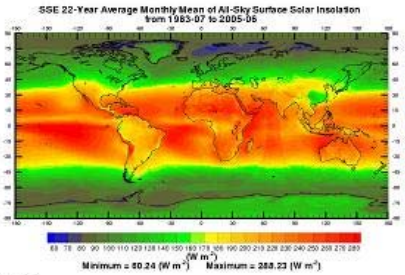
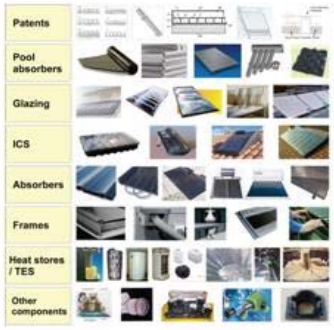
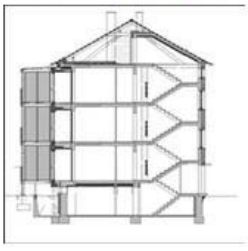
IEA SHC STRATEGIC PLAN 2009-2013







International Energy Agency

Solar Heating and Cooling Programme Strategic Plan 2009-2013

Edited by

Pamela Murphy

on behalf of the
International Energy Agency
Solar Heating and Cooling Programme
Executive Committee

STRATEGIC PLAN FOR THE IEA SOLAR HEATING & COOLING PROGRAMME 2009 - 20013

1. Introduction

The purpose of the Strategic Plan is to provide direction and focus for the activities of the Solar Heating and Cooling Implementing Agreement over the next five-year term. It was developed through an interactive process with the Executive Committee and represents the Committee's views.

Solar energy technologies and designs that include active solar heating and cooling, photovoltaics, passive solar and daylighting are essential components of a sustainable energy future. In this Plan, solar heating and cooling technologies refer to all of these, including photovoltaic/thermal technologies, except photovoltaics.

The Implementing Agreement on Solar Heating and Cooling was established in 1977 with the objective of co-operative research, development, demonstration and exchange of information regarding solar heating and cooling systems. The Agreement is responsive to the energy policies and programs of the participating countries, and as they continue to change, so will the Agreement. Solar technology is relevant to the work of many of the IEA Implementing Agreements, particularly the building related Agreements in the Working Parties on Renewable Energies and End Use Energy. Cooperation with these Agreements will continue to be important to achieve system and building integration and to generate energy savings.

Over the last years, the program has co-operated with solar thermal trade associations in Australia, Europe, and North America and the European Solar Thermal Technology Platform (ESTTP). The ESTTP recently released a vision, roadmap and strategic research agenda. Many of our experts were key contributors to these documents. It was agreed that the SHC Agreement should include the ESTTP research agenda in this strategic plan. Several research areas were not included in the ESTTP document, but are important areas for the SHC Agreement: passive solar design (including daylighting), the development of improved solar resource data, and a worldwide perspective, including harmonization of test standards and certification programs.

2. Current Status of Solar Heating and Cooling

Solar technologies can supply energy for all building applications—heating, cooling, hot water, light and electricity—without the harmful effects of greenhouse gas emissions created by conventional energy sources. Solar technologies are appropriate for all building types—single-family homes, multi-family residences, office and industrial buildings, schools, hospitals, and other public buildings—and applicable anywhere in the world. Active solar technologies can also be used for agricultural and industrial process heat applications.

2.1 Implementation

At the end of 2006, the global solar thermal capacity in operation reached 127.8 GWth, corresponding to 182.5 million square meters of collector area. Compared with forms of renewable energy, solar heating's contribution in meeting global demand is, besides the traditional renewables like biomass and hydropower, second only to wind. This fact, however, is still underestimated in energy policies.

