

IEA SHC

Proposal for new IEA-SHC task :
New generation solar cooling
systems

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Proposed Task Goals

(1) **to analyze the interest of new generation solar cooling & heating concepts systems for bulidings 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 technology** and identify most promising market areas in terms of cost competitiveness and value of electricity.

Scope of the Task

System : solar driven systems for cooling

- * Solar thermal driven innovative compact cooling+heating systems
- * Photovoltaic + air conditioning system (Compression air conditioning / heat pump (if heating as well) ; food conservation not included)

Applications : Off grid & grid connected buildings

(houses, small multi-family buildings, offices, shops, commercial center, hotels)

Power range : from 1 kW cooling to several tens kW cooling/heating

Limit : Need to have a direct coupling between solar and cold production machine. The coupling can be partial or total (for the PV-machine one especially)

Topics to be covered by the Task

- Interaction PV/solar thermal (ST) production – Cooling/heating/DHW demand
- Storage or no storage (thermal or electric)
- Electrical storage or water cold/hot storage
- Control strategy (peak demand management, full comfort or solar only, etc..)
- Value of electricity and value of cold including LCA analysis (embodied energy)
- Partial grid connection or stand alone
- New solutions for compressors, DC or AC and new solution for optimised compact sorption cooling kits
- Efficiency of existing compressors connected with PV DC or AC input ?
- Use of PV/ST to manage other heating or cooling devices (appliances, DHW, etc...)
- Size limit ? optimisation ?
- Standards and tests methods (for REC's, EU Ecodesign directive for instance)
- Best cost : high tech or low cost ? Sensibility to conventional energy cost ?
- Best suited PV/ST technology (cost vs performance)
- Integrated solutions BIPV/BIST to cool distribution devices

Outcome

- Investigate 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
- Prove cost effectiveness of new solar cooling & heating systems
- Assist market deployment of new solar cooling & heating systems for buildings worldwide
- Increased energy supply safety and influence virtuous demand side management behaviours

Time Schedule

- **40 months**
- **From end 2013 to end 2016**
- **Task Definition : 21-22/03/2013 in Paris**
- **Possible kick off meeting :**
October 2013 (after OTTI SAC 2013 conference)

Proposed Task Structure

Subtask A

**Components, Systems &
Quality**

Subtask B

**Control, Simulation &
Design**

Subtask C

Testing and demonstration projects

Subtask D

Dissemination & market deployment

Subtask A: Components, Systems & Quality

General objectives :

- * 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 ongoing and future related standards and testing methods
- * 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.

Specific objectives :

- * 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) so as to prepare a certification process
- * to define procedures for measuring the performance of the PV cooling & heating systems and prepare the conditions for a quality label

Subtask A: Components, Systems & Quality

Activities : Focusing on hardware side

- A1 : Reference system (innovative systems based on solar thermal)
- A2: Adapted compression chillers and heat pumps for solar cooling
- A3: new generation solar production for cooling (PV and others)
- A4: Storage
- A5: Systems

Deliverables

- * D-A1: Definition of the existing solar cooling reference system.
- * D-A2: State of the art of new generation commercially available products including costs, efficiency criteria ranking and performance characterization.
- * D-A3: Technical report on recent and ongoing R&D work on the topic
- * D-A4 : Report on best practices on how to manage the interface AC unit / PV modules and system /grid
- * D-A5: Technical report on best practices for energy storage including both efficiency and adaptability in solar cooling systems
- * D-A6: Techno-economical analysis report on comparison between thermal and PV existing solar cooling systems
- * D-A7: Report on a new and universal classification method "new generation solar cooling square view" for generic systems
- * D-A8 : Draft document defining the performance indicators and possible characterization test method (permitting to lead to a quality labeling scheme for new generation solar cooling systems) as well as standards

Subtask B: Control, Simulation & Design

General objective : 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

Specific objectives :

- * 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 estimate the value of electricity and LCA of the system
- * to create models including energy price variation sensibility

