IEA SHC Task 53

New Generation Solar Cooling & Heating systems (PV or solar thermally driven systems)

Daniel Mugnier, Operating Agent Task 53

November 2014

SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

www.tecsol.fr

Task 53

Task 53 Short description

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Task 53 Structure

Task 53

Subtask A

Components, Systems & Quality

Subtask B

Control, Simulation & Design

Subtask C

Testing and demonstration projects

Subtask D

Dissemination & market deployment

4 Subtasks & 19 activities

Time Schedule : 3,5 years

From March 2014 to June 2017

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Activities brief description (1/2)

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Subtask A: Components, Systems & Quality

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** & **techno-eco comparison** between reference & new systems

Subtask B: Control, Simulation & Design

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

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Activities brief description (2/2)

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Subtask C: Testing and demonstration projects

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 and market deployment

D1: Website dedicated to the Task

D2: **Handbook** and simplified brochure

D3: Newsletters, workshops and conferences

D4: **Road mapping** and lobbying actions

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Task 53

PV Heating/cooling

Market

Environment

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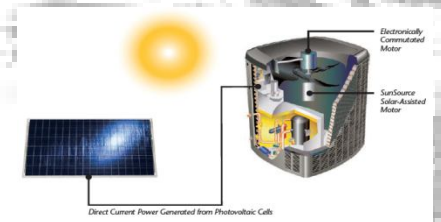
State of the art of this new **Market**



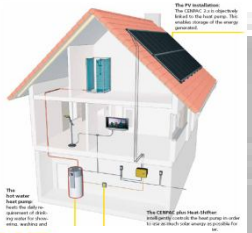
SUNSOURCE™
Solar by day. Electric by night. Savings all year.

LENNOX
Innovation never felt so good.™

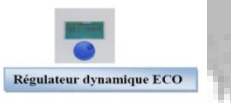
HOTSPOT ENERGY

Sud Concept
ACCELERATEUR D'INNOVATION

CENTROSOLAR
CENPAC plus



SOLAR LINE



CLIMATISATION SPLIT SOLAIRE DIRECTE

COSSECO

VIESSMANN
climate of innovation

SOLAR AIR
COOLING HEATING

(no claim for completeness)

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Main categories

Solar air conditioners : Splits

PV+ HP coupling for Office/Commercial

Task 53

hotspot energy

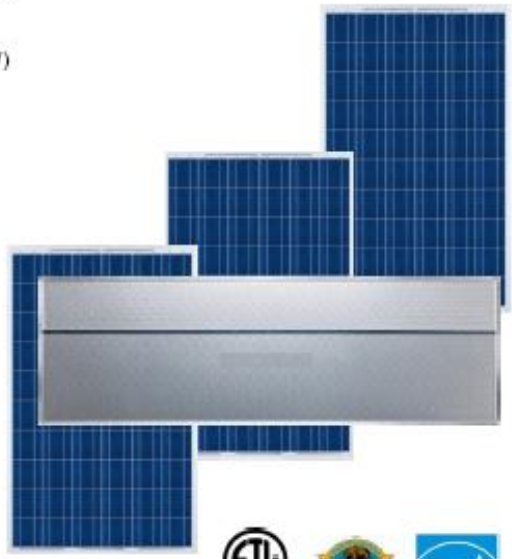
Solar Air Conditioner

SEER 35 • Solar Hybrid Heat Pump

Model ACDC12

Connect Up To Three Panels (Max 840W)
Runs On Solar Power & AC Power
11,000 BTU Cooling/12,000 BTU Heat
Plug-And-Play Solar Connection
No Batteries Required

HotSpot Energy LLC
(757) 410-8640



Home

Keep the inside cool all day for next to nothing in energy costs. Preventing daytime heat build-up also cuts evening cooling costs.

Office

Keep the work area comfortable during business hours for pennies per day. Cool or heat up to 750 Sq. Ft. (69m²).