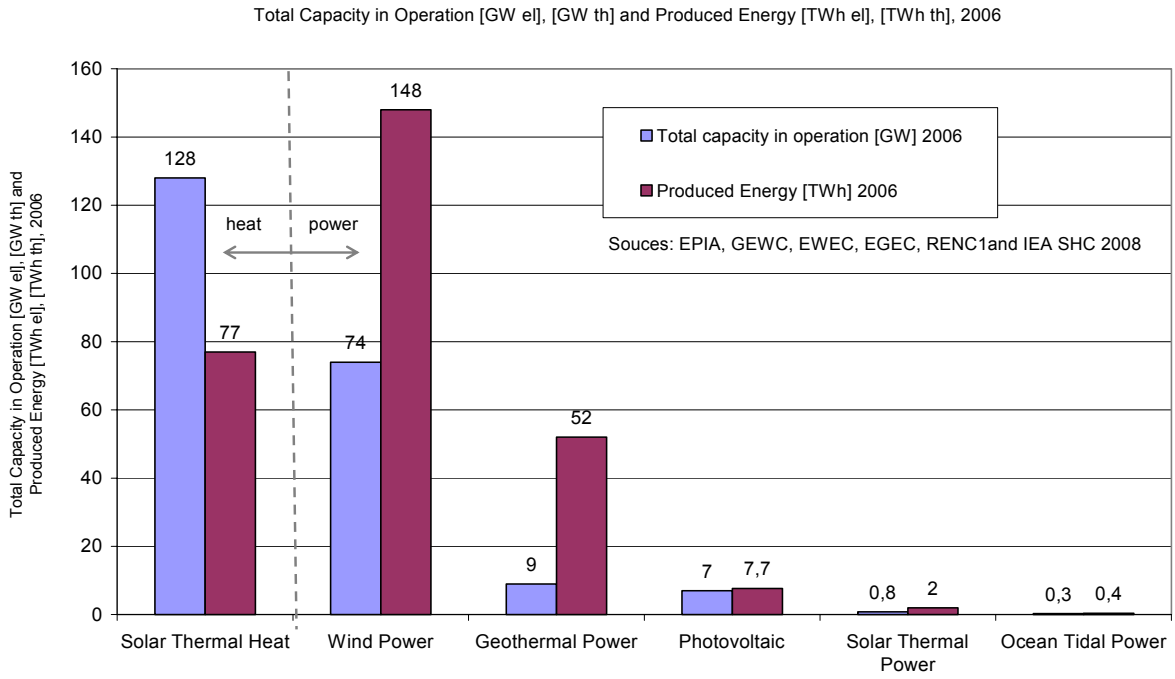


Figure 1. Total Capacity in Operation. (*Source: IEA SHC Solar Heat Report)*

2.2 Status of Industry and Market

Since the beginning of the 1990s, the solar thermal market has undergone favorable development. At the end of 2006, a total of 127.8 GW_{th} corresponding to 182.5 million square meters of collector area were installed in the 48 recorded countries. These 48 countries represent 3.87 billion people, about 60% of the world's population. The collector area installed in these countries represents 85-90% of the solar thermal market worldwide.

Of the 127.8 GW_{th} of installed collector area:

- 42.2 GW_{th} glazed flat-plate collectors and 59.9 GW_{th} evacuated tube collectors, which are used primarily to prepare hot water and for space heating.
- 24.5 GW_{th} unglazed plastic collectors, which are used primarily to heat swimming pools.
- 1.2 GW_{th} glazed and unglazed air collectors, which are used for drying agricultural products and space heating of production halls and homes.

The market for hot water and space heating using flat plate and evacuated tube collectors grew a remarkable 22% from 2005 to 2006. The most dynamic markets worldwide were in China and Europe as well as Australia and New Zealand.

