The Time for SOLAR is Now.

SHC
SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

International Energy Agency
Solar Heating & Cooling Programme

Mission

To continue to be the preeminent international collaborative programme in solar heating and cooling technologies and designs.

Most people don't realize it, but heating buildings consumes more energy than that used for electricity or transportation so increasing the use of solar thermal energy is not only important, but timely as our demand for energy continues to steadily grow.

Solar thermal energy is appropriate for both heating and cooling. Key applications for solar technologies are those that require low temperature heat, such as domestic hot water heating, space heating, pool heating, drying processes, and certain industrial processes. Solar applications also can meet cooling needs, where the supply (sunny summer days) and the demand (desire for a cool indoor environment) are well matched.

Unfortunately, solar represents only a small share of all the heating and cooling needs. The main barriers preventing the greater use of solar energy are:

- Many solar technologies are not yet cost-competitive.
- Current government policies benefit existing non-solar technologies.
- The environmental costs of using fossil fuels are not taken into account.

To overcome these barriers and penetrate the global market, the IEA Solar Heating and Cooling (SHC) Programme is working in three key areas:

- Education of users and decision makers.
- Expansion of the solar thermal market.
- Research, development and testing of hardware, materials and designs.

The Power of Collaboration

The collaborative work of the SHC Programme spans nearly three decades. Over these years, the investments made in this international partnership have generated valuable results and products beyond what any one country could do on their own.

To support its work, the SHC Programme also is collaborating with other key players in the field, including the solar industry associations of Australia, Europe and North America. Together they are working to increase the awareness of national and international government bodies and policy makers and to encourage industry to use new solar thermal products and services. By 2025, the SHC Programme and affiliated associations envision solar thermal technologies providing 10-15% of the total energy demand in the OECD countries. For Europe, the goal is even more optimistic with the Joint Declaration for a European Directive to Promote Renewable Heating and Cooling calling for 25% of the EU heating and cooling to be supplied by renewables in 2020.

