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<http://cms.shc2013.org/mobile>



## Chairpersons' Message



*Dr. Hans-Martin Henning*  
*Fraunhofer ISE*  
*Scientific Chair of SHC 2013*



*Xavier Noyon*  
*ESTIF*  
*Industry Chair of SHC 2013*

Societies and economies in almost all regions of the world have felt the tremendous impact of an energy supply infrastructure transition. The global fossil fuel market has undergone major changes recently; mostly due to a strong increase in shale gas exploitation in the US. In the short term, we have to deal with the scarcity and strong price fluctuations of fossil energy resources which, in the medium term, remain a factor of uncertainty and instability. In the long term, we are faced with a strictly limited amount of fossil fuels. Even more important, is the call for a concerted and swift action to achieve an immediate and fast transformation of our energy systems towards sustainability in order to limit global climate change.

Today, a major share of energy is consumed as heat. Low temperature heat is used for space heating in buildings and for domestic hot water. Heat at various temperatures operates applications in many industrial sectors and processes. And an increasing amount of energy is used for cooling of buildings and industrial refrigeration. Currently, most of these applications are operated by burning fossil fuels directly or – even worse – by electricity which is also predominantly generated using fossil fuels. Solar thermal energy is the most straightforward way to convert renewable energy directly to heat. Each unit of energy produced from the sun avoids the consumption of fossil fuels and the associated emissions of greenhouse gases. Although proven technical solutions exist, the overall contribution of solar thermal energy covering heat and cooling demands is still marginal at a global level. The main reason behind this is that, in most cases, the cost-competitiveness of solutions making use of solar energy is still not sufficient for a broad market penetration. Therefore, the main task facing the solar heating and cooling community is to work towards lowering the cost of heating and cooling generated by solar collectors and systems. Activities at all levels of the value chain, from raw materials through to manufacturing processes, system installation and building or process integration up to innovative marketing and business models must be addressed to exploit cost saving opportunities.

The international solar heating and cooling conference, jointly organized by the IEA Solar Heating and Cooling Programme (IEA SHC) and the European Solar Thermal Industry Federation (ESTIF), provides an excellent platform to exchange information at a global level. Hopefully, the conference will catalyze this exchange of ideas and concepts to accelerate progress in the further development and cost reduction of solar systems for heating and cooling of buildings, and their application in industry. We wish you a pleasant stay in Freiburg and a successful conference. Let's work together for a greater solar energy contribution to the clean energy supply.

*Dr. Hans-Martin Henning*  
*Scientific Chair of SHC 2013*

*Xavier Noyon*  
*Industry Chair of SHC 2013*

## Welcome to SHC 2013

The IEA Solar Heating and Cooling Programme and ESTIF are proud to welcome you to the second SHC conference on Solar Heating and Cooling for Buildings and Industry in Freiburg.

SHC 2013 will continue our objective to create a platform for strong cooperation between research and industry that we started last year in San Francisco, USA.

By teaming up the IEA SHC Programme, an inter-governmental organization, with a renowned industry association for this year's conference, we are bringing you the "best of both worlds" – the independence and reliability of the scientific community gathered in the IEA SHC Programme and the most current developments in innovation, market development and business models from the European solar thermal industry.

After hosting SHC 2012 in North America where the solar heating market is slowly gaining momentum, Europe will host SHC 2013 where solar heat is more advanced but facing challenges after a decade of strong growth. The European solar thermal markets vary considerably in terms of market development and technology, however, the 28 EU countries do have a common framework regarding research programs as well as the promotion of renewable energy resources, buildings standards and energy efficiency.

After China, the EU is the second largest regional market worldwide and is home to renowned solar thermal research centres and some of the largest manufacturers.

SHC 2013 is an international conference; the speakers, the attendees and the subjects are global, however, we are taking advantage of the location to offer the best of the European solar thermal experts to better understand the EU's market and research activities.

Welcome to SHC 2013 and the "solar city" Freiburg, the perfect location to illustrate the benefits of long-term research and a sustained investment in solar technologies. We welcome all those who want to contribute to the solar future and participate to the largest solar heating conference worldwide.

We are looking forward to meeting you in Freiburg.



*Werner Weiss*  
*AEE INTEC*  
*Chairman of the*  
*IEA SHC Program*



*Robin Welling*  
*TiSUN GmbH*  
*President of ESTIF*



*Werner Weiss*  
*IEA SHC Chairman*



*Robin Welling*  
*ESTIF President*

## Welcome to Freiburg!



*Dr. Dieter Salomon  
Lord Mayor  
City of Freiburg*

On behalf of the City of Freiburg, I'd like to extend a very warm welcome to this international three-day conference, "Solar Heating and Cooling for Buildings and Industry," hosted by the International Energy Agency IEA and ESTIF. The first conference in this series, held in San Francisco last year, took place during InterSolar North America, a very successful worldwide exhibition that was launched in Freiburg thirteen years ago.

We are very proud to be the second city hosting this conference on solar thermal energy topics. With numerous institutions in the field, the southwestern German city of Freiburg is counted among the world's most important locations for research, development and practical applications of solar technology. Freiburg has been committed to its goals and principles for creating a sustainable city for many years. This is also being achieved thanks to the dedication of its citizens, who identify with a "Green City" lifestyle.

One of the top European solar research institutes, the Fraunhofer Institute for Solar Energy Systems ISE, located in Freiburg, has contributed immensely to Freiburg's rise as one of the leading solar locations in the world. With its 1,200 employees, the Fraunhofer ISE is behind many important initiatives for solar projects, and cooperates with numerous companies to convert research into practice. All of this activity has created an extraordinary network in Freiburg, including important decision-makers in politics, research economics, and sustainability and climate protection.

The focus of this conference, solar thermal energy, will play an important role in the future. The Fraunhofer ISE is conducting intense research on projects in cooperation with the city of Freiburg and the innovation fund of our regional power company, badenova. Solar thermal energy is a crucial component of a new energy policy. It will have positive effects not only in the environment, but also on regional trade and the service sector.

I wish you all a fascinating and informative conference, and I hope you will find the time to visit some of Freiburg's green landmark projects like the green neighborhood, Vauban, the passive high rise buildings, or the Fraunhofer ISE.

Thank you!

A handwritten signature in black ink, appearing to read "Dieter Salomon". The signature is fluid and cursive, written on a white background.

*Dr. Dieter Salomon  
Lord Mayor, City of Freiburg*

## Conference Topics

### **Systems and Components**

- Solar Thermal Collectors
- Thermal Storage
- Other Innovative Components and Systems
- Durability and Reliability

### **Applications**

- Water Heating
- Solar Heating and Air-conditioning
- District Heating
- Solar Heat for Industrial Processes
- Solar Refrigeration
- Solar Architecture
- Building Integration
- Building Renovation
- Urban Planning
- Solar Resource Assessment

### **Market Reports and Framework Conditions**

- Framework Conditions and Policies
- Innovative Business Models and Marketing
- Standards and Certification
- Global Markets

### **Solar Heat in Multi Dwellings and Collective Systems**

## Committees

### Scientific Chair

Hans-Martin Henning, Germany

### Industry Chair

Xavier Noyon, Belgium

### Scientific Committee

Lex Bosselaar, Netherlands  
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Harald Drück, Germany  
Bärbel Epp, Germany  
Sonja Geier, Switzerland  
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Andreas Häberle, Germany  
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Michael Köhl, Germany  
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Wim van Helden, Netherlands  
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### Advisory Committee

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Thembakazi Mali, South Africa  
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Les Nelson, USA  
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Urs Wolfer, Switzerland  
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Michele Zinzi, Italy

## Organizing Committee

Hans-Martin Henning, Germany  
Xavier Noyon, Belgium  
Werner Weiss, Austria  
Peter Donat, Germany  
Andreas Häberle, Germany  
Pam Murphy, USA  
Theresa Doetsch, Belgium  
Beatrix Feuerbach, Germany  
Maria Frank, Germany

## Monday, September 23, 2013

### 09:00 - 10:45 Plenary MON-1: Opening Session / Systems and Components

Room: Rolf-Böhme-Saal

*Chairs: Werner Weiss / Andreas Häberle*

- 09:00 Welcome from the City of Freiburg  
*Gerda Stuchlik, Mayoress City of Freiburg*
- 09:05 Welcome from IEA-SHC  
*Werner Weiss, AEE INTEC*
- 09:10 Welcome from ESTIF  
*Robin Welling, TISUN GmbH*
- 09:15 Welcome from ISES  
*David Renné, ISES*
- 09:30 The Role of Solar Thermal in the Future Energy Mix  
*Paolo Frankl, International Energy Agency (IEA)*
- 09:55 Solar Thermal Plus Heat Pump  
*Michel Haller, Institut für Solartechnik HSR*
- 10:20 Architectural Integration of Solar Energy  
*Maria Cristina Munari Probst, EPFL-LESO*

### 10:45 - 11:15 Coffee Break

### 11:15 - 12:00 Industry Session

Room: Rolf-Böhme-Saal

*Chair: Xavier Noyon*

European Copper Institute  
RESOL  
Viessmann  
Alfa Laval  
Grundfos  
ITW-University of Stuttgart



**Dr. Paolo Frankl**

*International Energy Agency (IEA)*



Paolo Frankl is Head of the Renewable Energy Division at the International Energy Agency. He joined the Agency in July 2007.

In this role, Dr. Frankl leads the Agency's work on renewable energy issues, coordinating a team of policy analysts on the status and progress of renewable energy technologies, renewable energy markets, and system integration.

A physicist by training, Dr. Frankl holds a Ph.D in energy and environmental technologies from the University of Rome. Previous positions held were in academia and in private Italian consultancy firms researching renewable energy, life cycle assessment and eco-labeling.

**Dr. Maria Cristina Munari Probst**

*EPFL-LESO*



Dipl. Architect from the Istituto Universitario di Architettura di Venezia - IUAV (Italy) in 1998.

PhD at EPFL in Environment in 2008. Practicing architect specialized in solar architecture from 1999.

Works at EPFL-LESO (Solar Energy Lab) from 2003 as researcher and teacher. Research fields:

- criteria for architectural integration of solar systems in the design practice (among other, sub task leader in IEA Task 41 Solar Energy and Architecture)
- development of new, adapted, solar products for building integration (among other a PhD thesis and a book Routledge on Solar Thermal Systems design criteria)
- urban strategies for solar energy use (LESO-QSV method for the urban acceptability of active solar systems, IEA Task 51 Solar Energy in Urban Design).

**Dr. Michel Haller**

*SPF Institut für Solartechnik,  
University of Applied Sciences HSR*



Graduated in Environmental Sciences at the Swiss Federal Institute of Technology ETH in Zürich in 2000. After some years of experience in the solar thermal field acquired his PhD at the Institute of Thermal Engineering IWT at Graz University of Technology in Austria in 2010.

Since 2010 he is working at the SPF Institut für Solartechnik in Switzerland as a Research Project Manager dealing mostly with solar and heat pump combinations and with whole system testing approaches. Since 2010 he is also leader of the Subtask C "Modeling and Simulation" of the IEA SHC Task 44 / HPP Annex 38 "Solar and Heat Pump Systems". And since 2012 coordinator of the EU FP7 project Macsheep.

## Scientific Posters

There will be four poster areas, marked on the Floor Plan on page 43. The poster numbers are based on the topics and were assigned to the following areas:

### Systems and Components

- A Topic: Solar Thermal Collectors
- B Topic: Thermal Storage
- C Topic: Other Innovative Components and Systems
- D Topic: Durability and Reliability

### Applications

- E Topic: Water Heating
- F Topic: Solar Heating and Air-conditioning
- G Topic: District Heating
- H Topic: Solar Heat for Industrial Processes
- I Topic: Solar Refrigeration
- J Topic: Solar Architecture
- K Topic: Building Integration
- L Topic: Building Renovation
- M Topic: Urban Planning
- N Topic: Solar Resource Assessment

### Market Reports and Framework Conditions

- O Topic: Standards and Certification
- P Topic: Global Markets
- Q Topic: Solar Heat in Multi Dwellings and Collective Systems

**Poster Area 1:** A1 – A22; B1 – B8

**Poster Area 2:** B9 – B18; C1 – C10

**Poster Area 3:**

C11 – C21; all of: D, E, F, G; H1 - H4

**Poster Area 4:**

H5 – H10; all of: I, J, K, L, M, N, O, P, Q

## 12:00 - 13:00 Poster Session

A-1 Influence of Spray Pyrolysis Deposition Parameters on the Optical Properties of Porous Alumina Films  
*Elena Ienei<sup>1</sup>, Anca Duta<sup>1</sup>, Claudia Andreea Milea<sup>1</sup>*  
<sup>1</sup> Transilvania University of Brasov

A-2 Numerical Evaluation of the Flow Non-Uniformity in a Flat Plate Solar Collector  
*Lucas Faria<sup>1</sup>, Ivan Corgozinho<sup>1</sup>, Lucio Mesquita<sup>1</sup>, Elizabeth Pereira<sup>1</sup>*  
<sup>1</sup> University Center UNA

A-3 Quality Assurance for Solar Thermal Collector Production  
*Alois Resch*  
 Austria Solar Innovation Center

A-4 Simplicity and Reliability on Thermal Solar Installation for the Collective Market  
*Perrin Matthieu*  
 Alfa Laval HES

