Solar Cooling - Green Chiller Industry Association

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Abstract

The Green Chiller Association for Sorption Cooling e.V., Berlin, Germany was formed in March 2009 as German Industry Association to promote and develop the solar and thermal cooling markets. Founding members of the association are six companies (AGO AG, EAW Energieanlagenbau Westenfeld GmbH, InvenSor GmbH, Pink GmbH, SolarNext AG, SorTech AG) and two research institutes (Fraunhofer ISE, ILK Dresden). Since February 2010 the association has opened their memberships to all European manufacturers of sorption cooling technologies (closed and open systems) and sponsoring members from Europe.

1. Introduction

During the last few years especially in Europe various new sorption chillers with small and medium-scale cooling capacity (7 – 200 kW) have been developed. Many of these absorption and adsorption chillers have now passed over from prototype stadium into serial production. In general the market potential for solar cooling and thermal cooling is very large, but both markets are still under development. During 2005 and 2009, the Green Chiller members have produced and commissioned together 225 absorption and adsorption chillers with an accumulated cooling capacity of 5.8 MW up to now. Due to the fact of the growing market and the lack of awareness of sorption cooling technologies in politics, industry, trade and public the Green Chiller Association was founded to form a powerful lobby association.

2. Members

The Green Chiller association represents today around 60% of all European manufacturers of sorption chillers in the small and medium-scale cooling capacity range. Most of them are based in Germany. Furthermore, several partners from the industry, consultancies, research institutes, etc. are sponsoring members of the association. The association is looking forward to represent also the open sorption technologies like DEC Systems and LDAC in Europe in the future.

Up to know all closed sorption technologies like absorption cooling (working pair's water/lithium bromide and ammonia/water) and adsorption cooling (water/silica gel and water/zeolith) are offered by the members so far (Table 1).

Table 1: Profiles of the current members of the Green Chiller Association

Company	Location	Profile
ago	Kulmbach (Germany)	Manufacturer of Ammonia/Water Absorption Chillers (30 – 500 kW)
EAW	Westenfeld (Germany)	Manufacturer of Water/Lithium Bromide Absorption Chillers (15 – 200 kW)
Fraunhofer ISE	Freiburg (Germany)	Research Institute for Solar Energy Systems, Cooperation with SorTech
ILK Dresden	Dresden (Germany)	Institut für Luft- und Kältetechnik Dresden, Developments in Cooperation with EAW and AGO
invensor	Berlin (Germany)	Manufacturer of Water/Zeolith Adsorption Chillers (9 and 10 kW)
PINK	Langenwang (Austria)	Manufacturer of a Ammonia/Water Absorption Chillers (14 and 19 kW)
SOLARNEXT	Rimsting (Germany)	System Supplier of thermally driven Absorption/ Adsorption Chillers and Cooling Kits (7 – 105 kW)
SorTech AG	Halle (Germany)	Manufacturer of Water/Silica Gel Adsorption Chillers (8 and 15 kW)

3. Objectives

In general, the Green Chiller association would like to force a strong lobby work to increase the awareness for these innovative sorption cooling technologies in politics, industry, trade and the public. Therefore, a German (www.greenchiller.de) and English (www.greenchiller.eu) website is set up to present and offer related information on the association and the technologies. Moreover, the members have identified the following main objectives of the association:

- Promoting and developing of the solar and thermal cooling markets in Europe
- Demonstration of different applications
- Development of design tools
- Standardisation of chillers and solar cooling / thermal cooling systems

One important target for developing the solar cooling market is to create the basis for funding schemes of solar cooling systems. Therefore, a standardization of the solar cooling systems is necessary as well as the availability of design tools for planners and architects.

4. Market Developments

4.1. Conventional Air-Conditioning

Worldwide the energy consumption for cold and air-conditioning is rising rapidly. Usual electrically driven compressor chillers (split-units) have maximal energy consumptions in peak-load period during the summer. In the last few years even in Europe this regularly leads to overloaded electricity grids. The refrigerants that are currently used in the split-units do not have an ozone depletion potential (ODP) anymore, but they have a considerable global warming potential (GWP), because of leakages of the chiller in the area of 5 to 15% per year.

