

## TASK 53

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### New Generation Solar cooling and heating systems (PV or solar thermally driven systems)



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**Annex**

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**This text has been produced by**

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## 0. Preamble

In 2013, Solar Air-Conditioning is more than ever representing a huge potential of development for solar energy (within 2030 the expected growth of energy demand in buildings especially in developed countries is far bigger on the cooling side than on the heating side) but this promising technology is facing one main issue: a general lack of economic competitiveness – as it is still the case for many renewable energies unless incentives are in place.

Solar thermal cooling has difficulty to emerge as an economically competitive solution for the main following reasons:

- Technical : Limit on adaptability of the solar thermal cooling technology to a large spectrum of applications due to the presence of important hydraulics (several loops), complexity on the management between solar resource, cooling and heating loads and overheating risk management between the 2 seasons (thermal balance of the targeted building). Last but not least, sorption technology generally uses and needs cooling towers consuming water, chemical treatments and facing legionella development risks.
- Economical: the investment cost for solar thermal cooling technology is still significantly high (3 to 5 times more than an equivalent reversible heat pump), especially for small systems.

Therefore, this technology still needs intensive R&D for quality improvement and best solution selection

However, for large systems beyond  $100 \text{ kW}_{\text{cooling}}$ , (which means nearly more than  $300 \text{ m}^2$  solar thermal collectors) solar thermal cooling has very interesting perspectives because:

- A real capacity for economy of scale leading to solar cooling existing installations with investment cost of less than  $2000 \text{ € kW}_{\text{cooling}}$
- Specialised engineering and control. Thanks to the size of the systems, a specific custom made and adapted-to-the-building control can be set up, optimising the system integration and performances
- Energy sales. For the large systems beyond  $\text{MW}_{\text{cooling}}$ , first experiences out of Europe (Singapore and USA) exist with solar thermal cooling and heating systems in ESCO configurations permitting to work on an energy sales business model.

This innovating model has the very important interest for solar cooling to overcome the investment barrier for the building owner.

From all of these considerations, there is therefore a strong need to stimulate the solar cooling sector for small and medium power size by initiating a new task on new generation solar cooling and heating systems : PV and solar thermal approaches are included in the scope.

The proposed Task addresses these main goals:

- (1) to analyze the interest of **new generation (PV or solar thermally driven) solar cooling & heating concepts systems for buildings** in all climates and **select best solutions which lead to highly reliable, durable, efficient and robust solar cooling and heating** (ambient + DHW) systems
- (2) to contribute to **market entry of the new generation PV or solar thermally driven cooling technology** and identify **most promising market areas** in terms of **cost competitiveness and value of electricity**.

This new Task is deeply aimed as well to enlarge the actual European centred view and work to countries out of Europe (most of them are member of IEA SHC) such as China, India, Singapore, USA, Israel, South Africa and Australia. In these countries Solar Thermal and Solar PV technologies are really dynamic and represent a much bigger market potential for cooling (because of the climates, the energy structure, peak demand, etc.). Actions to stimulate participation to these countries will be implemented.

### *1. Description of Technical Sector*

In principle, solar assisted cooling systems may be operated by (1) solar thermal collectors connected to thermally driven cooling devices, (2) solar-to-electric converters (photovoltaics) combined with compression chillers or by (3) solar to mechanical energy converters (e.g. solar collector driven Rankine machines) combined with compression chillers.

The two first categories of systems seem to be closest to mass market application, although in particular in the case of small to medium units, PV driven compression chillers are the most promising and close to market solar solution today.

Even if, in areas with existing electricity grids, the question of PV driven cooling and heating seems to be reduced to the question of grid connected PV for reduction of peak loads, which result from air conditioning, the reality is not simple. Increase of self-consumption of solar PV in these countries leads to an important question of the coupling between PV and heat pumps as well as energy storage. PV driven solar cooling systems will be therefore specifically studied in this task.

The scope of the technologies in this Task is:

\* Photovoltaic + air conditioning system. By air conditioning, it means compression air conditioning and heat pumps (if heating as well) but as well in a larger extend, food conservation

\* Solar thermally driven innovative and compact cooling+heating systems.

The main application covered by the project is cooling of buildings. Until recently, it seemed that solar assisted cooling had best chances for market deployment in cases of large buildings with central air conditioning systems, because of the unique development of solar thermal cooling solutions. But, with the huge market increase for cooling equipment in the small residential and small commercial sector and the tremendous PV panels cost decrease, the situation has changed.

