Task 49/IV

Solar Process Heat for Production and Advanced Applications

Operating Agent IEA SHC:

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Sub-Tasks and Objectives

Start: February 2012 **Duration**: 4 years

Subtask A: Process heat collector (SPF)

- Improving solar process heat collectors and collector loop components
- Providing a basis for the comparison of collectors with respect to technical and economical conditions
- Giving comprehensive recommendations for standardized testing procedures

Subtask B: Process integration and Process Intensification combined with solar process heat (AEE INTEC)

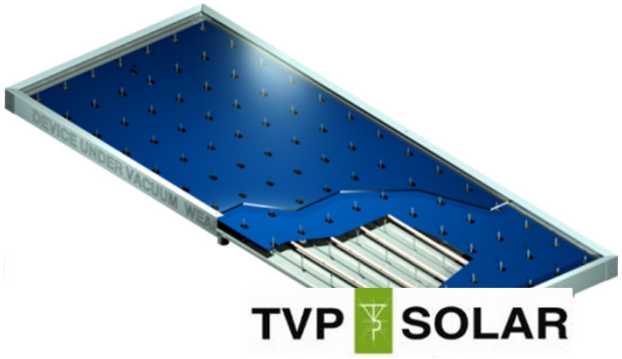
- Improved solar thermal system integration for production processes
- Increase of the solar process heat potential by PI and solar chemistry

Subtask C: Design Guidelines, Case Studies and Dissemination (ISE)

- Provide worldwide overview of results and experiences
- Performance assessment methodology for a comparison and analysis of different applications, collector systems, regional and climatic conditions
- Support future project stake holders by providing design guidelines, simplified fast and easy to handle calculation tools

Activities Sub Task A

- **<u>A1. Improvement of solar process heat collectors and collector loop components</u>**
- **ISFH (Germany) development of high efficiency flat plate collectors with spectrally selective double glazing (InSun).**
- **AEE INTEC (Austria) testing of advanced flat plate collectors (double glazing)**
- **ISFH (Germany) is working on heat pipes in solar collectors (heat transfer basics, assessment and new integration approaches).**
- **TVP Solar (Switzerland) developed a high vacuum flat plate collector**

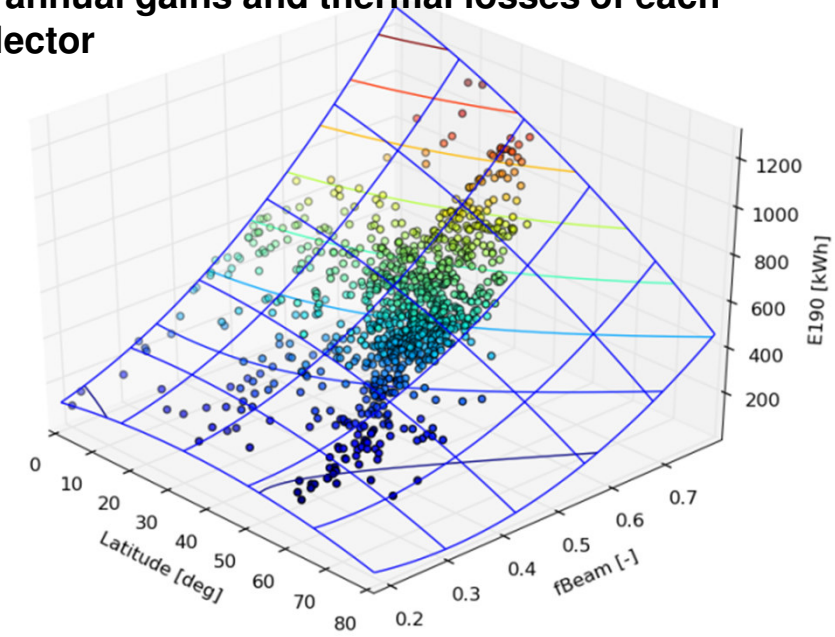


Activities Sub Task A

- **A2. Comparison of collectors with respect to technical and economical conditions**

➢ **TCS (Spain) conducted thermal performance simulations for 995 different climate conditions with four different collectors at 8 working temperatures.**