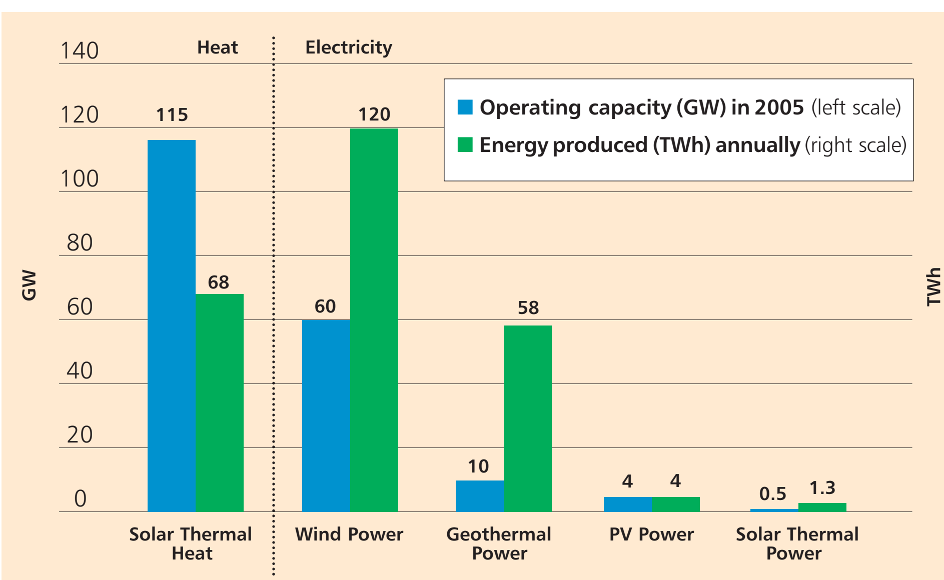
Solar's Untapped Potential

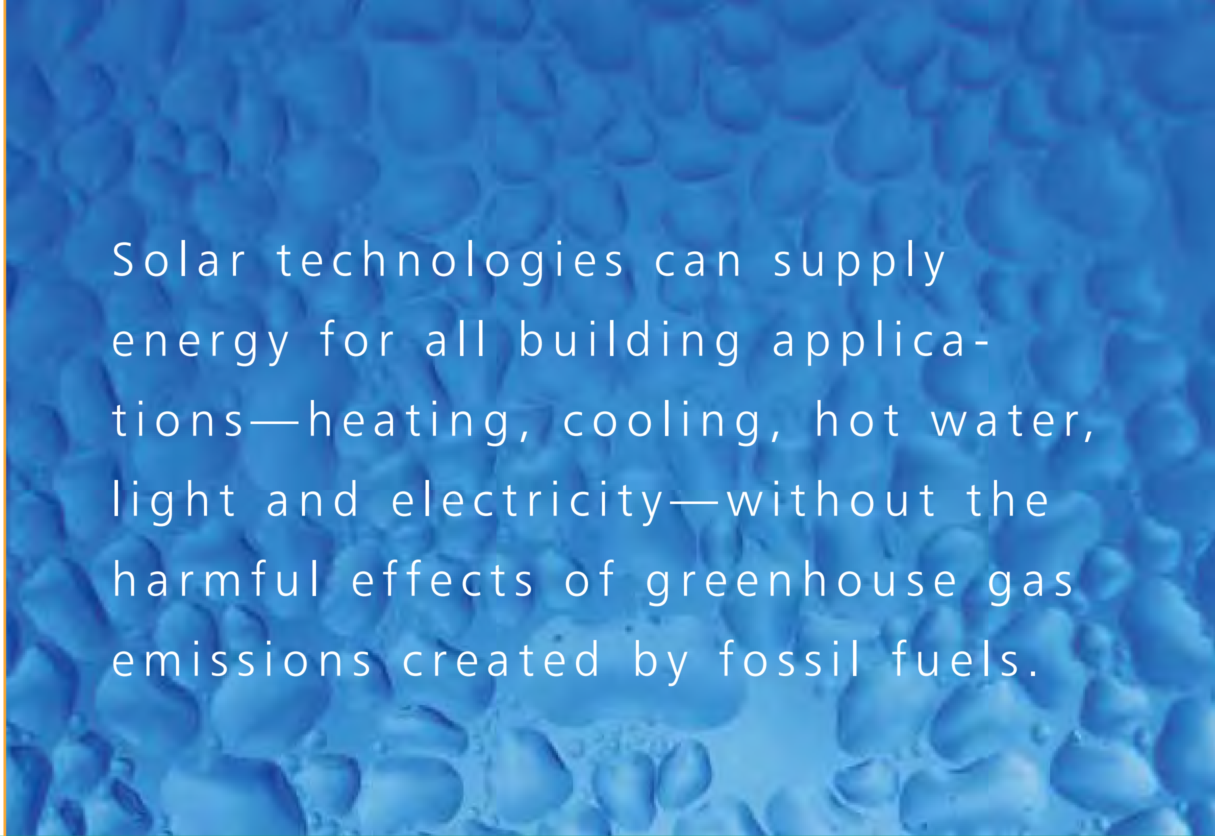
AS AN ENERGY SOURCE

Until recently, solar thermal installations were measured in square meters of installed collector area instead of their energy output. As a result, solar thermal was often excluded from official renewable energy statistics. Using a standard conversion factor of 0.7 kWth per m^2 of collector area developed by the SHC Programme and solar trade associations, it is now possible to compare solar thermal with other energy sources.

Solar, compared with other renewable energy sources, is second only to wind in meeting the global energy demand. The annual energy produced TWh and the cumulative capacity (GW) at the end of 2005 for solar heating, wind, geothermal, photovoltaics and solar thermal power stations is shown in the graph.

Cumulative Capacity at end of 2005 and Energy Generated





AS A TECHNOLOGY

Solar technologies can supply the energy for all of a building's needs—heating, cooling, hot water, light and electricity—without the harmful effects of greenhouse gas emissions created by fossil fuels. And, solar applications can be used almost anywhere in the world and are appropriate for all building types—

- single-family homes,
- multi-family residences,
- office and industrial buildings, schools,
- hospitals, and other public buildings

In the agriculture sector, solar technology is being used to dry crops ranging from coffee and tea to wool and chicken manure. Companies in Europe, North America, and numerous developing countries see this technology as a cost-effective and environmentally-sensitive process.

The majority of the energy used in commercial and industrial processes is below 250°C, a temperature range well suited for solar technologies. Solar technologies are being used for specific industrial processes, such as food processing, textile cleaning and drying, pharmaceutical and biochemical processes, desalination, and heating and cooling of factories.

