D2.2 Report on market situation and trends about relevant solar thermal applications

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1 European Solar Thermal Market Statistics

The solar thermal sector in the EU, presents a semi-steady growth rate the last decades, increasing with the additional features and type of use that the new-more advanced systems provide, numbering about 3.5 million m2 area of installed collectors (Figure 1). Accordingly, the cumulative installed capacity of solar-thermal systems in Europe in 2006 was 13 GWth[1], which accounts approximately to 0.7 Mtoe of useful heat. In more detail, the annual installations in the EU reached 2.1 GWth in 2006, compared to 1.5 GWth in 2005 and 1.1 GWth in 2004, demonstrating the continuous market growth of the sector. The average growth rate in terms of installed capacity during the period 2000-2005 was 13%, while the corresponding one for 2004 and 2005 was almost 25%.

Europe is one of the most dynamic markets for solar-thermal systems in the world, together with China and Oceania. The world installed capacity in 2006 was 118 GWth, with the largest markets being China[2] and Taiwan. The global growth rate during the period 2004 – 2005 was 11 % and the global average annual growth rate for the period 2000-2005 was 15%.

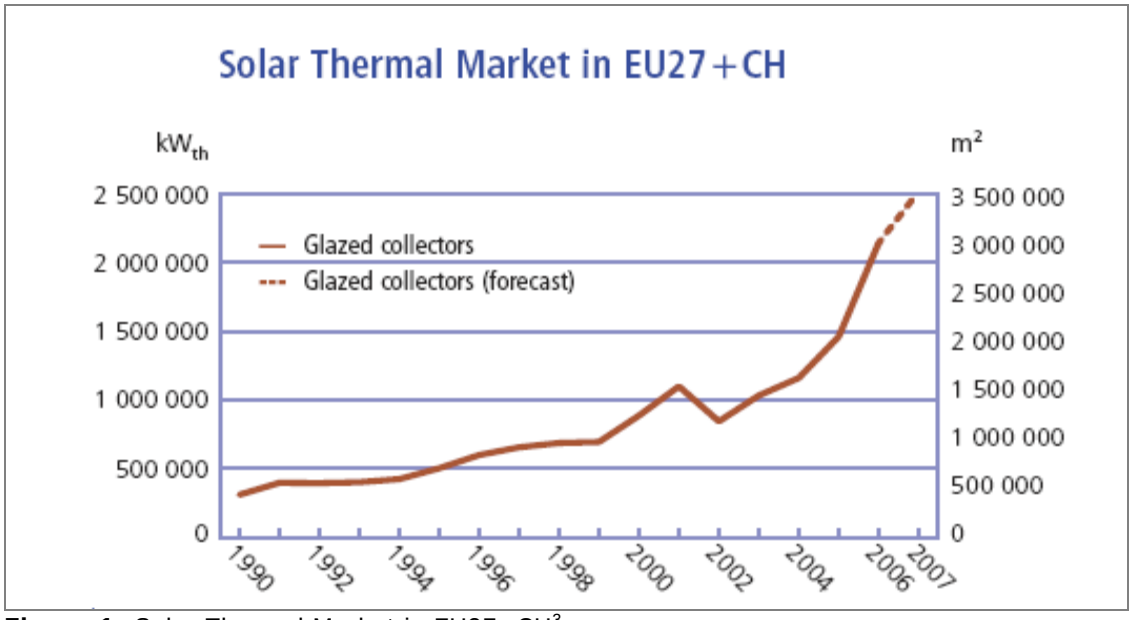

Figure 1: Solar Thermal Market in EU27+CH[3]

In the EU, three countries hold 72% of the market, a consequence of long-term financial incentive schemes for the development and deployment of solar-thermal technology: In descending order these countries are Germany (with 49% of the European installed capacity), Austria (12%) and Greece (11%); countries like France, Spain and Italy follow on equal market shares (fig.2).