Here reliable and cost effective solutions are necessary in which the solar collection provides heat and/or electricity over the whole year, i.e. for heating in winter, for cooling in summer and for production of domestic hot water in the entire year.

So called pre-engineered systems are seen as a solution for this application range. Therefore this Task also focuses on packaged solutions which will be pre-engineered systems with small capacities for the following building types: single family houses, small multi-family buildings, offices, shops, commercial centers, factories, hotels

All of these buildings can be **grid connected or off grid** in case of PV cooling and heating.

The studied cooling and heating power range will be from **1 kW<sub>cooling/heating</sub> to several tens of kW<sub>cooling/heating</sub>**.

As for the association between photovoltaic and reversible heat pumps or air conditioners can be made indirectly with the presence of an electric grid, the main scope of the present Task will be **the direct coupling between solar and cold production machine**. However, special configurations and control strategies will be considered for certain countries, in Central Europe especially, to allow a maximised use of PV power direct for heating/cooling even without direct coupling..

## **2. Objective and Scope**

The proposed project is intended therefore to create a logical follow up of the IEA SHC work already carried out by trying to find solutions to make the solar driven heating and cooling systems at the same time cost competitive. This major target should be reached thanks to five levels of activities:

- 1) Investigation on new small to medium size solar cooling systems (thermal and PV) and develop best suited cooling & heating systems technology focusing on reliability, adaptability and quality
- 2) Proof of cost effectiveness of new solar cooling & heating systems
- 3) Investigation on life cycle performances on energy & environmental terms (LCA) of different options
- 4) Assistance for market deployment of new solar cooling & heating systems for buildings worldwide
- 5) Increase of energy supply safety and influence the virtuous demand side management behaviours

To develop the 4 strategic axis, 4 subtasks are implemented.

### 3. Activities

The Participants shall share the coordinated work necessary to carry out this Task.

#### *(a) Main activities*

The objectives shall be achieved by the participants in the following Subtasks:

*Subtask A: Components, Systems & Quality*

*Subtask B: Control, Simulation & Design*

*Subtask C: Testing and demonstration projects*

*Subtask D: Dissemination & market deployment*

The tasks of dissemination of results and market support are included in the Operating Agent's general task.

In the following the specific objectives, activities and deliverables of the subtasks are described in more detail.

#### Subtask A: Components, Systems & Quality

The general objectives of Subtask A are to:

- \* to better know and characterize the most important components of the new solar cooling & heating systems, considering existing solar thermal cooling systems as a reference
- \* to identify where new solar cooling & heating systems are suitable
- \* to develop tools and deliverables permitting to show the level of quality of both the most critical components and systems.

The specific objectives of this subtask are:

- \* to know the commercially available equipment on the AC side compatible with PV electricity supply as well as solar thermal cooling equipment
- \* to know the R&D entities working at the moment on the topic and what are the ongoing outputs, especially the key points in the interface AC unit / PV modules and system /grid
- \* to define the different possibilities on the storage side for new solar cooling & heating
- \* to easily classify the ST/PV cooling products/application (schematic square view method)
- \* to estimate the value of electricity and LCA of the main components and systems

The activities to reach these objectives are defined below.

*A1: Reference systems*

*A2: New system configurations for cooling and heating*

*A3: Storage concepts and management*

*A4: Systems integration into buildings, microgrid and central Grid*

*A5: LCA and techno-eco comparison between reference and new systems*

Subtask B: Control, Simulation & Design

The general objective of Subtask B is to investigate the different control possibilities for the new generation cooling & heating systems for buildings so as to select the best strategies for given climates and countries and then develop modelling tools to predict performances and size/design systems. Besides, to manage a smart interaction with electric grid

The specific objectives of this subtask are:

- \* to analyze and select optimized control strategies to manage the interaction between solar and cooling machine (PV and heat pump unit especially)
- \* to provide modelling tools for complete generic systems
- \* to report sensitivity analysis on most of the selected systems
- \* to compare the performances at system level of all innovative systems
- \* to size the systems
- \* to investigate demand/response strategies to optimise the interaction with smart grids

The activities to reach these objectives are defined below.