International

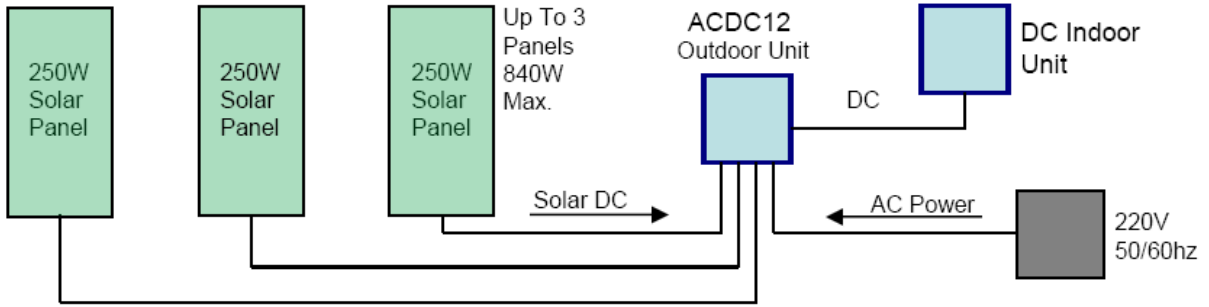
Compatible with 50hz and 60hz power, use it anywhere in the world.

Ultra-High SEER
Solar Air Conditioner

ACDC12-Hybrid

Retail/List-$1695ea FOB Factory
Dealer Price: 4-49 units $1290ea FOB Factory
Distributor Price: 50+ units $891ea FOB China
***Unit includes 3m lineset**

Connects Directly To Solar Panels



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Typical **ALREADY** EU market available solution

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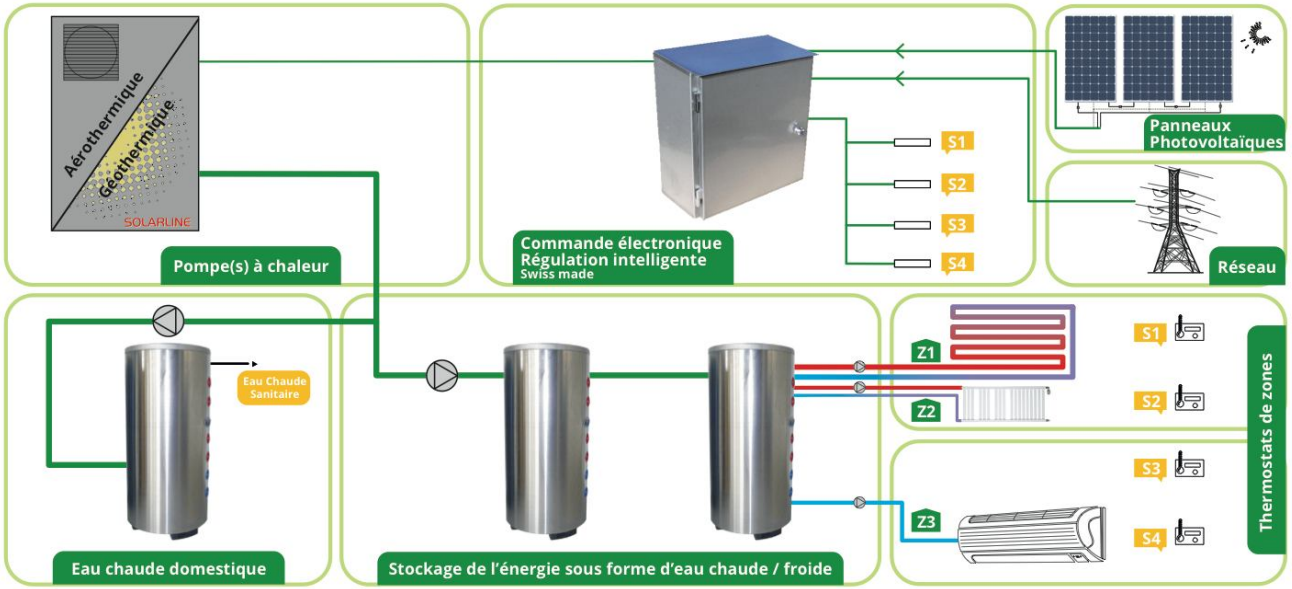
Efficient Geothermal Heat Pump : COP of 5,3
Field test since 2011 in Switzerland



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PV booster => **overall yearly COP of 6,9**