Subtask B: Control , Simulation and Design

Activities : Focusing on software side

- B1 : Peak demand and demand side management analysis
- B2: Control strategy analysis and optimisation for ST and PV
- B3: Model of subcomponents and validation
- B4: System simulation and validation
- B5: System inter-comparison (cost/performance/reliability)
(between systems and with conventional, solar thermal, gas, etc.)
- B6: Design tool

Deliverables

- * D-B1 : Overview on peak demand & demand side management possibilities
- * D-B1 : Technical report on optimised control strategies for solar cooling & heating systems
- * D-B2 : News models for components including LCA aspects
- * D-B3 : New system models including LCA aspects
- * D-B4 : Technical report on system simulation and validation
- * D-B5 : Technical report on system dimensioning
- * D-B6 : Design tool including a country- and climate-sensitive economical analysis

Subtask C: Testing and demonstration projects

General objective : to stimulate, monitor and analyse performances of field test systems and demonstration projects for new generation solar cooling & heating systems

Specific objectives :

- * 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
- * to validate and initiate standardised testing methods

Subtask C: Testing and demonstration projects

Activities:

- C1: Monitoring procedure and monitoring system selection criteria
- C2: System selection for field test and demo project
- C3: Monitoring data analysis on technical issues
- C4: Monitoring data on performances
- C5: Best practices based on measurements
- C6 : Testing method initiation for standards

Deliverables :

- * D-C1 : Monitoring procedure for field test & demo systems (depending on size and application)
- * D-C2 : Catalogue of selected systems (with full description)
- * D-C3 : Technical report on monitoring data analysis (technical issues + performances)
- * D-C4 : Technical content for best practice brochure on efficient new generation cooling and heating systems
- * D-C6 : Technical report presenting a draft testing method for a quality standard on new generation cooling & heating systems

Subtask D: Dissemination and market deployment

General objectives :

- * 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.

Specific objectives :

- * 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**
- * to create guidelines for **road mapping new generation solar cooling & heating**

Subtask D: Dissemination and market deployment

Activities :

D1 Website dedicated to the Task

D2 Guidelines and brochures

D3 Newsletters, workshops and conferences

D4 Roadmapping and lobbying actions

Subtask D: Dissemination and market deployment

Deliverables :

- * D-D1: Website dedicated to the Task
- * D-D2 : Best practices high quality brochure
- * D-D3 : Simplified short brochure
- * D-D4 : Guidelines for Roadmaps on new generation solar cooling & heating
- * D-D5 : Outreach report
 - Customer and policy maker workshops
 - Organising national industry workshops, industry workshops in national languages in participating countries addressing target groups (related to Experts meetings)
 - Publishing a semi-annual e-newsletter for the industry
 - Report on lobbying actions describing all the actions and their impacts

