How to reduce time-to-market for solar cooling technology

Convegno Nazionale sul Solare Termico – 10^a Edizione
Raffrescamento Solare: Dalle Applicazioni Pilota al Mercato
SolarExpo2009, Verona, Italy, 08.05.2009

Dr. Uli Jakob
SolarNext AG

Market Situation of Conventional Air-Conditioning Worldwide in 2002

<table>
<thead>
<tr>
<th>Region</th>
<th>Estimated Market Size (million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>11.8</td>
</tr>
<tr>
<td>China</td>
<td>12.0</td>
</tr>
<tr>
<td>Central/Southamerica</td>
<td>1.9</td>
</tr>
<tr>
<td>Europe</td>
<td>2.8</td>
</tr>
<tr>
<td>Middle East</td>
<td>1.8</td>
</tr>
<tr>
<td>India</td>
<td>0.8</td>
</tr>
<tr>
<td>Japan</td>
<td>8.0</td>
</tr>
<tr>
<td>East Asia</td>
<td>4.3</td>
</tr>
<tr>
<td>Australia</td>
<td>0.5</td>
</tr>
</tbody>
</table>

World total 2002: 44.0 million units

Source: JARN
Estimated RAC/PAC Market Size in 2008 (units: million)
Air-Conditioning Split-Units up to 5 kW (1.4 RT)

- USA 16
- Europe 8.6
- Middle East 4.0
- India 3.8
- Japan 8.0
- Central/Southamerica 4.7
- Africa 1.5
- East Asia 7.4
- Australia 1.0

World total 2008: 82.3 million units


Source: JARN

Market Potential Solar Cooling in Europe

Total amount of installed Solar Cooling systems

- 2004: 30 (Source: Climasol)
- 2006: 100 (Source: H.M. Henning)
- 2007: 200 (Source: Rococo)

year
Recent European Suppliers of Standardized Small-Scale Solar Cooling Kits (≤ 50 kW)

- Kingspan Climate System, 10 kW
- Suninversive, 10 kW
- LB Cooling System, 15 and 30 kW
- chillii® Cooling Kit, 7, 7.5, 10, 12, 15, 17.5, 30, 35 and 50 kW
- Alaska-Set, 7.5, 15, 30 and 54 kW

chillii® Cooling Kit PSC12

- chillii® PSC12 absorption chiller
- chillii® System Controller HC
- Wet cooling tower
- Hot water pump with IF-Module
- Recooling pump with IF-Module
- Mixing valve with actuators
- Frequency converter
- Magnetic valves and swimming valve
chillii® Cooling Kit ISC10

- chillii® ISC10 Adsorption chiller
- chillii® System Controller HC
- Dry cooling tower (with sprinkling system)
- Hot water pump with IF-Module
- Recooling pump with IF-Module
- Mixing valve with actuators
- Expansion tank
- Security valve with manometer

chillii® Cooling Technology

- Heat source 1
- Heat source 2
- Solar system
- Heat storage tank
- Cooling circuits
- Heating circuits
- Sorption chiller
- Electrical chiller
- Cold water storage tank
- Hot water storage tank
- Pool
- Cooler

Source: SolarNext

chillii® System Controller Development

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- Different Heat Sources
  (e.g. Solar, CHP unit, Biomass)
- Back-up System
  (e.g. Oil/Gas Boiler)
- Heat and Cold Storage
  Management
- Domestic Hot Water
- Chiller (e.g. chillii® PSC12)
- Recooler (e.g. Dry Recooler)
- Heating and Cooling Circuits

**Specific Costs of Low Capacity Solar Cooling Systems**

<table>
<thead>
<tr>
<th>Cooling Capacity [kW]</th>
<th>specific system costs without VAT [EUR/kW]</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.5</td>
<td>5,500</td>
</tr>
<tr>
<td>10.0</td>
<td>5,000</td>
</tr>
<tr>
<td>12.0</td>
<td>4,500</td>
</tr>
<tr>
<td>15.0</td>
<td>4,000</td>
</tr>
<tr>
<td>17.5</td>
<td>3,500</td>
</tr>
<tr>
<td>20.0</td>
<td>3,000</td>
</tr>
<tr>
<td>25.0</td>
<td>2,500</td>
</tr>
<tr>
<td>30.0</td>
<td>2,000</td>
</tr>
<tr>
<td>35.0</td>
<td>1,500</td>
</tr>
</tbody>
</table>

Source: SolarNext
**Cost Reduction Potential of Solar Cooling Kits**

- **Solar Plant (Collectors and Storage):**
  max. 10% Cost Reduction Potential in the next 2-3 years

- **Small-Scale Sorption Chillers:**
  max. 20% Cost Reduction Potential till 2011, from 2011 up to 50% if Serial Production is started (Production Capacity larger than 500 Units)

