



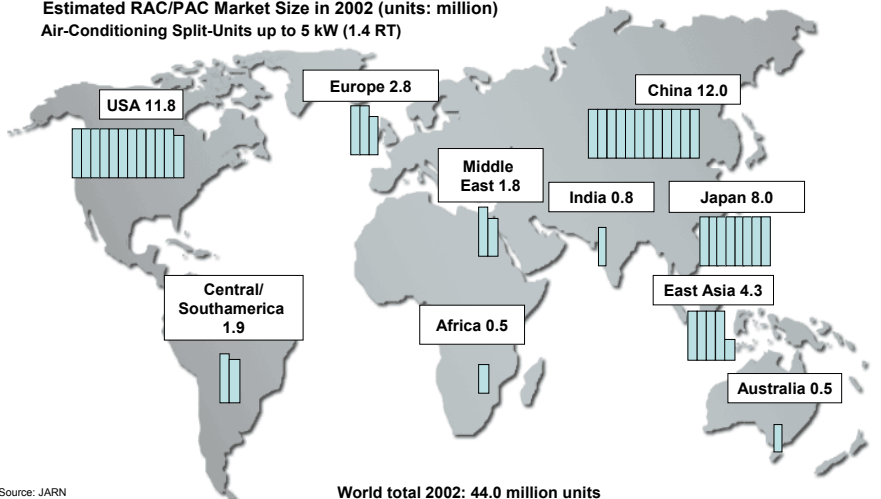
## How to reduce time-to-market for solar cooling technology

Convegno Nazionale sul Solare Termico – 10<sup>A</sup> Edizione  
Raffrescamento Solare: Dalle Applicazioni Pilota al Mercato  
SolarExpo2009, Verona, Italy, 08.05.2009

Dr. Uli Jakob  
SolarNext AG



Estimated RAC/PAC Market Size in 2002 (units: million)  
Air-Conditioning Split-Units up to 5 kW (1.4 RT)

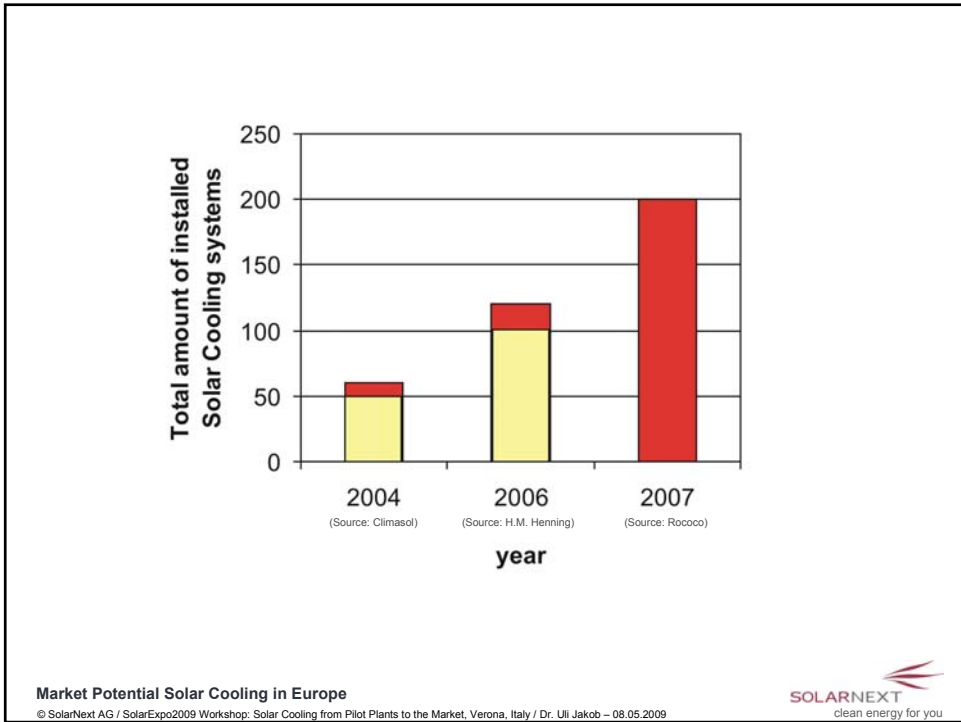
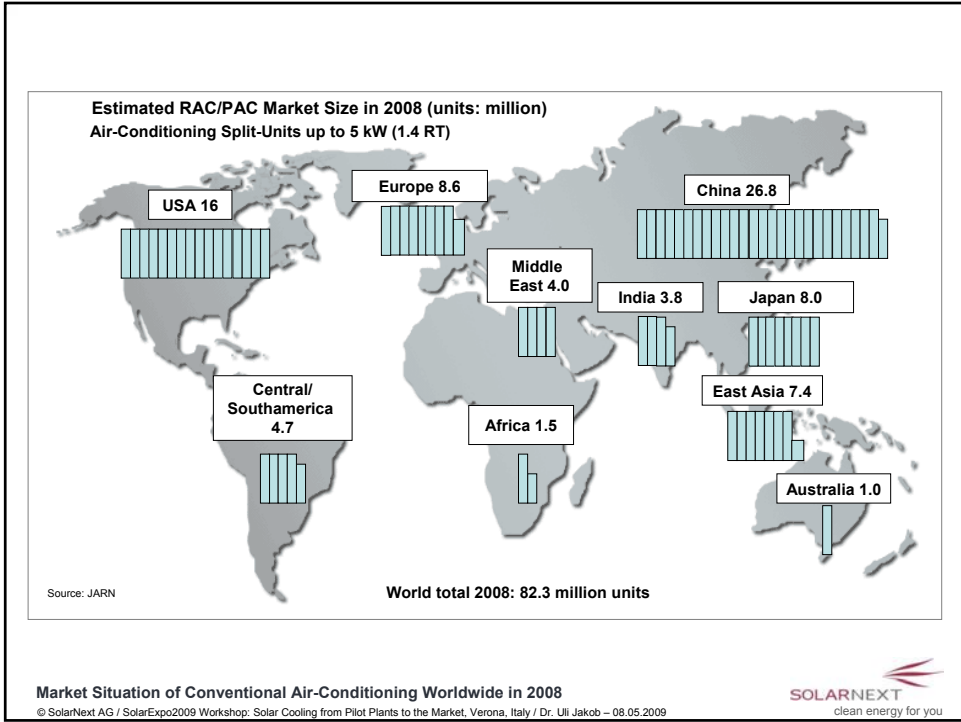