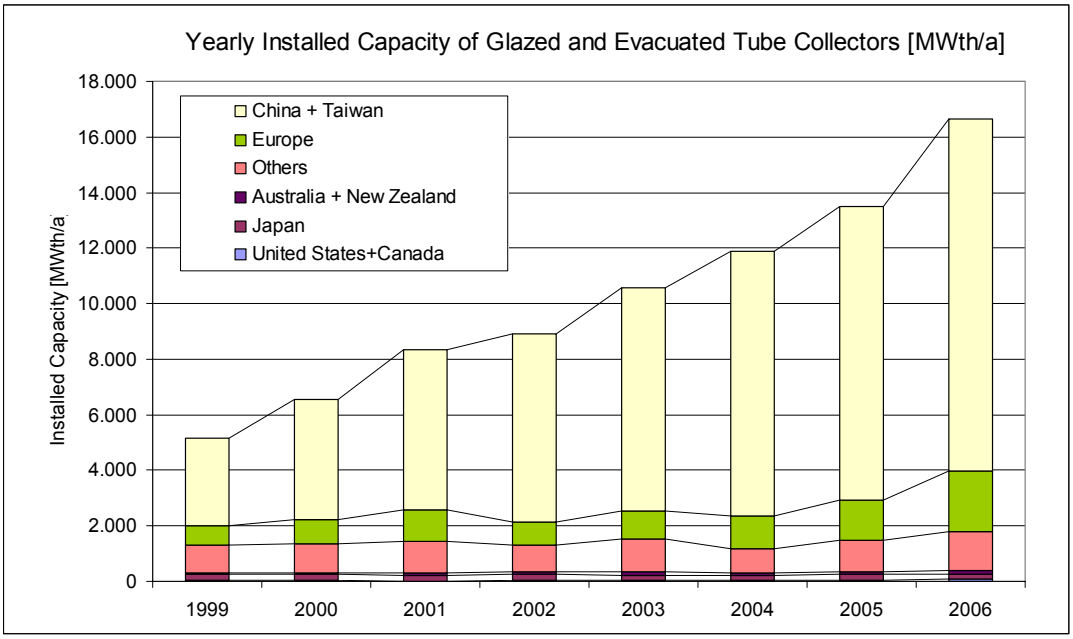


Figure 2. Annual Installations by Region. (*Source: IEA SHC Solar Heat Report)*

2.3 Impact on Energy Supply

Based on the data collected, the annual collector yield of all solar thermal systems installed by the end of 2006 in the 48 recorded countries is 76,959 GWth (more than 277,054 TJ). This corresponds to an oil equivalent of 12.5 billion liters and an annual avoidance of 34.1 million tons of CO_2.

2.4 Converting Statistic Metrics – m^2 to kW_{th}

Today, the contribution of solar heating is larger than what is accounted for in many national and international energy statistics because these statistics focus primarily on electricity. If the total heat demand were included in the energy balance, solar heating would be one of the major renewable energy sources.

To ensure that solar thermal data are accounted for in official energy statistics, the SHC Programme and several major solar thermal trade associations now present solar data in GW_{th} and the traditional m^2 of solar collectors. Using this new factor makes it possible to compare the installed capacity of solar thermal collectors with other renewable sources as can be seen in Figure 1. The conversion factor is nearly the same for all collector types—0.7 kW_{th} per m^2 of solar collector

3. Vision

The long term vision for solar thermal energy that is the basis for our agreement for the period 2009-2013, which is aligned with the vision of the ESTTP, is:

Solar thermal energy systems will provide up to 50%
of low temperature heating and cooling demand by 2030.

Matured solar thermal technologies are commercially available, but further developments are still needed to provide new products and applications, reduce the cost of systems and increase market deployment. Turning solar thermal into a major energy resource for heating and cooling by 2030 is an ambitious, but a realistic goal. It is achievable – provided that the right mix of research & development, industrial growth and consistent market deployment measures are applied.

A large percentage of the final energy demand in the world is used for heating and cooling requirements, mainly in buildings. On the basis of a strong reduction of energy demand through energy efficiency measures, solar thermal energy will be the most important energy source for heating and cooling in new buildings and in the existing building stock by 2030. Already state-of-the-art buildings are fully heated by solar thermal energy.