- A-5 An Approximate Analytical Approach to Steady State Simulation of Unglazed Solar Collectors  
*Luca Molinaroli<sup>1</sup>, Luigi Colombo<sup>1</sup>, Elisa Rovelli<sup>1</sup>*  
<sup>1</sup> Politecnico di Milano
- A-6 Collector Simulation Model with Dynamic Incidence Angle Modifier for Anisotropic Diffuse Irradiance  
*Stefan Hess*  
Fraunhofer ISE
- A-7 Combined Spectroscopic and Mechanical Investigation of the Effects of Degradation Factors on the Accelerated Ageing of Polymeric Materials for Solar Thermal Applications  
*Andreas Piekarczyk<sup>1</sup>, Michael Köhl<sup>1</sup>, Karl-Anders Weiß<sup>1</sup>*  
<sup>1</sup> Fraunhofer ISE
- A-8 Effect of Angle of Incidence of Sun Rays on the bending of absorber tube of solar parabolic trough concentrator  
*Sourav Khanna<sup>1</sup>, Shireesh Kedare<sup>1</sup>, Suneet Singh<sup>1</sup>*  
<sup>1</sup> Indian Institute of Technology Bombay
- A-9 Effect of Receiver Temperature on Performance Evaluation of Silver Coated Selective Surface Compound Parabolic Reflector with Top Glass Cover  
*Atul Sagade<sup>1</sup>, Promod Patil<sup>2</sup>, Nilkanth Shinde<sup>3</sup>*  
<sup>1</sup> New Satara College of Engineering; <sup>2</sup> Chonnam National University; <sup>3</sup> Shivaji University, Kolhapur
- A-10 Flat Plate Aluminum Heat Pipe Collector with Inherently Limited Stagnation Temperature  
*Steffen Jack*  
ISFH
- A-11 Flat Plate Collector for Process Heat with Front Foil, Full Surface Aluminum Absorber and Vacuum Super Insulation  
*Gloria Streib<sup>1</sup>, Thomas Beikircher<sup>1</sup>, Peter Osgyan<sup>1</sup>, Stephan Saller<sup>1</sup>*  
<sup>1</sup> ZAE Bayern
- A-12 Hourly and Monthly Variation in Shading and Blocking of Aperture Area in a Linear Fresnel Reflector Field  
*Vashi Sharma<sup>1</sup>, Sourav Khanna<sup>1</sup>*  
<sup>1</sup> Indian Institute of Technology Bombay
- A-13 Integrated Development and Modelling of Heat Pipe Solar Collectors  
*Katharina Morawietz<sup>1</sup>, Michael Hermann<sup>1</sup>*  
<sup>1</sup> Fraunhofer ISE
- A-14 Mass Flow, Pressure Drop, and Leakage Dependent Modeling and Characterization of Solar Air Collectors  
*Christian Welz<sup>1</sup>, Paolo Di Lauro<sup>1</sup>, Michael Hermann<sup>1</sup>, Christoph Maurer<sup>1</sup>, Gerhard Stryi-Hipp<sup>1</sup>*  
<sup>1</sup> Fraunhofer ISE
- A-15 A Modified Efficiency Equation of Solar Collectors  
*Kyoungho Lee<sup>1</sup>, Nam-Choon Baek<sup>1</sup>*  
<sup>1</sup> KIER
- A-16 Performance and Reliability of a High Efficiency Flat Plate Collector – Final Results on Prototypes  
*Sebastian Föste<sup>1</sup>, Federico Giovannetti<sup>1</sup>*  
<sup>1</sup> ISFH
- A-17 Progress on Integrated Compound Concentrator Design  
*Lun Jiang*  
UC Merced
- A-18 Solar Collector Cover with Temperature-Controlled Solar Light Transmittance  
*Olaf Muehling<sup>1</sup>, Ralf Ruhmann<sup>1</sup>, Arno Seeboth<sup>1</sup>*  
<sup>1</sup> Fraunhofer IAP
- A-19 Task 39 Exhibition Project: Assembly of Polymeric Components for Solar Thermal Systems  
*Michael Köhl<sup>1</sup>, Stephan Fischer<sup>2</sup>, Sandrin Saile<sup>1</sup>*  
<sup>1</sup> Fraunhofer ISE; <sup>2</sup> ITW-University of Stuttgart
- A-20 Testing Solar Air-Heating Collectors  
*Korbinian Kramer<sup>1</sup>, Sven Fahr<sup>1</sup>, Stefan Mehnert<sup>1</sup>, Christoph Thoma<sup>1</sup>*  
<sup>1</sup> Fraunhofer ISE
- A-21 Thermal Analysis for Different Receivers at a CPC Module  
*Mexitli Sandoval<sup>1</sup>, Octavio García Valladares<sup>1</sup>, Víctor Hugo Gómez<sup>1</sup>, Naghelli Ortega<sup>1</sup>, Iris Santos<sup>1</sup>*  
<sup>1</sup> UNAM
- A-22 Transpired Solar Collector Installations in Wales and England  
*Richard Hall<sup>1</sup>, Catherine Brown<sup>2</sup>, Emmanouil Perisoglou<sup>2</sup>, Vicki Stevenson<sup>3</sup>*  
<sup>1</sup> SBEC; <sup>2</sup> Welsh School of Architecture; <sup>3</sup> WEST

- B-1 Compact Hot Water Storage Systems Combining Copper Tube with High Conductivity Graphite and Phase Change Materials  
*Yoram Shabtay<sup>1</sup>, John Black<sup>2</sup>*  
<sup>1</sup>Heat Transfer Technologies; <sup>2</sup>International Copper Assoc.
- B-2 MERITS: More Effective Use of Renewables Including Compact Seasonal Thermal Energy Storage - Project Overview and Initial Results  
*Ruud Cuypers<sup>1</sup>, Christian Finck<sup>1</sup>*  
<sup>1</sup>TNO
- B-3 A Review on Properties of Salt Hydrates for Thermochemical Storage  
*Fanny Trausel<sup>1</sup>, Ruud Cuypers<sup>1</sup>, Ard-Jan de Jong<sup>1</sup>*  
<sup>1</sup>TNO
- B-4 Study on Performance of Storage Tanks in Solar Water Heater System in Charge and Discharge Progress  
*Shuhong Li<sup>1</sup>, Yang Li<sup>1</sup>, Xiaosong Zhang<sup>1</sup>*  
<sup>1</sup>Southeast University
- B-5 Thermal Stability Test of Sugar Alcohols as Phase Change Materials for Medium Temperature Energy Storage Applications  
*Aran Solé<sup>1</sup>, Luisa F. Cabeza<sup>1</sup>, Hannah Neumann<sup>2</sup>, Sophia Niedermaier<sup>2</sup>, Elena Palomo<sup>3</sup>*  
<sup>1</sup>University of Lleida; <sup>2</sup>Fraunhofer ISE; <sup>3</sup>Université Bordeaux
- B-6 Thermo-economic Analysis of Storage Systems For Solar Heating And Cooling Systems: A Comparison Between Variable-Volume and Fixed-Volume Tanks  
*Gabriele Ferruzzi<sup>1</sup>, Annamaria Buonomano<sup>1</sup>, Francesco Calise<sup>1</sup>, Laura Vanoli<sup>2</sup>*  
<sup>1</sup>Università "Federico II"; <sup>2</sup>Università Parthenope
- B-7 Thermophysical Characterization of Sorption TCM  
*Camila Barreneche<sup>1</sup>, Luisa F. Cabeza<sup>2</sup>, Ruud Cuypers<sup>3</sup>, Inés Fernández<sup>1</sup>*  
<sup>1</sup>Universitat de Barcelona; <sup>2</sup>Universitat de Lleida; <sup>3</sup>TNO
- B-8 Corrosion Test of Salt Hydrates and Vessel Metals for Thermochemical Energy Storage  
*Aran Solé<sup>1</sup>, Camila Barreneche<sup>1</sup>, Luisa F. Cabeza<sup>1</sup>, A. Inés Fernández<sup>2</sup>, Ingrid Martorell<sup>1</sup>, Laia Miró<sup>1</sup>*  
<sup>1</sup>University of Lleida; <sup>2</sup>University of Barcelona
- B-9 Design of a Finned Plate Latent Heat Thermal Energy Storage System for Domestic Applications  
*Álvaro Campos Celador<sup>1</sup>, Gonzalo Diarce<sup>1</sup>, Ane Miren García-Romero<sup>1</sup>, José María Sala<sup>1</sup>, Jon Terés-Zubiaga<sup>1</sup>*  
<sup>1</sup>UPV/EHU
- B-10 Development of a Prototype System for Seasonal Solar Heat Storage Using a Reversible Sorption Process  
*Robert de Boer<sup>1</sup>, Simon Smeding<sup>1</sup>, Herbert Zondag<sup>1</sup>*  
<sup>1</sup>ECN
- B-11 Electric Power Generation from Solar Pond Using Combination of Thermosyphon and Thermoelectric Modules  
*Sura Tundee*  
 Rajamangala University
- B-12 Experimental Results of a 3 kWh Thermochemical Heat Storage Module for Space Heating Application  
*Christian Finck<sup>1</sup>, Ruud Cuypers<sup>1</sup>, Ellemieke Henquet<sup>1</sup>, Henk Oversloot<sup>1</sup>, Ard-Jan de Jong<sup>1</sup>, Hans van 't Spijker<sup>1</sup>, Christiaan van Soest<sup>1</sup>*  
<sup>1</sup>TNO
- B-13 Investigation and Modeling of a Simultaneous Charging and Discharging of a PCM Heat Exchanger  
*Peter Omojaro<sup>1</sup>, Cornelia Breitkopf<sup>1</sup>*  
<sup>1</sup>Institut für Energietechnik
- B-14 Operation of the Experimental High Temperature BTES with CHP Unit - Early Results  
*Zdeněk Rozehnal<sup>1</sup>, David Grycz<sup>1</sup>, Petr Hemza<sup>1</sup>*  
<sup>1</sup>Green Gas DPB, a.s.
- B-15 Opportunities and Constraints of a Combined Hot Water and Sorption Store for Solar Thermal Systems  
*Rebecca Weber<sup>1</sup>, Harald Drück<sup>1</sup>, Henner Kerskes<sup>1</sup>*  
<sup>1</sup>ITW-University of Stuttgart
- B-16 Sensitivity Analysis of the Energy Density in a Thermochemical Heat Storage Device  
*Syntia Metchueng Kamdem<sup>1</sup>, Hassan Bouia<sup>1</sup>, Kevyn Johannes<sup>2</sup>, Frédéric Kuznik<sup>2</sup>*  
<sup>1</sup>EDF R&D; <sup>2</sup>Centre Thermique de Lyon