➢ **Preliminary correlations have been found for the annual gains and thermal losses of each collector**



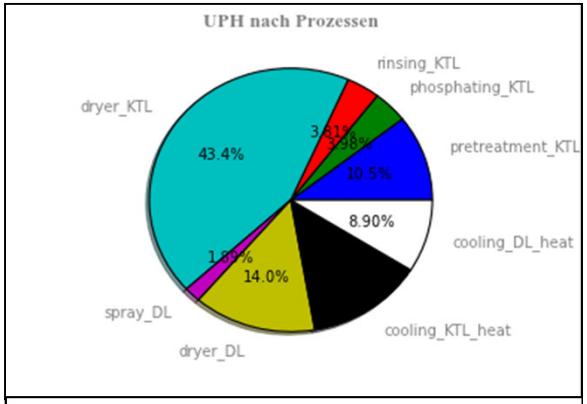
A3. Comprehensive recommendations for standardized testing procedures

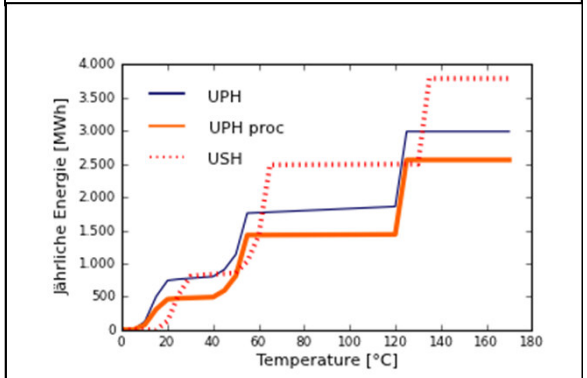
SPF (Switzerland): a new collector testing loop for measurements and experimental investigations at operating temperatures up to 200℃ is under construction.
Parabolic Trough Collector : 1.2m x4 m (NEP)

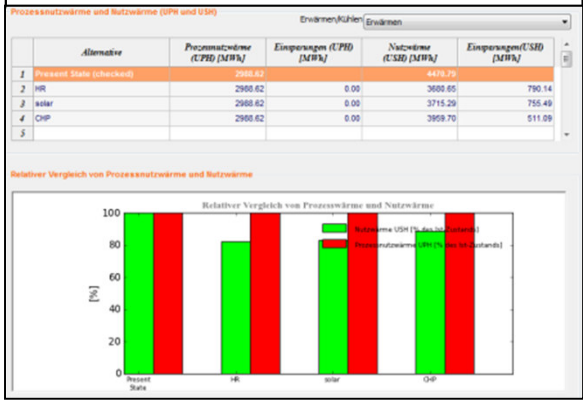
Activities Sub Task B

- **<u>B1. Development of advanced pinch and storage management tool(s)</u>**
- **Overview of existing pinch tools, process development and simulation programs to analyse**
  - ➢ the potential for heat recovery and process optimization in industry
  - ➢ the ideal integration point for solar process heat in industrial processes.

- **SPRINT, HEAT-int, STAR, Site-Int, Aspen Energy Analyzer, Supertarget, APROS, PE², SOCO, Einstein**







Activities Sub Task B

- **B2. Survey on integration methodologies for solar process heat**

	DATA	REMARKS
Type of solar thermal collector	**flat plate collector**	Klicken Sie hier, um Text einzugeben.
Installed collector area [m²]	Klicken Sie hier, um Text einzugeben.	**aperture area**
Installed thermal peak capacity [$kW_{peak,th}$]:	Klicken Sie hier, um Text einzugeben.	
Kind of installation	**roof mounted (on flat roof)**	Klicken Sie hier, um Text einzugeben.
SOLAR loop heat transfer medium	**Water / Glycol (specify glycol type)**	Klicken Sie hier, um Text einzugeben.
Solar loop operating temperature [°C] Solar loop supply temperature *Tsupply* Solar loop return temperature *Treturn* Solar loop operating pressure [bar_{gauge}]	Klicken Sie hier, um Text einzugeben. Klicken Sie hier, um Text einzugeben. Klicken Sie hier, um Text einzugeben. Klicken Sie hier, um Text einzugeben.	Solar loop operating temperature = $\frac{\text{[redacted]} + \text{[redacted]}}{2}$
SOLAR loop heat exchanger (HX)	**YES (please specify type of HX)**	Klicken Sie hier, um Text einzugeben.
SOLAR gross heat production [MWh/a]	Klicken Sie hier, um Text einzugeben.	...in the year: specify reference year
Measures to avoid stagnation	**stagnation cooler (pl**	
OTHER REMARKS	Klicken Sie hier, um Te	