4. Mission

The mission for the Agreement for the period 2009-2013 is:

To advance international collaborative efforts for
solar energy to reach the goal set in the vision of contributing 50%
of the low temperature heating and cooling demand by 2030.

The Solar Heating and Cooling Agreement's mission assumes a whole building approach to the application of solar technologies and designs. Based on this mission, the Agreement will continue to cooperate with other IEA Implementing Agreements as well as the solar industry to expand the solar market. Through international collaborative activities, the Agreement will support market expansion by providing access to reliable information on solar system performance, design guidelines and tools, data, etc. and by developing and integrating advanced solar energy technologies and design strategies for the built environment and for agricultural and industrial process heat applications.

The Agreement's target audience is the design community, the solar manufacturers, and the energy supply and service industries that serve the end-users and building owners, therefore, the Agreement must strengthen its links to these intermediary businesses.

5. Key Technologies and Applications

The SHC Agreement has adopted the vision and strategic research agenda developed by the European Solar Thermal Technology Platform (www.esttp.org), but as noted in the Introduction, several research areas were not included in the ESTTP documents that are important to the Agreement. The SHC Agreement not

only has a global perspective, its work includes building design (including passive solar and daylighting) and the development of solar resource assessment.

In the near future, the most important solar heating and cooling applications in the IEA member countries are expected to be:

- Domestic hot water
- Solar combi systems for domestic hot water and space heating with an increasing solar fraction
- Solar industrial applications
- Passive and active solar buildings (including daylighting)
- Solar cooling
- Solar district heating
- Solar water treatment

To reach these goals the following technologies need to be further developed:

- **High-efficiency solar collectors** will increase the energy gained under winter conditions, while maintaining high levels of durability and increasing the cost efficiency of the manufacturing and installation process.
- New **compact, time indifferent thermal storage technologies** will significantly reduce the space required for heat storage devices. This will lead to cheaper and more practical seasonal heat storage, allowing large amounts of heat accumulated during the summer to be used for space heating during the winter.
- Improved **solar thermally driven cooling systems** will make it possible to cover much of the rising demand for air conditioning with solar energy.
- I**ntelligent control systems** of the overall energy flows in buildings will contribute to a reduction in energy consumption and the optimisation of solar energy usage.

In addition to these new technology developments, the introduction of solar technologies needs integration with existing technologies and energy saving technologies. The Agreement will focus on the effective integration of solar technologies in buildings and industrial processes. Specific areas of work include:

- Solar design for new and existing buildings (including dayighting, solar cooling and passive solar)
- Solar design for industrial applications
- Simulation models that include solar technologies
- Test methods for new applications and components
- Solar resource assessment
- Rating and certification procedures

In the long-term, solar heating and cooling applications will become a significant renewable option in buildings and industry. To achieve our Vision, a number of **barriers** need to be overcome:

- Current system prices are too high for self sustaining commercialization
- Lack of long-term storage options
- Need for improved performance as defined as higher efficiency, lower cost, improved reliability and durability, and greater user acceptance,
- Lack of awareness of solar thermal's potential in homes, commercial buildings and industrial buildings
- Perceived or actual high initial cost and/or technical risk
- Infrastructure is inadequate for broad market acceptance – standardized products, marketing, installation and operation
- Lack of assessments on the technologies strategic, competitive advantages in relation to other alternative technologies

6. Objectives and Strategies

To fulfill its mission, the SHC Executive Committee has agreed upon the following strategies to meet the objectives stated above.

SHC OBJECTIVE 1

To be the primary source of high quality technical information and analysis on solar heating and cooling technologies, designs and applications.

Strategies

- Assure that technical **information** and **analysis** developed in this Agreement is available and disseminated to the target audiences in useful formats.

- Working through relevant international standards organizations, support the development and harmonization of **standards** necessary for the widespread use of solar designs and technologies in the building, agricultural and industrial sectors.

SHC OBJECTIVE 2

To contribute to a significant increase in the performance of solar heating and cooling technologies and designs.

