needed, there is virtually no solar radiation to use. While long-term storage could make the energy available when needed, the economics of seasonal storage was only feasible if done on a large scale. Therefore, the Programme began to investigate in the early 1980s the feasibility and cost-effectiveness of central solar heating plants with seasonal storage. The Programme



**A central solar heating plant with seasonal storage in** Lyckebo, Sweden.

has maintained steady involvement in this area through specific Task work and forums designed to continue the transfer of knowledge, nationally and internationally, on CSHPSS for residential heating, district heating, and process heating at moderate temperatures.

One of the many success stories is the CSHPSS plant in Lyckebo, Sweden. Heat is supplied to the district heating system by a solar collector area of 4,320 $m^2$ and a 100,000 $m^3$ rock cavern storage area. The system provides heat for 550 homes.

### Photovoltaics in Buildings

Photovoltaics in building technology and applications has taken a giant step for ward because of the Programme's collaborative research conducted by Task 16 experts. In 1990 the Programme took on the challenge of how to meet both the architectural and engineering aspects of building integrated photovoltaic systems. In tackling this technology, experts addressed the relationship of PV systems with solar thermal and/or conventional energy components in buildings, explored new PV systems and components, and dealt with the technology's economic competitiveness. Task achievements include the introduction of new products to the market, construction of 17 buildings throughout Europe and North America, and the sharing of research results and know-how around the world. Perhaps the greatest accomplishment has been to show both architects and engineers that PV is a viable and attractive energy option.

"The IEA BESTEST procedure has established a credible and systematic process for evaluating the accuracy of building energy analysis tools. It is being used to certify tools for energy standard compliance analysis and for home energy rating systems."

**Michael Holtz**
Task *12 Operating* Agent

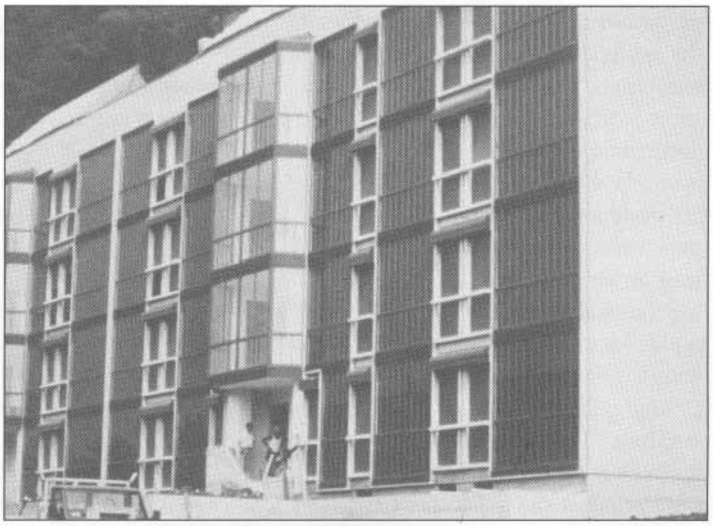
The success of building integrated PV is demonstrated in the Lord House in Cape Porpoise, Maine, USA.

The Lord House is one of the 17 commercial and residential buildings designed and monitored under Task 16. This house, which is approximately 250 $m^2$, uses the sun to produce heat, hot water and electricity. The south roof has an integrated array of solar thermal collectors and large-area PV modules which form a single, uniform glass pane. What makes this house unusual is that it does not have a roof beneath the solar panels-the panels are the roof. The house also incorporates passive solar heating and cooling, super insulation, R-8 windows, monolithic air and vapor barriers, air-lock vestibules, and a heat recovery ventilation system.

### Solar Air Heated Buildings

To advance the application of solar air systems in buildings, the Programme is testing and demonstrating several different systems. The advantages of solar air heating systems are many, such as they require no protection from freezing temperatures, leaks pose no damage to the building structure or its contents, and they are compatible with mechanical ventilation. Unfortunately, these systems are often not considered in building construction or renovation. To increase the application and improve the cost-effectiveness of this technology, Task 19 experts are monitoring exemplary buildings and examining additional uses these systems can serve, such as admitting daylight, inducing cooling, providing sunshading, generating electricity, and preheating domestic hot water. To encourage the use of solar air systems, Task experts are helping building designers and others to better understand the different systems and to select one which meets their needs.

