SOL*ution* solar cooling systems

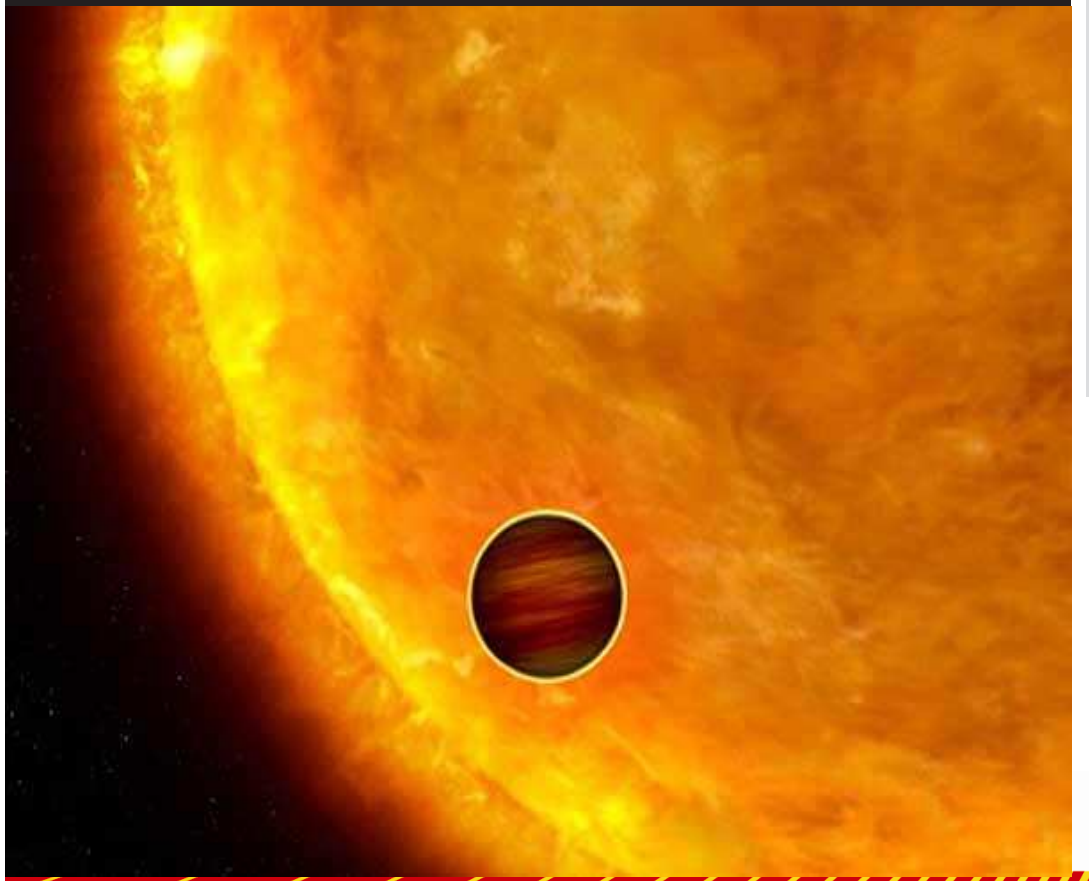
solarcombi+

www.sol-ution.com

Die bessere Zukunft.

SOLution® Solartechnik

There are energy sources that will never dwindle.
There are those who do not wish to open their eyes and comprehend.



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Solar energy: The future begins now!

SOLution **philosophy is based on:**

Customer orientation

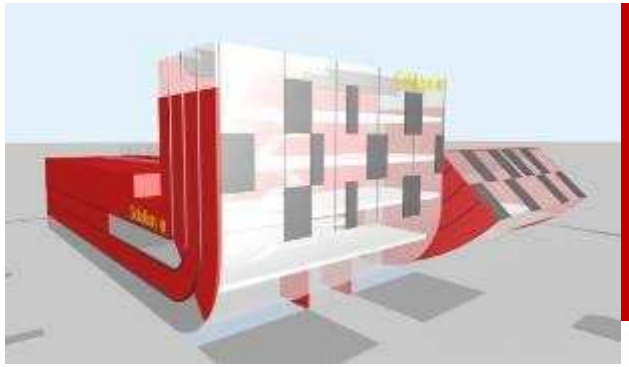
Our aim is the customer's satisfaction. Company policy focused on the customer's needs.