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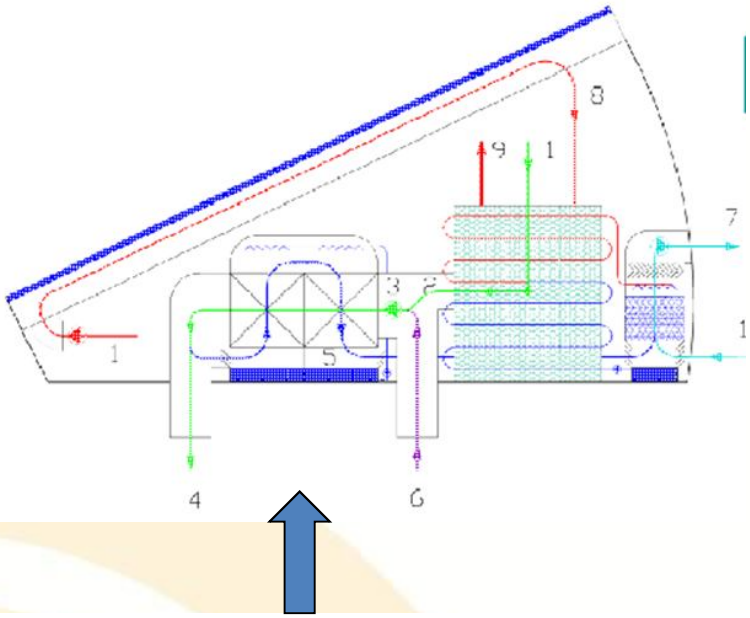
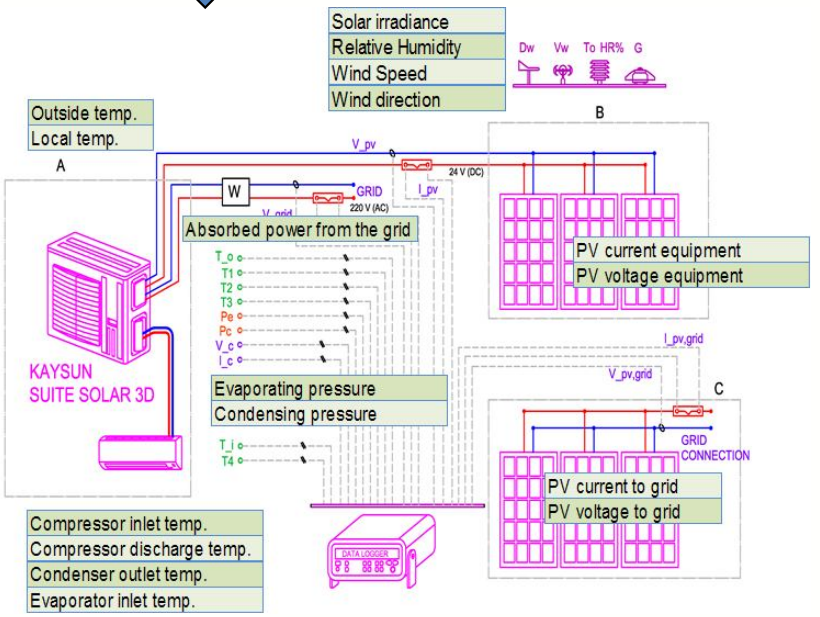
State of the art of the future new **Market**

Active R&D participants in Task 53



Concept for compact solar thermal air conditioner based on fixed & cooled adsorption beds (Source: Solarinvent)

Testing principle for a Chinese PV split unit (Source: Universidad Miguel Hernández de Elche)



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Task 53

Task 53 new developments & progress

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Subtask A: Components, Systems & Quality

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	Activity A2
Objective :	**New system configurations for cooling (AC, food conservation) and heating (DHW, ambient)**
	This activity will be dedicated at building the state of the art of the new system configurations for cooling and heating. This activity will be achieved realised in the early beginning part of the Task according to existing market available solutions. A second step of this activity will be to update this state of the art with progress occurring in the field thanks to R&D
Company	COSSECO
Address	Route de Pra de Plan 5
	CH-1618 Châtel-St-Denis
Country	Switzerland
Contact	David Orlando
	Tél: +41 21 948 81 70
	Fax: +41 21 964 81 72
	Mob: +41 79 790 31 29
	E-mail: dorlando@cosseco.ch
	www.cosseco.ch
Brand name	SOLARLINE
Cooling power range	10-20 kW

Template for investigation with 2 examples

5	Investment - Material		COSSECO

Task 53 — COSSECO

Please, enter available data into the **yellow** boxes. The **red** coloured data fields will be updated automatically
Please, include installation cost into total cost and specify the installation cost