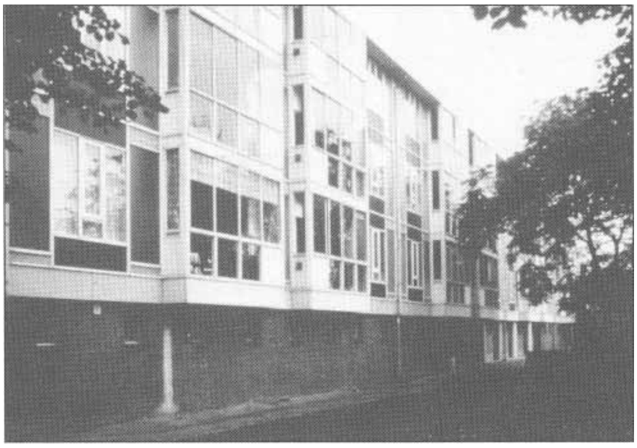
An Italian apartment building in Marostics, which is being monitored under Task 19, demonstrates the benefits of coupling solar air systems and water heating systems to make use of the otherwise wasted solar gains during the summer. The building uses thermosyhphon air collectors which form part of the facade and south facing windows for passive solar heating. Solar energy storage is located in ceiling units.



**An apartment building in Marostics, Italy, combines a solar air system with a solar water heating system.**

### Solar Energy in Building Renovation

Existing buildings, which dominate the building sector, account for a large share



**The Reitse Hoeve apartment building in Tilburg, Netherlands, after renovation using solar technologies.**

of the overall energy use in buildings. Therefore, if solar energy is to gain a more prominent place in the energy market, solar technologies must be integrated effectively and economically into the building renovation process. Energy considerations often are not the driving force behind building renovation, and that presents a challenge for increasing the application of solar technologies in buildings. The key to using solar measures is to add value to the solution of a particular renovation problem, for example, to integrate solar technologies when replacing the roof or windows, repairing the building facade, replacing the heating and ventilation system, or changing the use of the building. Task 20 researchers are developing strategies and guidelines for integrating solar technologies in residential and non-residential building renovation as a means to encourage greater use of these technologies.

The Reitse Hoeve apartment building in the Netherlands demonstrates the impact solar technologies can have in building renovation. Renovation of this apartment building reduced fuel requirements by 30 percent; the solar system contributed 64 percent of that reduction. A variety of technologies were used both to save energy and to improve these apartments, including air collectors integrated into the south facade for preheating ventilation air, glazed balconies on the south facade, glazed galleries on the north facade, better windows, and additional insulation.

**"Collaboration among several countries is essential to obtain the benefits of comparative and empirical evaluation efforts of building energy analysis. Only when you compare results between tools, do you begin to see patterns or areas of disagreement from which you can learn and improve the tools."**

**Michael Holtz**
Task 22 Operating Agent

## THE IMPACT OF SOLAR ENERGY

The Solar Heating and Cooling Programme buildings highlighted above show how great an impact solar technologies can have on the energy use of individual buildings. For example, Programme results show that advanced solar low-energy technologies can meet 75 percent of a building's total energy demand and solar air heating technology can generally meet 40 percent of the heating demand required for a building.

Programme results such as these suggest the potential effect that solar energy can have on a country's entire building sector. Studies generally show that slightly more than half the buildings in a country are not properly oriented or designed for solar technologies. With that in mind, for example in the United States, residential buildings account for 41 percent of the energy demand in the building sector, therefore, if every suitable residential building applied advanced solar low-energy technologies, which are capable of meeting 75 percent of the total energy demand, the national impact would be dramatic. Solar energy could also significantly impact the heating demand of commercial and residential buildings, which is 12 percent and 38 percent, respectively.

Capable of meeting up to 40 percent of the heating demand, solar air heating systems could also have a dramatic impact if incorporated into suitable new and existing buildings.

To achieve the full potential of these and other solar technologies, increasing their market share is necessary. The rate at which solar technologies enter the market is critical, but sometimes hard to control. Market factors which will help to determine the success of solar technologies include competitive costs, high technology performance, government and industry incentives/subsidies, and location and orientation. Initiatives, such as those taken by the SHC Programme, are a means for addressing some of these market factors and encouraging the successful commercialization of solar technologies.

**It would not have been possible for any country working alone to complete the System Design Handbook now in progress. The handbook is based on a breadth and depth of experience of leading experts from nine countries and lessons learned from over 30 built projects."**

**Robert Hastings**
*Task* 19 Operating Agent

As an energy source, solar energy should not and cannot be overlooked, and that is why the IEA Solar Heating and Cooling Programme intends to continue its work into the 21st century. The IEA provides a unique framework within which collaborative, results-oriented work is identified, planned, and accomplished. And, the resources and dedication of the many countries and people involved in the Programme are a guarantee that solar energy's share will continue to grow in the energy sector.


