Solar Air-Conditioning in Europe

Chinese Solar Cooling Conference,
Shanghai Jiao Tong University, China, 27.03.2015

Dr. Uli Jakob
Green Chiller – Association for Sorption Cooling e.V.
• **Formed in March 2009**
  as Industry Association
  (today 10 Companies, 11 Institutes, 1 Association)

• **Located in Berlin, Germany**

• Representing around 60% of all European manufacturers of thermally driven sorption chillers in the small and medium-scale cooling capacity range (5 - 200 kW)

• **Lobbying of Sorption Cooling Technologies**

• Promoting and Developing of the Solar and Thermal Cooling Market on European Level

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Green Chiller – Association for Sorption Cooling

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World exhibition in Paris – First ice block through solar energy (1878)
SolabCool
SolabChiller
Water / Silica gel

SorTech
eCoo 2.0
Water / Silica gel

- Cooling capacity range: 4.5 kW to 10 kW
- Heating temperatures: 60 – 95°C / 50 – 95°C
- Cold water temperatures: 15°C
- COP: 0.6 – 0.65

New small-scale capacity water/silica gel adsorption chillers

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SorTech
eZea
Water / Zeolithe

InvenSor
LTC10 & LTC10e & HTC18
Water / Zeolithe

InvenSor
LTC30e
Water / Zeolithe

- Cooling capacity range: 10 kW to 30 kW
- Heating temperatures: 75 – 95°C / 60 – 95°C
- Cold water temperatures: 15°C
- COP: 0.53 / 0.6 – 0.65 (0.7*)

New small-scale capacity water/zeolite adsorption chillers

-source: SorTech
-source: InvenSor
-source: InvenSor

* High Efficiency Modus

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EAW
SE15
Water / Lithium bromide

Pink
PC19
Ammonia / Water

• Cooling capacity range: 15 kW to 19 kW
• Heating temperatures: 65 – 95°C
• Cold water temperatures: 6 – 7°C (NH₃ -5°C)
• COP: 0.65 – 0.75 (0.5)

Small-scale capacity water/LiBr and NH₃/water absorption chillers

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EAW
Wegracal SE 30 - 200
Water / Lithium bromide

- Cooling capacity range: 30 kW to 200 kW
- Heating temperatures: 70 – 95°C
- Cold water temperatures: 6 – 7°C
- COP: 0.7 – 0.75

Medium-scale capacity water/LiBr absorption chillers

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Fischer Eco Solutions
fischer ARU 15 – 5000
Water / Lithium bromide

Baelz
Biene 50 & Hummel 160
Water / Lithium bromide

- Cooling capacity range: 15 kW to 5,000 kW
- Heating temperatures: 55 – 95°C
- Cold water temperatures: 6 – 7°C (16°C)
- COP: 0.6 – 0.7 (0.8)

New medium-scale capacity water/LiBr absorption chillers

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• Cooling capacity range: 25 kW to 1,000 kW
• Heating temperatures: 80 – 105°C
• Brine temperatures: -5 – -10°C
• COP: 0.5

Medium-scale capacity NH₃/water absorption chillers

Source: AGO

AGO
congelo50 - 1000
Ammonia / Water

Source: Tranter Solarice

Tranter Solarice
XS30 & XS50
Ammonia / Water
En-Save Cold® XS30 – XXL100
Ammonia / Water

- Cooling capacity range: 30 kW to 250 kW
- Heating temperatures: 80 – 135°C (170°C)
- Brine temperatures: 0 – -10°C (-30°C)
- COP: 0.5

Köhler Industries EcoFreez50 & 300
Ammonia / Water

New medium-scale capacity NH₃/water absorption chillers

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Integrated hydraulic unit for comfortable system integration

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chillii® Cooling Kit ISC18

chillii® Cooling Kit WFC175

Solar / thermal cooling kits (small and medium-scale capacity)

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Solar Cooling Kit
Heating, DHW, Cooling

System development & field test

Solar collection
Hydraulics
System integration

Chiller
Heat rejection
Hydraulics

Tests, optimisation, evaluation

Latest developments of solar cooling kits / example #1
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Solar combi+ system
Commercial development – Velta Italia with EURAC

Source: EURAC

Latest developments of solar cooling kits / example #2
Recent solar cooling kit suppliers in Europe

- **coolySun,**
  8, 15, 30, 54, 83, 150 and 200 kW

- **SOLARTIK,**
  17.5, 35, 70 and 105 KW

- **Package System,**
  17.5, 35, 70, 105, 140 and 210 KW

- **chillii® Cooling Kit,**
  8, 10, 15, 17.5, 18, 19, 30, 35, 50, 70, 105 and 175 kW

no claim on completeness
Market development of solar cooling

• **About > 1,200 systems** installed worldwide (2014)

Total amount of installed Solar Cooling systems in Europe and the World

Source: Solem Consulting / TECSOL

- Small, but steadily growing market

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Sales numbers Green Chiller manufactures (2006-2013)

Source: Green Chiller.
• **Cost reduction of 45-55% within last years!**

Cost development of solar cooling Kits in Europe (2007-2012)
• $1.5 \times 10^{18} \text{ J/a} = 416.7 \text{ TWh/a}$ Solar Cooling by 2050
• Solar Cooling nearly 17% of total energy use for cooling!

• **MAP (market incentive program):** BAFA offers **200 EUR/m²** for collector areas between 20 m² and 100 m² for solar thermal cooling at existing buildings, now also for new buildings **150 EUR/m²** (NEW 1.4.2015).

• **MAP:** BAFA offers also an annual solar energy yield based subsidy for solar cooling of **0.45 EUR per kWh/a/collector** (Solar Keymark) for collector areas between 20 m² and 100 m² (NEW 1.4.2015).

• **BAFA** has opened the program for promotion of efficient cooling systems in industry for sorption technology/solar cooling between 5 – 500 kW cooling capacity **25% of net investment** (since 1.1.2014).
• About 1,200 solar cooling systems installed worldwide (2014)

• Several new small and medium-scale Absorption and Adsorption chillers were developed in Europe

• Standardized Solar Cooling Kits available to bring down the costs

• Incentive schemes available, e.g. in Germany (BAFA) up to 200 EUR/m² collector area and 25% repayment bonus of net investment costs for sorption chiller systems!

• Solar heat is particularly of interest if a solar thermal system is used for other heat needs, too (e.g. heating, DHW)
Thank you.

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www.greenchiller.eu