Source: JARN

Market Situation of Conventional Air-Conditioning Worldwide in 2002

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coolySun,  
7.5 and 15 kW



Kingspan Climate System,  
10 kW



Suninverse,  
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



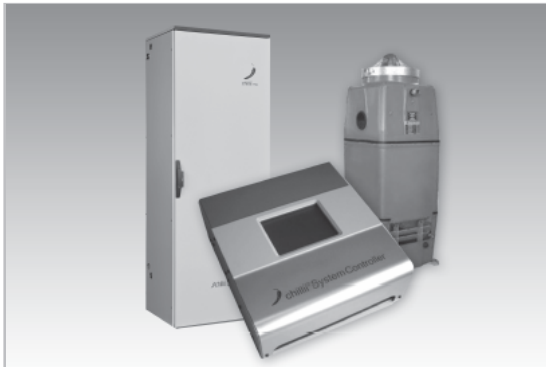
Alaska-Set,  
7.5, 15, 30 and 54 kW

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

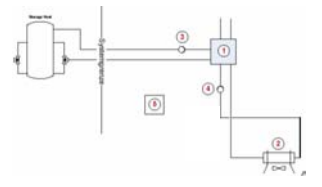
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chillii® Cooling Kit PSC12



- + 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



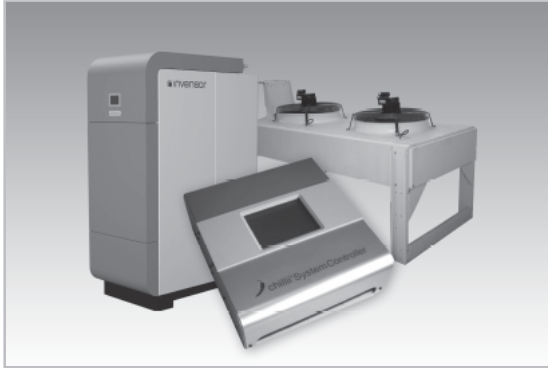
chillii® Cooling Kit PSC12

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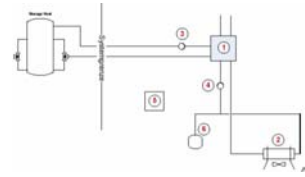