Why Use Solar Technology?

Energy Security

More than half of the world's conventional oil reserves are concentrated in the Middle East. With the IEA Member countries depending on foreign sources for the majority of its oil needs, energy security is not only a matter of scarcity, but regional distribution and relations between the export and import countries.

Solar energy is the most abundant and widely distributed renewable energy resource in the world, and yet the potential of this "local" energy source—produced close to where it is needed—has hardly been tapped.

Environment

Managing the interaction between energy use and the environment remains a major challenge for policy-makers today. Carbon dioxide from fossil fuel combustion alone creates roughly four-fifths of the total man-made greenhouse gas emissions.

Solar energy displaces carbon-emitting sources while providing a non-polluting energy source for heating and cooling.

Economic Growth

Investments made in solar thermal technologies create jobs in many different sectors from research and manufacturing to the service industry (e.g., installers and distributors). It is estimated that in 2005 alone there were 180,000 jobs in the solar thermal sector worldwide.

Benefits to Users

Increasing gas and oil prices mean higher utility bills. With no decrease in costs insight, consumers are tied to this volatile market. Solar technologies in homes can lower the use of non-renewable energy sources for space and water heating by a factor of three. In offices, daylighting applications alone can reduce electric lighting use by 30% - 50% as well as improve worker performance.

The Power of Solar

AT HOME

The SHC Programme is demonstrating the value of solar's contribution in residential buildings. This work is important because space heating and hot water heating account for over 75% of the energy used in single and multi-family homes. Solar energy can meet up to 100% of this demand.

An innovative solar technology is the solar **combisystem** as it provides both heat and hot water. These systems can meet up to 100% of a building's heating demand, depending on the collector size, the storage capacity, the heat load, and the region's climate.

In Austria, after the successful installation of pilot systems on new multi-family houses, several developers decided to make solar combisystems a standard technology in all their new buildings. As a result around 1,000 systems with a capacity of 50 MWth (70,000 m^2) are now in operation.

A combination of reliable, low-cost technologies and effective marketing strategies is required to push **sustainable, low-energy solar houses** further into the conventional housing market. With the technical performance of this type of house proven, how these houses are marketed is critical.

In the Netherlands, the Dutch branch of the World Wildlife Fund (WWF) started a campaign to stimulate the construction of sustainable housing. This effort soon evolved into a collaborative project with the WWF, five major property developers and energy experts. Working together, this group developed the WWF-label for housing. Over 10,000 homes have been built meeting the label requirement of 50% greater energy efficiency in heating than the current Dutch building standard plus the installation of either a solar water heater or photovoltaic (PV) panels for electricity. The main reason for the success of the WWF housing project was the creation of

WWF Housing Project
WWF housing project in the Netherlands – a SHC success story on effectively marketing sustainable houses..

Gneis Moos Housing Estate
Gneis Moos housing estate in Austria – a SHC Programme demonstration project on the benefits of solar combisystems.

win-win alliances for all the parties involved—WWF, project developers, local government, and home buyers. As a result of the WWF initiative, a Dutch National Certificate for Solar Housing was developed.

New York Times Building

New York Times Building in Manhattan, New York–applied SHC Programme research to a major building project to stimulate change in manufacturers' product offerings and ultimately promote broader market acceptance of daylighting systems.

AT THE OFFICE

The SHC Programme, working with building designers, owners, and operators, is optimizing systems and demonstrating the economic and environmental benefits of applications in commercial buildings. This work is important because office building energy bills are the highest of any commercial building type. The combination of heating, ventilation, air conditioning and lighting account for approximately 70% of a building's energy use.

Solar assisted air-conditioning of commercial buildings is a promising concept. The advantage of solar is that the demand for cooling coincides with the availability of high solar radiation. To bring this technology into the market, the SHC Programme monitored 11 systems to understand how they perform and identify ways to improve their performance. The system monitored at the Chamber of Trade and Commerce in Freiburg, Germany is a solar-assisted desiccant cooling system operated by a solar air collector. It is used to cool the top floor seminar room and cafeteria, which had been very uncomfortable during the summer.

This system saves approximately 30% of the primary energy used compared to a conventional system. The extra cost for the solar collector field was about 10% of the overall installation. In operation for over three years, the users continue to be very satisfied with their decision to install this environmentally-sound technology.