Innovation

We keep developping our brand and we participate at new product's reserach and development. SOLution is member of the European solar thermal associations.

Partnership

The key to our success is the partnership with our representatives, we offer proximity to the customer but with a long experience as backup.

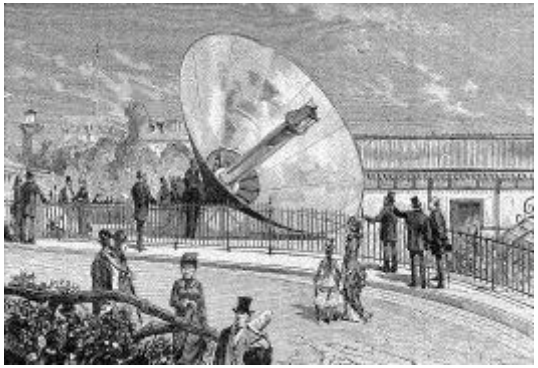


100% renewable energy !

SOL*ution* has now built the new company's headquarter in Austria, with a new logistic center, offices and more room for training. About 550 m² solar thermal collectors provide energy for heating and cooling, together with a PV installation and a heating pump, the building is provided just by renewable energy.
A new house for a growing company in a growing market !

History of Solar Cooling

1755: Producing Ice by **evacuation** (Cullen)
1834: **Compression chiller** (Perkins)
1850: Cooling device by the brothers Carré
1876: Compression chiller by LINDE
1878: World Trade Fair in Paris (**Mouchot**)
1900 – 1940: Time of prosperity of **Absorption chillers**
1930: Refrigerant (CFC Compression chillers)
1944: Developing of LiBr/H_2O-Absorption chillers
1978 – 1991: Environmental Problems with refrigerants; alternate refrigerants (without chlorine); **adsorption chillers**