Total investment costs excl. VAT	**Total investment costs** ➔ solar thermal plant + storage + process integration **If possible, please specify (in € or %)** • Solar loop • Storage • Process integration • Other	€ % % % %
subsidies	please specify type of subsidy	**€**
O&M costs		€/a
fuel cost	cost for conventional fuel replaced by solar thermal plant	€/MWh
calculated solar thermal system life time		years

Activities Sub Task B

- **B4. Survey and dedicated Workshop on new process technologies**
- **Objectives of the WS PI-Solar:**
  - **Collect existing solutions of solar process heat in combination with intensified technologies already applied in the food industry**
  - **Identify new potential solutions for specific unit operations (e.g. evaporation, drying)**
  - **Identify the necessary steps to evaluate the effects of new PI approaches and technologies on the potential of solar process heat**
  - **Identify upcoming research needs**

Solar process heat for production and advanced applications

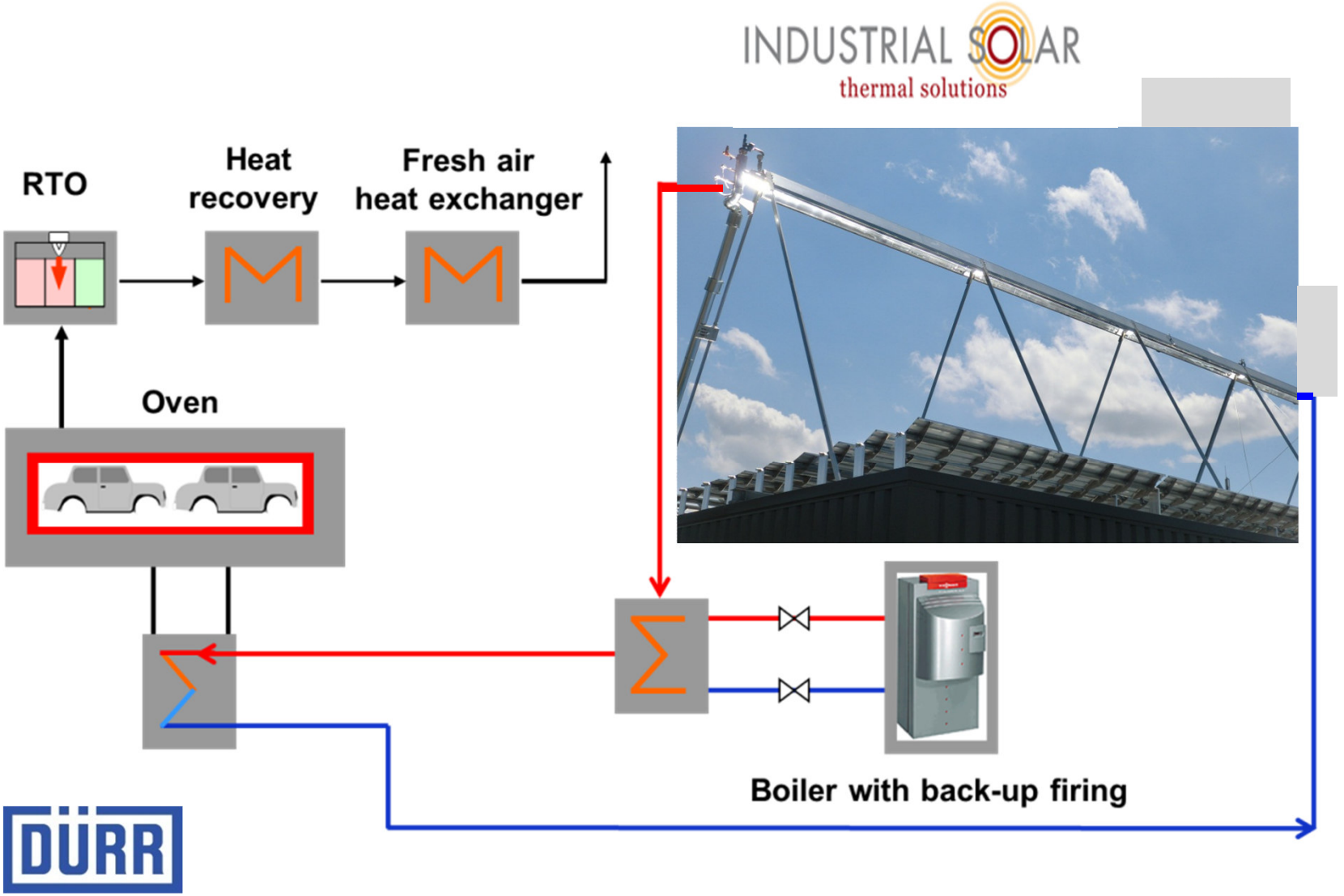
Task 49 / Task IV

Preliminary Agenda for the 1st Workshop on "Solar Process Heat and Process Intensification – Applications in the food industry"

Graz, Austria, September 5th, 2012

SMART.events, Dreihackengasse 1, 8020 Graz Austria

Activities Sub Task C



Activities Sub Task C

- **C5. Dissemination of task results**
  - Presentation at Intersolar Europe, SHC Conference, EuroSun, PIN, Otti
  - Logo
  - Press release
  - Flyer
  - Article: Solar thermal World

Solar process heat can provide a relevant fraction of the overall energy demand

The usage of solar heat for industrial processes is at an early stage of development: It accounts for only 24 Megawatt hours of solar energy worldwide. This could be much more as for example 28 percent of the energy demand in the EU is used for industrial processes. A third of that is required at temperatures below 100 degree Celsius, which could be easily met with state of the art technology. And this is only the beginning! If both solar thermal systems and industrial processes will be optimised, a large fraction of the processes at temperatures between 100 and 400 degree Celsius could be supplied by solar heat.