Linking research to implementation accelerates the development, application, and market acceptance of solar technologies. The New York Times Building in New York City is an excellent example of this approach at work. This project, building upon the SHC Programme's **daylighting** work, used extensive field performance data to stimulate changes in manufacturers' product offerings and ultimately promote broader market acceptance of daylighting systems.

Through demonstration, this project shows that integrating automated shades and daylighting controls saves money and improves occupant comfort. By simply including the ability to dim lights, the energy savings range from 50% to 70% for the south and west facing windows.

AT THE FACTORY & ON THE FARM

The energy needed by commercial and industrial companies in their **production processes** and to heat their factories can be met using solar thermal collectors. The lower temperature levels, less than 80°C, can be reached using solar thermal collectors that are already on the market, while the continued development of high-performance collectors and system components will improve the cost-effectiveness of higher temperature applications.

This work is important because solar's potential contribution is significant. For example, by installing a 360 kW solar thermal collector at Contank, a Spanish plant that cleans rail transport containers, the estimated annual savings are € 13,050 with a 10-year payback period.

One of the most promising agricultural applications for active solar heating is the **drying of agricultural products**. Wood and conventional fossil fuels are used extensively, and in many countries more expensive diesel and propane fuels are replacing wood. The use of solar crop drying systems results in significant energy savings, reduced use of fossil fuels and lower GHG emissions. The solar-assisted drying system installed at a Costa Rican coffee cooperative uses 850 square meters of solar collectors on the roof to warm air that intake fans use to dry the coffee beans. This system has lowered operating costs, replaced wood heat with solar, and reduced CO_2 emissions.

IN THE LAB & IN THE FIELD

Collaborative research and testing foster the production of quality products and the development of certification methods for products and software. The SHC Programme is working in both areas.

In **laboratory test facilities**, international teams of SHC Programme experts have tested many new technologies and components. Manufacturers from seven countries tested well-established and promising prototype solar air collectors at a facility in Austria. The tests resulted in a common testing procedure and technical improvements in specific systems.

Chamber of Trade and Commerce

Chamber of Trade and Commerce in Freiburg, Germany – a SHC Programme demonstration project for solar assisted air-conditioning system performance.

Coopeldos R.L. Coffee Plant
Coopeldos R.L. coffee plant in Costa Rica – one of six SHC Programme solar drying projects that are estimated to reduce carbon dioxide emissions by 1,000 tons a year.

The results of **design tool evaluations** by the SHC Programme are used in building energy code compliance by national and international standards organizations. In the United States, IEA BESTEST (Building Energy Simulation Test) results were used to develop a standard test method for evaluating building energy analysis programs and for home energy rating software certification. Other countries, such as the Netherlands, Australia and New Zealand, are using BESTEST as a standard method of testing building energy analysis tools for their national energy codes and home energy rating software. In addition, many of the test methods for solar technologies in the ISO and CEN standards are based on test methods developed in the SHC Programme.

Arsenal Test Facility
Arsenal test facility in Vienna, Austria – a SHC Programme project to test solar air collectors.

Contank Industrial Plant
Contank industrial plant in Barcelona, Spain – a SHC Programme demonstration project on the technical options and economic benefits of solar process heat.