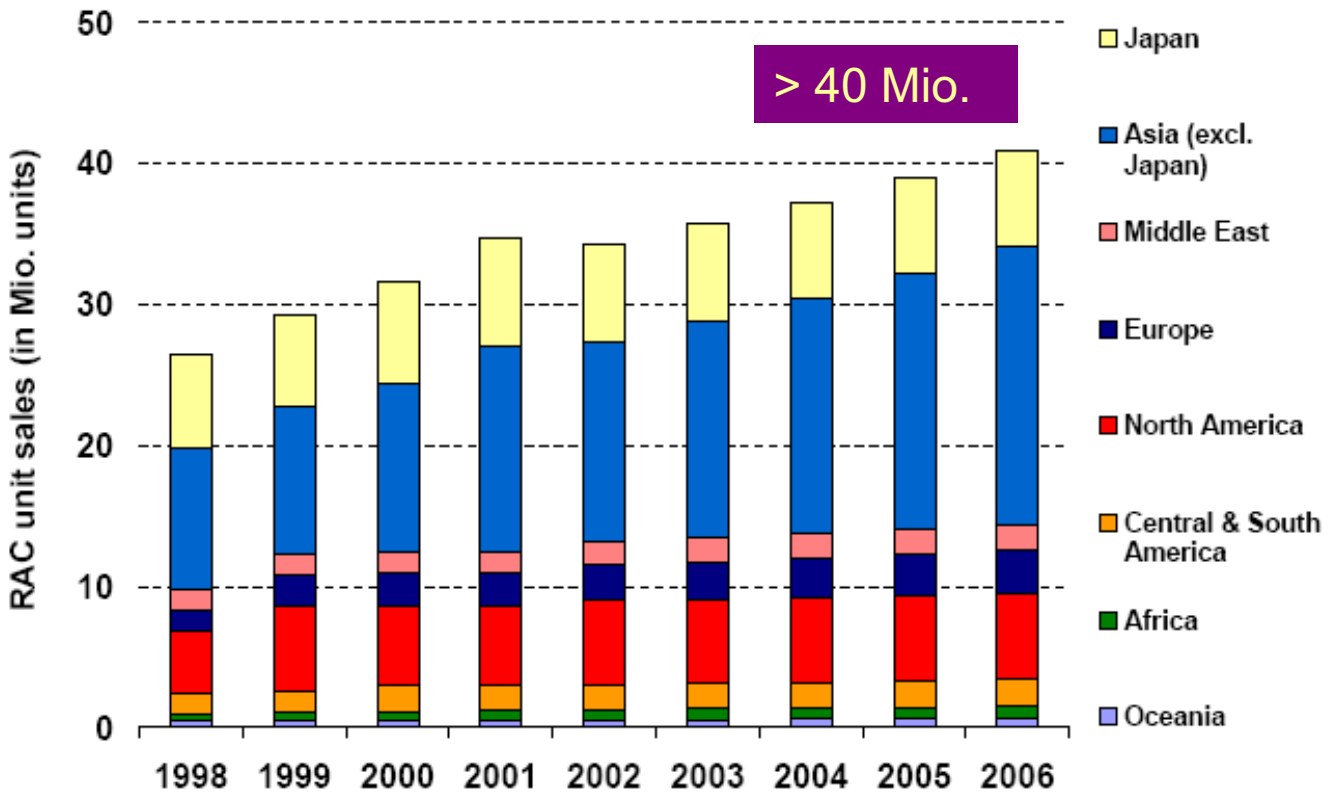


Source: ASiC,
Austria Solar Innovation
Center

World trade fair 1878 in Paris:
Mouchot
produces the first ice cube with the help of solar energy

Overview

Annual sold chillers (in Mio. units)

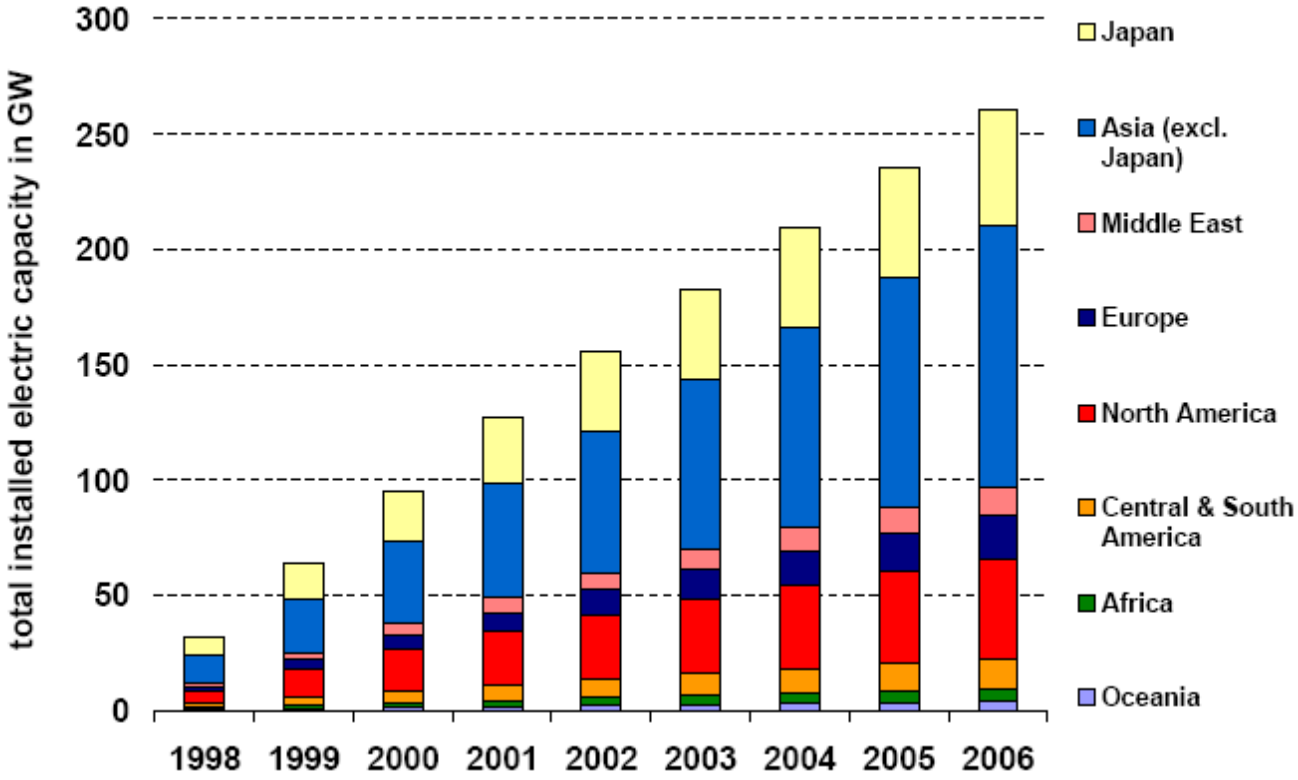


source: ASiC from F. Butera: The use of environmental energies for sustainable building in Mediterranean climates; Intelligent Building Middle East, Bahrain, December 2005