**Solar Innovations '96 Workshop**
The 1st International Workshop on Residential Solar Water Heating and Utilities was sponsored by the SHC Programme and Natural Resources Canada. The June workshop in Canada provided a forum for information exchange between industry and utility representatives and researchers from ten countries. The major findings of the workshop were:

- The market for solar domestic water heaters is increasing in many countries. For example, in the Netherlands 3,200 systems were sold in 1995, 5,000 systems in 1996, and the projected sale in the year 2000 is 15,000 systems.
- Utility interest is increasing.
- Many different system types and components are in the market and costs vary widely.
- Systems expected to gain a larger share of the market include low flow stratified storage systems, ICS and combined domestic hot water/space heating systems.

**New Task Planned on Solar Procurement**
Supply and demand go hand-in-hand. In an effort to increase the demand for active solar systems, a new SHC Task on solar procurement will focus on the cooperative procurement of active solar systems. The Task's objective will be to bring together major purchasers to form buyers groups, and the buyers groups will in turn stimulate further investment in the development and production of active solar systems. The overall goal is to not only improve system performance, but decrease costs and increase product market share.

## Upcoming Events Highlight IEA SHC Programme

### Solar `97
**April 25-30, 1997**

**Washington, DC USA**

The SHC Programme will celebrate its 20th Anniversary with a slide show and exhibit at the National Solar Energy Conference. Each year for over a quarter of a century, this conference has served as a major meeting ground for professionals in the field.

For more information contact: ASES, 2400 Central Avenues, Suite G-1, Boulder, Colorado, USA 80301, fax: 1/303-443-3212, e-mail: ases@ases.org

### North Sun `97
**June 9-11, 1997**

**Espoo-Otaniemi, Finland**

The SHC Programme will continue its 20th Anniversary celebration with an exhibit and presentations at North Sun, a conference designed to address the potential of solar energy use at high latitudes.

For more information contact: North Sun `97 Secretariat, Helsinki University of Technology, Advanced Energy Systems and Technologies, Rakentajanaukio 2 C, FIN-02150 Espoo, Finland, fax: 358/9-451-3195, e-mail: peter.lund@hut.fi

## The SHC Web Site
The Solar Heating and Cooling Programme is in the process of changing its web site address from http://www-iea.vuw.ac.nz:90 to:

Its new address
**http://www.ieo-shc.org**
Visit our web site next time you're using the Internet. You will find a variety of Programme information, including publications, Task activities, names of Programme contacts, calendar of upcoming SHC meetings and workshops as well as other useful information.

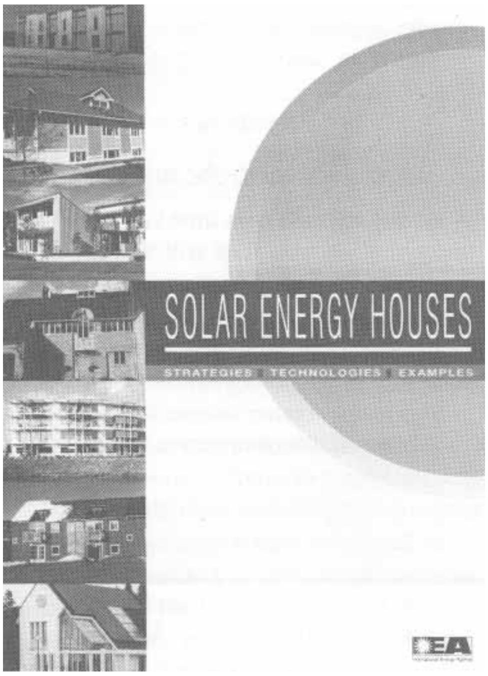
### Solar Low Energy Houses

**Solar Energy Houses:**

**Strategies, Technologies, Examples**
*A.G. Hestnes, R. Hastings, B. Saxhof co-editors, December 1996*

This book presents the design strategies, technologies and monitoring results of fourteen experimental residential buildings built under Task 13. The buildings were designed to advance solar building technologies through the identification, development and testing of new and innovative passive and active solar concepts as well as advanced energy conservation measures. These buildings demonstrate that is it possible to significantly reduce total energy consumption. The average total energy consumption of the experimental buildings is 44kWh/$m^2$ per year. This is about 25 percent of the energy purchased in traditional houses today. The detailed results obtained from the different houses built and the technologies used are presented in this book, and provide a worthwhile reference for architects and planners as well as engineers.

This book may be ordered from James and James Science Publishers, Waterside House, 47 Kentish Town Road, London NW 1 8N2, England. Cost: £43.