- B-17** Simulation of a Vertical Ground Heat Exchanger as Low Temperature Heat Source for a Closed Adsorption Seasonal Storage of Solar Heat  
*Samuel Hennaut<sup>1</sup>, Philippe André<sup>1</sup>, Elisabeth Davin<sup>1</sup>, Marc Frère<sup>2</sup>, Alexandre Skrylnyk<sup>2</sup>, Sébastien Thomas<sup>1</sup>*  
<sup>1</sup>University of Liège; <sup>2</sup>University of Mons
- B-18** UNISOL – Solar Combistore Evaluation and Optimization  
*Ricardo Amorim<sup>1</sup>, Maria João Carvalho<sup>1</sup>, Jorge Facão<sup>1</sup>, João Carlos Rodrigues<sup>1</sup>*  
<sup>1</sup>LNEG
- C-1** Computational Heat and Fluid Flow Analysis of a Combined Heat and Power Solar Receiver  
*Faisal Ghani<sup>1</sup>, Ahmad Mojiri<sup>1</sup>*  
<sup>1</sup>RMIT University
- C-2** Design of a New Medium-Temperature Stirling Engine for Distributed Solar Cogeneration Applications  
*Fabrizio Alberti<sup>1</sup>, Luigi Crema<sup>1</sup>*  
<sup>1</sup>Fondazione Bruno Kessler
- C-3** Model Based Optimization of a Combined Biomass-Solar Thermal System  
*Florian Stift<sup>1</sup>, Stefan Aigenbauer<sup>2</sup>, Tarik Ferhatbegovic<sup>1</sup>, Michael Hartl<sup>1</sup>, Andreas Simetzberger<sup>3</sup>*  
<sup>1</sup>AIT-Energy Department; <sup>2</sup>bioenergy2020+; <sup>3</sup>SOLARFOCUS GmbH
- C-4** Solar Assisted Heat Pump Systems with Ground Heat Exchanger– Simulation Studies  
*Erik Bertram*  
ISFH
- C-5** Theoretical Evaluation of Night Sky Cooling in the Czech Republic  
*Ondrej Sikula<sup>1</sup>, Katarina Kosutova<sup>1</sup>, Josef Plasek<sup>1</sup>, Jiri Sima<sup>1</sup>*  
<sup>1</sup>Brno University of Technology
- C-6** Characterization of Selective Laser Melting Materials for Micro Co-Generation Solar Plant Components  
*Barbara Rivolta<sup>1</sup>, Fabrizio Alberti<sup>2</sup>, Luigi Crema<sup>2</sup>, Riccardo Gerosa<sup>1</sup>*  
<sup>1</sup>Politecnico di Milano; <sup>2</sup>Fondazione Bruno Kessler
- C-7** Coloured Solar-Thermal Absorbers – a Comparative Analysis of Cermet Structures  
*Anca Duta<sup>1</sup>, Elena Ienei<sup>1</sup>, Aurelia Meghea<sup>2</sup>, Maria Mihaly<sup>2</sup>, Dana Perniu<sup>1</sup>*  
<sup>1</sup>Transilvania University; <sup>2</sup>Politechnica University
- C-8** Development of Glazed and Unglazed PVT Collectors and First Results of their Application in Systems and Pilot and Demonstration Projects  
*Matthias Rommel<sup>1</sup>, Aleksis Baggenstos<sup>1</sup>, Daniel Zenhäusern<sup>1</sup>*  
<sup>1</sup>SPF Institut für Solartechnik
- C-9** Development of Solar Heating using Information and Communication Technologies for Northern Houses  
*Atsuhiko Kawamura<sup>1</sup>, Makoto Arai<sup>1</sup>, Kazunori Chida<sup>1</sup>, Hiroki Hayashi<sup>1</sup>, Hidekazu Kajiwara<sup>2</sup>, Taro Mori<sup>3</sup>, Takafumi Noguchi<sup>1</sup>, Hiroshi Uchiumi<sup>4</sup>*  
<sup>1</sup>Kushiro NCT; <sup>2</sup>Muroran Institute of Tech.; <sup>3</sup>Hokkaido University; <sup>4</sup>ACT Co. Ltd.
- C-10** Evaluation of Combined Solar Thermal Heat Pump Systems Through Dynamic System Simulations  
*Werner Lerch<sup>1</sup>, Richard Heimrath<sup>1</sup>, Andreas Heinz<sup>1</sup>*  
<sup>1</sup>IWT TU Graz
- C-11** Field Test Results from Combined Solar Thermal and Air-Source Heat Pump Systems with a Special Focus on Defrosting  
*Sven Stark<sup>1</sup>, Harald Drück<sup>1</sup>, Anja Loose<sup>1</sup>*  
<sup>1</sup>ITW-University of Stuttgart
- C-12** Heat Pump Systems with Uncovered and Free Ventilated Covered Collectors in Combination with a Small Ice Storage  
*Igor Mojic<sup>1</sup>, Elimar Frank<sup>1</sup>, Michel Haller<sup>1</sup>, Bernard Thissen<sup>2</sup>*  
<sup>1</sup>SPF Institut für Solartechnik; <sup>2</sup>Energie Solaire S.A.
- C-13** High Performance Coatings for Solar Receivers and New Dedicated Manufacturing Solution  
*Michael Zettl*  
Zettl Process Technology
- C-14** Hydraulic Integration and Control of Heat Pump and Combi-Storage: Same Components, Big Differences  
*Michel Haller<sup>1</sup>, Elimar Frank<sup>1</sup>, Robert Haberl<sup>1</sup>, Igor Mojic<sup>1</sup>*  
<sup>1</sup>SPF Institut für Solartechnik

- C-15 Influence of Economic Conditions to the Specific Costs of Cooling by Chilling Machines  
*Janine Bruchmann*  
*SWK-Energiezentrum E<sup>2</sup>*
- C-16 Pipe Internal Recirculation in Storage Connections – Characteristics and Influencing Parameters  
*Jan Steinweg<sup>1</sup>, Francis Kliem<sup>1</sup>, Gunter Rockendorf<sup>1</sup>*  
<sup>1</sup>ISFH
- C-17 Solar-Assisted Heat Pump Test Apparatus: Design, Construction, and Operation  
*Carsen Banister<sup>1</sup>, Michael Collins<sup>1</sup>, Will Wagar<sup>1</sup>*  
<sup>1</sup>University of Waterloo
- C-18 Solar Heat Pump - Flamingohuset  
*Ole Balslev-Olesen*  
*Cenergia Energy Consultants*
- C-19 Thermotropic Glazings: Theoretical and Practical Assessment of Overheating Protection Performance  
*Andreas Weber<sup>1</sup>, Dieter P. Gruber<sup>1</sup>, Katharina Resch<sup>2</sup>*  
<sup>1</sup>PCCL GmbH; <sup>2</sup>University of Leoben
- C-20 Validation of a Single Tank, Multi-Mode Solar-Assisted Heat Pump TRNSYS Model  
*Carsen Banister<sup>1</sup>, Michael Collins<sup>1</sup>, Will Wagar<sup>1</sup>*  
<sup>1</sup>University of Waterloo
- C-21 Web-Based Functionality Check for Solar Heating Systems  
*Sandra Stettler<sup>1</sup>, Werner Gut<sup>2</sup>, Roger Ruch<sup>3</sup>, Thomas Schlegel<sup>4</sup>, Bruno Schläpfer<sup>5</sup>*  
<sup>1</sup>Egon AG; <sup>2</sup>Steca Elektronik GmbH; <sup>3</sup>Industrielle Werke Basel; <sup>4</sup>Meteotest; <sup>5</sup>Ernst Schweizer AG, Metallbau
- D-1 Influence of Oil-Soaked Insulation on the Heat Loss of Thermal Oil Piping Used in High-Temperature Solar Cooling Applications  
*Paul Kohlenbach<sup>1</sup>, Lutz Ackermann<sup>1</sup>, Kira Mörtl<sup>1</sup>, Jeremy Osborne<sup>2</sup>, Gregor Punzel<sup>1</sup>*  
<sup>1</sup>Beuth University of Applied Sciences; <sup>2</sup>Solem Consulting
- D-2 Modeling the Soiling of Glazing Materials in Arid Regions with Geographic Information Systems (GIS)  
*Jan Herrmann<sup>1</sup>, Michael Köhl<sup>1</sup>, Karolina Slamova<sup>1</sup>*  
<sup>1</sup>Fraunhofer ISE
- D-3 Solubility Coefficients for Solar Liquids, a New Method to Quantify Undissolved Gases and Practical Recommendations  
*Martin Heymann<sup>1</sup>, Felix Panitz<sup>1</sup>, Karin Rühling<sup>1</sup>*  
<sup>1</sup>TU Dresden
- D-4 Testing of Components for Solar Thermal Collectors in Respect of Saline Atmospheres  
*Karl-Anders Weiss*  
*Fraunhofer ISE*
- E-1 Comparison Between Solar-Assisted Domestic Water Heating System Configurations for Multi-Family Buildings with Individual Water Consumption Metering, a Case Study for São Paulo - Brazil  
*Lucio Mesquita<sup>1</sup>, Elizabeth Pereira<sup>2</sup>*  
<sup>1</sup>Thermosol Consulting; <sup>2</sup>Centro Universitário UNA
- F-1 Climate Specific Design and Effectiveness of Solar DEC-Systems - A Methodological Zoning Approach  
*Tobias Bader<sup>1</sup>, Sebastian Brandmayr<sup>1</sup>, Vic Hanby<sup>2</sup>, Christoph Trinkl<sup>1</sup>, Wilfried Zörner<sup>1</sup>*  
<sup>1</sup>Ingolstadt University; <sup>2</sup>De Montfort University
- F-2 Life Cycle Assessment of Central Solar Heating Plants with Seasonal Storage  
*Luis M. Serra<sup>1</sup>, Mateo Guadalajara<sup>1</sup>, Miguel A. Lozano<sup>1</sup>, R. Gemma Raluy<sup>1</sup>*  
<sup>1</sup>ISA / Universidad de Zaragoza
- F-3 On Standardizing Solar Cooling – Field Test in the Small Capacity Range  
*Christine Weber<sup>1</sup>, Ingo Daßler<sup>2</sup>, Achim Fregin<sup>3</sup>, Florian Mehling<sup>1</sup>, Peter Schossig<sup>1</sup>*  
<sup>1</sup>Fraunhofer ISE; <sup>2</sup>Sortech AG; <sup>3</sup>Solvis GmbH & Co. KG
- F-4 Operation and Energy Efficiency of an Hybrid Air Conditioner Simultaneously Connected to the Grid and to Photovoltaic Panels  
*Francisco J. Aguilar Valero<sup>1</sup>, Simón Aledo Vives<sup>2</sup>*  
<sup>1</sup>Universidad Miguel Hernández; <sup>2</sup>Prointer, S.L.
- F-5 Simulation Studies on Performance of Solar Cooling System in UAE Conditions  
*Martin Ssembatya<sup>1</sup>, Manoj Kumar Pokhrel<sup>1</sup>, Rajesh Reddy<sup>1</sup>*  
<sup>1</sup>CSEM-UAE
- F-6 Solar Thermal Trigenation System in a Canadian Climate Multi-Unit Residential Building  
*Martin Kegel<sup>1</sup>, Roberto Sunye<sup>1</sup>*  
<sup>1</sup>NRCan - CanmetENERGY

- F-7 Analysis of Net Zero-Energy Building in Spain. Integration of PV, Solar Domestic Hot Water and Air-Conditioning Systems  
*Alessandro Gallo<sup>1</sup>, José Gonzalez Aguilar<sup>1</sup>, Milan Prodanovic<sup>1</sup>, Manuel Romero Álvarez<sup>1</sup>, María Belén Tellez Molina<sup>1</sup>*  
<sup>1</sup>IMDEA Energía
- F-8 An Analysis of Solar Thermal Technologies Integrated into a Canadian Office Building  
*Justin Tamasauskas<sup>1</sup>, Martin Kegel<sup>1</sup>, Roberto Sunye<sup>1</sup>*  
<sup>1</sup>Natural Resources Canada
- F-9 Application of a Novel, Vacuum-Insulated Solar Collector for Heating and Cooling  
*Helfried Burckhart*  
CERN
- F-10 Combined Solar Ejector Heating and Air-Conditioning System  
*Olexiy Buyadgie*  
WILSON/SRTC
- F-11 The Effect of Inlet Velocity and Unbalanced Flow on Optimal Working Conditions of Desiccant Wheels  
*Manuel Intini<sup>1</sup>, Stefano De Antonellis<sup>1</sup>, Cesare Maria Joppolo<sup>1</sup>*  
<sup>1</sup>Politecnico di Milano
- F-12 Exergetic Evaluation of Solar Controller Using Software-In-The-Loop Method  
*Max Huber<sup>1</sup>, Claudius Bons<sup>1</sup>, Dirk Müller<sup>1</sup>, Martin Schmidt<sup>1</sup>*  
<sup>1</sup>RWTH Aachen
- F-13 The Experimental Performance of an Air-Based Photovoltaic-Thermal (PVT) Collector  
*Jin-Hee Kim<sup>1</sup>, Se-Hyun Park<sup>1</sup>*  
<sup>1</sup>Kongju National University
- F-14 German/Egyptian Demonstration Project on Solar Cooling in a Hot Arid Climate  
*Peter Schwerdt*  
Fraunhofer UMSICHT
- F-15 Influence of Hydraulics and Control in Thermal Stores for Solar Assisted Heat Pump Combisystems  
*Stefano Poppi*  
Dalarna University
- F-16 The Influence of Measured/Simulated Weather Data on Evaluating the Energy Need in Buildings  
*Daniela Ciobanu<sup>1</sup>, Elena Eftimie<sup>1</sup>, Codruta Jaliu<sup>1</sup>*  
<sup>1</sup>Transilvania University of Brasov
- F-17 Life Cycle Impact Assessment of a Solar Assisted Heat Pump for Domestic Hot Water Production and Space Heating  
*Sara Eicher<sup>1</sup>, Jacques Bony<sup>1</sup>, Stéphane Citherlet<sup>1</sup>, Catherine Hildbrand<sup>1</sup>, Annelore Kleijer<sup>1</sup>*  
<sup>1</sup>HEIG-VD - LESBAT
- F-18 Optimization of a Hybrid Solar Air Conditioner Using Efficient Approximation Assisted Optimization Technique  
*Ali Al-Alili<sup>1</sup>, Khaled Saleh<sup>2</sup>*  
<sup>1</sup>The Petroleum Institute; <sup>2</sup>University of Maryland
- F-19 Optimizing Solar Collector Tilt Angle to Improve Energy Harvesting in a Solar Cooling System  
*Paolo Corrada<sup>1</sup>, John Bell<sup>1</sup>, Lisa Guan<sup>1</sup>, Cesare Maria Joppolo<sup>2</sup>, Nunzio Motta<sup>1</sup>*  
<sup>1</sup>Queensland University of Technology; <sup>2</sup>Politecnico di Milano
- F-20 Results of System Configurations to Optimize Solar-Driven Desiccant Evaporative Cooling Systems in Full Year Operation  
*Anita Preisler<sup>1</sup>, Markus Brychta<sup>1</sup>*  
<sup>1</sup>AIT
- F-21 Sensitivity Analysis of the New Sizing Tool "PISTACHE" for Solar Heating, Cooling and Domestic Hot Water Systems  
*Hamza Semmari<sup>1</sup>, François Boudehenn<sup>2</sup>, Amandine Le Denn<sup>3</sup>, Franck Lucas<sup>1</sup>, Olivier Marc<sup>1</sup>, Daniel Mugnier<sup>3</sup>, Philippe Papillon<sup>2</sup>, Jean Philippe Praene<sup>1</sup>*  
<sup>1</sup>PIMENT laboratory; <sup>2</sup>CEA; <sup>3</sup>TECHSOL
- F-22 Solar Cooling & Heating Systems to Transform Low Energy Buildings in Nearly Zero Energy Buildings  
*Macedon Moldovan<sup>1</sup>, Bogdan Burduhos<sup>1</sup>, Ion Visa<sup>1</sup>*  
<sup>1</sup>Transilvania University of Brasov
- F-23 Solar Heating and Cooling System with Absorption Chiller and Latent Heat Storage - A Research Project Summary -  
*Kilian Hagel<sup>1</sup>, Martin Helm<sup>1</sup>, Stefan Hiebler<sup>1</sup>, Werner Pfeffer<sup>1</sup>*  
<sup>1</sup>ZAE Bayern