Overview

Installed electric capacity (in GW)

European Energy consumption for cooling: + 90 %, about 2/3 Spain and Italy



source: ASiC from F. Butera: The use of environmental energies for sustainable building in Mediterranean climates; Intelligent Building Middle East, Bahrain, December 2005

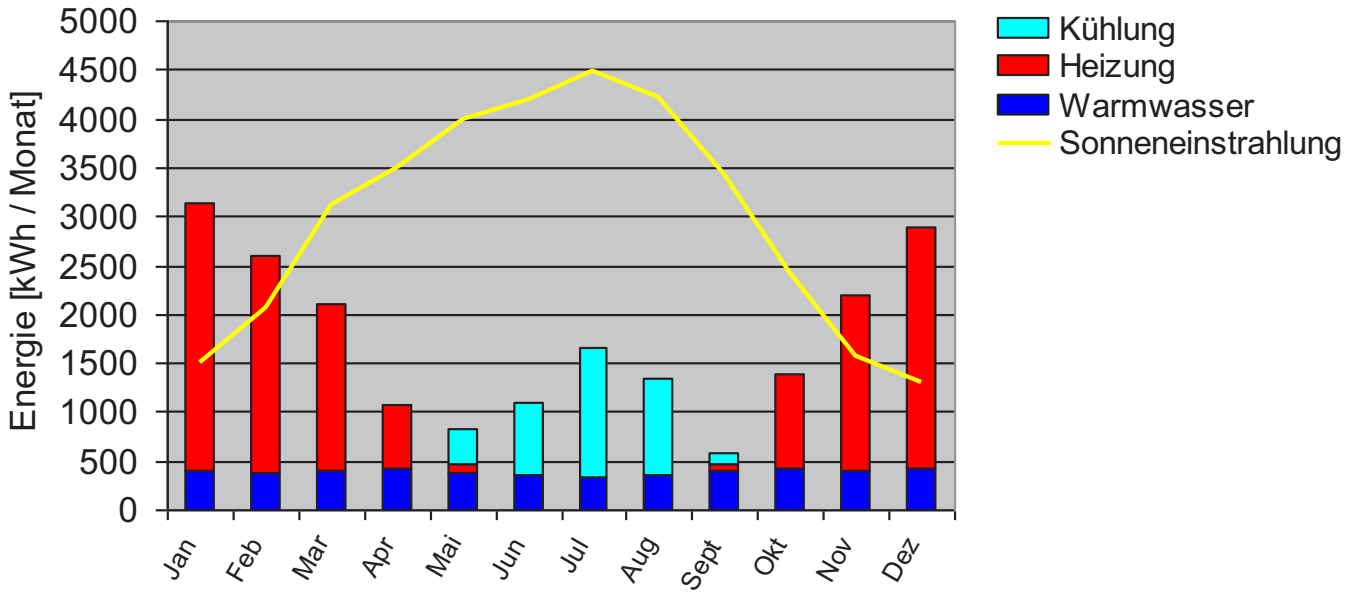
Overview

Solar irradiation: 30 m² collector surface area, inclination 45°, direction south

Domestic hot water: 240 l/day, 45°C

heating: 8 kW heat load

cooling: for example



source: ASiC

Advantages

- Thermally driven chillers, driven by heat from solar collectors

  In summer: Solar irradiation is very high when cooling demands occur

→ Less electricity for driving of the machines is needed

- Low driving temperatures (beginning with 70 °C) ideal for flat plate collectors
- Avoiding stagnation of the collector field in summer because the heat can be used for cooling

→ High efficiency of the solar collector field for the whole course of the year (DHW, cooling in summer and heating in winter)

- Existing solar collector systems can be enlarged
- Non toxic materials as working pair (sorbent and refrigerant) of the cooling machine
- Simple construction of the machines, especially adsorption chillers

Solar Cooling Principle

1- Collectors

The solar thermal panels collect the solar radiation through a high selective copper absorber. A selective antifreeze mix enters at a lowers temperature and runs inside the collectors, warms up and comes out at a higher temperature. Through a heat exchanger, this hot mix warms up the storage tank.

2- Hot Water Storage*

In the hot water tank, we storage the water warmed up by the solar circuit. By storing the hot water we can assure the function of the solar cooling system also during the night as the hot water is the necessary input to keep it working.