All costs in euros and excluding VAT

Base for specific costs: collector area 4,80 kWp
Base for specific costs: electrical heat pump capacity 54 kW

TOTAL INVESTMENT COST

TOTAL [€]	Lifetime [y]	Annual cost [€/y]	Specific costs [€/kWp]	Specific costs [€/kW]
64 333	20	3217	13403	1191

1. SOLAR PV COLLECTORS

Total cost [€]	Lifetime [y]	Annual cost [€/y]	Specific costs [€/kWp]
	25	0	0

Cost details — cost included in Total cost (yes / no)

no data available

	yes	no	
installation	☑	☐	€
collector+mounting structure	☑	☐	€
solar inverter	☑	☐	€
other (wiring, ..)	☑	☐	€

Comments:

2. COLD PRODUCTION including **RECOOLING DEVICE**
e.g., Sorption chiller, DEC (including sorption rotor, humidifier, heat recovery wheel, AHU)
and e.g., Cooling tower, waste water, drycooler, water treatment device

Total cost [€]	Lifetime [y]	Annual cost [€/y]	Specific costs [€/kWp]	Specific costs [€/kW]
	20	0	0	0

Cost details — cost included in Total cost (yes / no)

no data available

	yes	no	
installation	☑	☐	€
Compression heat pump	☑	☐	€
Heat rejection	☑	☐	€
cold storage	☐	☐	€
	☐	☐	€
other (wiring..)	☐	☐	€

Comments:

State of the art of new generation commercially Available activity <u>ongoing</u>

(A2 : New system configurations for cooling and heating)

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Subtask A: Components, Systems & Quality

Task 53

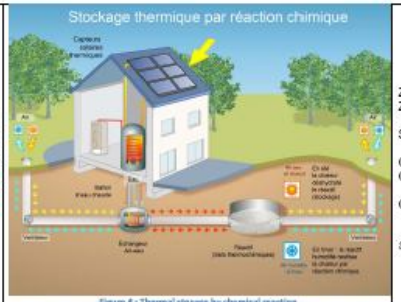
Milestone report-A3.0 – Status of the subtask A3

Date: 10.10.2014

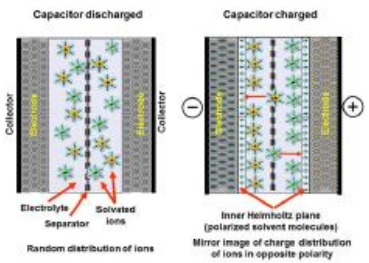
Authors: Matthias Rouge
Dr. Elena-Lavinia Niederhauser

Institution: University of Applied Sciences of Western Switzerland, Fribourg site, EIA-FR, Switzerland
Address: Bd de Pérolles 80, CH-1700 Fribourg, Switzerland
Phone +41 26 429 66 61
e-mail elena-lavinia.niederhaeuser@hefr.ch

Milestone report

Thermal storage by chemical reaction	The energy is stored in a chemical reactant which is contained in a tank. In summer, the warm air in combination with the excess energy produced by thermal solar panels will dry the reactant and in winter, the cool and moist air will humidify the reactant. During humidification, an exothermic chemical reaction occurs and generates heat. This reaction is then used to heat up air and water with the use of a heat exchanger.	 Figure 4 : Thermal storage by chemical reaction Source: http://www.ceo.fr/jeunes/themes/l-energie/l-essentiel-sur-le-stockage-stationnaire-de-l-e	Zeolite /H2OZeo : 124 kWh/m³K hot Zeolite /H2OZeo : 100 kWh/m³K cold Silica/H20 : 50 kWh/m³K Chemisorption (Na2S/H20) : 780 kWh/m³K hot Chemisorption (Na2S/H20) : 580 kWh/m³K cold Chemisorption (MgS04 7H20) : 760 kWh/m³K Source : [2]

Electrical energy storage methods

Storage type	Description	Diagram	Storage Capacity
Super capacitor	Some systems can directly store energy in electrical form. This is mainly done by super capacitors. It's an electric components consisting of two conducting plates that store opposite electrical charges separated by a membrane. They are capable of delivering high power for a short time. They can be used to smooth down strong energy spikes that can occur a specific times in the day.	 Figure 5 : Super capacitor Source: http://en.wikipedia.org/wiki/Supercapacitor	Available capacity: 1-5 kWh Power : 10 kW – 5 MW Efficiency : 90-95 % Source : [1]