Taken as a whole this huge market and technology potential is a treasure ready to be unearthed. With our activities of Task 49 we want to tap into this potential and foster the economic utilization of solar thermal heat in manufacturing processes. Solar heat and energy efficiency measures can be combined to reduce operation cost for industry globally – with locally adapted technical solutions.

We want to claim the treasure and provide

Photo: GEA Brewery Systems GmbH

Our activities in solar generation ...

Collector development and testing

- Investigate all kind of collectors such as uncovered collectors, flat-plate collectors, improved flat-plate collectors with and without reflectors, evacuated tubular collectors with and without reflectors, CPC collectors, parabolic trough collectors, Fresnel collectors, air collectors
- Improve loop components
- Do research on material aspects
- Investigate overheating behaviour of large medium temperature collector fields
- Update the IEA SHC Task 33 survey on process heat collectors
- Improve numerical collector models in simulation programs
- Recommend testing standards for the medium temperature level

We want to optimize the generation of solar

Photo: GEA Brewery Systems GmbH

... and in industrial heat processes

Process Integration

- Improve the general methodology for the integration of solar thermal energy into industrial processes based on IEA SHC TASK 33/IV
- Adapt existing heat management strategies and optimize operation of storages
- Consider time dependency of the industrial production profile
- Reduce energy demand and increase potential for solar thermal integration by technology optimization of the applied process technologies
- Propose methodology for decision on integration types incl. thermodynamic and cost factors
- Provide checklists for ideal integration
- Investigate new process technologies

We want to optimise the demand side in

Photo: Sunmark A/S

PRESS RELEASE

Strengthening solar heat for industrial processes – IEA SHC launches new research project

May 2012. The IEA Solar Heating and Cooling Programme (IEA SHC) has launched a 4-year research project aimed at the growing market for solar heat in industrial processes. Researchers of IEA SHC and SolarPACES will work on hard- and software in order to make solar an even more attractive option for industrial applications.