- **Recooler:**
  Cost Reduction Potential between 40-50%

- **Control:**
  min. 60% Cost Reduction Potential, Increasing of the System Performance

- **Installation:**
  10-30% Cost Reduction Potential through Standardized Solar Cooling Kits
chillii® Design Tool for Cooling Kits – Input Mask

chillii® Design Tool – Results Cooling Kits
chillii® Design Tool – Offer

5 kW clean energy for you

chillii® Cooling Kit STC8 at Greenhouse, Pescia, Italy

(2008)

H₂O/Silica gel chillii® STC8

in Pescia, Italy for Cooling of a Greenhouse

19 m² Vacuum Tube Collectors
1,500 l Hot Water Storage, 1,000 l Cold Water Storage
7.5 kW Cooling Capacity
22 kW Dry Cooler Capacity (with Water Spraying)

chillii® Cooling Kit STC8 at Greenhouse, Pescia, Italy
H₂O/Zeolith chillii® ISC10

in Wyong, Australia for Space Cooling (Coffee Shop)

34.8 m² Vacuum Tube Collectors
1,500 l Hot Water Storage and 500 l Cold Water Storage
10 kW Cooling Capacity
30 kW Dry Cooler Capacity (with Water Spraying)

chillii® Cooling Kit ISC10 at the Milk Factory, Wyong, Australia

Green Chiller – Association for Sorption Cooling

• Green Chiller – Verband für Sorptionskälte e.V.

• Formed in March 2009 as German Association (7 Companies, 2 Institutes)

• Office in Berlin, Germany

• Elected President Roland Weidner (EAW, Senior Consultant)
  and Vice-President Dr. Uli Jakob (SolarNext, Director Solar Cooling)
<table>
<thead>
<tr>
<th>Company</th>
<th>Representative</th>
<th>Location</th>
<th>Profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGO</td>
<td>Helmut Peetz</td>
<td>Kulmbach (Germany)</td>
<td>Manufacturer of Ammonia/Water Absorption Chillers (30 – 500 kW)</td>
</tr>
<tr>
<td>EAW</td>
<td>Gregor Weidner, Roland Weidner</td>
<td>Westenfeld (Germany)</td>
<td>Manufacturer of Water/Lithium Bromide Absorption Chillers (15 – 200 kW)</td>
</tr>
<tr>
<td>ILK Deskien</td>
<td>Dr. Hans-Martin Henning</td>
<td>Freiburg (Germany)</td>
<td>Research Institute for Solar Energy Systems, Cooperation’s with SorTech</td>
</tr>
<tr>
<td>invensor</td>
<td>Dr. Peter Albring</td>
<td>Dresden (Germany)</td>
<td>Institut für Luft- und Kältetechnik Dresden, Developments in Cooperation with EAW and AGO</td>
</tr>
<tr>
<td>PINK</td>
<td>Werner Pink</td>
<td>Langenwang (Austria)</td>
<td>Manufacturer of a Ammonia/Water Absorption Chiller for SolarNext (12 kW)</td>
</tr>
<tr>
<td>SOLARNEXT</td>
<td>Dr. Uli Jakob</td>
<td>Rinsting (Germany)</td>
<td>System Supplier of thermally driven Absorption/Adsorption Chillers and Cooling Kits (7 – 50 kW)</td>
</tr>
<tr>
<td>SOMMENKUMA</td>
<td>Manfred Bitter</td>
<td>Berlin (Germany)</td>
<td>Manufacturer of a Water/Lithium Bromide Absorption Chiller (10 kW)</td>
</tr>
<tr>
<td>SorTech AG</td>
<td>Walter Oblin</td>
<td>Halle (Germany)</td>
<td>Manufacturer of Water/Silica Gel (and Water/Zeolith) Adsorption Chillers (7.5 – 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, 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**

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• ausSCIG is an Australian Industry Interest Group

• Target is to develop the Solar Cooling Industry in Australia (Residential and Commercial Building Sectors)

• The Group is operated as a Subgroup of AIRAH and the Australian National Committee of the International Institute of Refrigeration (IIR)

• Over 130 Industry Stakeholders are currently Registered

• Members come from a Diverse Background Including:
  • Industry
  • Government
  • Academia
  • Public
• First Small-Scale Thermal/ Solar Cooling Kits are on the Market

• Specific Collector Surface of the chilli® Solar Cooling Kits is 4.5 m²/kW
  (Average Value of Market Available Solar Cooling Kits in Europe is 4.2 m²/kW)

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

• Specific Costs of Solar Cooling Kits in Europe\(^{(\text{a})}\):
  - 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

\(^{(\text{a})}\) 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
SolarNext AG

www.solarnext.de
www.greenchiller.de