## chillii® Cooling Kit ISC10



- + 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

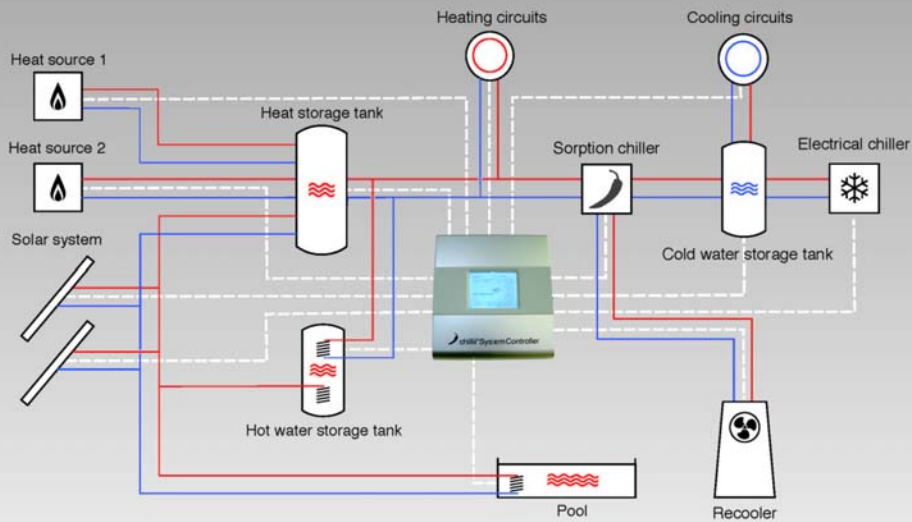


### chillii® Cooling Kit ISC10

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## chillii® Cooling Technology



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**

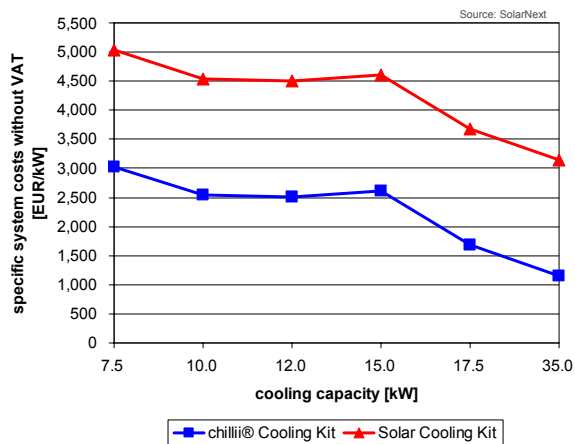
Source: SolarNext

chillii® System Controller

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### Specific Costs of Low Capacity Solar Cooling Systems



Without Installation Costs and Cold Distribution

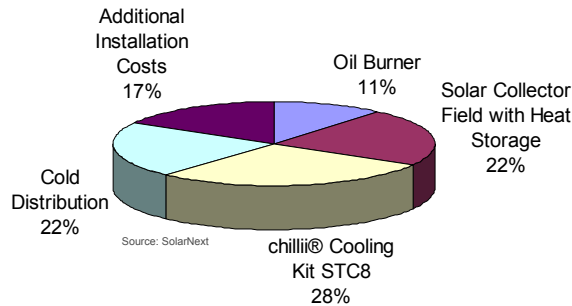
Specific System Costs of chillii® Cooling Kits and Solar Cooling Kits (2009)

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## Total System Costs of a Installed chillii® Cooling Kit STC8



Costs of Installed Solar Cooling System	60.400 EUR (8.053 EUR/kW incl. 19% VAT)
Subsidy (BAFA)	- 8.400 EUR
Total System Costs	52.000 EUR (6.933 EUR/kW incl. 19% VAT)

Source: Brinkmoller

### System Costs chillii® Cooling Kit STC8 for Residential Building

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- **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

### Cost Reduction Potential of Solar Cooling Kits

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### Auslegung chilliii® Cooling Kit

Wetter und Standort | Rückkühlung | Kältemaschine

1. Bitte wählen Sie ein Land

2. Bitte wählen Sie eine Stadt

Standort und Auslegungstemperaturen

Außenlufttemperatur: 31,7  
 Feuchtkugeltemperatur: 22,1  
 Temperatur für Besprühung: 24,7

Geografische Breite: 49,02  
 Geografische Länge: 12,12

5 kW

Zurück Weiter OK

### Auslegung chilliii® Cooling Kit

Wetter und Standort | Rückkühlung | Kältemaschine

1. Bitte wählen Sie die Rückkühlungsart

Alle Rückkühler  
 Auswahl Rückkühler beschränken  
 Sonstige Rückkühlung  
 Eintrittstemperatur chiller:  °C

Auswahl Rückkühler

Nasser Rückkühler

Automatische Größenwahl  
 EWK 036/06 (Axima)  
 EWK 064/09 (Axima)

Trockener Rückkühler

kleiner Rückkühler (5 K)  
 großer Rückkühler (3 K)

Besprühter Rückkühler

kleiner Rückkühler (5 K)  
 großer Rückkühler (3 K)