"*Industrial use of solar heat is clearly on the rise,*" says Christoph Brunner, leader of the new IEA SHC project Solar Process Heat for Production and Advanced Applications (Task 49). "*Until a few years ago, it seemed that this topic was mostly driven by academics, but with ever increasing energy prices industrial users of heat have newly discovered solar energy as an attractive option*".

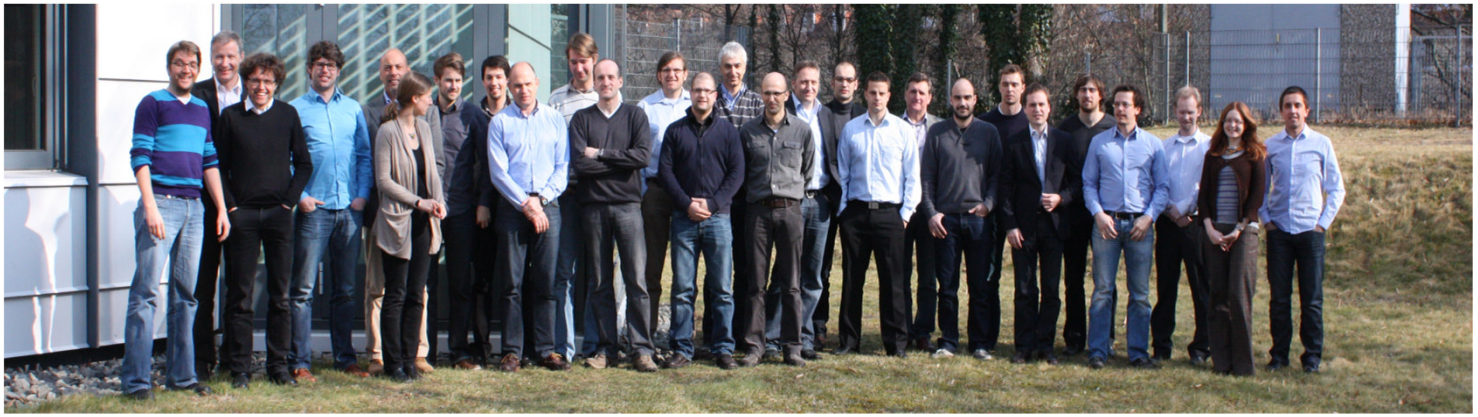
Last year, the researchers from 5 countries had carefully analysed what hindered more industrial companies to use solar energy for their thermal energy demand. The result was not one big road block but a bundle of issues which are now addressed in the project:

- Process heat collectors: improving existing collector designs and extending test standards to allow for quality assurance of these important components
- Overall system design: reviewing and improving the way solar thermal is integrated into industrial heating systems
- Guidelines: Development of monitoring tools and design guidelines supporting those who plan and install solar installations for industrial process heat.