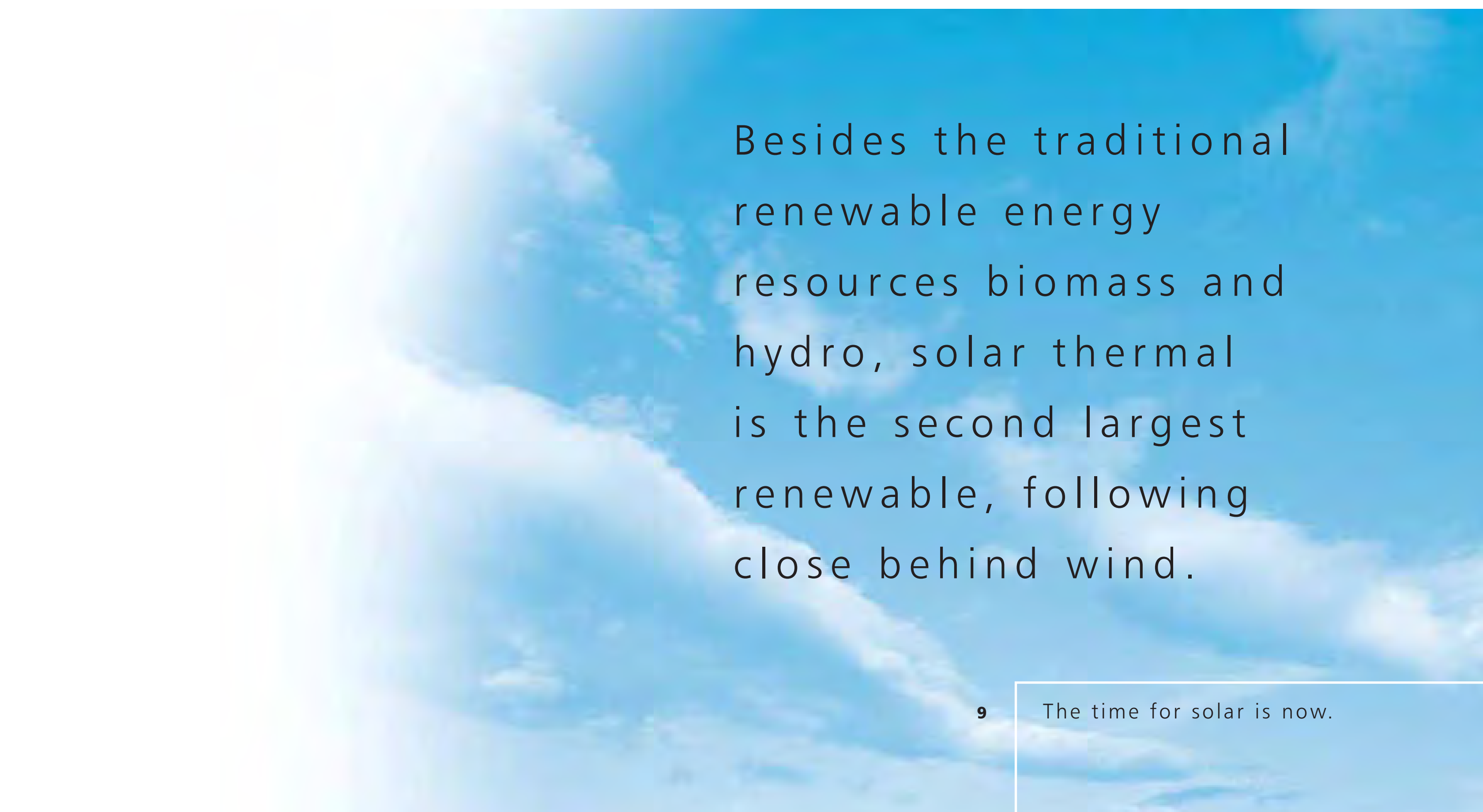
Ensuring A Bright Future

International organizations, national governments and private industry are committed to increasing the use of renewables in the world. For solar thermal technology, its growth is steady and its contribution as a renewable energy source significant—but there is more to do.

Solar must become economically competitive with other energy technologies to continue to expand its reach. The SHC Programme will do its part by focusing on:

- Improving current technologies.
- Making products more cost competitive.
- Continuing R&D on new materials and processes that can improve building performance (e.g., electrochromic and thermochromic materials for controllable windows, phase change materials, energy storage materials, transparent insulation, etc.).
- Finding ways to better integrate and optimize solar components into energy efficient buildings.
- Testing and certifying components and products.
- Producing and disseminating critical information to targeted audiences.
- Developing improved methods for calculating and disseminating accurate and reliable worldwide solar resource information relevant to all solar technologies.

The SHC Programme is proud of the role it has played in the forefront of solar heating and cooling technologies and will continue to work for a brighter and greener energy future.



Besides the traditional renewable energy resources biomass and hydro, solar thermal is the second largest renewable, following close behind wind.

The Solar Heating & Cooling Programme

The Solar Heating and Cooling Programme was established in 1977, one of the first programmes of the International Energy Agency. The Programme's work is unique in that it is accomplished through the international collaborative effort of experts from Member countries and the European Commission. The benefits of this approach are:

- accelerates the pace of technology development,
- promotes standardization,
- enhances national R&D programmes,
- permits national specialization, and
- saves time and money.