Zurück Weiter OK

### Auslegung chilliii® Cooling Kit

Wetter und Standort | Rückkühlung | Kältemaschine

1. Auswahl Kältemaschine

Alle Kältemaschinen auswählen  
 Auswahl beschränken

Adsorber:  ISC 7,  ISC 10,  STC 8,  STC 15  
 Absorber:  PSC 12,  WFC 16

2. Benötigte Kälteleistung  
 kW

3. Temperaturbereich Heißwasser

Untere Grenze  
 minimale Heißwassertemperatur  
 untere Heißwassertemperatur:  °C

Obere Grenze  
 maximale Heißwassertemperatur  
 obere Heißwassertemperatur:  °C

4. Kaltwassersolltemperatur

mit Entfeuchtung (Maschinenabhängig 6°C bis 12°C)  
 ohne Entfeuchtung (15°C)  
 beliebige Kaltwassertemperatur (6°C bis 15°C):  °C  
 Tieftemperatur (-3°C bis -7°C):  °C

Zurück Weiter OK

Source: SolarNext

**chilliii® Design Tool for Cooling Kits – Input Mask**  
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### Auslegung chilliii® Cooling Kit

Wetter und Standort | Rückkühlung | Kältemaschine

1. Auswahl Kältemaschine

Alle Kältemaschinen auswählen  
 Auswahl beschränken

Adsorber:  ISC 7,  ISC 10,  STC 8,  STC 15  
 Absorber:  PSC 12,  WFC 16

2. Benötigte Kälteleistung  
 kW

3. Temperaturbereich Heißwasser

Untere Grenze  
 minimale Heißwassertemperatur  
 untere Heißwassertemperatur:  °C

Obere Grenze  
 maximale Heißwassertemperatur  
 obere Heißwassertemperatur:  °C

4. Kaltwassersolltemperatur

mit Entfeuchtung (Maschinenabhängig 6°C bis 12°C)  
 ohne Entfeuchtung (15°C)  
 beliebige Kaltwassertemperatur (6°C bis 15°C):  °C  
 Tieftemperatur (-3°C bis -7°C):  °C

Zurück Weiter OK Kundendaten ändern Druckvorschau Beenden

	Variante 1	Variante 2	Variante 3	Variante 4
<b>chilliii® Cooling Kit</b>	chilliii® Cooling Kit ISC 10	chilliii® Cooling Kit PSC 12	chilliii® Cooling Kit STC 15	chilliii® Cooling Kit WFC 16
<b>Kälteleistung [kW]</b>	9,1 kW	10 kW	10 kW	10 kW
<b>Preis Basisakt Netto ab Werk</b>	25.449 EUR	30.049 EUR	39.149 EUR	29.449 EUR
	<a href="#">-&gt; weitere Info</a>	<a href="#">-&gt; weitere Info</a>	<a href="#">-&gt; weitere Info</a>	<a href="#">-&gt; weitere Info</a>
	<a href="#">-&gt; Optionen</a>	<a href="#">-&gt; Optionen</a>	<a href="#">-&gt; Optionen</a>	<a href="#">-&gt; Optionen</a>
	<input type="checkbox"/> auswählen	<input type="checkbox"/> auswählen	<input type="checkbox"/> auswählen	<input type="checkbox"/> auswählen

Source: SolarNext

**chilliii® Design Tool – Results Cooling Kits**  
 © SolarNext AG / SolarExpo2009 Workshop: Solar Cooling from Pilot Plants to the Market, Verona, Italy / Dr. Uli Jakob – 08.05.2009

Datum: 28. April 2009

Standort: Freiluft, Standort: 10, 03053 Rostock

Dr. Heiko Mustermann  
SolarNext AG  
Nordstr. 10  
03053 Rostock  
Deutschland

**chilliii® Cooling Kit PSC 12**

Standort: Freiluft (Deutschland) [ geografische Länge: 7.80°; geografische Breite: 49° ]  
Anlagekategorie: Freiluftklimatisierung  
Lufttemperatur: 24.3°C Feuchtkugeltemperatur: 24.2°C

Kälteerzeuger:	Wärmepumpe:	Heizwassererzeuger:
Kälteleistung: 10 kW	Wärmepumpe: 24.9 kW	Heizleistung: 14.9 kW
Erdboden-Temperatur: 18 °C	Erdboden-Temperatur: 27.2 °C	Erdboden-Temperatur: 78.7 °C
Aufluft-Temperatur: 15 °C	Aufluft-Temperatur: 32.2 °C	Aufluft-Temperatur: 71.7 °C
Volumenstrom: 2965 l/h	Volumenstrom: 4274 l/h	Volumenstrom: 1825 l/h
Druckverlust: 0.28 bar	Druckverlust: 0.28 bar	Druckverlust: 0.13 bar