3- Back up system

In case the solar radiation is not enough to keep the tank at the temperature we need to keep the chiller working, a backup boiler (gas, fuel, electric, etc) starts and will heat up the tank. Using an electronic regulation we assure the back up system will start running only in case the solar circuit is not enough to reach the desired temperature, assuring the highest efficiency of the solar system

4- Absorption machine

The absorption machine generates cold water from hot water, through an absorption and condensation process. Using a semi-liquid component the heat from the hot water is absorbed and sent to the cooling tower

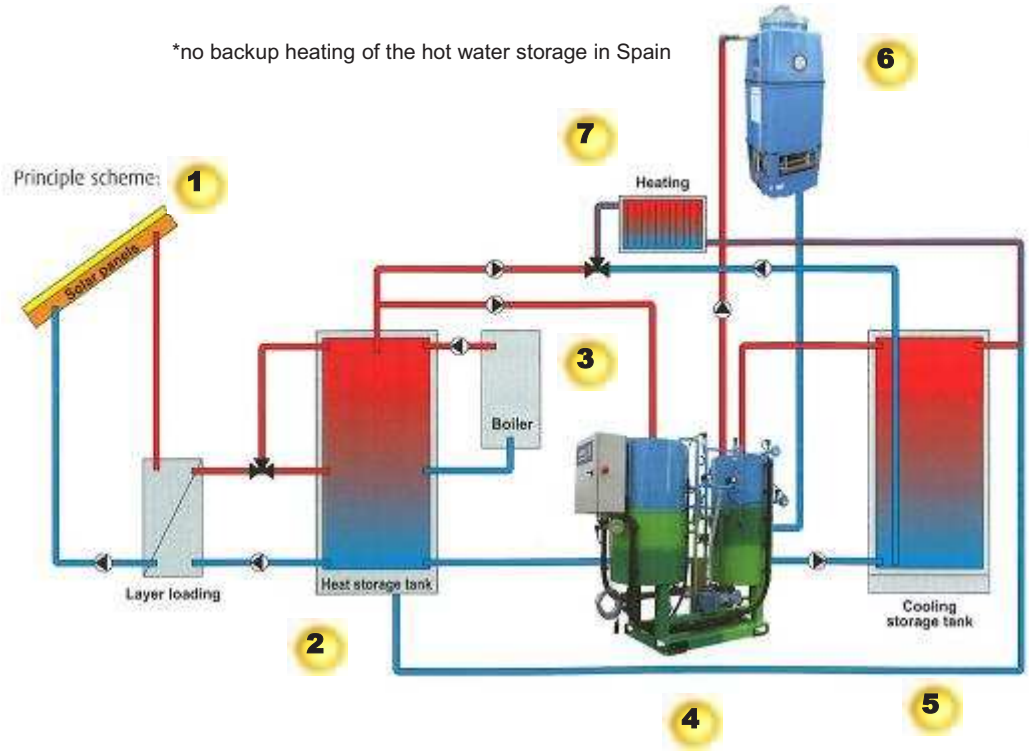
5- Cold water storage

In the cold water tank we storage the chilled water coming from the absorption machine. The system will make the cold water from this tank circulate all along the building to be cooled through the circulation circuit.

6- Cooling tower

Through the cooling tower the heat absorbed from the water by the machine will be released into the atmosphere as steam. This component has to be installed outside and the power will depend not only on the capacity and size of the system but also on the average ambience humidity. For places with a high humidity level, the cooling tower has to be over-dimensioned otherwise the heat will not release into steam.

*no backup heating of the hot water storage in Spain



7- Circulation circuit

Once the system has generated cold water, we need to make circulate this cold water through the building to cool down the ambience and therefore the temperature. This circulation can be made using different systems acting as heat exchanger (fan coils, chilled ceilings). The chilled water from the tank will be warmed up along the circuit and will come back to the cold storage tank at a higher temperature to be chilled again and restart the circuit.