- F-24 Sorption Composite Materials for Solar Thermal Energy Storage  
*Alenka Ristic<sup>1</sup>, Stefan Henninger<sup>2</sup>*  
<sup>1</sup>Nation. Institute of Chemistry; <sup>2</sup>Fraunhofer ISE
- F-25 Two-Stage Air-Dehumidification System for Tropical Climate  
*MD Arifeen Wahed<sup>1</sup>, Constanze Bongs<sup>2</sup>, Hans-Martin Henning<sup>2</sup>, Joachim Luther<sup>1</sup>, Alexander Morgenstern<sup>2</sup>, M. Reza Safizadeh<sup>1</sup>, Khin Zaw<sup>1</sup>*  
<sup>1</sup>SERIS; <sup>2</sup>Fraunhofer ISE
- G-1 Control Aspects of Decentralised Solar Thermal Integration into District Heating Networks  
*Ilyes Ben Hassine<sup>1</sup>, Ursula Eicker<sup>1</sup>*  
<sup>1</sup>HfT Stuttgart
- G-2 Decentralized Solar District Heating for a New Eco District in France: Design, Performance and Energy Cost  
*Cedric Paulus<sup>1</sup>, Philippe Papillon<sup>1</sup>*  
<sup>1</sup>CEA-INES
- G-3 Development of a Solar District Heating Online Calculation Tool  
*Laure Deschaintre<sup>1</sup>, Thomas Pauschinger<sup>1</sup>*  
<sup>1</sup>Solites
- H-1 Design and Simulation of a Solar Field Coupled to a Cork Boiling Plant  
*Lourdes González Martínez<sup>1</sup>, Mario Biencinto Murga<sup>1</sup>, Arantxa Fernandez García<sup>1</sup>, Loreto Valenzuela Guierrez<sup>1</sup>*  
<sup>1</sup>Ciemat-PSA
- H-2 Design, Control and First Monitoring Data of a Large Scale Solar Plant at the Meat Factory Berger, Austria  
*Robert Söll<sup>1</sup>, Mariela Cotrado<sup>2</sup>, Antoine Dalibard<sup>2</sup>, Dirk Pietruschka<sup>2</sup>*  
<sup>1</sup>S.O.L.I.D. GmbH; <sup>2</sup>zahf.net
- H-3 Development of an Integrated Solar-Fossil Powered Steam Generation System for Industrial Applications  
*Olaf Stoppok<sup>1</sup>, Klaus Hennecke<sup>2</sup>, Christian Zahler<sup>3</sup>*  
<sup>1</sup>Viessmann Werke Berlin GmbH; <sup>2</sup>DLR; <sup>3</sup>Industrial Solar GmbH
- H-4 Increasing Sustainable Energy Supply in Industry: Assessment of the Economic Efficiency of Solar Thermal Energy in Industrial Applications on the Basis of Different Implementation Concepts  
*Marcus Hummel<sup>1</sup>, Christoph Brunner<sup>2</sup>, Jürgen Fluch<sup>2</sup>, Felix Hummel<sup>3</sup>, Lukas Kranzl<sup>1</sup>*  
<sup>1</sup>Energy Economics Group; <sup>2</sup>AEE INTEC; <sup>3</sup>University of Vienna
- H-5 Process Heat Generation with Parabolic-Trough Collectors for a Vegetables Preservation Industry in Southern Spain  
*Ricardo Silva<sup>1</sup>, Francisco Javier Cabrera<sup>1</sup>, Manuel Pérez-García<sup>1</sup>*  
<sup>1</sup>University of Almería
- H-6 Solar Driven Desalination by Membrane Distillation  
*Joachim Koschikowski<sup>1</sup>, Florian Groß<sup>1</sup>, Martin Rolletschek<sup>1</sup>, Rebecca Schwantes<sup>1</sup>, Daniel Winter<sup>1</sup>*  
<sup>1</sup>Fraunhofer ISE
- H-7 Solar Thermal Plant Integration into an Industrial Process  
*Antoine Frein<sup>1</sup>, Marco Calderoni<sup>1</sup>*  
<sup>1</sup>POLIMI
- H-8 Climate Relevance in Solar Process Heat System Optimization - Case Studies with Different Temperature and Load Profiles  
*Werner Platzer*  
 Fraunhofer ISE
- H-9 Solar Process Heat for a Galvanic Company  
*Peter Pärtsch<sup>1</sup>, Christina Bleiker<sup>1</sup>*  
<sup>1</sup>ISFH
- H-10 Storage in Solar Process Heat Applications  
*Sebastian Schramm*  
 Fachhochschule Düsseldorf
- I-1 Design and Realization of a Solar Adsorption Refrigeration Machine Powered by Solar Energy  
*Mohand Berdja<sup>1</sup>, Brahim Abbad<sup>1</sup>, Bouzeffour Fateh<sup>1</sup>*  
<sup>1</sup>UDES
- I-2 History and Status of Solar Cooling in the United States  
*Mark Thornbloom*  
 Kelelo Engineering



- J-1 BiPV System Performance and Efficiency Drops: Overview on PV Operating Temperature Conditions of Different Module Categories  
*Laura Maturi<sup>1</sup>, Giorgio Belluardo<sup>1</sup>, Matteo Del Buono<sup>1</sup>, David Moser<sup>1</sup>*  
<sup>1</sup>EURAC
- J-2 Cross-Night Ventilation Measurements in Building Free Cooling Applications  
*Hervé Pabiou<sup>1</sup>, Sergio Diaz de Garayo<sup>2</sup>, Christophe Ménézo<sup>1</sup>, Damien Rabourdin<sup>1</sup>*  
<sup>1</sup>INSA Lyon ; <sup>2</sup>University Zaragoza
- J-3 Angular Dependence of Solar Reflectance and Calculation Method for the Optimisation of Solar Gains  
*Emiliano Carnielo<sup>1</sup>, Giuseppe Rossi<sup>2</sup>, Michele Zinzi<sup>3</sup>*  
<sup>1</sup>Università Roma Tre; <sup>2</sup>INRIM; <sup>3</sup>ENEA
- J-4 Experimental Study of Thermal Response of PV Modules Integrated into Naturally-Ventilated Double Skin Facades  
*Leon Gaillard<sup>1</sup>, Stéphanie Giroux<sup>1</sup>, Rémi Le-Berre<sup>2</sup>, Christophe Ménézo<sup>1</sup>, Hervé Pabiou<sup>1</sup>*  
<sup>1</sup>INSA Lyon <sup>2</sup>EDF
- J-5 From Solar Building Design to Net Zero Energy Buildings: Performance Insights of an Office Building  
*Laura Aelenei*  
LNEG
- J-6 ISIS Facchinetti: A Nearly Zero Energy Retrofit in Italy  
*Michele Sauchelli<sup>1</sup>, Gabriele D'Antona<sup>1</sup>, Giampaolo Manzolini<sup>1</sup>, Gabriele Maserà<sup>1</sup>*  
<sup>1</sup>Politecnico di Milano
- J-7 Spectral Light Transmission Measure of Metal Screens for Glass Façades and Assessment of their Shading Potential  
*Andrea Giovanni Mainini<sup>1</sup>, Tiziana Poli<sup>1</sup>, Michele Zinzi<sup>2</sup>*  
<sup>1</sup>Politecnico di Milano; <sup>2</sup>ENEA
- K-1 Comparison Assessment of BIPV Façade Semi-Transparent Modules: Further Insights on Human Comfort Conditions  
*Cristina S. Polo López<sup>1</sup>, F. Javier Neila González<sup>2</sup>*  
<sup>1</sup>ISAAC-SUPSI; <sup>2</sup>ETSAM - UPM Madrid
- K-2 Design of Solar Water Heating System for Detached House in Cold Climate Area  
*Taro Mori<sup>1</sup>, Atsushi Kawamura<sup>2</sup>*  
<sup>1</sup>Hokkaido University; <sup>2</sup>KNCT
- K-3 Development of Multifunctional Building Components - Comparison of Different Concepts  
*Natalie Gohl<sup>1</sup>, Harald Drück<sup>1</sup>, Anja Loose<sup>1</sup>, Sven Stark<sup>1</sup>*  
<sup>1</sup>ITW-University of Stuttgart
- K-4 The Experimental Performance of Heating System with BIPV-Thermal Collector  
*Jin-Hee Kim<sup>1</sup>, Se-Hyun Park<sup>1</sup>*  
<sup>1</sup>Kongju National University
- K-5 Experimental Testing under Real Conditions of Different Solar Building Skins when Using Multifunctional BIPV Systems  
*Francesco Frontini<sup>1</sup>, Gabi Friesen<sup>1</sup>, Thomas Friesen<sup>1</sup>, Cristina Polo Lopez<sup>1</sup>*  
<sup>1</sup>SUPSI - ISAAC
- K-7 PV as a Building Component: Testing Experience  
*Francesco Frontini<sup>1</sup>, Thomas Friesen<sup>1</sup>*  
<sup>1</sup>SUPSI - ISAAC
- K-8 Thermal Analysis of Flat and Transpired Solar Facades  
*Hoy Yen Chan<sup>1</sup>, Saffa Riffat<sup>2</sup>, Kamaruzzaman Sopian<sup>1</sup>, Jie Zhu<sup>2</sup>*  
<sup>1</sup>Solar Energy Research Institut; <sup>2</sup>University of Nottingham
- K-9 Thermal Energy Load Based Adaptive Algorithm for Flat Solar Collectors Tracking Systems  
*Mircea Neagoe<sup>1</sup>, Bogdan Burduhos<sup>1</sup>, Macedon Moldovan<sup>1</sup>, Radu Saulescu<sup>1</sup>*  
<sup>1</sup>Transilvania University of Brasov
- L-1 Calculation Model for Optimization Design of the Low Impact Energy Systems for the Buildings  
*Roberto De Lieto Vollaro<sup>1</sup>, Gabriele Battista<sup>1</sup>, Fabio Botta<sup>1</sup>, Matteo Calvesi<sup>1</sup>, Luca Evangelisti<sup>1</sup>*  
<sup>1</sup>University of Rome 3
- L-2 Research of Economic Sustainability of Different Energy Refurbishment Strategies for an Apartment Block Building  
*Enrico De Angelis<sup>1</sup>, Giorgio Pansa<sup>1</sup>, Ermanno Serra<sup>2</sup>*  
<sup>1</sup>Politecnico di Milano; <sup>2</sup>Università degli Studi Brescia

- M-1 Assessment of Thermal Stress in a Street Canyon in Pedestrian Area with or without Canopy Shading  
*Riccardo Paolini*<sup>1</sup>, *Andrea Giovanni Mainini*<sup>1</sup>, *Tiziana Poli*<sup>1</sup>, *Andrea Vallati*<sup>2</sup>  
<sup>1</sup>Politecnico di Milano; <sup>2</sup>Università la sapienza di Roma
- M-2 Solar Urban Planning: a Parametric Approach  
*Miguel Amado*<sup>1</sup>, *Francesca Poggi*<sup>1</sup>  
<sup>1</sup>Faculdade Ciências Tecnologia
- M-3 Analysis of the Role of Solar Space Heating in the Progress of China's Urbanization  
*Tao He*<sup>1</sup>, *Min Wang*<sup>1</sup>  
<sup>1</sup>CABR
- M-4 PV Integration in Minor Historical Centers: Proposal of Guide-Criteria in Post-Earthquake Reconstruction Planning  
*Pierluigi Bonomo*<sup>1</sup>, *Pierluigi De Berardinis*<sup>1</sup>  
<sup>1</sup>University of L'Aquila
- N-1 The Solar Map as a Decision Support Tool  
*Jouri Kanters*<sup>1</sup>, *Elisabeth Kjellsson*<sup>1</sup>, *Maria Wall*<sup>1</sup>  
<sup>1</sup>Lund University
- N-2 Typical Values for Active Solar Energy in Urban Planning  
*Jouri Kanters*<sup>1</sup>, *Marie-Claude Dubois*<sup>1</sup>, *Maria Wall*<sup>1</sup>  
<sup>1</sup>Lund University
- O-1 Classification of Rating Methods for Solar Heating and Cooling Systems  
*Matthias Schick Tanz*<sup>1</sup>, *Roberto Fedrizzi*<sup>2</sup>, *Christian Schmidt*<sup>1</sup>  
<sup>1</sup>Fraunhofer ISE; <sup>2</sup>EURAC Research
- O-2 Calculation of Solar Gains for Solar Heating and Cooling Using the Bin-Method  
*Matthias Schick Tanz*<sup>1</sup>, *Jochen Döll*<sup>1</sup>, *Hannes Fugmann*<sup>1</sup>  
<sup>1</sup>Fraunhofer ISE
- P-1 Solar Heating and Cooling Application Potential and Application Case Analysis in New-type Urbanization in China  
*Xuan Wang*<sup>1</sup>, *Tao He*<sup>1</sup>  
<sup>1</sup>CABR
- Q-1 Comparison of Simple Methods for the Design of Central Solar Heating Plants with Seasonal Storage  
*Mateo Guadalfajara*<sup>1</sup>, *Miguel A. Lozano*<sup>1</sup>, *Luis M. Serra*<sup>1</sup>  
<sup>1</sup>Universidad de Zaragoza
- Q-2 A Simple Method to Calculate Central Solar Heating Plants with Seasonal Storage  
*Mateo Guadalfajara*<sup>1</sup>, *Miguel A. Lozano*<sup>1</sup>, *Luis M. Serra*<sup>1</sup>  
<sup>1</sup>Universidad de Zaragoza
- Q-3 Solar Thermal Potential for Collective Systems in Palma Beach (Balearic Island's).  
*Andreu Moia-Pol*<sup>1</sup>, *Ramon Pujol-Nadal*<sup>1</sup>, *Josep Maria Rigo*<sup>1</sup>  
<sup>1</sup>Universitat de les Illes Balear