Storage types

Next steps

Best practices activity for energy storage ongoing

(A3 : Storage concepts and management)

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Subtask C: Testing and demonstration projects

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Task 53

Deliverable M–C1.1 – 01 Monitoring Procedure for Field Test & Demo Systems with Compression Heat Pumps Driven by Photovoltaic Solar Energy
First Draft

Date: 10.10.2014

By Pedro Vicente Quiles[1]

[1]Institution Universidad Miguel Hernández de Elche
Address Avenida de la Universidad, s/n, Edificio Innova, 03203 Elche, Spain
Phone +34 96 6658561
e-mail pedro.vicente@umh.es

Milestone report

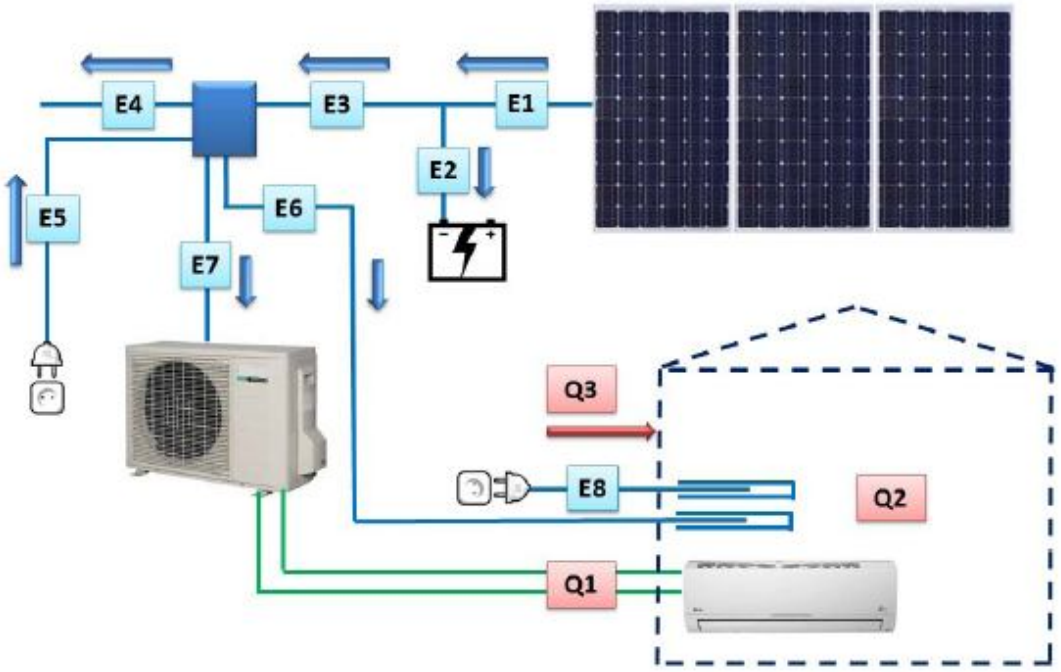

Figure 2 PV driven solar heating and cooling system of a HVAC installation.

Monitoring procedure
KPI's
Reference conditions
Example

Monitoring procedure for field test & demo systems <u>ongoing</u>
(C1 : Monitoring procedure and monitoring system selection criteria)