Particularly the sale figures of split-units with a cooling capacity range up to 5 kW are rising rapidly. In Europe the number of sold units has risen about 210% from 2.8 million in 2002 to 8.6 million in 2008 with a predicted decrease in 2009 of 40% to 5.2 million units [1]. The Japan Refrigeration and Air Conditioning Industry Association (JRAIA) has expected a worldwide sales of 70 million units in 2009 as shown in Figure 1.

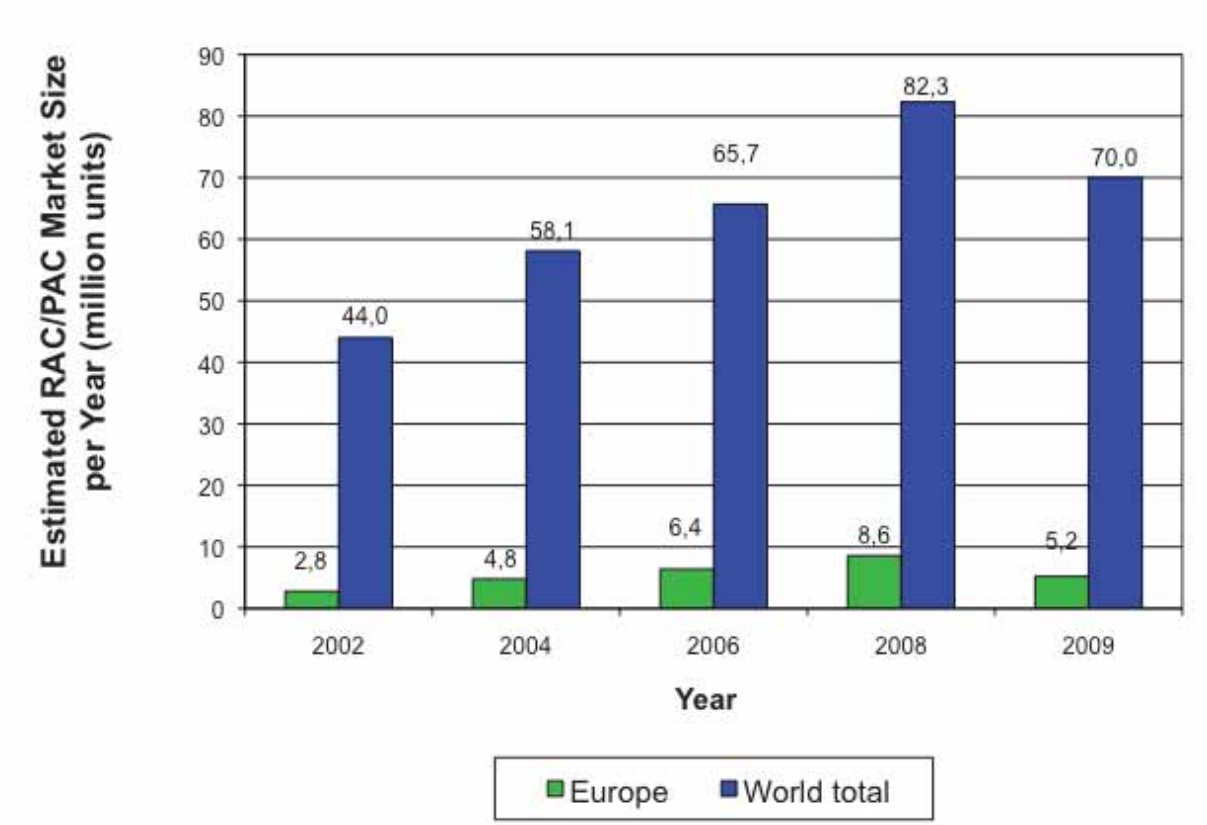

Figure 1: Market development of split-units up to 5 kW in Europe and worldwide (Source: Solem Consulting/JARN)

4.2 Solar Cooling

Thermal cooling by solar energy or district heating or waste heat from CHP units, biomass as well as processes could be lead to a considerable reduction of energy consumption. The sorption chillers use environmentally friendly refrigerants and have only very low electricity demand. Therefore the operating costs of these chillers are very low and the CO_2 balance compared to split-units is considerably better. The main advantage of solar air-conditioning is the coincidence of solar irradiation and cooling demand. In case active cooling being necessary, the long running times of the chillers are the key for economic efficiency of solar air-conditioning. For domestic buildings in the southern Mediterranean area approximately 800 to 1,000 full load cooling hours occur.