The Programme is headed by an Executive Committee composed of one representative from each Member country and Sponsor organizations, while the management of the individual projects is the responsibility of project managers (Operating Agents) who are selected by the Executive Committee.

The Programme's work is enhanced through collaboration with other IEA Programmes—Energy Conservation in Buildings and Community Systems Programme, Photovoltaic Power Systems Programme, and SolarPACES Programme—and solar trade associations in Europe, North America, and Australia.

HOW TO PARTICIPATE

Visit the SHC Programme web site at ***www.iea-shc.org*** to learn more about the Programme's work and its Member countries.

If your country is a **Member** then contact the Executive Committee member from your country or the Operating Agent of the specific Task you are interested in joining.

If your country is **not a Member**, but a government agency or an organization is interested in joining, please contact the SHC Executive Secretary.

If you represent an **international industry association** or **international non-profit organization** and are interested in joining as a Sponsor, please contact the SHC Executive Secretary.

SHC Projects & Lead Countries

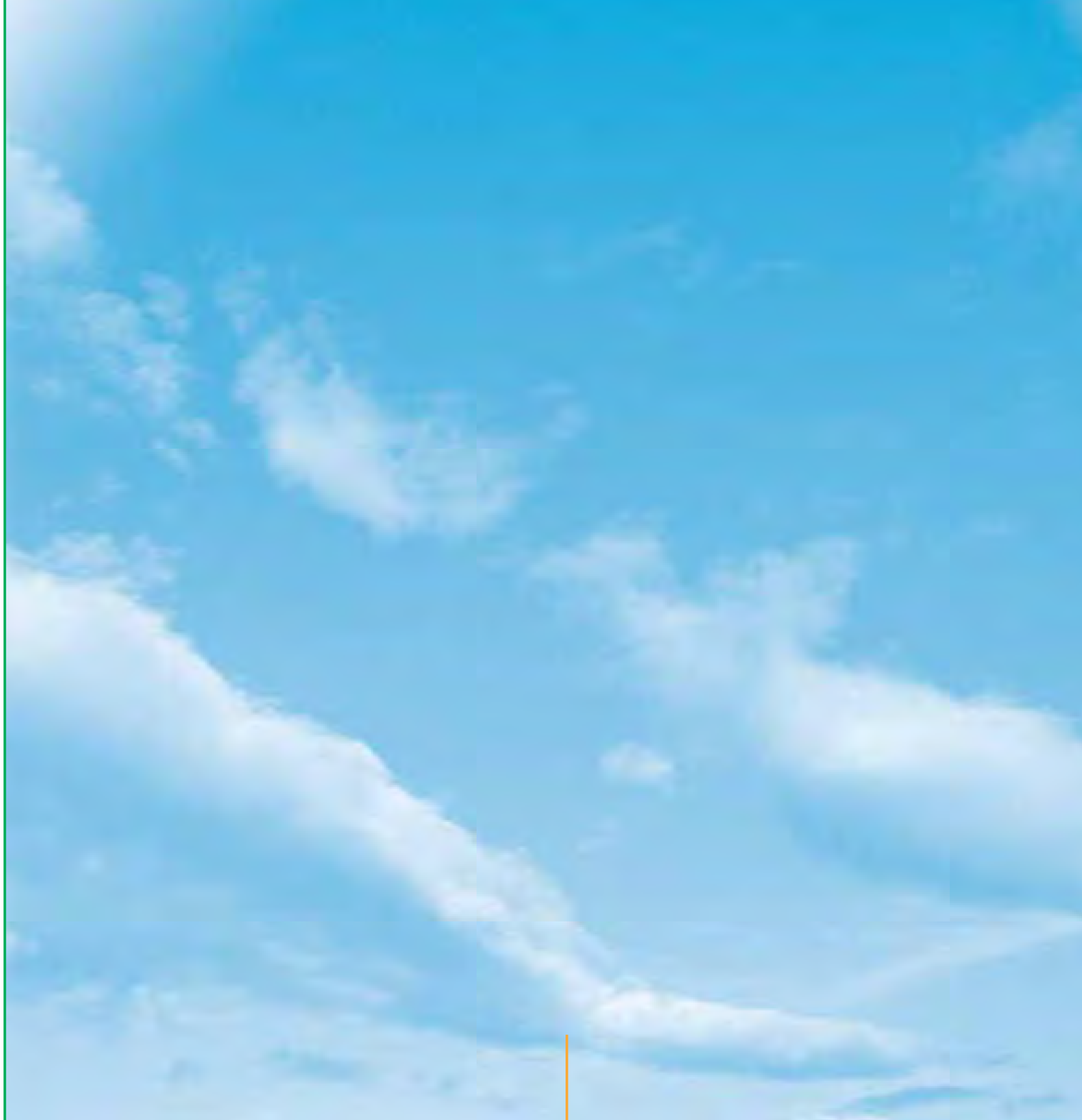
Task 1	Performance of Solar Heating and Cooling Systems, 1977-83 (Denmark)
Task 2	National Solar R & D Programs & Projects, 1977-84 (Japan)
Task 3	Solar Collector and System Testing, 1977-87 (Germany and United Kingdom)
Task 4	Insolation Handbook and Instrumentation Package, 1977-80 (United States)
Task 5	Existing Meteorological Information for Solar Applications, 1977-82 (Sweden)
Task 6	Evacuated Tubular Collector Performance, 1979-87 (United States)
Task 7	Central Solar Heating Plants with Seasonal Storage, 1979-89 (Sweden)
Task 8	Passive Solar Low Energy Homes, 1982-89 (United States)
Task 9	Solar Radiation and Pyranometry, 1982-91 (Canada and Germany)
Task 10	Solar Materials R & D, 1985-91 (Japan)
Task 11	Passive Solar Commercial Buildings, 1986-91 (Switzerland)
Task 12	Solar Building Analysis Tools, 1989-94 (United States)