**13:00 - 14:00**

**Lunch Break**



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## 14:00 - 15:45 Session MON-3A: Solar Thermal Collectors

Room: Rolf-Böhme-Saal

Chair: Matthias Rommel

- 14:00 Development of an Insulated Glass Solar Thermal Collector  
*Federico Giovannetti<sup>1</sup>, Maik Kirchner<sup>1</sup>, Gunter Rockendorf<sup>1</sup>*  
<sup>1</sup> ISFH
- 14:15 PVT Collector Development  
*Stefan Fortuin<sup>1</sup>, Michael Hermann<sup>1</sup>, Peter Nitz<sup>1</sup>, Werner Platzer<sup>1</sup>, Gerhard Stryi-Hipp<sup>1</sup>*  
<sup>1</sup> Fraunhofer ISE
- 14:30 Performance and Economic Analysis of Hybrid PVT Collectors in Solar DHW System  
*Tomas Matuska*  
Czech Technical University
- 14:45 Quantifying Optical Loss Factors of Small Linear Concentrating Collectors for Process Heat Applications  
*Anna Heimsath<sup>1</sup>, Peter Nitz<sup>1</sup>, DeWet Van Rooyen<sup>1</sup>*  
<sup>1</sup> Fraunhofer ISE
- 15:00 New Cermet Coatings for Mid-Temperature Applications for Solar Concentrated Combined Heat and Power Systems  
*Ewa Wackelgard*  
Uppsala University
- 15:15 Novel Selective Coatings for Flat Plate and Tubular Absorbers Based on Sol Gel Paints  
*Mohor Mihelčič<sup>1</sup>, Janko Jamnik<sup>1</sup>, Ivan Jerman<sup>1</sup>, Dimitrios Peros<sup>2</sup>*  
<sup>1</sup> National Institut of Chemistry Slovenia; <sup>2</sup> ALANOD GmbH & Co. KG

## 14:00 - 15:45 Session MON-3B: Solar Architecture / Urban Planning

Room: Runder Saal

Chair: Maria Wall

- 14:00 Experimental Analysis of an Advanced Dynamic Glazing Prototype Integrating PCM and Thermotropic Layers  
*Francesco Goia<sup>1</sup>, Lorenza Bianco<sup>1</sup>, Ylenia Cascone<sup>1</sup>, Marco Perino<sup>1</sup>, Valentina Serra<sup>1</sup>*  
<sup>1</sup> Politecnico di Torino
- 14:15 Two Years of Experience with a Net Zero Energy Balance – Analysis of the Swiss MINERGIE-A® Standard  
*Monika Hall*  
Institut Energie am Bau FHNW
- 14:30 Novel Type of Façade-Window Collector-Double Benefits: Good Architectural Appearance of Façade and Solving the Problems of Long Term Stability/Efficiency  
*Ilija Nasov<sup>1</sup>, Michael Köhl<sup>2</sup>, Anka Trajkovska Petkoska<sup>3</sup>*  
<sup>1</sup> Plasma Ltd.; <sup>2</sup> Fraunhofer ISE; <sup>3</sup> University St. Kliment Ohridski

14:45 Solar Energy in Urban Environment: How Urban Densification Effect Existing Buildings

*Gabriele Lobaccaro<sup>1</sup>, Francesco Frontini<sup>2</sup>*

<sup>1</sup> Politecnico di Milano; <sup>2</sup> SUPSI

15:00 European Energy Avantgarde

*Markus Kratz<sup>1</sup>*

<sup>1</sup> Forschungszentrum Jülich

15:15 Transparent Multilayer ETFE Panels for Building Envelope: Thermal Transmittance Evaluation and Assessment of Optical and Solar Performance Decay Due to Soiling

*Andrea Giovanni Mainini<sup>1</sup>, Riccardo Paolini<sup>1</sup>, Tiziana Poli<sup>1</sup>, Michele Zinzi<sup>2</sup>*

<sup>1</sup> Politecnico di Milano; <sup>2</sup> ENEA - UTEE ERT

## **14:00 - 15:45 Session MON-3C: Water Heating / Solar Heating and Air-conditioning / District Heating / Solar Heat in Multi Dwellings and Collective Systems**

Room: K9

*Chair: Jan-Erik Nielsen*

14:00 Numerical Study on the Thermal Environment of UFAD System with Solar Chimney for the Data Center

*Kai Zhang<sup>1</sup>, Shuhong Li<sup>1</sup>, Geng Wang<sup>1</sup>, Xiaosong Zhang<sup>1</sup>*

<sup>1</sup> Southeast University

14:15 Large Solar Assisted Heat Pump Systems in Collective Housing: In-Situ Monitoring Results for Summer Season

*Carolina Fraga<sup>1</sup>, Pierre Hollmuller<sup>1</sup>, Bernard Lachal<sup>1</sup>, Floriane Mermoud<sup>1</sup>, Eric Pampaloni<sup>1</sup>*

<sup>1</sup> Université de Genève

14:30 Innovative Compact Solar Air Conditioner Based on Fixed and Cooled Adsorption Beds and Wet Heat Exchangers

*Pietro Finocchiaro<sup>1</sup>, Marco Beccali<sup>1</sup>*

<sup>1</sup> University of Palermo

14:45 Field Test of an Advanced Solar Thermal and Heat Pump System with Solar Roof Tile Collectors and Geothermal Heat Source

*Anja Loose<sup>1</sup>, Harald Drück<sup>1</sup>*

<sup>1</sup> ITW-University of Stuttgart

15:00 Performance of a 23KW Solar Thermal Cooling System Employing a Double Effect Absorption Chiller and Non-Tracking Concentrators

*Roland Winston<sup>1</sup>, Lun Jiang<sup>1</sup>, Bennett Widyolar<sup>1</sup>*

<sup>1</sup> University of California

**15:45 - 16:15 Coffee Break**

## 16:15 - 18:00 Session MON-4A: Solar Thermal Collectors

Room: Rolf-Böhme-Saal

Chair: Klaus Vajen

- 16:15 Analysis of the Mechanical Behaviour of an All-Round Fully Adhesive Supported Absorber  
*Hermann Riess<sup>1</sup>, Sebastian Brandmayr<sup>1</sup>, Richard Greenough<sup>2</sup>, Wilfried Zörner<sup>1</sup>*  
<sup>1</sup>Hochschule Ingolstadt; <sup>2</sup>De Montfort University
- 16:30 Analysis of the Overheating and Stagnation Problems of Solar Thermal Installations  
*Pedro G. Vicente Quiles<sup>1</sup>, Francisco J. Aguilar Valero<sup>1</sup>*  
<sup>1</sup>Universidad Miguel Hernández
- 16:45 Characterization and Energy Performance of a Slurry PCM-based Solar Thermal Collector: A Numerical Analysis  
*Gianluca Serale<sup>1</sup>, Sara Baronetto<sup>1</sup>, Francesco Goia<sup>1</sup>, Marco Perino<sup>1</sup>*  
<sup>1</sup>Politecnico di Torino
- 17:00 Development of Collector Integrated Sorption Modules for Solar Heating and Cooling: Performance Simulation  
*Olof Hallström<sup>1</sup>, Gerrit Fuedner<sup>2</sup>, Frank Salg<sup>3</sup>*  
<sup>1</sup>Mälardalen University; <sup>2</sup>Fraunhofer ISE; <sup>3</sup>Vaillant GmbH
- 17:15 Green Systems: Bioplastics for Solar Thermal Applications  
*Katharina Resch*  
University of Leoben
- 17:30 Performance Optimisation of Polymeric Collectors by Means of Dynamic Simulation and Sensitivity Analysis  
*Christoph Reiter<sup>1</sup>, Sebastian Brandmayr<sup>1</sup>, Vic Hanby<sup>2</sup>, Christoph Trinkl<sup>1</sup>, Wilfried Zörner<sup>1</sup>*  
<sup>1</sup>Ingolstadt University; <sup>2</sup>De Montfort University

## 16:15 - 18:00 Session MON-4B: Building Integration

Room: Runder Saal

Chair: Christian Röcker

- 16:15 Urban Acceptance and Energy Efficiency of Facade Integrated Solar Thermal Collectors  
*Ion Visa<sup>1</sup>, Mihai Comsit<sup>1</sup>, Florin Lordache<sup>2</sup>*  
<sup>1</sup>Transilvania University of Brasov; <sup>2</sup>University of Civil Engineerin
- 16:30 Barriers of the Market Penetration of Façade-Integrated Solar Thermal Systems  
*Christoph Cappel<sup>1</sup>, Tilmann E. Kuhn<sup>1</sup>, Christoph Maurer<sup>1</sup>*  
<sup>1</sup>Fraunhofer ISE
- 16:45 Monolithic Masonry with PCM for Thermal Management  
*Bernd Gassenfeit<sup>1</sup>, Dieter Brüggemann<sup>1</sup>*  
<sup>1</sup>Universität Bayreuth

17:00 Net Zero Energy Buildings Solution Sets: Lessons Learned from International Projects  
*Francois Garde*<sup>1</sup>  
<sup>1</sup> University of La Reunion

17:15 First Measurement Results of a Pilot Building with Transparent Façade Collectors  
*Christoph Maurer*<sup>1</sup>, *Joze Hafner*<sup>2</sup>, *Sabina Jordan*<sup>2</sup>, *Tilmann E. Kuhn*<sup>1</sup>, *Thibault Pflug*<sup>1</sup>  
<sup>1</sup> Fraunhofer ISE; <sup>2</sup> ZAG

**16:15 - 18:00 Session MON-4C: Water Heating / Solar Heating and Air-conditioning / District Heating / Solar Heat in Multi Dwellings and Collective Systems**

Room: K9

*Chair: Daniel Mugnier*

16:15 Minimization of the Residual Energy Demand of Multi-Storey Passive Houses – Energetic and Economic Analysis of Solar Thermal and PV in Combination with a Heat Pump  
*Fabian Ochs*<sup>1</sup>, *Georgios Dermentzis*<sup>1</sup>  
<sup>1</sup> University of Innsbruck

16:30 Polymeric Solar Collectors or Heat Pump? Lessons Learned from Passive Houses in Oslo  
*Michaela Meir*<sup>1</sup>, *Espen Murtnes*<sup>1</sup>, *John Rekstad*<sup>1</sup>  
<sup>1</sup> University of Oslo

16:45 Numerical Analysis of the Use of R-407C in Direct Expansion Solar Assisted Heat Pump  
*Luca Molinaroli*  
Politecnico di Milano

17:00 A Micro Photovoltaic-Heat Pump System for House Heating by Radiant Floor: Some Experimental Results  
*Marcelo Izquierdo*<sup>1</sup>, *Pablo de Agustin*<sup>1</sup>, *Emilio Martin*<sup>1</sup>  
<sup>1</sup> Instituto C.C. Eduardo Torroja

17:15 Solar-Active-Houses- Analyses of the Building Concept Based on Detailed Measurements  
*Axel Oliva*  
Fraunhofer ISE

17:30 A Simplified Design Tool for Solar DHW Systems in Multi-Family Houses with Decentralized Storages  
*Philippe Papillon*<sup>1</sup>, *David Cheze*<sup>1</sup>, *Florent Lefrançois*<sup>1</sup>, *Cédric Paulus*<sup>1</sup>  
<sup>1</sup> CEA-INES

**18:00 - 19:00 Happy Hour Bar**

**18:30 - 19:30 Sightseeing Tours**

## Tuesday, September 24, 2013

### **09:00 - 10:45 Plenary TUE-1: Market Reports and Framework Conditions**

Room: Rolf-Böhme-Saal

*Chair: Xavier Noyon*

- 09:00 Classification of Demand Side Support Schemes: Pros and Cons of Different Models  
*Bärbel Epp*  
*Solrico*
- 09:25 The Future of Solar Thermal Energy in Buildings - Important Pillar or Minor Element?  
*Gerhard Stryi-Hipp*  
*Fraunhofer ISE*
- 09:50 Renovate Europe: How to Trigger Energy Efficient Renovation in Europe  
*Adrian Joyce*  
*Renovate Europe*
- 10:15 Implementation of the Energy Performance of Buildings Directive: Which Role for Renewable Heating?  
*Oliver Rapf*  
*BPIE*

**10:45 - 11:15 Coffee Break**

### **11:15 - 13:00 Plenary TUE-2: Panel Discussion**

Room: Rolf-Böhme-Saal

*Chair: Uwe Trenkner, Pedro Dias*

Nearly Zero Energy Buildings and Energy Renovation - What is the Role for Solar Thermal Technologies?