The majority of solar-thermal systems, which accounts for 90% of the installed capacity in Europe, is designated for the supply of domestic hot water at single family house units, while the remaining is equally split between systems of domestic hot water at multi-family house units, and combi-systems for single family houses that provide both hot water and space heating. The market portion of the abovementioned type of systems however varies among the various

[1] This corresponds to a total collector area of 19 million m^2.
[2] The Chinese market was initiated 10 years ago.
[3] ESTIF/ Solar Thermal Markets in Europe (Trends and market statistics 2006) June 2007

countries. In addition, a number of large scale solar thermal installations based in countries like Denmark, Sweden, Germany and Austria are committed for supplying heat to district heating networks. Some of them are also coupled with seasonal heat storage[4].

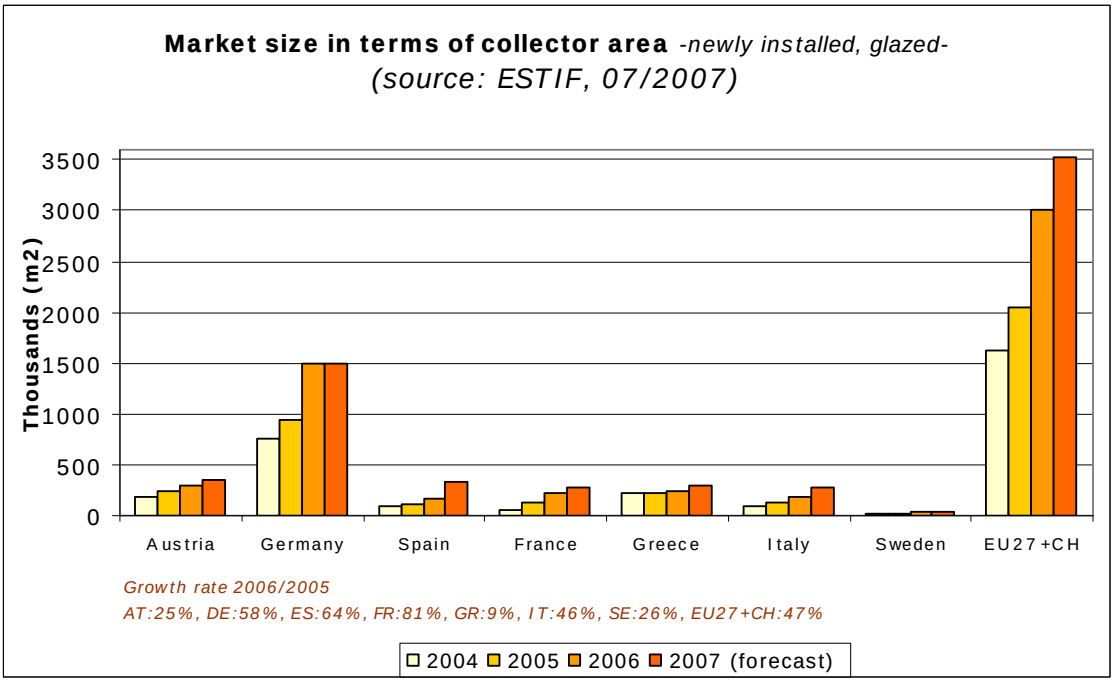

Figure 2: Solar Thermal Market in participating countries (installed collector area)