Dissemination / Information plan

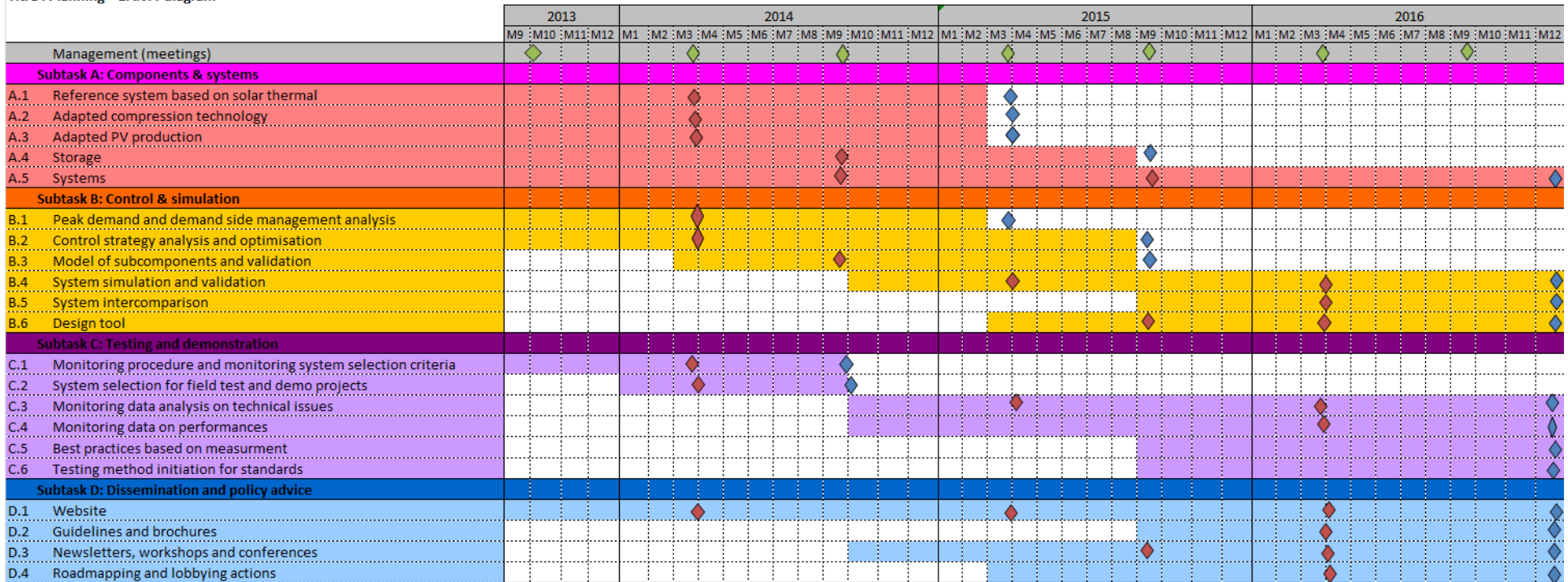
- * **Website** dedicated to the Task (D)
- * **Training material** for installers and planners and training seminars feedback report (D)
- * Semi-annual e-newsletter for the industry (D)
- * **Industry workshops** in national languages in participating countries addressing target groups (related to Experts meetings) (D)
- * **Best practices high quality brochure** (D) : 30 pages
- * **Simplified short brochure** (D) jointly edited by the Subtask Leader and IEA SHC program
- * **Guidelines for Roadmaps on New Generation Solar Cooling & Heating** (D) and possibly general international Roadmap on PV cooling & heating (optional)

Proposed Time schedule

IEA Task on New generation solar cooling systems

Duration : 40 months

Titre : Planning - GANTT diagram



Légende :

- ◆ Deliverable
- ◆ Semi annual Expert meetings
- ◆ Milestones

Task definition meeting goals

- Call for interest among potential participants
- Consolidation of the proposed Work Plan
 - Topics
 - Milestones
 - Deliverables
 - Planning
- Proposal of Task responsibilities
- Interaction with other Tasks and IEA Programs (PVPS, HPP)
- Planned location and date : Paris, 21-22/03/2013 (during ECOBAT fair, Porte de Versailles)

Possible participants (not confirmed and no claim for completeness)

- France : TEC SOL*, INES, Ecole des Mines Paris, Clipsol*
- Korea: Daewoo*, Daikin* (*OBSERVERS*)
- Japan: Panasonic*, Mitsubishi*, NEDO
- USA: Trane*, Copland*, Johnson controls*
- Germany : Mann*, Fraunhofer ISE, Viessmann*, Schüco*, Centrosolar*, Stiebel Eltron*, ZAFH.NET, SOLEM*
- Denmark: Danfoss*
- Italy: Polimi
- Spain: LLeida University
- Switzerland: EPFL IA Gillet, HEIG LESBAT cooling, Hadorn, Solarmax, Velasolaris*, PVSYST*, *3S, etc...
- EU: EHPA, EPIA
- Senegal: Touba (*OBSERVERS*)
- Austria : AIT, Univ. Innsbrück
- Australia : CSIRO

* : *companies*

Target group for R&D experts of the Task

- Cooling & heating (SORPTION/HP/compression) industrials (**very strategic**)
- Building engineers (**strategic**)
- Utilities (**strategic**)
- Optimal control engineers
- Electrical engineering
- Solar cooling system companies
- Solar PV & ST producers
- Batteries & thermal storage manufacturers
- Certification and standards bodies

More information

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