*B1: Reference conditions*

*B2: Grid access conditions and building load management analysis*

*B3: Models of subcomponents and system simulation*

*B4: Control strategy analysis and optimization for ST and PV*

*B5: System inter-comparison*

Subtask C: Testing and demonstration projects

The general objective of Subtask C is to stimulate, monitor and analyse performances of field test systems and demonstration projects for new generation solar cooling & heating systems

The specific objectives of this subtask are:

- \* to create a monitoring procedure for field tests or demo projects
- \* to select identified projects and organise a complete field test monitoring campaign for it
- \* to analyse potential technical issues on the monitored systems
- \* to report on the measured performances of the systems

The activities to reach these objectives are defined below.

*C1: Monitoring procedure and monitoring system selection criteria*

*C2: System description for field test and demo project*

*C3: Monitoring data analysis on technical issues & on performances*

*C4: Best practices / feedback*

## Subtask D: Dissemination & market deployment

The general objective of Subtask D are :

- \* implementation of targeted promotion activities based on the collective work results;
- \* production of dissemination material for external communication; the implementation of knowledge transfer measures towards the technical stakeholders;
- \* development of instruments and their provision for policy makers and the creation and promotion of certification and standardisation schemes.

The specific objectives of this subtask are:

- \* to disseminate the Task results on national and international level
- \* to provide efficient communication tools such as brochures and guidelines
- \* to collect and structure evidence for policy actions

The activities to reach these objectives are defined below.

*D1: Website dedicated to the Task*

*D2: Handbook and simplified brochure*

*D3: Workshops and conferences*

### ***(b) Workshops and seminars***

#### International workshops

The task participants will organise at least once per year and in margin of one of the Expert meetings an international workshop dedicated to the policy makers and potential customers. This action will be organised during international conferences (INTERSOLAR in Munich or Sustainable Energy Week in Brussels for example) so as to touch important decision makers on solar cooling (investors, distributors, ESCO's, etc..). The workshops will present the results of the work done in the Task and try to constitute an important lobbying and promotion action. A mix and marriage of R&D institutes and industry partners will make presentations. The organisation of such workshops will be prepared by building inside this activity sets of presentations on solar cooling available for organisers. A list of contact in partnership with National Professional associations (solar, chiller, air conditioning, ..) will be built as well to create a useful database for organisers.

### ***(c) Publications***

The target groups for Task information include:

- \* Utilities/heating companies/ESCos
- \* Planners/Engineering companies
- \* Installers & Operators (O&M companies)

- \* Technical Schools and Universities
- \* Producers of relevant components (chillers, solar collectors, system manufacturers),
- \* Policy makers and public authorities,
- \* Professional associations

### Handbook

The Task is aimed at producing a Handbook on New generation solar cooling and heating systems. This book will present the results of the full Task through the 3 subtasks : state of the art of the technology, results of the modelling and optimisation work achieved in Subtask B and then as a third chapter the best practices results obtained in Subtask C. The book will be part of the SHC publications and will be written not only by putting together the activity reports. An important work of arrangement and didactic approach will be done so as to make this publication a reference book on the topic of New Generation solar cooling and heating systems.

### Simplified short brochure

This brochure will have maximum 4 to 6 pages and should underline what was the methodology used to progress on the development of New Generation Solar cooling and heating systems. This brochure will be edited jointly by the Subtask Leader and IEA SHC program.

### Lobbying actions

Organisation of evidence for policy / lobbying actions to promote solar cooling: preparation of specific documents (after identifying one or several efficient funding mechanism(s), a scenario analysis tool will be used to identify and optimise impact of evidence for policy actions), networking, preparation of press release, creation of articles relating the Task activity. Organisation of meetings with policy makers at national levels.

## **4. Expected Results/Deliverables**

The products of work performed in this Annex are designed for the solar industry (manufacturers of components and systems; system sales companies), for the air conditioning industry (manufacturers of components and systems) and for professionals such as HVAC engineers, civil engineers and planners, and architects.

