Commercialising of thermal powered refrigeration

SIRAC – London Network Meeting
University College London, U.K., 29.10.2009

Dr. Uli Jakob
Green Chiller Association
chillii®
Technology by SOLARNEXT

- Development of Solar/Thermal Cooling and Heating Kits for Residential and Office Building Applications and other Cooling Applications (2 – 50 kW)
- System Design for Cooling Applications on Industrial Scale (50 kW & up) (business stopped December 2008)
- R&D on Sorption Chillers e.g. Air-Cooled Absorption Chiller (stopped February 2009)
- R&D on Recooling Systems e.g. Dry Coolers (stopped February 2009)
- R&D on System Controllers


chillii® Test Facilities – Experimental Setup with an Absorption Chiller
Product Range of Small-Scale chillii® Chillers (7, 8, 10, 12, 15, 17.5 kW)

- chillii® STC8 & STC15
  Water / Silica Gel
- chillii® ISC7 & ISC10
  Water / Zeolith
- chillii® PSC12
  Ammonia / Water
- chillii® WFC18
  Water / Lithium Bromide

Product Range of Small to Medium-Scale chillii® Chillers (15 - 500 kW)

- Yazaki WFC 10 - 30
  Water / Lithium Bromide
- chillii® ESC 15 - 200
  Ammonia / Water
- chillii® ACC50 - 100
  Ammonia / Water
Heat Sources for Thermally Driven Cooling and Heating Systems

CHP Unit, Biomass, Process Heat etc.

chillii® Cooling Technology

Source: SolarNext

chillii® System Controller Development

Source: SolarNext
Development of chillii® Thermal/ Solar Cooling Kits


- **H₂O/LiBr EAW Wegracal SE15**
- **Hightex Office Building in Rimsting, Germany for Office Space Cooling and Heating**
- 37 m² Flat Plate and 34 m² Vacuum Tube Collectors & Oil Burner Back-up
- 2,000 l Hot Water Storage and 1,000 l Cold Water Storage
- 15 kW Cooling Capacity
- 35 kW Wet Cooling Tower Capacity

**Sources:** SolarNext

(2006/2007)
chili® Design Tool for Cooling Kits

Realized chili® Cooling Kit Installations by Countries (2006-2009)
Solar Cooling Market in Europe

Recent Small-Scale Solar Cooling Kit Supplier (< 50 kW)

- coolySun (Europe) 7.5 and 15 kW
- Kingspan Climate System (Europe) 10 kW
- LB Cooling System (Europe) 15 and 30 kW
- chillii® Cooling Kit (Europe, Australia) 7, 8, 10, 12, 15, 17.5, 30, 35 and 50 kW
- Alaska-Set (Europe) 7.5, 15, 30 and 54 kW
SolarNext University and Industry Cooperation Partners (selection)

- Fraunhofer Institute for Solar Energy Systems (ISE), Freiburg i.Br. (Germany)
- Fraunhofer Institute for Building Physics (IBP), Stuttgart and Holzkirchen (Germany)
- Technische Universität München (Germany)
- Stuttgart University of Applied Sciences (Germany)
- Zentrum für Angewandte Forschung an Fachhochschulen - Nachhaltige Energieotechnik (zafh.net), Stuttgart (Germany)
- Doppelintegral, Stuttgart (Germany)
- University of Warwick (U.K.)
- Bayerische Forschungsstiftung, Stuttgart (Germany)
- ZAE Bayern, Amberg (Germany)
- EURAC, Bolzano (Italy)
- InvenSor, Berlin (Germany)
- Citirol Solar, Moosburg (Germany)
- VHF, Yverdon (Switzerland)
- Cabot, Frankfurt (Germany)
- InverSor, Berlin (Germany)
- Würth, Germany
- AGO, Kulmbach (Germany)
- EAW, Westerfeld (Germany)
- Yasaki Europe, Cologne (Germany)
- SorTech AG, Halle (Germany)
- AGO, Kulmbach (Germany)
- InvenSor, Berlin (Germany)
- VHF, Yverdon (Switzerland)
- Cabot, Frankfurt (Germany)

SolarNext R&D Projects

- Liquid Sorption (2007-2010)
  Development of a Sorption Assisted Air Handling Unit with Liquid Sorption
  Partner: Stuttgart University of Applied Sciences (Germany), Grammer Solar (Germany)