Solar Cooling Principle

$$\text{COP (coefficient of performance)} = \frac{\text{Energy chiller}}{\text{Energy driving the machine}}$$

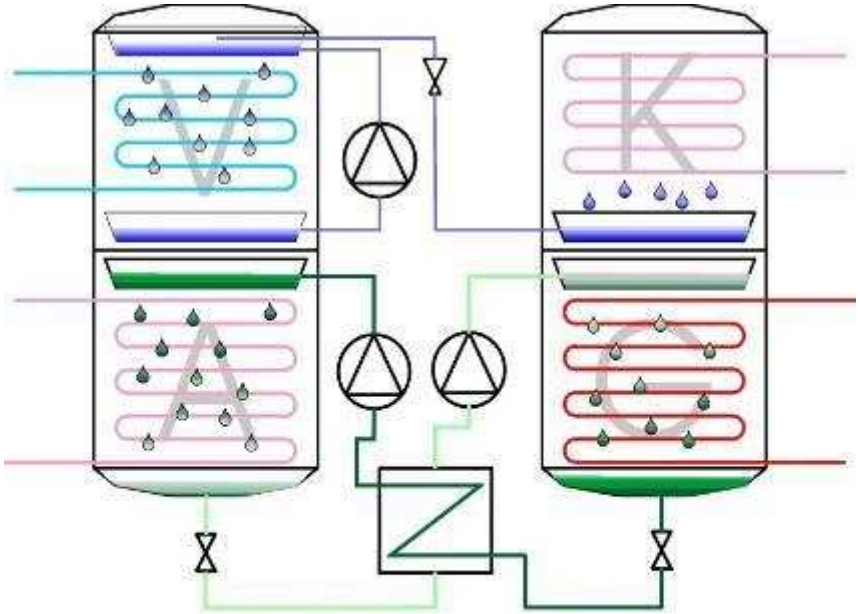
$$= \frac{\text{Energy chiller}}{\text{Energy solar + Energy backup heater}}$$

Solar Cooling with ABSORPTION chiller

Absorption chiller performance

15kW, 30 kW and 54kW in set.
Possible systems up to 200 kW upon request.
Liquid sorbent: Lithium Bromide
Refrigerant: Water

Exemple: Cooling load		15 kW	
COP		0,71	
Chilled water:	In	17°C	
	Out	11°C	
	Quantity	1,9 m³/h	
Hot water:	Performance	21 kW	
	In	90°C	
	Out	80,5°C	
	Quantity	2 m³/h	
Cooling water:	Performance	35 kW	
	In	30°C	
	Out	36°C	
	Quantity	5 m³/h	Electricity 0,3 kW



Solar Cooling with ABSORPTION chiller

Solution pump: The rich solution containing cooling solvent is then being transported through a heat exchanger to the generator.

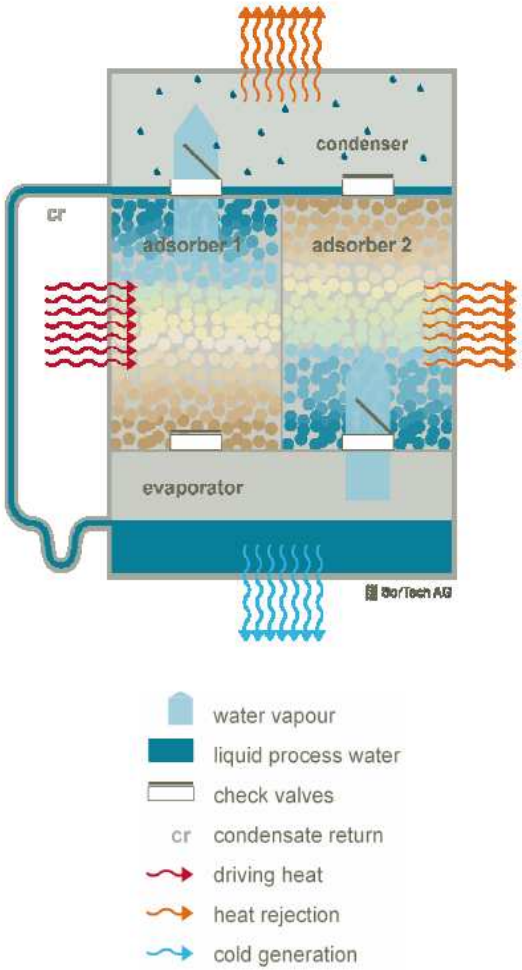
Generator: The solution containing cooling solvent is evenly spread over the generator. By the input of heating water, the cooling solvent is evaporated out of the solution. The lithium-bromide solution, which is now concentrated again is transported back to the absorber.

Condenser: The cooling solvent steam evaporated in the generator is now streaming to the condenser in order to be fluidified. The fluidified solvent is decompressed by a restrictor and applied to the evaporator.