Strategies

- Increase **user acceptance** of solar designs and technologies.

- Continue to develop **cost-effective** designs and technologies in collaboration with appropriate intermediary industries.

- Identify and prioritize **R&D needs** for solar heating and cooling that will lead to expanded markets

SHC OBJECTIVE 3

To enhance cooperation with industry and government on increasing the market share of solar heating and cooling technologies and designs.

Strategies

- Work with appropriate **intermediary industries** and end users to accelerate the market penetration of solar designs and technologies.

- Work with governments to promote and expand **favorable policies** to increase the market share.

- Work towards or support the greater use of solar designs and technologies in **developing countries**.

- Work to address issues regarding building design, aesthetics and architectural value.

SHC OBJECTIVE 4

To increase the awareness and understanding on the potential and value of solar heating and cooling systems by providing information to decision makers and the public.

Strategies

- **Communicate** the value of solar heating and cooling designs and technologies in publications, conferences, workshops and seminars to the public and relevant stakeholders.

- Provide **analysis** that links solar heating and cooling designs and technologies to energy security concerns, environmental and economic goals.

- **Quantify and publicize** the environmental, economic and climate change benefits of solar heating and cooling and supporting policy measures solar design and technologies in meeting environmental targets and addressing policies and energy, supply security.

- **Review** our products in relation to our objectives **–** Annual Reports, Solar Update Newsletters, National Programme Review Reports, "*Solar Heating Worldwide: Markets and Contributions to the Energy Supply report."* **Present** the SHC Solar Award annually/bi-annually. **Maintain** the SHC web site.

7. Action Plan 2009 - 2013

To contribute to a significant increase in the performance of solar heating and cooling technologies and designs

The SHC Executive Committee identified the following priority areas for new work based on national funding priorities over the next five years. These include new and continued areas of work for the Agreement.

Top 6 Priority Areas

- Solar Cooling
- Building Integration
- Thermal Storage (materials, central and distributed, seasonal and short-term)
- Zero Energy Housing
- Building Renovation
- Advanced Materials and Components (including durability, polymers, integrated facade and roof materials, absorbers, copper substitutes, etc.)
- Solar Resource Assessment
- Rating and Certification Procedures

Other Important Work Areas

- Optimized Building Design/Solar Architecture
- Solar Industrial Process Heat
- Solar Space Heating
- Solar Water Heating
- Daylighting (including technology, user behavior, assessment tools)
- Solar Water Treatment

To be the primary source of high quality technical information and analysis on solar heating and cooling technologies, designs and applications

- Review existing studies linking cost effective SHC to environment, economy and energy security (e.g., series of White Papers)
- With industry representatives, review Task results and package select results for specific audiences
- With standards organizations, identify and perform supporting work for standards to expand SHC markets

Help industry and government increase the market share of solar heating and cooling technologies and designs

- Document demonstration and monitoring performance of SHC systems - best practices
- Develop market transformation activities to support industry efforts (e.g., utilities, municipalities)
- Initiate solar heating and cooling projects in non-IEA countries {use instead of developing countries?}

Help educate decision makers and the public on the status and value of solar heating and cooling

- With trade associations, prepare a white paper on the value of SHC
- Quantify the environmental benefits of SHC
- Initiate a policy-related Task
- Conduct meetings with decision makers to present the results of the above activities
- Provide specific Task knowledge upon request

The annual Action Plan for 2009 is attached as Appendix 1.

8. Programme Management

8.1 Organization

The Executive Committee is the management body of the IEA Solar Heating and Cooling Agreement. It is composed of one representative from each Contracting Party to the Implementing Agreement. Each member country has one vote. The Executive Committee elects a Chairman and up to two Vice-Chairman who serve for a two-year term. The Chairman may serve for a maximum of two consecutive terms.

The management of the individual projects is the responsibility of Operating Agents who are selected by the Executive Committee.