**13:00 - 14:00 Lunch Break**



**Bärbel Epp**

*solrico*



Bärbel Epp is managing director of the agency solrico – solar market research & international communication. She is responsible for the international newsletter of [www.solarthermalworld.org](http://www.solarthermalworld.org). solrico has launched a business climate index called ISOL Index analysing the market development in the global solar thermal industry. She graduated in physics and looks back at 15 years of journalism and market research in the field of solar energy.

**Adrian Joyce**

*EuroACE*



Adrian Joyce qualified as an architect in 1984 and, after 18 years in private practice, started to work in architectural policy. He first held a post as Director of the Royal Institute of Architects of Ireland (RIAI) and then as Director at the Architects' Council of Europe (ACE). In 2011 he took up the post of Secretary General at the European Alliance of Companies for Energy Efficiency in Buildings (EuroACE) and also became Director of the Renovate Europe Campaign. He is also a part time lecturer in construction technology at the Faculty of Architecture (LOCI) at the Catholic University of Louvain-le-Neuve.

**Oliver Rapf**

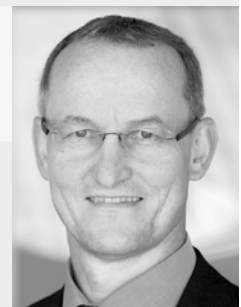
*BPIE*



Oliver Rapf is Executive Director of the Buildings Performance Institute Europe, a think-do-tank with a focus on energy and the built environment and represents BPIE in the Executive Committee of the Global Buildings Performance Network (GBPN). Before that, Oliver worked as Head of the Climate Business Engagement unit of WWF International, managing strategy and partnership development with the private sector. Leading an international team, he advised multinational companies on climate change and energy issues. His experience in buildings efficiency goes back to the late 90s when he was a project leader for several deep renovation projects on behalf of WWF in cooperation with housing companies across Germany.

**Gerhard Stryi-Hipp**

*Fraunhofer ISE*



Gerhard Stryi-Hipp is a physicist and is working in the solar energy sector since 1992. Until 2008, he was managing director of the German Solar Industry Association BSW-Solar and its predecessors. In 2009 he moved to the Fraunhofer Institute for Solar Energy Systems ISE as Head of Energy Policy and Group Leader Solar Thermal Systems. Currently he is leading research on solar thermal energy in the field of Photovoltaic-Thermal Hybrid Collectors and Solar-Active-Houses with high solar fraction of their heating demand. Since 2011, he is coordinating the topic »Smart Energy Cities« at Fraunhofer ISE. Gerhard Stryi-Hipp is president of the European Technology Platform on Renewable Heating and Cooling and chairman of the Solar Thermal Panel of the platform.

## 14:00 - 15:45 Session TUE-3A: Market Reports and Framework Conditions

Room: Rolf-Böhme-Saal

Chair: *Pedro Dias*

- 14:00 The "Conto Termico": A New Support Scheme for Solar Thermal in Italy  
*Riccardo Battisti*  
*Ambiente Italia*
- 14:15 The Egyptian Programme for Promotion of Solar Thermal  
*Khaled Gasser*  
*SEDA*
- 14:30 Solar Thermal Consumer Decisions Regarding Preferences of Immediate Over Future Benefits  
*Jan-Peter Seevers*  
*Universität Kassel*
- 14:45 The Turkish Solar Thermal Market  
*Bulent Yesilata*  
*Harran University*
- 15:00 The Tunisian Solar Thermal Market, the Change of Scale  
*Abdelkader Baccouche*  
*National Agency of Energy*

## 14:00 - 15:45 Session TUE-3B: Building Renovation

Room: Runder Saal

Chair: *Hans-Martin Henning*

- 14:00 New Construction of an Energy-Surplus Day Care Center for Children to Experience Energy-Efficiency  
*Anna Hoier<sup>1</sup>, Hans Erhorn<sup>1</sup>*  
<sup>1</sup> *Fraunhofer IBP*
- 14:15 Renovation of Non-Residential Buildings Towards NZEB Standards - Lessons Learned from Exemplary Projects  
*Fritjof Salvesen*  
*Asplan Viak AS*
- 14:30 The Use of Attached-Sunspaces in Retrofitting Design: The Case of Residential Buildings in Portugal  
*Daniel Aelenei<sup>1</sup>, Laura Aelenei<sup>2</sup>, Hugo Leal<sup>1</sup>*  
<sup>1</sup> *Universidade Nova de Lisboa*; <sup>2</sup> *LNEG*
- 14:45 Energy Efficiency and Renewable Solar Energy Integration in Historical Buildings Heritage  
*Cristina S. Polo López<sup>1</sup>, Francesco Frontini<sup>1</sup>*  
<sup>1</sup> *ISAAC-SUPSI*

15:00 Sustainable Renovation of Non Residential Buildings, a Response to Lowering the Environmental Impact of the Building Sector in Europe

*Sophie Trachte*<sup>1</sup>, *Fritjof Salvesen*<sup>2</sup>  
<sup>1</sup> Université catholique de Louvain; <sup>2</sup> Asplan Viak AS

15:15 Development of Zero Energy Houses with Air Heating PVT Collector

*Mitsuhiro Udagawa*<sup>1</sup>, *Takafumi Kusunoki*<sup>2</sup>, *Hyunwoo Roh*<sup>2</sup>  
<sup>1</sup> Kogakuin University; <sup>2</sup> OM Solar Inc.

## 14:00 - 15:45 Session TUE-3C: Thermal Storage

Room: K9

*Chair: Jean-Christophe Hadorn*

14:00 Thermal Storage by Thermoreversible Chemical Reaction Systems

*Stefano Bruzzano*<sup>1</sup>, *Görge Deerberg*<sup>1</sup>, *Bärbel Egenolf-Jonkmanns*<sup>1</sup>, *Matthias Fischer*<sup>1</sup>,  
*Holger Wack*<sup>1</sup>, *Barbara Zeidler-Fandrich*<sup>1</sup>  
<sup>1</sup> Fraunhofer UMSICHT

14:15 Physicochemical and Thermal Study of a PCS of PMMA Shell and Paraffin Wax as a Core

*Jessica Giró-Paloma*<sup>1</sup>, *Camila Barreneche*<sup>1</sup>, *Luisa F. Cabeza*<sup>2</sup>, *Mónica Delgado*<sup>3</sup>,  
*A. Inés Fernández*<sup>1</sup>, *Mònica Martínez*<sup>1</sup>  
<sup>1</sup> University of Barcelona; <sup>2</sup> Universitat de Lleida; <sup>3</sup> University of Zaragoza

14:30 Novel Latent Heat Storages for Solar Thermal Applications

*Katharina Resch*<sup>1</sup>, *Alexander Klutz*<sup>1</sup>  
<sup>1</sup> University of Leoben

14:45 Experimental Studies of Mechanism and Kinetics of Hydration Reactions

*Kirsten Linnow*<sup>1</sup>, *Dennis Bonatz*<sup>1</sup>, *Michael Niermann*<sup>1</sup>, *Michael Steiger*<sup>1</sup>  
<sup>1</sup> University of Hamburg

15:00 Steamed Zeolites for Heat Pump Applications and Solar Driven Thermal Adsorption Storage

*Thomas Herzog*<sup>1</sup>, *Jochen Jänchen*<sup>1</sup>, *Eythymios Kontogeorgopoulos*<sup>2</sup>, *Wolfgang Lutz*<sup>3</sup>  
<sup>1</sup> TH Wildau; <sup>2</sup> InvenSor GmbH; <sup>3</sup> BTU Cottbus

## 14:00 - 15:45 Side Event: Energy Avantgarde

Room: K5-6

*Chair: Markus Kratz*

for more information see page 38

15:45 - 16:15 **Coffee Break**

## 16:15 - 18:00 Session TUE-4A: Market Reports and Framework Conditions

Room: Rolf-Böhme-Saal

Chair: Lex Bosselaar

- 16:15 Solar Thermal Strategic Research Priorities of the European Technology Platform on Renewable Heating and Cooling  
*Gerhard Stryi-Hipp<sup>1</sup>, Pedro Dias<sup>2</sup>, Daniel Mugnier<sup>3</sup>, Werner Weiß<sup>4</sup>*  
<sup>1</sup> Fraunhofer ISE; <sup>2</sup> ESTIF; <sup>3</sup> Tecsol SA; <sup>4</sup> AEE INTEC
- 16:30 Technological Forecasting: Heat Pumps and the Synergy with Renewable Energy  
*Antonio Carlos Ventilii Marques<sup>1</sup>, Wagner Oliveira<sup>1</sup>*  
<sup>1</sup> UNICAMP - Brazil
- 16:45 The Roadmap Research of China Solar Thermal Development  
*Ruicheng Zheng<sup>1</sup>, Tao He<sup>1</sup>, Xuan Wang<sup>1</sup>*  
<sup>1</sup> China Academy of Building Research
- 17:00 New Developments in Home Automation – Opportunities and Challenges for Solar Thermal  
*Uwe Trenkner*  
Trenkner Consulting
- 17:15 Solar Thermal – Ecodesign and Energy Label  
*Gerard Van Amerongen*  
vA Consult
- 17:30 Collective Solar Thermal System : The French Path to Competitiveness  
*Philippe Gay*  
ENERPLAN

## 16:15 - 18:00 Session TUE-4B: Other Innovative Components and Systems

Room: Runder Saal

Chair: Harald Drück

- 16:15 The PHOTOTHERM Project: Full Scale Experiments and Modeling of a Photovoltaic - Thermal (PV-T) Hybrid System for Domestic Hot Water Application  
*Pierrick Haurant<sup>1</sup>, Patrick Dupeyrat<sup>2</sup>, Christophe Ménézo<sup>1</sup>*  
<sup>1</sup> INSA Lyon; <sup>2</sup> EDF - R&D
- 16:30 Experimental Study on the Performance of Membrane Based Multi-Effect Dehumidifier Regenerator Powered by Solar Energy  
*M Kumja<sup>1</sup>, F.H. Choo<sup>1</sup>, Kui Zhao<sup>2</sup>*  
<sup>1</sup> Energy Research Institute @ NTU; <sup>2</sup> Memsys Clearwater Pte. Ltd
- 16:45 Thermal Performance of a Hybrid BIPV-PCM: Modeling, Design and Experimental Investigation  
*Laura Aelenei*  
LNEG

- 17:00 Seasonal Performance of a Combined Solar, Heat Pump and Latent Heat Storage System  
*Christian Winteler<sup>1</sup>, Thomas Afjei<sup>1</sup>, Ralf Dott<sup>1</sup>*  
<sup>1</sup> *Institut Energie am Bau FHNW*
- 17:15 A Novel Approach to the Analysis of Hydraulic Designs in Large Solar Collector Arrays  
*Philip Ohnewein<sup>1</sup>, Robert Hausner<sup>1</sup>, Dieter Preiß<sup>1</sup>*  
<sup>1</sup> *AEE INTEC*
- 17:30 Simulations of Combined Solar Thermal and Heat Pump Systems for Domestic Hot Water and Space Heating  
*Dani Carbonell<sup>1</sup>, Elimar Frank<sup>1</sup>, Michel Haller<sup>1</sup>*  
<sup>1</sup> *SPF Institut für Solartechnik*

## 16:15 - 18:00 Session TUE-4C: Thermal Storage

Room: K9

Chair: *Wim van Helden*

- 16:15 Combining Heat Pumps with Combistores: Detailed Measurements Reveal Demand for Optimization  
*Haberl Robert<sup>1</sup>, Reber Andreas<sup>1</sup>, Frank Elimar<sup>1</sup>, Michel Haller<sup>1</sup>*  
<sup>1</sup> *SPF Institut für Solartechnik*
- 16:30 Comparison of the Thermal Performance of a Solar Heating System with Open and Closed Solid Sorption Storage  
*Florian Bertsch<sup>1</sup>, Sebastian Asenbeck<sup>1</sup>, Harald Drück<sup>1</sup>, Dagmar Jaehnig<sup>2</sup>, Henner Kerskes<sup>1</sup>, Waldemar Wagner<sup>2</sup>, Werner Weiss<sup>2</sup>*  
<sup>1</sup> *ITW-University of Stuttgart*; <sup>2</sup> *AEE INTEC*
- 16:45 On the Road to Large-Scale Seasonal Solid Sorption Heat Stores  
*Gernot Mauthner<sup>1</sup>, Florian Bertsch<sup>2</sup>, Dagmar Jaehnig<sup>1</sup>, Jochen Jaenchen<sup>3</sup>, Henner Kerskes<sup>2</sup>, Waldemar Wagner<sup>1</sup>*  
<sup>1</sup> *AEE INTEC*; <sup>2</sup> *ITW-University of Stuttgart*; <sup>3</sup> *Technische Hochschule Wildau*
- 17:00 Thermochemical Heat Storage, System Design Issues  
*Ard-Jan de Jong<sup>1</sup>, Ruud Cuypers<sup>1</sup>, Christian Finck<sup>1</sup>, Henk Oversloot<sup>1</sup>, Hans van 't Spijker<sup>1</sup>*  
<sup>1</sup> *TNO*
- 17:15 Closed Sorption Heat Storage Based on Aqueous Sodium Hydroxide  
*Benjamin Fumey<sup>1</sup>, Xavier Daguenet-Frick<sup>2</sup>, Viktor Dorer<sup>1</sup>, Paul Gantenbein<sup>2</sup>, Robert Weber<sup>1</sup>, Tommy Williamson<sup>3</sup>*  
<sup>1</sup> *EMPA*; <sup>2</sup> *SPF Institut für Solartechnik*; <sup>3</sup> *Kingspan Environmental Ltd*
- 17:30 Development of Sensors for Measuring the Enthalpy of PCM Storage Systems  
*Gerald Steinmaurer*  
*Austria Solar Innovation Center*