Evaporator: The cooling solvent, arriving from the condenser streams to the evaporation vat. There it is aspirated by a cooling solvent pump, pumped upwards into an affusion system and spread over the evaporator tubes. Due to the high vacuum, a part of the cooling solvent evaporates already at a very low temperature. The cooling solvent takes the heat required for the evaporation out of the cold water flowing through the evaporator tubes, which is now cooling down from 15 °C to 9 °C.

Absorber: Inside the absorber the cooling solvents vapour, arriving from the evaporator gets in contact with concentrated solution at the time when the solution is also spread by an affusion system. During this action, the cooling solvents steam is being absorbed from the solution. The heat which is set free by this is absorbed by the re-cooling water and released to the environment by a re-cooling tower. The cooling solvents solution occurring collects on the bottom of the absorber and is being aspirated by a solution pump.

Solar Cooling with ADSORPTION chiller



First solar cooling for one family house and small applications

The first product generation has a nominal cooling capacity of 7.5 kW and uses the working pair silica gel / water. The machine is especially suitable for low heating temperatures starting at 70°C.

Technical Principle of the SOLACS 08 Adsorption Chiller:

Step 1: Desorption – Drying of the adsorbent

Water vapour is set free by heating the adsorber by solar collectors and liquefied in the condenser. The upper check valve closes.

Step 2: Adsorption – water vapour is adsorbed at the surface of the adsorbent

After a cool down phase, water vapour is aspired through the opened lower check valve and will be adsorbed by the silica gel. Water evaporates in the evaporator and generates cold.

Step 3: Condensate instead of liquefied water

In a final step the condensate is returned to the evaporator and the circuit is closed. In order to produce continuously cold, the two adsorber chambers are anticyclically operated

Area of Application

Solar cooling for private homes and small offices.
Due to its compact size the SOLACS08 is particularly suitable for the solar cooling in the private and small commercial sector.

Arctic technical info

		ACS 08	ACS 15
	Unit	Nominal working point	
Cooling capacity, nominal	kW	7.5	15
Cooling capacity, effective	kW	5 - 10	10 - 20
COP, nominal		0.56	0.56
Chilled water circuit Temperature range (out): 6-20°C			
Temperature in/out	°C	18/15	18/15
Volume flow	m³/h	2.0	4.3
Pressure loss	mbar	370	550
Operating pressure, max.	bar	4	4
Supply	external thread	1"	1 1/4"
Heat rejection circuit Temperature range (in): 22-37°C			
Temperature in/out	°C	27/32	27/32
Volume flow	m³/h	3.7	7.0
Pressure loss	mbar	610	850
Operating pressure, max.	bar	4	4
Supply	external thread	1"	1 1/4"
Heat supply circuit Temperature range (in): 60-95°C			
Temperature in/out	°C	72/65	72/66
Volume flow	m³/h	1.6	3.8
Pressure loss	mbar	300	600
Operating pressure, max.	bar	4	4
Supply	external thread	3/4"	1 1/4"
Electricity supply			
Voltage	V	230 ~	230 ~
Frequency	Hz	50	50
Power consumption ∅	W	9	12
Dimensions			
Lenght	mm	790	790
Width	mm	1060	1350
Height	mm	940	1450
Weight	kg	ca. 260	ca. 510

Version 07.07.2008

Subject to change without notice

Structure

Technology: Adsorption, single-effect
Model type: Chiller
Working pair: Silica gel/water

The system will be delivered ready to connection and includes the adsorption chiller with an integrated control.

The table summarizes the technical data under certain design points and alternative boundary conditions. The nominal cooling capacity and the COP are highly dependent on the temperatures of the three circuits.

If desired, we provide you with a calculation of COP and cooling capacity under your specific conditions.

Cooling tower for absorption chiller

Through the open cooling tower, the heat produced by the cooling machine is released.

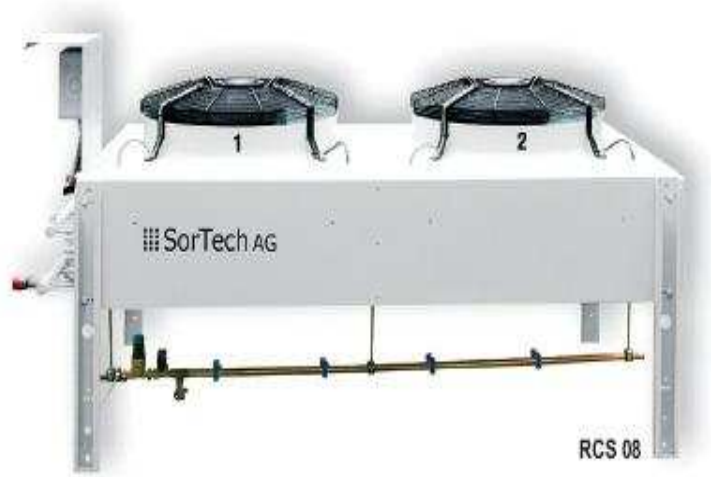
The tower has to be installed outside and has a water consumption of about 50 liters per day.