8.2 Sponsors

To increase collaboration with industry associations, the SHC Agreement has adopted the new IEA member category of "Sponsors." Based on the IEA's definition, the following guiding principles were adopted by the Executive Committee:

- Admission shall be limited to major international industry associations and international non-profit organizations which are in-line with the SHC Agreement's objectives.
- A single company shall not be accepted as a Sponsor.
- The number of Sponsors in the Implementing Agreement shall not be greater than half of the number of Contracting Parties.
- Sponsors are to have voting rights in the Executive Committee except on issues of unanimity.
- Sponsors are to pay half the amount that Contracting Parties pay annually to the Common Fund.
- As stated in the IEA Framework, Sponsors must participate in at least 1 Task.
- Sponsors may propose and initiate new Tasks.
- All Publication Review Committees shall have at least 1 Contracting Party.
- Sponsors are to follow the same procedure, as stated in the SHC Policy & Procedures Handbook, to withdraw from the Implementing Agreement as Contracting Parties.

8.3 Committees

To manage specific Agreement activities, the Executive Committee has created the following Committees:

- **Information and Marketing Group** to help guide and inform the Programme of opportunities for promoting and disseminating Programme results, to review Task Information Plans, and to develop and improve information guidelines and policies. The group is also responsible for raising the visibility of the Programme. The group consists of 2 Executive Committee members, the OA chair and the Executive Secretary.

- **Award Committee** for the selection of the SHC Solar Award recipient among the nominated candidates. The Committee consists of the ExCo Chair, the Chair of the Information & Marketing Group, 2 Executive Committee members and the OA Chair.

- **Trade Association Committee** to work with the major solar heating and cooling trade associations to maximize the synergy between their interests and the SHC Agreement's activities. The Group consists of 4-5 Executive Committee members.

- **International Solar Heating and Cooling Conference Committee** to organize with ISES and ISES Europe this international conference.

8.4 Information Dissemination

Recognizing the absence of or limited information and statistical data disseminated on solar heating and cooling, daylighting and integrated building technology and design, the Agreement will continue to strengthen its dissemination activities through its own platforms (SHC Solar Award, website, newsletter, annual report, Task reports, conference presentations, journal articles) and other channels, such as the IEA (OPEN Bulletin, CADDET newsletter, etc.), conferences/events, trade journals, etc.

9. Performance Review

This strategic plan is a guiding reference document and not a set course of action. The objective of an annual review is to assess if the current strategy should be altered to account for changes in the Agreement or in the field of solar heating and cooling.

9.1 Annual Review

The Strategic Plan will be reviewed every year to assess its relevance and progress being made to achieve the Strategic Objectives and annual Action Plan. The Chair and Vice-Chairs will review progress and present their findings to the Executive Committee, who will approve of their report and recommend corrective actions, if required.

9.2 National Programme Review

An online national report will be submitted by Executive Committee annually. Every 2-3 years the Executive Committee will conduct a national programme review session. At this time, each Executive Committee member prepares an oral and written paper on the current status of solar in their country. An annual summary will also be prepared by each country using the online template.

9.3 Task Evaluations

Mid-term and **final evaluations** of Tasks and Working Groups will be conducted to assess the quality of the technical work, management, products and results. The Agreement's Policies and Procedures Handbook contains a description of the evaluation process. These evaluations will be carried out by the Operating Agent or Working Group Leader. The Task subcommittee will review the Task evaluation and provide an independent overview prior to the Operating Agent's presentation at an Executive Committee meeting. Executive Committee is then to vote on its approval or request modifications. In general, the evaluations will be qualitative rather than in-depth, quantitative analysis. Criteria to be applied are:

Mid-term Evaluations

- Progress towards meeting Task objectives
- Milestones achieved
- Scientific and technical quality
- Management quality and effectiveness
- Industry involvement
- Adherence to work plan and information plan
- Country adherence to commitments

Final Evaluations

Regarding quality:

- Objectives achieved
- Management quality and effectiveness
- Technology outcomes
- Information plan outcomes
- Relevance of results
- Fulfillment of industrial needs
- Adequacy of allocated resources

Regarding impacts:

- Adequacy of SHC and national technology transfer efforts
- Did the activity make a difference? If so, why? If not, why not?
- Economic value to national participants and industries
- Information/technology transfer from the activity
- Application of the Task results
- Educational benefits

10. Collaboration

10.1 Within the IEA

In order to conduct efficient R&D and eliminate duplication of work, it is important to identify common R&D

topics, and if appropriate, coordinate activities with the other IEA building-related Implementing Agreements in the buildings co-ordination group. Other important collaborative activities are the exchange of information, hosting of joint meetings, and development of joint projects in areas of common interest.

It also is important to continue to enhance the dissemination of information through collaborative activities with IEA Headquarters, the statistics department and the Renewable Energy Working Party.

10.2 With other IEA Agreements

Collaborating with other Implementing Agreements is critical. The SHC Agreement currently has collaborative Tasks with the following IEA Agreements: Energy Conservation in Buildings and Community Systems (ECBCS), Energy Conservation through Energy Storage, Photovoltaic Power Systems, and SolarPACES. The SHC Agreement will continue to develop its current relationships and foster new ones with the Building-Related Implementing Agreements. The SHC Agreement also will actively collaborate with the IEA's Building Coordination Group.

While there are several IEA programs that are related to the building sector, this Agreement and the ECBCS Agreement focus primarily on buildings and communities. Synergy between these two Agreements occurs because one seeks to meet a large portion of energy demand using solar energy while the other seeks to cost-effectively reduce energy demand. The combined effect results in buildings that require less purchased energy, thereby saving money and conventional energy resources, and reducing greenhouse gas emissions. The SHC Agreement has the primary responsibility for solar designs and solar technologies to supply energy to buildings areas. The ECBCS Agreement has primary responsibility for efficient use of energy in buildings and community systems. To facilitate this collaboration the Executive Committees will meet together every two years to discuss areas of common interest, including new Tasks.

To facilitate collaborative activities with other Implementing Agreements, the Executive Committee approved a policy on collaborative Tasks with other IEA Agreements. This policy recognizes that although the IEA SHC Executive Committee believes that, from a management point of view, it is better to formally manage a Task in only one Executive Committee at a time there are Tasks that lend themselves to collaboration. To facilitate this process, the SHC Executive Committee has agreed upon four levels of collaboration.

Level 1 At this level, ExCo B can provide experts who participate in the Task with the same rights and responsibilities as experts from ExCo A, i.e., they must attend Task meetings, must provide requested input on time, etc. In addition, the ExCo A Operating Agent distributes Task Status Reports, Tasks reports, and other Task documents to ExCo B.

ExCo B does not help to define the work. The Task is fully defined and managed by ExCo A with appropriate input from ExCo B.

To ensure accountability, ExCo B members must send a National Participation Letter for their

experts. This letter should be sent to the ExCo A Chairman with copies to the Task OA and ExCo A Executive Secretary.

Level 2 At this level, the Task work is jointly defined, that is, ExCo B provides experts and input to the Task Concept Paper and the Task Definition Phase (preparation of the Annex, Work Plan and Information Plan). Once the work is defined, ExCo A manages the Task.

To ensure accountability, ExCo B members must send a National Participation Letter for their experts. This letter should be sent to the ExCo A Chairman with copies to the Task OA, and ExCo A Executive Secretary.

Level 3 At this level, in addition to jointly defining the Task work, ExCos A and B shall agree on any proposed revisions to the Task Work Plan once the Task is underway. ExCo A is still responsible for the management of the Task.

National Participation Letters should be sent to the Task OA with a copy to the ExCo A Executive Secretary.