The world first solar cooling system was running in Paris, France (Figure 2) during the world exhibition 1878 [2]. This system has consisted of an ammonia/water absorption chiller and a parabolic reflector to produce ice.

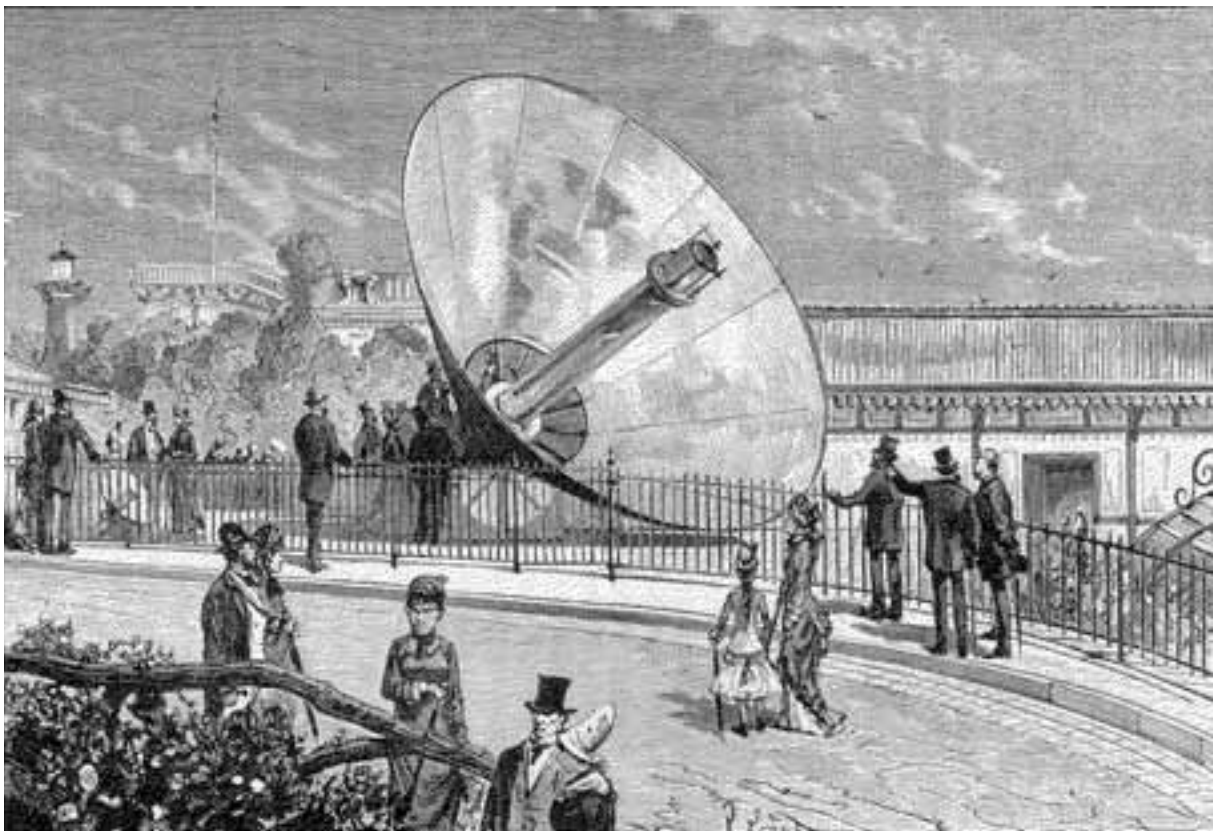

Figure 2: World exhibition 1878, Paris: Augustin Mouchot produced the first ice block through solar energy (Source: Olynthus Verlag)

The first commercial solar cooling systems for air-conditioning were developed in Europe and the USA one hundred years later, e.g. by the companies Dornier-Prinz Solartechnik, Germany [3, 4] and Arkla Industries, USA (today Robur, Italy) [5]. These systems have been realized in several demonstration projects. Due to the lack of demand on the market for solar cooling during this time, the production of these solar cooling systems was stopped in the late eighties of the 20th century.