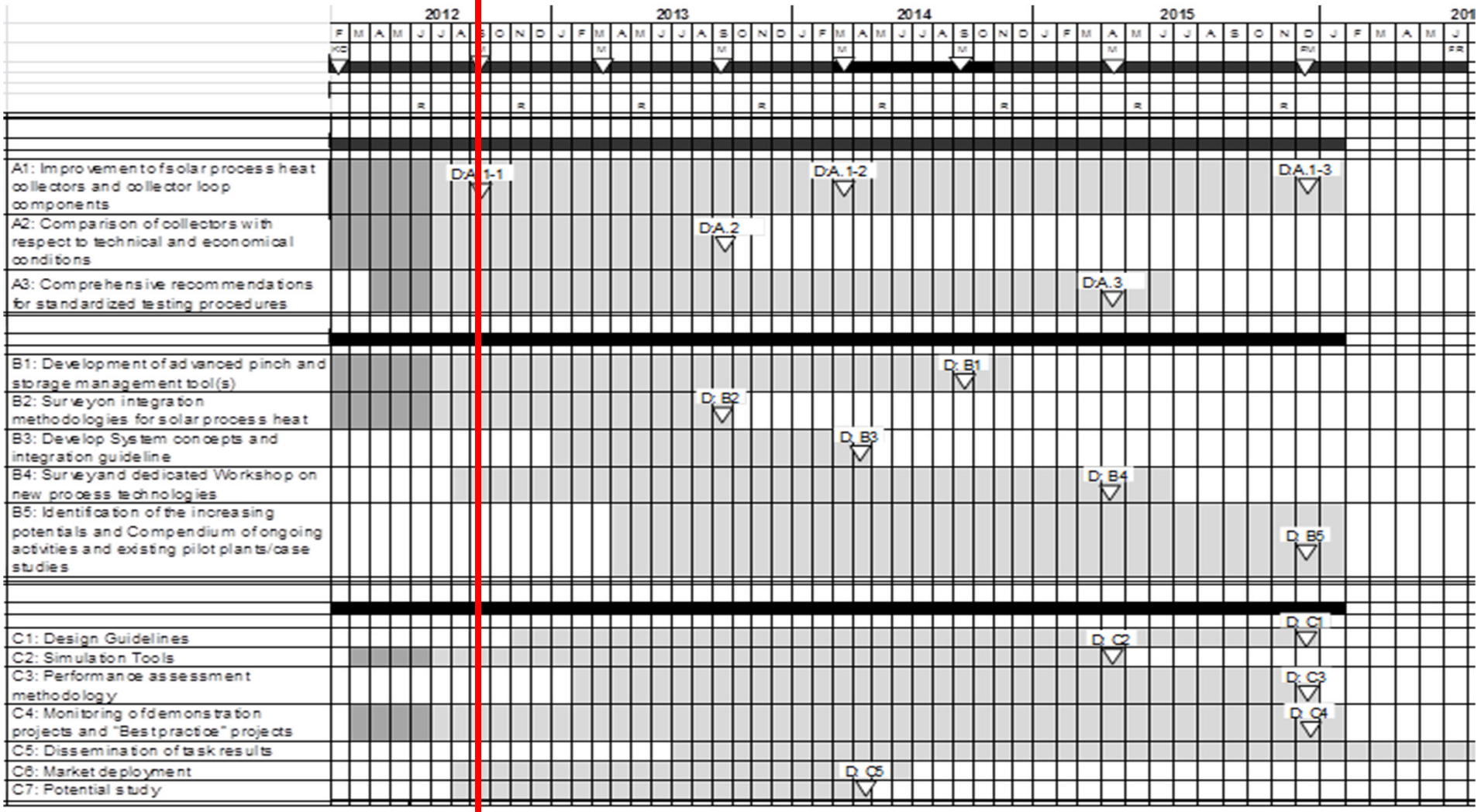
Expert meetings

- **Kick off meeting:**
- **Freiburg, Germany: 29th February – 1st March 2012**
- **Graz, Austria: 6th September – 7th September 2012**

- **The preliminary list of further expert meetings:**
- **3rd IEA Task 49/IV meeting: SPF, Rapperswil, Switzerland, 4-6. of February 2013**
- **4th IEA Task 49/IV meeting: Tecnalia, Spain, Sept/Oct 2013**
- **5th IEA Task 49/IV meeting: Stellenbosch University, Spring 2014**



Time Schedule



Milestones

- **Sep 2012; A1-1: Definition of general requirements and relevant parameters for process heat collectors (and specific collector loop components) and their improvement (delayed and discussed at Expert Meeting)**

- **<u>Upcoming milestones:</u>**
- **Sep 2013; A2: Guideline for comparison of collectors for process heat applications**
- **Sep 2013; B2: Integration Guideline**

Issues for the Executive Committee:

- **Following countries participated at the meetings: Germany, Switzerland, Portugal, Italy, Spain, Austria, India, France, South Africa**
- **India and GB indented to start the process for joining the SHC programme due to the interest of joining Task 49/IV**
- **Participants suggest to combine at least one Expert Meeting with a SolarPACES Conference. Date and Place to be co-ordinated.**

SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

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Thank You for Your attention

Task website: www.iea-shc.org/task49/

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