### Subtask A - Deliverables

- D-A1: Definition of the existing cooling reference systems (**A1**)
- D-A2-1: State of the art of new generation commercially available products and close to market products including costs, efficiency criteria ranking and performance characterization (**A2**)
- D-A2-2: Update of the state of the art including technical report on recent R&D work on the topic (**A2**)

- D-A3 : Technical report on best practices for energy storage including both efficiency and adaptability in solar cooling systems (including KPI's) (A3)
- D-A4-1: Report on a new and universal classification method “new generation solar cooling square view” for generic systems (A4)
- D-A5-1: Techno-economic analysis report on comparison between thermal and PV existing solar cooling systems including as well LCA approach and Eco label sensibility (A5)
- D-A5-2 : Draft document defining the Key Performance Indicators (KPI) of the market available systems and possible characterization test method (permitting to lead to a quality labeling scheme for new generation solar cooling systems) as well as standards (A5)

#### Subtask B - Deliverables

- \* D-B1: Technical report presenting the reference conditions for modelling
- \* D-B2: Overview on peak demand & demand side management possibilities including a state of the art on the management of the interface solar cooling (eg. AC unit / PV modules) and distribution system /grid
- \* D-B3: Technical report on components & system model validation
- \* D-B4: Technical report on optimised control strategies for solar cooling & heating systems
- \* D-B5-1: Technical report on system dimensioning
- \* D-B5-2: Guidebook/guideline on results of simulations including a country- and climate-sensitive economical analysis

#### Subtask C - Deliverables

- \* D-C1: Monitoring procedure for field test & demo systems
- \* D-C2: Catalogue of selected systems (with full description)
- \* D-C3: Technical report on monitoring data analysis (technical issues + performances)
- \* D-C4: Technical content (best practices) for a part of the Handbook on efficient new generation cooling and heating systems

#### Subtask D - Deliverables

- D-D1: Website dedicated to the Task
- D-D2.1 : Handbook for new generation solar cooling and heating systems
- D-D2.2 : Simplified short brochure
- D-D4 : Outreach report
  - Customer and policy maker workshops
  - Organising industry workshops
  - Report on lobbying actions describing all the actions and their impacts

## 5. Rights and Obligations of Participants

(a) In addition to the obligations enumerated in Article 7 of this Agreement

1. Each Participant shall commit himself in actively working in the Task and provide Operating Agent with detailed reports on the results of the work carried out in each Subtask.
2. Each Participant shall collect, assess and report to the Operating Agent data on solar heat + heat pumps systems.
3. Each Participant shall participate in the editing and reviewing of draft reports of the Task and Subtasks
4. Each Participant shall participate in the editing and reviewing of the final design book of Task 45 “Large solar thermal systems”.

(b) Individual Financial Obligations.

Each country will bear the costs of its own participation in the Task, including reporting and necessary travel costs

(c) Task-Sharing Requirements.

The Participants agree on the following funding commitment: Each Participant (country) will contribute to this Task **a minimum of 0.15 person year per year of the Task**, i.e. a total of at least 0,7 person year over the period (of 4,4 years);

Participation in the Task requires participation in at least one of the Subtasks A, B, C, D.

The Operating Agent will contribute with **a minimum of 0.5 person year per year to the Task**.

Participation may partly involve funding already allocated to a national (or international) activity, which is substantially in agreement with the scope of work outlined in this Annex.

Aside from providing the resources required for performing the work of the Subtasks in which they are participating, all Participants are required to commit the resources necessary for activities which are specifically collaborative in nature and which would not be part of activities funded by national or international sources. Examples include the preparation for and participation in Task meetings, co-ordination with Subtask Participants, contribution to the documentation and dissemination work and Task related R&D work which exceeds the R&D work carried out in the framework of the national (or international) activity.

## 6. Management

(a) ADEME, acting through Daniel Mugnier of TECSOL, is the Operating Agent.

(b) In addition to the obligations enumerated in Articles 4 and 7 of this Agreement, the Operating Agent shall:

- (1) Prepare and distribute the results described above;
- (2) Prepare joint assessments of research development and demonstration priorities for system using solar heat and heat pumps;
- (3) At the request of the Executive Committee organize workshops, seminars, conferences and other meetings;
- (4) Prepare the detailed Programme of Work for the Task in consultation with the Subtask Leaders and the Participants and submit the Programme of Work for approval to the Executive Committee;
- (5) Provide, at least semi-annually, periodic reports to the Executive Committee on the progress and the results of the work performed under the Programme of Work;
- (6) Provide to the Executive Committee, within six months after completion of all work under the Task, a final management report for its approval and transmittal to the Agency;
- (7) In co-ordination with the Participants, use its best efforts to avoid duplication with activities of other related programmes and projects implemented by or under the auspices of the Agency or by other competent bodies;
- (8) Provide the Participants with the necessary guidelines for the work they carry out with minimum duplication;
- (9) Perform such additional services and actions as may be decided by the Executive Committee, acting by unanimity.