Level 4 A fully joint Task is one managed by two ExCos acting in unanimity and described by an Annex in both Implementing Agreements. Joint Tasks should be undertaken when it is the only way to successfully accomplish specific collaborative work. There must be clearly perceived benefits to justify the significant administrative burdens on both ExCos and the OA of the Joint Task. And, it must be clear to both ExCos that the work can not be successfully done by either ExCo alone.

It is proposed that whenever one ExCo believes it has a special interest in a new Task that is under consideration by another ExCo, the two ExCo Chairs should review the proposed new Task and determine the level of collaboration required to assure the successful accomplishment of the new work. Their recommendations should be submitted to both ExCos for their review and decision. It is recommended that a memorandum of understanding be exchanged outlining the agreed upon level of collaboration.

National Participation Letters should be sent to the Task OA with a copy to the respective Executive Secretaries.

10.3 With Industry

The Agreement will continue to foster its relationships with the solar thermal industry and trade associations. A Memorandum of Agreement has been signed with associations from around the world. It is expected that joint meetings will continue to be held every 1-2 years.

It is strongly recommended that industry workshops organized by Tasks continue to be held as this is critical for collaboration and the dissemination of Task results.

10.4 With Other Institutes

To strengthen dissemination activities and increase the number of individuals using Task results, the Agreement will build upon and expand its existing relationships with institutes outside of the IEA. These institutes include, but are not limited to:

- European Union
- ESTTP
- International Solar Energy Society (ISES)
- International standard organizations, (e.g., ISO, CEN, ASHRAE)
- World Bank

Appendix 1

ACTION PLAN 2009

This plan will be updated accordingly over 2008-2009.

ACTION		COMMENT
To be the primary source of high quality technical information and analysis on solar heating and cooling technologies, designs and applications.		
1	Produce 2008 Annual Report & Programme Highlights booklet	Publish by February 2009
2	Produce Solar Heat Worldwide Report	Publish by June 2009
3	Announce new Task publications on web site	To be done once reports are approved by the ExCo
To contribute to a significant increase in the performance of solar heating and cooling technologies and designs.		
1	Start new work on ratings and certification procedures	1st quarter of 2009
2	Start new work on solar energy and architecture	1st quarter of 2009
3	Start Task 42, Compact Thermal Energy Storage	January 2009
4	Finalize Task 37, Advanced Housing Renovation with Solar & Conservation, and disseminate results	December 2009
5	Finalize Task 38, Solar Thermal Cooling and Air Conditioning, and disseminate results	November 2009
To enhance cooperation with industry and government on increasing the market share of solar heating and cooling technologies and designs.		
1	Continue to collaborate with trade associations	If agreed upon in 2008, hold meeting with MOU signatories. Continue representation on ESTTP Steering Committee
2	Collaborate with the World Bank	Continue communication with bank representatives on possible areas for collaboration
3	Collaborate with other IEA Agreements	Consider holding a joint meeting with the Energy Storage IA Participate in Building Coordination Group meetings
To increase the awareness and understanding on the potential and value of solar heating and cooling systems by providing information to decision makers and the public.		
1	Present the SHC Solar Award	Date dependent on venue
2	Prepare with ISES for 2nd International Conference on Solar Heating and Cooling	To be held in 2010

Appendix 2

A description of all Tasks and a list of their publications are provided on the SHC web site, www.iea-shc.org.

Current Tasks of the IEA Solar Heating and Cooling Programme

Task 36 Solar Resource Knowledge Management, 2005-10 (United States)
Task 37 Advanced Housing Renovation with Solar & Conservation, 2006-09 (Norway)
Task 38 Solar Air Conditioning and Refrigeration, 2006-09 (Germany)
Task 39 Polymeric Materials for Solar Thermal Applications, 2006-10 (Germany)
Task 40 Towards Net Zero Energy Solar Buildings, 2008-13 (Canada)
Task 42 Compact Thermal Energy Storage, 2009-12 (Netherlands)

Tasks Under Development

Solar Energy & Architecture
Rating & Certification Procedures