**16:15 - 18:30 Side Event: Schools of the Future: Towards NZEB and Surplus-Energy**

Room: K5-6

*Chair: Hans Erhorn*

16:15 School of the Future – Towards Zero Emission with High Performance Indoor Environment  
*Heike Erhorn-Kluttig<sup>1</sup>, Hans Erhorn<sup>1</sup>*  
<sup>1</sup> Fraunhofer IBP

16:30 Retrofit of an Existing School in Italy with High Energy Standards  
*Michele Zinzi<sup>1</sup>, Stefano Agnoli<sup>1</sup>*  
<sup>1</sup> ENEA

16:45 Deep Retrofit of the Solitudegymnasium in Stuttgart Weilimdorf  
*Jürgen Görres<sup>1</sup>, Hans Erhorn<sup>2</sup>, Stephan Kempe<sup>1</sup>*  
<sup>1</sup> Landeshauptstadt Stuttgart; <sup>2</sup> Fraunhofer IBP

17:00 Ambitious Renovation of a Historical School Building in Cold Climate  
*Karin Buvik<sup>1</sup>, Geir Andersen<sup>2</sup>, Sverre Tangen<sup>3</sup>*  
<sup>1</sup> SINTEF; <sup>2</sup> Drammen Eiendom KF; <sup>3</sup> Glass og Fasadeforeningen

17:15 Energy Saving Technology Screening within the EU-Project School of the Future  
*Ove Christen Morck<sup>1</sup>, Anton Jarlsvig Paulsen<sup>1</sup>, Carlo Romeo<sup>2</sup>, Simone Steiger<sup>3</sup>, Michele Zinzi<sup>2</sup>*  
<sup>1</sup> Cenergia Energy Consultants; <sup>2</sup> ENEA; <sup>3</sup> Fraunhofer IBP

17:30 Energy Retrofitting of School Buildings to Achieve Plus Energy and 3-Litre Building Standards  
*Johann Reiss<sup>1</sup>, Hans Erhorn<sup>1</sup>*  
<sup>1</sup> Fraunhofer IBP

17:45 Energy-Plus Primary School, Hohen Neuendorf, Germany  
*Ingo Luetkemeyer*  
*IBUS Architects and Engineers*

18:00 Power Generation Using District Heat: Energy Efficient Retrofitted Plus-Energy School Rostock  
*Simon Winiger*  
*Fraunhofer ISE*

18:15 Converting a School-Building from 1954 into Surplus-Energy  
*Hans Erhorn<sup>1</sup>, Jürgen Görres<sup>2</sup>*  
<sup>1</sup> Fraunhofer IBP; <sup>2</sup> Landeshauptstadt Stuttgart

**19:00 - 24:00 Networking Dinner with SHC Award Ceremony**

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## Wednesday, September 25, 2013

### 09:00 - 10:45 **Session WED-1A: Solar Heat for Industrial Processes / Solar Refrigeration**

Room: Rolf-Böhme-Saal

*Chair: Christoph Brunner*

- 09:00 Development of an Evaluation Methodology for the Potential of Solar-Thermal Process Energy Use in the Food Industry  
*Holger Müller<sup>1</sup>, Sebastian Brandmayr<sup>1</sup>, Wilfried Zörner<sup>1</sup>*  
<sup>1</sup> Ingolstadt University
- 09:15 A New Solar Combined Heat and Power System for Sustainable Automobile Manufacturing  
*Oliver Mark Iglauer<sup>1</sup>, Christian Zahler<sup>2</sup>*  
<sup>1</sup> Dürr Systems GmbH; <sup>2</sup> Industrial Solar GmbH
- 09:30 Monitoring of a MW Class Solar Field Set up in a Brick Manufacturing Process  
*Roberto Fedrizzi<sup>1</sup>, Francesco Orioli<sup>2</sup>, Dirk Pietruschka<sup>3</sup>, Alice Vittoriosi<sup>1</sup>*  
<sup>1</sup> EURAC; <sup>2</sup> SOLTIGUA, Laterizi Gambettola; <sup>3</sup> ZAFH-NET
- 09:45 Manufacture of Malt and Beer with Low Temperature Solar Process Heat  
*Franz Mauthner<sup>1</sup>, Christoph Brunner<sup>1</sup>, Christian Fink<sup>1</sup>*  
<sup>1</sup> AEE INTEC
- 10:00 Application of Solar Heating System for Raw Petroleum During its Piping Transport  
*Zinian He*  
*Beijing Solar Energy Research*
- 10:15 A Solar Thermally Driven Cold Storage Room - Measurement Results and Optimization Potential  
*Jochen Döll*  
*Fraunhofer ISE*

### 09:00 - 10:45 **Session: WED-1B: Durability and Reliability / Solar Resource Assessment / Standards and Certification**

Room: Runder Saal

*Chair: Michael Köhl*

- 09:00 Solar Thermal Collectors Outdoor Testing in Saline Environment  
*Daniela Ciobanu<sup>1</sup>, Anca Duta<sup>1</sup>, Ion Visa<sup>1</sup>*  
<sup>1</sup> Transilvania University of Brasov
- 09:15 Soiling and Anti-Soiling Coatings on Surfaces of Solar Thermal Systems  
*Elisabeth Klimm*  
*Fraunhofer ISE*



09:30 Evaluating Performance, Qualification, and Durability of PVT Hybrid Collectors: Toward a Dedicated Industry Standard

*Ulrich Fritzsche<sup>1</sup>, Matthias Bott<sup>1</sup>, Mark Witt<sup>2</sup>*

<sup>1</sup>TÜV Energie und Umwelt GmbH; <sup>2</sup>TUV Rheinland PTL, LLC

09:45 A New Method for Fusion of Measured and Model-Derived Solar Radiation Time-Series

*Richard Meyer<sup>1</sup>, Theresa Mieslinger<sup>2</sup>*

<sup>1</sup>Suntrace GmbH; <sup>2</sup>Suntrace/Univ. of Hamburg

10:00 Long Term Satellite Global and Diffuse Irradiance Validation

*Pierre Ineichen*

*University of Geneva*

10:15 A GIS Tool for the Land Carrying Capacity of Ground-Mounted PV Plants

*Enrico Fabrizio<sup>1</sup>, Enrico Borgogno Mondino<sup>1</sup>, Roberto Chiabrando<sup>1</sup>*

<sup>1</sup>University of Torino

## 09:00 - 10:45 Session WED-1C: Other Innovative Components and Systems

Room: K9

*Chair: Philippe Papillon*

09:00 Solar Active Building with Directly Heated Concrete Floor Slabs

*Jens Glembin<sup>1</sup>, Christoph Büttner<sup>1</sup>, Gunter Rockendorf<sup>1</sup>, Jan Steinweg<sup>1</sup>*

<sup>1</sup>ISFH

09:15 Spectrally Splitting Hybrid Photovoltaic/Thermal Receiver Design for a Linear Concentrator

*Ahmad Mojiri<sup>1</sup>, Faisal Ghani<sup>1</sup>, Gary Rosengarten<sup>1</sup>*

<sup>1</sup>RMIT University

09:30 Distributed m-CHP Generation Form a Small Scale Concentrated Solar Power

*Luigi Crema<sup>1</sup>, Fabrizio Alberti<sup>1</sup>, Sebastian Hesse<sup>2</sup>, Drummond Hislop<sup>3</sup>, Lorenzo Luminari<sup>4</sup>, Brian Restall<sup>5</sup>, Barbara Rivolta<sup>6</sup>, Ewa Wackelgard<sup>7</sup>*

<sup>1</sup>Fondazione Bruno Kessler; <sup>2</sup>NARVA Lichtquellen GmbH + CO.KG; <sup>3</sup>Sustainable Engine Systems Ltd.;

<sup>4</sup>Electronic Machining Snc; <sup>5</sup>Projects in Motion; <sup>6</sup>Politecnico di Milano; <sup>7</sup>Uppsala University

09:45 Improved NORYL Resin for Solar Thermal Absorbers

*Joris Wismans<sup>1</sup>, Adrie Landa<sup>1</sup>, James Pickett<sup>2</sup>*

<sup>1</sup>SABIC Innovative Plastics; <sup>2</sup>GE Global Research

10:00 Fluid Dynamics Optimization of a Novel Isothermal Adsorption Dehumidification System for Solar Driven Applications

*Lorenzo Pistocchini<sup>1</sup>, Silvia Garone<sup>1</sup>, Mario Motta<sup>1</sup>*

<sup>1</sup>Politecnico di Milano

10:15 The COOLSUN Triple-Technology Approach to Reach High Solar Fractions for Space Heating, Space Cooling and Domestic Hot Water Preparation

*Catherine Baldo<sup>1</sup>, Antonio Lobato<sup>2</sup>, Jorge Manuel Vieira Facão<sup>3</sup>*

<sup>1</sup>EnerSun; <sup>2</sup>Cidade Solar; <sup>3</sup>LNEG

10:45 - 11:15 **Coffee Break**

**11:15 - 13:00 Plenary WED-2: Large-scale Applications / Closing Session**

Room: Rolf-Böhme-Saal

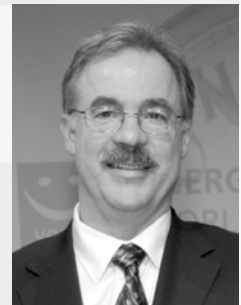
*Chairs: Hans-Martin Henning / Ken Guthrie*

- 11:15            Solar District Heating with Seasonal Storage in Canada  
*Doug McClenahan*  
*Natural Resources Canada*
  
- 11:40            Solar Process Heat - Best Practice Plants and Future Developments  
*Christoph Brunner*  
*AEE INTEC*
  
- 12:05            Large Scale Systems in China  
*Tao He*  
*China Academy of Building Research*
  
- 12:30            Conference Wrap-up  
*Hans-Martin Henning*  
*Fraunhofer ISE*
  
- 12:40            Conference Wrap-up  
*Xavier Noyon*  
*ESTIF*
  
- 12:50            SHC 2014

**13:00 - 14:00 Lunch Break**

**Doug McClenahan**

*CanmetENERGY-Ottawa, Natural Resources Canada*



Doug McClenahan is the Solar Thermal R&D Program Manager for Natural Resources Canada's CANMET Energy Technology Centre in Ottawa, the lead energy S&T delivery organization of the Government of Canada. He is the Past Chair of the International Energy Agency's Solar Heating and Cooling Program. Prior to working with CanmetENERGY, he was a Solar Research Associate with the University of Toronto. Throughout his career he has been actively involved in the development and commercialization of low temperature solar heating systems including low flow solar water heaters, transpired solar air collectors, and more recently has led the development of the award winning Drake Landing Solar Community, the first solar seasonal storage community space heating demonstration in North America.

**Christoph Brunner**

*AEE INTEC*



Since 2010 head of department at AEE INTEC: Industrial Processes and Energy Systems, Project coordinator of several national and international projects as SolarFoods, GREENFOODS (IEE), SOLAR BREW (FP 7), EINSTEIN (IEE project for energy audits and training), Operating agent in the IEA Task 49 - Solar Process Heat for Production and Advanced Applications. Expert for industrial energy efficiency and process intensification with focus on the food and beverage industry including the pinch analyses (PE2, SOCO, EINSTEIN) and involved in the Austrian and European work of Standardization for energy audits (CEN), worked for UNIDO in field of energy efficiency for industry. Lector at the Applied Science in Pinkafeld for energy process engineering, solar thermal energy.

**Prof. He Tao**

*China Academy of Building Research*



He Tao is deputy director of Testing Center of Solar Heating Systems at CABR and IEA-SHC Executive Committee representative of China. His research focus is in the field of building energy efficiency, solar application in builds' R & D. He worked as a HVAC engineer in China Academy of Building Research (CABR) for more than 10 years. He Tao designed or installed dozens of HVAC systems since he graduated in HVAC Engineering at Tianjin University in 1996. He also engaged in heating radiator testing from 1996 to 2000. He was in charge of the project to establish three national solar thermal testing laboratories according to Chinese and International standards under the technical and financial support of UNDP from 1999 to 2004.

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## Side Events

### 2013 SAHWIA Annual Conference

The Solar Air Heating World Industries Association will be holding its annual conference & general meeting in conjunction with SHC 2013 on Monday September 23, 2013 in Freiburg. Solar air heating is an exciting technology that has been used on buildings around the world, and is now posed to deliver an increasing share of "Renewable Heating". Join to meet other participants in the solar air heating market and get involved with this growing market.

Monday, September 23, 14:00 – 17:30

Room: K 2-4

Fee: CAD \$135, pre-registration is required

### Energy Avantgarde

#### New Initiative for International Collaboration, Competition and Excellence in Energy Technologies

The idea for the European Energy Avantgarde is to establish an international competition in Europe aiming to develop sustainable concepts for specific problems in existing buildings and cities.