- SolarDEC_Sys (2008-2011)
  Solar Thermal Cooling with DEC Systems – Optimization and Development of Basic Principles as well as Operation and Control Strategies
  Partner: Ingolstadt University of Applied Sciences (Germany), Wolf Anlagentechnik (Germany) and pbb (Germany)

- InnoCOOL (2008-2010)
  Innovative, Energy Optimised, Hygienic Heat Rejection Systems for Thermal Driven Chillers
  Partner: Joanneum Research (Austria), Pink (Austria) and SOLID (Austria)
- **Green Chiller – Association for Sorption Cooling e.V., Berlin, Germany**

- Formed in March 2009 as German Industry Association

- Representing around 60% of all European manufacturers of thermally driven sorption chillers in the small and medium-scale cooling capacity range

- Elected President Roland Weidner (EAW, Senior Consultant) and Vice-President Dr. Uli Jakob (SolarNext, Senior Consultant)

**Founding Members of Green Chiller**

<table>
<thead>
<tr>
<th>Company</th>
<th>Location</th>
<th>Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kulpbach</td>
<td>Kulmbach (Germany)</td>
<td>Manufacturer of Ammonia/Water Absorption Chillers (30 – 500 kW)</td>
</tr>
<tr>
<td>EAW</td>
<td>Westenfeld (Germany)</td>
<td>Manufacturer of Water/Lithium Bromide Absorption Chillers (15 – 200 kW)</td>
</tr>
<tr>
<td>Fraunhofer IST</td>
<td>Freiburg (Germany)</td>
<td>Research Institute for Solar Energy Systems, Cooperation with SorTech</td>
</tr>
<tr>
<td>ILK Dresden</td>
<td>Dresden (Germany)</td>
<td>Institut für Luft- und Kältetechnik Dresden, Developments in Cooperation with EAW and AGO</td>
</tr>
<tr>
<td>Inensor</td>
<td>Berlin (Germany)</td>
<td>Manufacturer of Water/Zeolith Adsorption Chillers (7 – 10 kW)</td>
</tr>
<tr>
<td>Link</td>
<td>Langenwang (Austria)</td>
<td>Manufacturer of a Ammonia/Water Absorption Chiller for SolarNext (12 kW)</td>
</tr>
<tr>
<td>SolarNext</td>
<td>Rimsting (Germany)</td>
<td>System Supplier of thermally driven Absorption/ Adsorption Chillers and Cooling Kits (7 – 50 kW)</td>
</tr>
<tr>
<td>Sonnenklima</td>
<td>Berlin (Germany)</td>
<td>Manufacturer of a Water/Lithium Bromide Absorption Chiller (10 kW) – Insolvent since September 2009</td>
</tr>
<tr>
<td>SorTech AG</td>
<td>Halle (Germany)</td>
<td>Manufacturer of Water/Silica Gel (and Water/Zeolith) Adsorption Chillers (8 – 15 kW)</td>
</tr>
</tbody>
</table>
- Lobbying of Sorption Cooling Technologies in general but especially in the Politics (Small and Medium Cooling Capacity Range)

- Promoting and Developing of the Solar and Thermal Cooling Market in Germany as well as Europe

- Increasing Awareness of Thermal Cooling Technologies (Publicity at Fairs, Conferences, Workshops, etc.)

- Standardization of Chillers/Cooling Kits as a Requirement for Funding

- Preparing of a Design Tool and Related Information on the Association's Website

Main Objectives of Green Chiller

- Large and Medium-Scale Absorption and Adsorption Chillers are available since several years and used for Custom-Made Systems

- First Small-Scale Thermal/Solar Cooling Kits are on the Market

- Huge Market Potential for Thermal/Solar Cooling and Refrigeration

- First Solar/Thermal Cooling Associations Founded (Green Chiller, ausSCIG)

- Specific Costs of Solar Cooling Kits in Europe(1):
  - 5,000 to 8,000 EUR/kW in 2007
  - 4,000 to 4,500 EUR/kW in 2008
  - 3,500 to 4,500 EUR/kW in 2009

(1) The solar cooling kit consist of solar thermal collectors, hot water storage, pump-set, chiller, re-cooler, partly cold water storage and system controller. The specific costs are without cold distribution and installation costs.

Conclusion
Thank you.

Dr. Uli Jakob
Green Chiller Association

www.solarnext.de
www.greenchiller.de