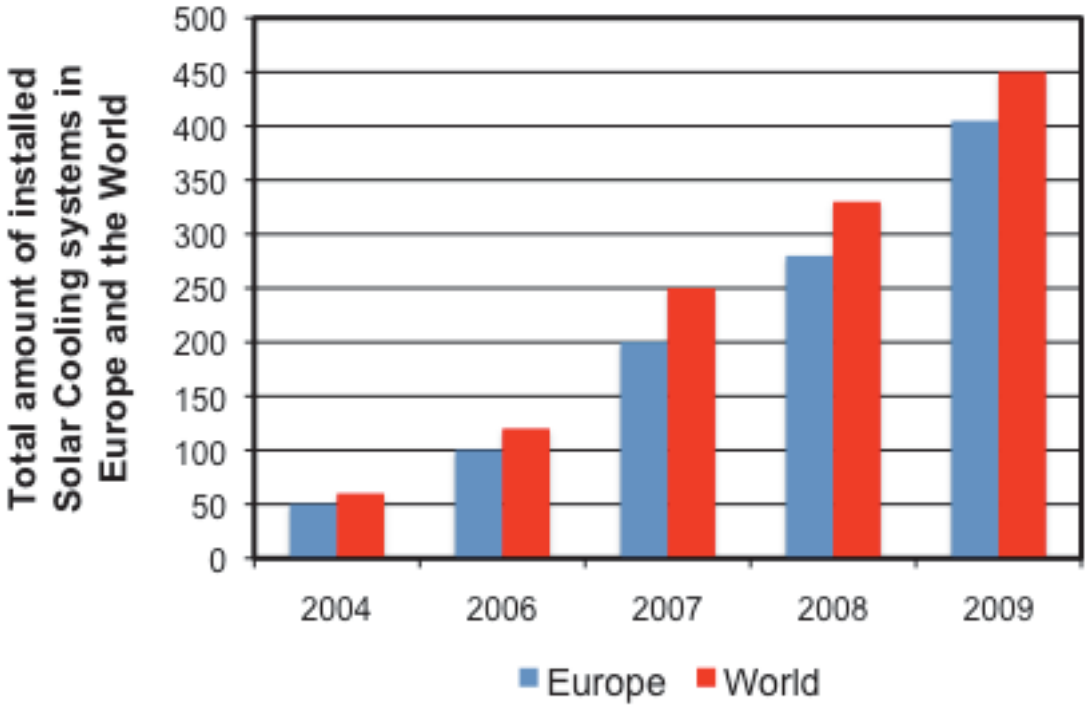

Figure 3: Market development of small to large-scale solar cooling systems in Europe and worldwide between 2004 and 2009 (Source: Solem Consulting)

At present about 450 solar cooling systems are realized in total worldwide in 2009 [6]. Four hundred of these installations are in Europe. The market for solar cooling in Europe has increased in the last five years by 50 to 100% each year as shown in Figure 3. The total amount of installations shows that the solar cooling market is still a niche market, which is under development. Approximately 71% of these systems using absorption chillers, 13% adsorption chillers and 16% open systems (DEC and liquid sorption systems) [7].

5. Conclusion

Active air-conditioning of buildings is also necessary at European climate conditions, especially in Southern Europe, if high internal and external loads can not be removed by an efficient night ventilation. The refrigerants that are currently used in the

electrically driven compressor chillers (split-units) do not have an ozone depletion potential (ODP) anymore, but they have a considerable global warming potential (GWP), because of leakages of the split-units in the area of 5 to 15 % per year. Usual split-units have maximal energy consumptions in peak-load period during summertime. On the contrary, solar cooling systems provide a sustainable active air-conditioning possibility. The sorption chillers use environmentally friendly refrigerants (water or ammonia) and have only very low electricity demand. Therefore the operating costs of these chillers are very low and the CO_2 balance compared to split-units is considerably better.

Therefore, the Green Chiller Association for Sorption Cooling was formed in Berlin, Germany in March 2009 to develop and promote the solar cooling and thermal cooling markets in Europe. Eight companies (sorption chiller manufactures, system supplier, component supplier and consultancy), four research institutes and one chamber of crafts have brought together their expertise so far to get solar cooling out of its niche existence. The target of the Green Chiller Association is to increase the awareness for these innovative technologies and with that to raise considerably the amount of solar cooling installations in the next few years from today 450 systems worldwide. A first step to reach that target is, that standardised solar cooling kits from system suppliers are now available on the market to bring down the costs and to simplify the system design and installation.

References:

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