The cooling tower has to be dimmensioned considering the absorption machine performance and the average ambience humidity, depending on the location of the planned system.

Cooling tower for adsorption chiller

Through the closed cooling tower, the heat absorbed by the cooling machine is released.

The tower has to be installed outside and has an electrical consumption assumes to 0,58 kW.



The cooling tower has to be dimmensioned considering the absorption machine performance and the average ambience humidity, depending on the location of the planned system.

Cold distribution system

For example there are different systems available:

-chilled ceilings
-cooling sails
(see links)

Source:

http://www.luftkuehldecke.de/html/kuhlsegel.html

www.klimatop.info
www.klimadecke.com
http://www.klix-deckenradiatoren.de/
http://www.klix-sandra.de/
http://www.rcs.co.at/PDF/kuehl_heizdecken.pdf
http://www.luftkuehldecke.de/html/kuhlsegel.html

-also fan coils

Source:

http://www.klix-sandra.de/details/waermeprofil-badheizkoerper-klix-sandra-details.html

EXAMPLE:

Chilled ceiling 75 W/m² ceiling area → cooling performance of 20 kW

result: 265 m² ceiling surface

Project Management

Some facts:

- Filling the checklist for solar cooling projects as far as possible
  (important: cooling load calculated or estimated, square meters of the building, location)
- Solar Cooling Offer will be provided by SOLution:
  Solar components, storages, chiller, cooling tower, pumps…
  (costs for planning: 500 Euro)
- Offer shall be presented to the interested client; SOLution provides help for open questions
- Appointment for the solar cooling system
- Delivery of the system, mounting of the collector field
- Hydraulic installation (preparation) by the local installer
- initial operation of the solar cooling system by SOLution resp. manufacturer

Checklist

Checklist for solar cooling projects

Customer (Name, Adress): .....
Contact person: .....
Telephone: .....
Fax: .....
Email: .....

Actual cooling system

Is there one?
O Yes
O No

Brand: .....
Kind of cooling/ Cooling principle: .....
What is the cooling performance in kW? .....
Is there an actual calculation for the cooling load? .....
O Yes
O No

Actual heating system

Is there one?
O Yes
O No

Functional Principle:
O Petrol
O Gas
O Wood
O Pellets
O Electricity
O Other
Brand: .....
Performance in kW: .....

About the building

Use of the building (private/office/etc): .....
How many square meters has the building? .....
Number of floors: .....
Square meters per floor: .....
Location: .....
All the rooms have to be cooled/heated? .....

Kind of cooling/heating distribution:
O Heating/cooling ceiling
O Concrete Core heating/cooling
O Fan-Coil System
O Air
O Heating floor
O Heating/cooling wall
O Other

Designated chiller system (adsorption, absorption): .....
Designated chilled water temperature: .....
Designated recooling system (opened, closed circuit): .....

Place for the cooling/heating system

Is there place for:

Hot water storage (about 50-100 ltr / m² collector area)? .....

Cold water storage (about 30 ltr /m² collector area)? .....

Absorption or Adsorption chiller (about 3-10 m²)? .....

Cooling tower (about 1 to 5 m² outside the building)? .....

The collectors might be:

O Inroof
O Onroof

About the roof:

Inclination: .....
Direction: .....
Kind of covering: .....
Maximum load capacity: .....

Demo installation

Some facts:

- 2000 m² office
- 25 working places
- 60 kW cooling load
- Concrete Core Cooling

One system for:

- ✓Domestic hot water
- ✓Heating
- ✓Cooling

550 m² collector area

60 kW adsorption chiller

SOL*ution* can also provide following services to you:

- Technical support
- Engineering projects
- Mounting Systems
- Start up Systems

Come and visit us!

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Take a look on www.sol-ution.com and you will find more information about the company and the solar systems we can provide to you.

Thank you for your attention.