(c) Subtask Leaders

A Subtask Leader for each of the foregoing Subtasks will:

- (1) Co-ordinate the work performed under that Subtask;
- (2) Assist the Operating Agent in preparing the detailed Programme of Work;
- (3) Direct technical workshops and provide the Operating Agent with written summaries of workshops results and
- (4) Edit technical reports resulting from the Subtask and organise their publication.

- (5) Subtask leaders may arrange meetings in between or in association with Experts meetings of the Task.

The Subtask Leader shall be a Participant which provides to the Subtask a high level of expertise and undertakes substantial research and development in the field of the Subtask. The Subtask Leaders shall be proposed by the Operating Agent and designated by the Executive Committee, acting by unanimity of the Participants. Changes in the Subtask Leaders may be agreed to by the Executive Committee, acting by unanimity of the Participants.

(d) Experts Meetings.

Experts meetings of the Task will be carried out at intervals of approximately 6 months. Subtask leaders may arrange meetings in between or in association with Experts meetings of the Task. To facilitate the participation of Experts from countries out of Europe, one meeting per year will have to be organized so that a video conference is technically feasible between the Experts so that it is no more mandatory for all the Experts to attend this meeting. Attendance at the Experts meetings of the Task will be mandatory then only once a year (for the second meeting). The cost of organizing meetings will be borne by the host country.

(e) Technical Advisory Committee

The Participants shall establish a Technical Advisory Committee consisting of the Subtask Leaders and the Operating Agent or their respective designees. The Technical Advisory Committee shall assist the Operating Agent in the co-ordination of the Task and advise the Operating Agent on the performance of the task.

## **7. Admissions, Participation and Withdrawal of Participants**

In addition to the specific obligations, the Operating Agent will produce, promote and distribute the results of the Task. The Participants will support these activities by contributing respective papers and by dissemination activities financed by the individual Participants.

## **8. Information and Intellectual Property**

(a) Executive Committee's Powers

The publication, distribution, handling, protection and ownership of information and intellectual property arising from this Task shall be determined by the Executive Committee, acting by unanimity, in conformity with the Agreement.

(b) Right to Publish

Subject only to copyright restrictions, the Participants shall have the right to publish all information provided to or arising from this Task, except proprietary information.

### (c) Proprietary Information

The Participants and the Operating Agent shall take all necessary measures in accordance with this paragraph, the laws of their respective countries and international law to protect proprietary information provided to or arising from this Task. For the purposes of this Task, proprietary information shall mean information of a confidential nature such as trade secrets and know-how (for example computer programs, design procedures and techniques, chemical composition of materials, or manufacturing methods, processes, or treatments) which are appropriately marked, provided such information:

- \* Is not generally known or publicly available from other sources.
- \* Has not previously been made available by the owner to others without obligation concerning its confidentiality.
- \* Is not already in the possession of the recipient Participant without obligation concerning its confidentiality.
- \* It shall be the responsibility of each Participant supplying proprietary information and of the Operating Agent for appraising proprietary information, to identify the information as such and to ensure that it is appropriately marked.

### Arising Information

All information developed in connection with and during activities carried out under this Task (arising information) shall be provided to each Participant by the Operating Agent, subject only to the need to retain information concerning patentable inventions in confidence until appropriate action can be taken to protect such inventions.

For arising information regarding inventions the following rules shall apply:

(1) Arising information regarding inventions shall be owned in all countries by the inventing Participant. The inventing Participant shall promptly identify and report to the Executive Committee any such information along with an indication whether and in which countries the inventing Participant intends to file patent applications.

(2) Information regarding inventions on which the inventing Participant intends to obtain a patent protection shall not be published or publicly disclosed by the Operating Agent or the other Participants until a patent has been filed, provided, however, that this restriction on publication or disclosure shall not extend beyond twelve months from the date of reporting of the invention. It shall be the responsibility of the inventing Participants to appropriately mark Task reports that disclose inventions that have not been appropriately protected by filing a patent application.

(3) The inventing Participant shall license proprietary information arising from the Task for non-exclusive use to participants in the Task:

- (a) On the most favorable terms and conditions for use by the Participants in their own country
- (b) On favorable terms and conditions for the purpose of sub-licensing others for use in their own country.
- (c) Subject to sub-paragraph (1) above, to each Participant in the Task for use in all countries, on reasonable terms and conditions.
- (d) To the government of any Agency Member country and nationals designated by it, for use in such country in order to meet its energy needs.