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Task 53

Task 53 meetings

& communication with PVPS

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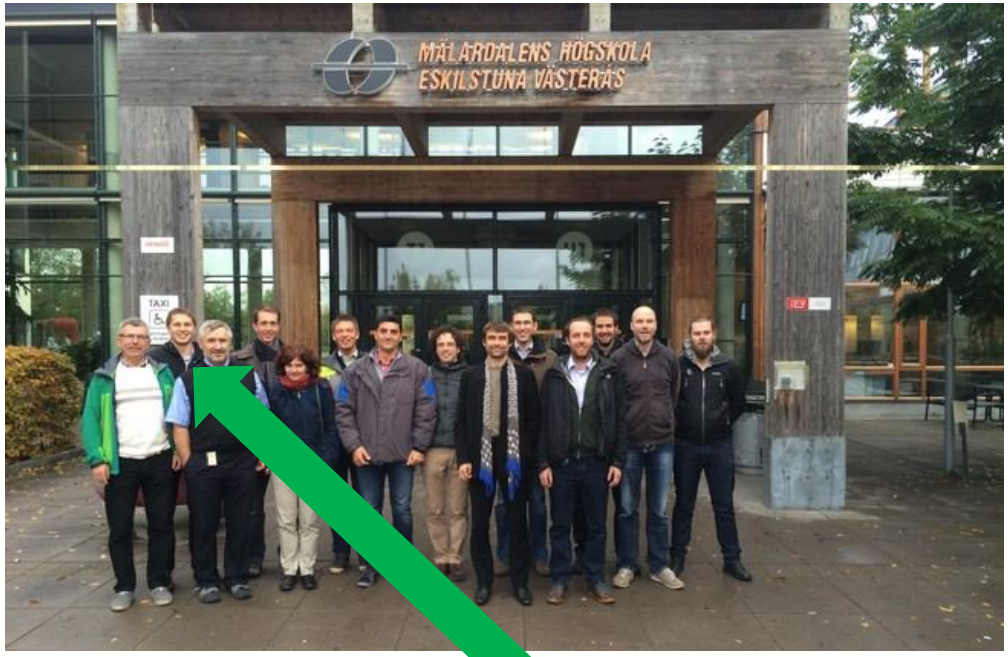
Last Task Expert meeting

Task 53

Place : Västeras, MDH

Date : 07-08/10/2014

Side event : SUNCOOL CLIMATEWELL worskop



14 experts

from 8 countries

- To deal with admin issues
- To confirm the content of the Annex & Work plan document
- To have a discussion on the priority targets
- To make a status on ongoing Activities
- To make a planning for next steps

Johan Lindhal, PVPS Task 1 from Sweden

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Participating countries

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.. at least 8 countries

France
Austria
Spain
Italy
Sweden
Australia
Switzerland
China

Turkey ?
Germany ?
Netherlands ?

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Task 53 next meetings

3rd Task 53 expert meeting :

The next meeting will be organized during a "**Solar Cooling week**" in Shanghai, gently organized by SJTU from25 to 26/03/2015.

This meeting will be organized in conjunction with Task 48 final expert meeting (23-24/03) and including a Dissemination workshop on 27/03

Planned schedule from SJTU

Tasks	date	Morning	Afternoon	Dinner	
Registration				Reception	Visiting to solar cooling facilities in SJTU can be arranged at coffee break time.
Task 48	23/03	General session	Technical session	Liuyuan Restaurant	
	24/03	Concluding session	General session	Qibao Old Town	
Task 53	25/03	Technical session	Technical session	City centre	
	26/03	Summary	Technical visiting, Shanghai	Nanxaing Town	
Conference	27/03	Plenary report	Session report	Liu Yuan	
Departure					

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Task 53 next meetings

Task 53

Meeting 4: Autumn 2014

– Place to be determined but option for **Innsbrück (AT)** –

Strong ambition to coordinate the Meeting 4 of Task 53 with **Task 14 PVPS** (High penetration in grids) managed by AIT(Austria) because a common workshop should be co-organised during **EU PVSEC 2015 conference** which will take place from 14 to 18/09 in Hamburg (Germany).

Proposed dates to be confirmed : **15 & 16/09/2015**

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EU PVSEC 2014 Conference 22 – 26 Sep 2014 Exhibition 23 – 25 Sep 2014
29th European PV Solar Energy Conference and Exhibition
RAI Convention & Exhibition Centre • Amsterdam • The Netherlands

Task 53

IEA PVPS Task 1 Meeting + Workshop

Place : EU PVSEC conference - Amsterdam

Date : 22/09/2014

Self-consumption business models - technical and economic challenges

Jointly with IEA – International Energy Agency PVPS Task 1 / Task 14

IEA SHC Task 53 presentation on what means PV for Solar Cooling and Heating

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PVPS ⇔ IEA SHC Task 53

Task 53

Proposed type of Collaboration :

- Task Liaison-Officers (mainly Task 1 PVPS and Task 53 SHC)
- Joint Task Meetings when possible
- Meetings at same place & time when possible
- Joint Workshops at Conferences
- **Type of collaboration : Based on expert-level not (only) formally**

Official position validated by 76th SHC ExCo
in Beijing (October 2014)

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http://task53.iea-shc.org/

Source : Climatewell

Thanks for your attention !

Contact : Daniel Mugnier, TECSOL

daniel.mugnier@tecsol.fr

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