Addressing the task of increasing urban density and modernizing buildings in Europe will rank first in the list of priorities.

As evolution of "Internationale Bauausstellung" and Solar Decathlon the new competition format shall involve the whole society and pioneer the path of transition towards sustainable energy supply.

The event provides information about ongoing activities in France and Germany and the panel will discuss how the new approach for international competition can be managed as a European initiative.

Tuesday, September 24, 14:00 – 15:45

Room: K 5-6

#### Speakers

Bruno Mesureur,  
 Markus Kratz,  
 Pascal Rollet and  
 Karsten Voss

followed by a discussion with representatives from the European Commission.

### Schools of the Future

The workshop presents practical solutions for deep retrofitting of school buildings in Europe.

Tuesday, September 24, 16:15 – 18:30

Room: K 5-6

### Workshop on EU-Project DiGeSPo

This workshop will present the research results of the DiGeSPo (Distributed CHP GEneration from small size concentrated Solar Power) project, part-funded under the EU's 7th Framework Programme. Project partners will present the research and development results of a modular 1-3 kWe, 3-9 kWth micro Combined Heat and Power (m-CHP) system, based on innovative Concentrated Solar Power (CSP) and Stirling engine technology, that is capable of providing electrical power, heating and cooling for single or multiple domestic dwellings.

Monday, September 23, 16:15 – 18:00

Room: K 5-6

### Task 39 Exhibition of Polymeric Collectors and Components

The Solar Heating and Cooling Programme's Task 39 exhibits polymeric solar thermal collectors and components in front of the conference venue from 23 to 25 September.

The Task 39 Exhibition is the first of its kind to put selected polymeric collectors, storage tanks and other components on stage. Next to polymeric collectors and thermosiphon systems from Magen Eco Energy, the companies Aventa, Enerconcept, Roth, Consolar and Kompetenzzentrum Holz showcase pioneering solar thermal collectors for building integration, polymer based air collectors, collector storage tanks and innovate wood plastic composites. Additional information on current research activities is provided by associated Task 39 research institutes and partners like Fraunhofer ISE, SWT Stuttgart, PCCL, the University of Leoben and Sunlumo. Thus highlighting established and novel combinations of polymeric components, the exhibition will show a range of possibilities for re-thinking solar thermal. The Task 39 experts invite everyone to visit the Task 39 truck and learn more about this new generation of solar thermal energy systems.

## Social Events

### Welcome Reception

All participants are invited to take part in the Welcome Reception, which will take place on Sunday, September 22, 2013, from 17:00 to 19:00 at the conference venue, Congress Center Concert Hall Freiburg.



The Welcome Reception will be sponsored by the International Solar Energy Society (ISES).

Thank you!

The Welcome Reception will not only serve as an opening event and as an initial get-together for social networking in a relaxed atmosphere, it will also give participants the opportunity to register early for the conference. This will allow you to avoid long lines at the registration desks in the morning of the first conference day, and make registration easier for those who arrive later. During the Welcome Reception, refreshments will be served.

Sunday, September 22, 17:00 – 19:00

Location: Congress Center Concert Hall Freiburg

### Networking Dinner

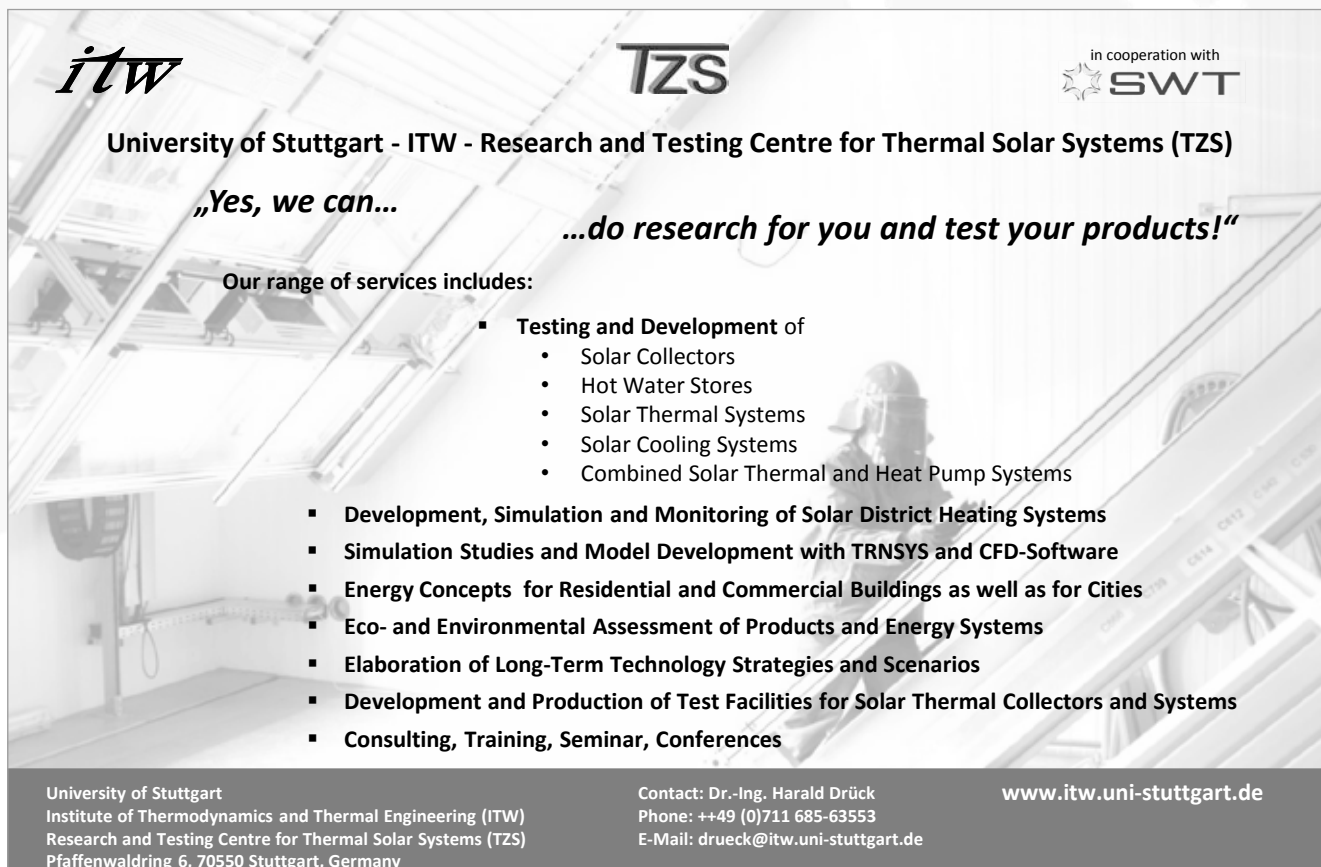
The Networking Dinner will take place in the Freiburg Market Hall, a popular lunchtime venue for the city's residents in the old town of Freiburg. During the dinner a live band will provide musical entertainment, and the "SHC Award" for outstanding achievements in the field of solar heating and cooling will be conferred.

This uniquely attractive venue will provide the ideal environment for conference participants to maximise their networking in a relaxed and convivial atmosphere.

Tuesday, September 24, 19:00 – 24:00

Location: Freiburger Markthalle (Market Hall),  
Martinsgässle, Freiburg

Fee: € 35, pre-registration is required



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 E-Mail: drueck@itw.uni-stuttgart.de

[www.itw.uni-stuttgart.de](http://www.itw.uni-stuttgart.de)

## Technical Tours

### Tour 1 Freiburg

On Tour 1 we will visit four stations, showing research activities in solar thermal energy as well as applications of solar concepts.

#### Facility/Developer

- Magistrale/Fraunhofer ISE
- Passive High-rise Building/Fraunhofer ISE
- SorLuko Project/Fraunhofer ISE/Airwasol/Contherm
- Test Stands/PSE AG

Date: Wednesday, September 25

**Departure:** 14:30, bus departs from Congress Center Concert Hall Freiburg

**Arrival:** 19:00 bus returns to Congress Center Concert Hall Freiburg (est. time)

Meeting point: Main entrance Congress Center Concert Hall Freiburg

Fee: Pre-registration is required

### Tour 2 Achern

Tour 2 will take you to three facilities, demonstrating mainly solar cooling systems

#### Facility/Company/Developer

- Cold Storage Room / Kramer / Fraunhofer ISE / Industrial Solar
- Manufacturer of Absorption Cooling Machines/ Fischer Eco Solutions / Industrial Solar
- Test Stands/PSE AG

Date: Wednesday, September 25

**Departure:** 14:30, bus departs from Congress Center Concert Hall Freiburg

**Arrival:** 19:00 bus returns to Congress Center Concert Hall Freiburg (est. time)

Meeting point: Main entrance Congress Center Concert Hall Freiburg

Fee: € 30, pre-registration is required



## Tours

### Solar Tower of the Richard-Fehrenbach-Trade School Tour

In 1993 the solar tower of the Richard-Fehrenbach-Trade School, Freiburg began operating, using a variety of solar thermal collectors to demonstrate to students the uses of solar energy. In 2013 the demonstration project was renewed as part of the Fraunhofer ISE's SolCoolSys research project (Low-power Solar Cooling). Energy efficiency and operational safety were prioritized in the selection of technical components: high-efficiency pumps, a stratified-charge accumulator, the use of geothermal energy, flat panels (21m<sup>2</sup>) and latest generation vacuum-tube collectors (10m<sup>2</sup>) were used as well as a state-of-the-art absorption chiller (8kW cold performance). The overall supervision and optimization of the plant are undertaken by the Fraunhofer ISE, but the intention is that students will oversee the day-to-day running and maintenance of the system as part of a supervised teaching project.

Date: Monday, September 23, 18:30 – 19:30  
 Meeting point: Main entrance Congress Center Concert Hall Freiburg  
 Fee: € 15 , pre-registration is required

### Freiburg Sightseeing Tour

We invite you to join us on a “renewable energy and sightseeing” tour through the old heart of Freiburg's inner city. Special points of interest are the two beautifully-preserved city gates (the “Schwabentor” and “Martinstor”), the famous “Freiburger Münster” and the “Historisches Kaufhaus” (historic mall). The “Altes Rathaus” and “Neues Rathaus” (old and new city halls) as well as “Martinskirche” (church) are also well worth a visit.

Date: Monday, September 23, 18:30 – 20:00  
 Meeting point: Main entrance Congress Center Concert Hall Freiburg  
 Fee: € 15, pre-registration is required

### Green City District “Vauban” Tour

Built on the site of a former military quarter, Vauban exemplifies Freiburg's image as a “Green City”. Situated to the southeast of Freiburg's city center, this area is famous for its solar architecture and numerous pedestrian zones. It combines a high quality of living with environmental awareness and a focus on low-energy consumption. Tour highlights will include Rolf Disch's solar estate, which comprises 59 houses with negative energy-consumption on an area of 11,000 sqm. One element of this solar estate is the so-called “Solarschiff” (solar ship), a 125m long building that protects the area from traffic noise.

Date: Monday, September 23, 18:30 – 20:30  
 Meeting point: Main entrance Congress Center Concert Hall Freiburg  
 Fee: € 15, pre-registration is required

## General Information

### Registration

Each participant must register in person at the registration desk to collect a conference bag and name badge before attending any sessions. Please make sure to wear your badge for admission to all sessions and social events. Participants who have lost their badge must report to the registration desk to get a new one.

Registration times are on Sunday, September 22, from 17:00 – 19:00 and during conference hours, starting at 8:00, at the Congress Center Concert Hall in Freiburg.

### Posters

There are 4 poster areas, situated in the first and second floor. Please refer to page 12 to find out in which area your poster will be located. The poster areas are marked in the Floor Plan on page 43. Please mount your poster during pre-registration on Sunday, September 22, or on the first conference day before the start of the poster session.

Do not remove your poster until the end of the conference. The posters are an important part of the scientific program and should be displayed the whole time. Please remove your poster after the closing session on Wednesday, September 25, before you leave. Any posters left behind will be discarded.

### Speaker Information

All presentations must be handed in at the Media Upload Desk, located beside the Registration Desk at the main entrance, at least one hour before your oral session. You will not be able to display your presentation directly from your laptop computer or memory stick. Our technical support team will welcome you at the Media Upload Desk during all conference days from 8:00 on.

Please meet your session chairs inside the conference room at least 10 minutes prior to the beginning of your session to get familiar with the technical equipment.

### List of Participants

Registered conference participants can download a full list of participants on the conference website, [www.shc2013.org](http://www.shc2013.org). The login and password sent to you during registration will be required to gain access to the download area.

### Certificate of Attendance

Certificates of attendance for conference participants will only be available on-site at the registration desk and cannot be issued after the conference.

### Conference Proceedings

Accepted papers, which were presented at the conference, will be published online in Elsevier's Energy Procedia. Energy Procedia is an open-access online platform of Elsevier. All papers published in Energy Procedia feature individual DOI numbers and are therefore fully citable.

Selected SHC 2013 Conference papers will be recommended for publication in the Solar Energy Journal, the most renowned peer reviewed journal devoted exclusively to the science and technology of solar energy applications and the official journal of the International Solar Energy Society.

Before publication in Energy Procedia, access to the non-reviewed papers will be available on the restricted download area of the conference website, which is accessible to all conference participants with a login and password provided after their conference registration.