Task 13	Advanced Solar Low Energy Buildings, 1989-94 (Norway)
Task 14	Advanced Active Solar Systems, 1990-94 (Canada)
Task 15	Advanced Central Solar Heating Plants, not initiated
Task 16	Photovoltaics for Buildings, 1990-95 (Germany)
Task 17	Measuring and Modeling Spectral Radiation, 1991-94 (Germany)
Task 18	Advanced Glazing Materials, 1991-97 (United Kingdom)
Task 19	Solar Air Systems, 1993-99 (Switzerland)
Task 20	Solar Energy in Building Renovation, 1993-98 (Sweden)
Task 21	Daylight in Buildings, 1995-99 (Denmark)
Task 22	Building Energy Analysis Tools, 1996-00 (United States)
Task 23	Optimization of Solar Energy Use in Large Buildings, 1997-02 (Norway)
Task 24	Solar Procurement, 1998-03 (Sweden)
Task 25	Solar Assisted Air Conditioning of Buildings, 1999-04 (Germany)
Task 26	Solar Combisystems, 1998-02 (Austria)
Task 27	Performance of Solar Facade Components, 2000-05 (Germany)
Task 28	Solar Sustainable Housing, 2000-05 (Switzerland)
Task 29	Solar Crop Drying, 2000-06 (Canada)
Task 30	Solar Cities, not initiated
Task 31	Daylighting Buildings in the 21st Century, 2001-05 (Australia)
Task 32	Advanced Storage Concepts for Solar and Low Energy Buildings, 2003-06 (Switzerland)
Task 33	Solar Heat for Industrial Processes, 2003-07 (Austria)
Task 34	Testing and Validation of Building Energy Simulation Tools, 2003-07 (United States)
Task 35	PV/Thermal Solar Systems, 2005-07 (Denmark)
Task 36	Solar Resource Knowledge Management, 2005-10 (United States)
Task 37	Advanced Housing Renovation with Solar & Conservation, 2006-09 (Norway)
Task 38	Solar Thermal Cooling and Air Conditioning, 2006-09 (Germany)
Task 39	Polymeric Materials for Solar Thermal Applications, 2006-10 (Germany)

SHC Resources

www.iea-shc.org

Visit our website to find—

- Solar thermal statistics report, Solar Heat Worldwide
- Handbooks, design guidelines, and technical reports
- Project descriptions
- Programme publications—Solar Energy Activities in IEA Countries, SHC Annual Report, SHC Newsletter
- Contact Information for Executive Committee members, project leaders (Operating Agents) and Executive Secretary



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