**Systemumfang**

Pos.	Menge	Art.-Nr.	Text	Einzelpreis	Gesamtpreis
1	1	PSC12_01H1811426	chilliii® Cooling Kit PSC 12 1 Stk. chilliii® PSC 12 Absorptionskältemaschine  12 kW Jeneralkältemittel: 0.80 (A) / 0.80 (B) / 2.20 (K) m, 490 kg Kältemitteltemperatur: 120°C Heizwasser-Temperatur: 80/70°C Kälteschleifen-Temperatur: 24/29°C  1 Stk. Nassschlamm m. Zubehör  1 Stk. chilliii® System Controller HC mit Sensor Back Kit, Sensor Cooling Kit  1 Stk. Pumpe für Heißwasser, 1 Stk. Pumpe für Rückkühlung Mischer m. Drehmotor	3068 EUR	3068 EUR

SolarNext AG, Nordstr. 10, 03053 Rostock | Germany  
Tel.: +49 031 6888-400 Fax: +49 031 6888-405 info@solarnext.de www.solarnext.de  
Vorstand: Frank Röhler Aufsichtsrat: David Richter (Vorsitz) Dr. Uli Heider (Beisitzer) Hart Schödl  
Beratende/ring Ingenieurbüro München, B.L.Z. 7900370 Hix Art. 342868

Source: SolarNext

chilliii® Design Tool – Offer

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Sources: CRA-VIV

(2008)

**H<sub>2</sub>O/Silica gel chilliii® STC8**  
in Pesca, Italy for Cooling of a Greenhouse

19 m<sup>2</sup> 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)

**chilliii® Cooling Kit STC8 at Greenhouse, Pesca, Italy**

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Sources: Urban Energy

(2009)

**H<sub>2</sub>O/Zeolith chilliii® ISC10**

in Wyong, Australia for Space Cooling (Coffee Shop)

34.8 m <sup>2</sup>	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)

**chilliii® Cooling Kit ISC10 at the Milk Factory, Wyong, Australia**

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VERBAND FÜR SORPTIONSKÄLTE E.V.

- 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)

**Green Chiller – Association for Sorption Cooling**


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Company	Representative	Location	Profile
	Helmut Peetz	Kulmbach (Germany)	Manufacturer of Ammonia/Water Absorption Chillers (30 – 500 kW)
	Gregor Weidner, Roland Weidner	Westenfeld (Germany)	Manufacturer of Water/Lithium Bromide Absorption Chillers (15 – 200 kW)
	Dr. Hans-Martin Henning	Freiburg (Germany)	Research Institute for Solar Energy Systems, Cooperation's with SorTech
	Dr. Peter Albring	Dresden (Germany)	Institut für Luft- und Kältetechnik Dresden, Developments in Cooperation with EAW and AGO
	Uwe Eckstein	Berlin (Germany)	Manufacturer of Water/Zeolith Adsorption Chillers (7 – 10 kW)
	Werner Pink	Langenwang (Austria)	Manufacturer of a Ammonia/Water Absorption Chiller for SolarNext (12 kW)
	Dr. Uli Jakob	Rimsting (Germany)	System Supplier of thermally driven Absorption/ Adsorption Chillers and Cooling Kits (7 – 50 kW)
	Manfred Bitter	Berlin (Germany)	Manufacturer of a Water/Lithium Bromide Absorption Chiller (10 kW)
	Walter Oblin	Halle (Germany)	Manufacturer of Water/Silica Gel (and Water/Zeolith) Adsorption Chillers (7.5 – 15 kW)

**Founding Members of Green Chiller**

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- 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 – Australian Solar Cooling Interest Group

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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

#### ausSCIG – Background and Stakeholders

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- First Small-Scale Thermal/ Solar Cooling Kits are on the Market
- Specific Collector Surface of the chillii® Solar Cooling Kits is 4.5 m<sup>2</sup>/kW  
(Average Value of Market Available Solar Cooling Kits in Europe is 4.2 m<sup>2</sup>/kW)
- First Solar/ Thermal Cooling Associations Founded (Green Chiller, ausSCIG)
- Specific Costs of Solar Cooling Kits in Europe<sup>(\*)</sup>:
  - 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

<sup>(\*)</sup> 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

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**Thank you.**

Dr. Uli Jakob  
SolarNext AG

[www.solarnext.de](http://www.solarnext.de)  
[www.greenchiller.de](http://www.greenchiller.de)