Royalties, if any, under licenses pursuant to this paragraph shall be the property of the inventing Participant.

#### (d) Production of Relevant Information by Governments

The Operating Agent should encourage the governments of all Agency Participating Countries to make available or to identify to the Operating Agent all published or otherwise freely available information known to them that is relevant to the Task.

#### (e) Production of Available Information by Participants

Each Participant agrees to provide to a Subtask Leader or to the Operating Agent all previously existing information, and information developed independently of the Task, which is needed by a Subtask Leader or by the Operating Agent to carry out its functions under this Task and which is freely at the disposal of the Participant and the transmission of which is not subject to any contractual and/or legal limitations:

If no substantial cost is incurred by the Participant in making such information available, at no charge to the Task.

If substantial costs must be incurred by the Participant to make such information available, at such charges to the Task as shall be agreed between the Operating Agent and the Participant with the approval of the Executive Committee.

#### (f) Use of Confidential Information

If a Participant has access to confidential information which would be useful to a Subtask Leader or to the Operating Agent in conducting studies, assessments, analyses, or evaluations, such information may be communicated to a Subtask Leader or to the Operating Agent but shall not become part of the reports, handbooks, or other documentation, nor be communicated to the other Participants, except as may be agreed, between the Subtask Leader or the Operating Agent and the Participant.

#### (g) Reports on Work Performed under the Task

The Operating Agent shall, in accordance with section 6 above, provide reports of all work performed under the Task and the results thereof, including studies, assessments, analyses, evaluations and other documentation, but excluding proprietary information.

(h) Copyright

The Operating Agent may take appropriate measures to protect copyrightable material generated under this Task. Copyrights obtained shall be the property of the IEA SHC IA for the benefit of the Participants provided, however, that the Participants may reproduce and distribute such material, but if it shall be published with a view to profit, permission should be obtained from the Executive Committee.

(i) Authors

Each Participant will, without prejudice to any rights of authors under its national laws, take necessary steps to provide the co-operation from its authors required to carry out the provisions of this paragraph. Each Participant will assume the responsibility to pay awards or compensation required to be paid to its employees according to the laws of its country.

## **9. Entry in Force, Term and Extension**

This Annex shall enter into force 1 March 2014 and shall remain in force for a period of three years until 30 June 2018. At the conclusion of that period, this Annex can be extended by at least two Participants, acting in the Executive Committee, for a period to be determined at that time, provided that in no event shall the Annex continue beyond the current term, or actual termination, of the Implementing Agreement.

## 10. Participants in this Task (status on 01/05/2016).

Country	Organization
Australia	<a href="#">CSIRO</a> (Commonwealth Scientific and Industrial Research Organisation)
Austria	<a href="#">AIT</a> (Austrian Institute of Technology)
	<a href="#">AEE INTEC</a> , AEE - Institute for Sustainable Technologies
	<a href="#">UIBK</a> (University of Innsbruck)
China	<a href="#">SJTU</a> (Jiao Tong University Beijing)
	YAZAKI China
France	<a href="#">TECSOL</a> S.A
	<a href="#">ATISYS Concept</a>
	<a href="#">2IDEA</a>
	<a href="#">Université de Rennes 1</a>
Germany	<a href="#">ILK Dresden</a>
	<a href="#">ZAE Bayern</a>
	<a href="#">University of Munich</a>
	Fraunhofer ISE
Italy	<i>SOLARINVENT</i>
	<a href="#">EURAC research</a>
	<a href="#">Università degli Studi di Palermo, Dip. Ricerche Energetiche e Ambientali</a>
	<a href="#">CNR-ITAE</a>
Netherlands	<a href="#">De Beijer</a>
Spain	<a href="#">Universidad Miguel Hernández de Elche, Alicante</a>
	<a href="#">TECNALIA</a>
Sweden	<a href="#">Mälardalen University</a>

Country	Organization
	<a href="#">Climatewell</a>
	<a href="#">Dalarna University</a>
<b>Switzerland</b>	<b><a href="#">VELASOLARIS</a></b>
	<i><a href="#">HE//SO Fribourg</a></i>
	<b><a href="#">COSSECO</a></b>
	<a href="#">SPF</a>

In **bold letters**, regular participating entities present at the 5 first expert meetings.

In *italic letters*, entities not systematically present at the meetings but contributing to the Task