### Solar Energy Systems

**Large Solar Energy Systems**
*P. Isakson et. al., April 1996*

This report documents lessons learned from three large-scale heating systems studied under Task 14, Advanced Solar Systems. Although the projects were very different, each one represents important applications of active solar systems. The report provides a description and analysis of the projects and concludes with recommendations and guidelines for the construction of large solar systems based on the lessons learned from this international research.

This report may be ordered from A.C. de Geus, TNO Building and Construction Research, P.O. Box 49, NL-2600 AA Delft, The Netherlands.

**Advanced Solar Domestic Hot Water Systems**
*W. Duff, editor, August 1996*

The Task 14 Advanced Solar DHW Working Group focused on developing advanced DHW systems using the "low flow" concept. Participating experts designed systems appropriate for their countries which provided a significant cost/performance improvement (as high as 48 percent) over systems on the market in their respective countries when the Task began. This report is designed to make it easy for solar equipment manufacturers/distributors to locate information on specific systems and components, including cost and performance data.

This report may be ordered from Professor William Duff, Solar Energy Applications Laboratory, Colorado State University, Department of Mechanical Engineering, Fort Collins, Colorado 80523, USA.

**Dynamic Testing of Active Solar Heating Systems, Volumes A & B**
*H. Visser, editor, October 1996*

This two-volume report describes the combined dynamic testing of components and system simulation for small solar heating systems as well as in situ measurements of large solar heating systems and the dynamic testing of solar DHW systems. Both volumes include summaries of the work conducted and a collection of papers describing in more detail the experiences with dynamic testing and measuring.

The report may be ordered from TNO Building and Construction Research, P.O. Box 49, NL-2600 AA Delft, The Netherlands. Cost US $60 excluding VAT and mailing costs.

### Estimating Solar Radiation

**Improved Measurement of Solar Irradiance by Means of Detailed Pyranometer Characterisation**
**D.I.** *Wardle, et al., April 1996*

This report documents the work conducted on pyranometry in Task 9, Solar Radiation and Pyranometer Studies. The purpose of the Task 9 subtask was to demonstrate the use of characterization to improve measurements made with pyranometers. The main part of the report addresses characterization methods and their accuracy. The results from eleven laboratories on nearly thirty pyranometers of seven types have been examined. Other sections include comparison and analysis of calibration results and different ways to measure irradiance with pyranometers.

The report may be ordered from the National Atmospheric Radiation Centre, Atmospheric Environment Service, 4905 Dufferin Street, Downsview, Ontario M3H 5T4, Canada. Report #IEA-SHCP-9C-2. Cost: CDN $65.

**Using Pyranometers in Tests of Solar Energy Convertors: Step-by-Step Instructions**
*L.J.B. McArthur et. al., November 1995*

This report of Task 9 offers a stepby-step guide to the measurement of global solar radiation for the purpose of determining the efficiency of flat plate collectors. It presents a straightforward set of procedures to simplify the task of measuring solar irradiance. Comprehensive instructions are provided for each stage of the procedure, including where to obtain instrument responsivities and how to install and operate pyranometers and their data acquisition systems.

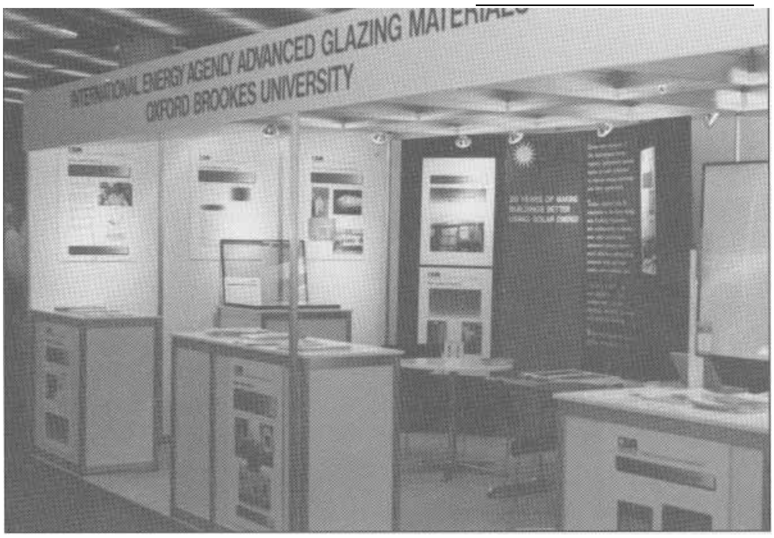
This report may be ordered from the Experimental Studies Division, Atmospheric Environment Service, 4905 Dufferin Street, Downsview, Ontario M3H 5T4, Canada. Cost CDN $15.

## Advanced Glazings Exhibited at Glastec '96

Glastec is Europe's largest glass and glazings trade fair and is held every two years in Dusseldorf, Germany. This year's October event attracted 48,000 visitors viewing the 800 exhibition stands. Amongst the exhibitors was the IEA Solar Heating and Cooling Programme presenting the work of Task 18 on advanced glazing materials. Task 18 has interacted strongly with industry throughout its lifetime and this event provided an opportunity to build upon the success of 1995 when the Task presented its work to the North American glass industry at the Windows Innovation `95 conference in Toronto, Canada.

The IEA Glastec exhibition stand contained a series of posters presenting technical results on insulated glazing units, switchable glazings, frame and edge seal technology, and the major test facilities of the member countries. Also on show were some 10 glazings, many of which have been evaluated in the Task. The glazings included a triple glazed xenon filled unit from Interpane, Germany, with a center-of-glass Uvalue of 0.4 W. m'. K$^{-'}$, transparent insulation and a glazing with integrated blinds from Okalux, Germany, and electrochromic switchable glazings from Pilkington, United Kingdom.

The stand also contained the world's first full-size vacuum window which attracted much attention. The edge-sealed 1 x 1 $m^2$ evacuated glazing was built by the University of Sydney, Australia, and sent to Norway for U-value measurements. Norway, leader of the Task's frame and edge seal technology project, designed and constructed a low-loss wooden frame and mounted the glazed unit. The window, possibly one of the most traveled in the world, was then shipped from Trondheim to Dusseldorf! In a vacuum window the two sheets of glass are separated by an array of sub-millimeter dimensioned glass pillars but it was evident from the visitors' responses that these were barely visible to the human eye.



The Task 18 exhibition stand at Glastec '96.

Glastec also contained a large exhibition and symposium titled "Visions of Glass." The Task 18 Operating Agent, Prof. Michael Hutchins of Oxford Brookes University, UK, gave an invited plenary lecture to the symposium. At the Visions of Glass exhibition the Fraunhofer Institute for Solar Energy Systems of Freiburg, Germany, displayed examples of the switchable thermotropic hydrogel window and the "gasochromic" device which switches from its clear state to a colored state upon injection of small quantities of hydrogen gas.

During the exhibition some 3,000 brochures and newsletters were picked up by visitors to the IEA stand.

The next venue for Task 18 is Nagoya, Japan, where a joint workshop with Japanese industry is planned for March 13, 1997.

*Prof. Michael Hutchins, Oxford Brookes University, is the Operating Agent for Task 18 on behalf of the United Kingdom Department of Environment.*

## Thanks To...

**Anne Grete Hestnes** who was the Operating Agent for Task 13, Advanced Solar Low Energy Buildings. To the Executive Committee's good fortune, Anne Grete will continue to be a part of the Programme as the organizer for the new Task 23 on the optimization of solar energy in larger buildings.

**Doug Lorriman** who was the Operating Agent for Task 14, Advanced Active Solar Systems. Doug's sense of humor and lengthy Task reports will be greatly missed by all Executive Committee members.

**Heribert Schmidt** who completed his work as Operating Agent for Task 16, Photovoltaics for Buildings. Not only has the Executive Committee appreciated the contributions Heribert made as Operating Agent, but also as the Programme's ad hoc photographer.

# IEA Solar Heating and Cooling Programme

The International Energy Agency was formed in 1974 within the framework of the Organization for Economic Cooperation and Development (OECD) to implement a program of international energy cooperation among its member countries, including collaborative research, development and demonstration projects in new energy technologies. The 20 members of the IEA Solar Heating and Cooling Agreement have established a total of 21 R & D projects (known as Tasks) to advance solar technologies for buildings. The overall program is managed by an Executive Committee while the individual Tasks are led by Operating Agents.

## Current Tasks and Operating Agents

**Task 18: Advanced Glazing Materials**
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**Task 19: Solar Air Systems**
Mr. Robert Hastings
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**Task 20: Solar Energy in Building Renovation**
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**Task 21: Daylight in Buildings**
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**Task 22: Solar Building Energy Analysis Tools**
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SOLAR UPDATE

The Newsletter of the IEA Solar Heating and Cooling Programme

**No. 28, January 1997**

Prepared for the IEA Solar Heating and Cooling Executive Committee
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*Editor:*
Pamela Murphy Kunz




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