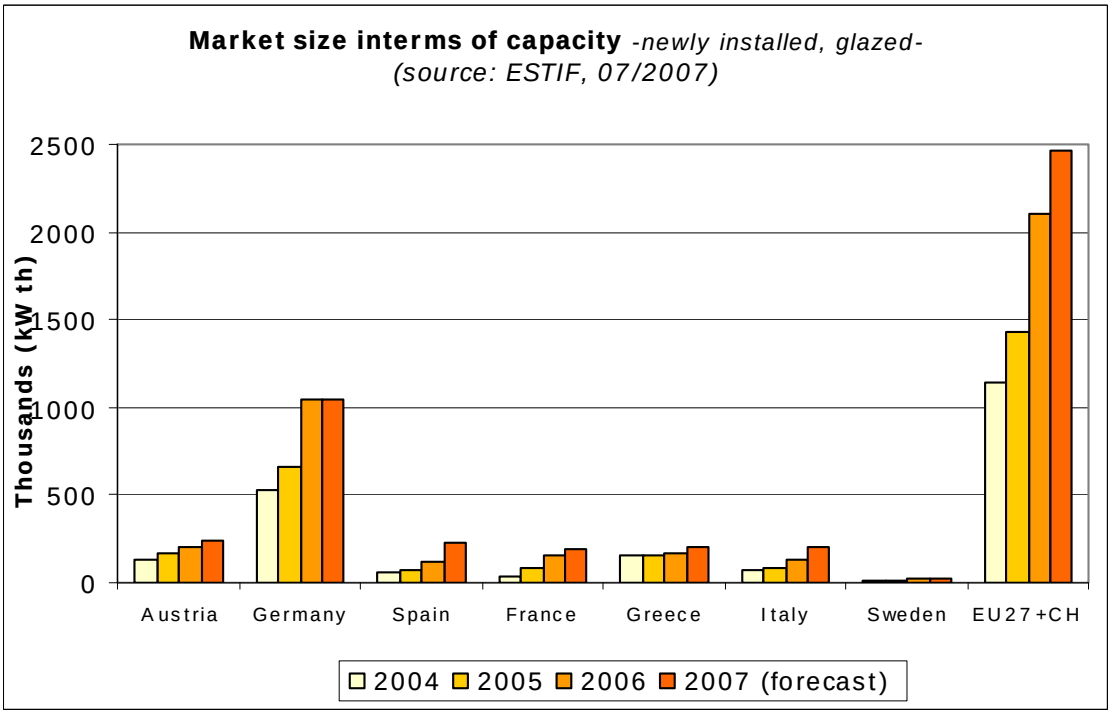

Figure 3: Thermal Market in participating countries (in terms of capacity)

[4] Report on the Hearing of the Solar Thermal European Technology Platform/ European Commission, Joint Research Center Directorate-General, Institute for Energy, Energy Systems Evaluation Unit

SC+ countries are characterized by different growth rates for their solar thermal market, as presented in figures 2 and 3. Countries like France, Italy and Spain exhibit growth rates of either the same or higher scale than the European average (47%), while markets like Greece (about 10%) or Austria (about 25%) seem to have reached a market saturation phase. The German case, presents some quite unique characteristics that should also be correlated with the fiscal incentives that were / are active in the country and, at the end, are forming the way that the solar thermal market develops.

2 National Solar Thermal Markets

This section of the report presents a short description of the solar markets of the participating countries. The input is based on the synergy among the IEE projects SOLARCOMBI+ & SOLAIR project. Sweden is not participating in both projects, so the data is based on other sources.

2.1 Germany

Table 1: Solar thermal systems data for Germany[5]

Newly installed capacity in 2006	1.05 GW
	(+ 58 % compared to 2005)
of which flat-plate	*0.95 GW*
of which vacuum tubes	*0.1 GW*
Total installed capacity in 2006	5.64 GW
Newly installed area in 2006	1.5×10^6 m²
of which flat-plate	*1.35* $\times 10^6$ *m²*
of which vacuum tubes	*0.15* $\times 10^6$ *m²*
Total installed capacity in 2006	8.05×10^6 m²

The newly installed capacity of solar thermal systems in 2006 has shown an increase of approx. 50% compared to the year before. However this behaviour is projected to change, since differentiations at the market mechanisms and incentives given by the state are estimated to freeze this market growth. In absolute terms, the number of installed systems can be even lower in 2007.

[5] Country data provided by ISE, SOLAIR & SOLARCOMBI+ project partner

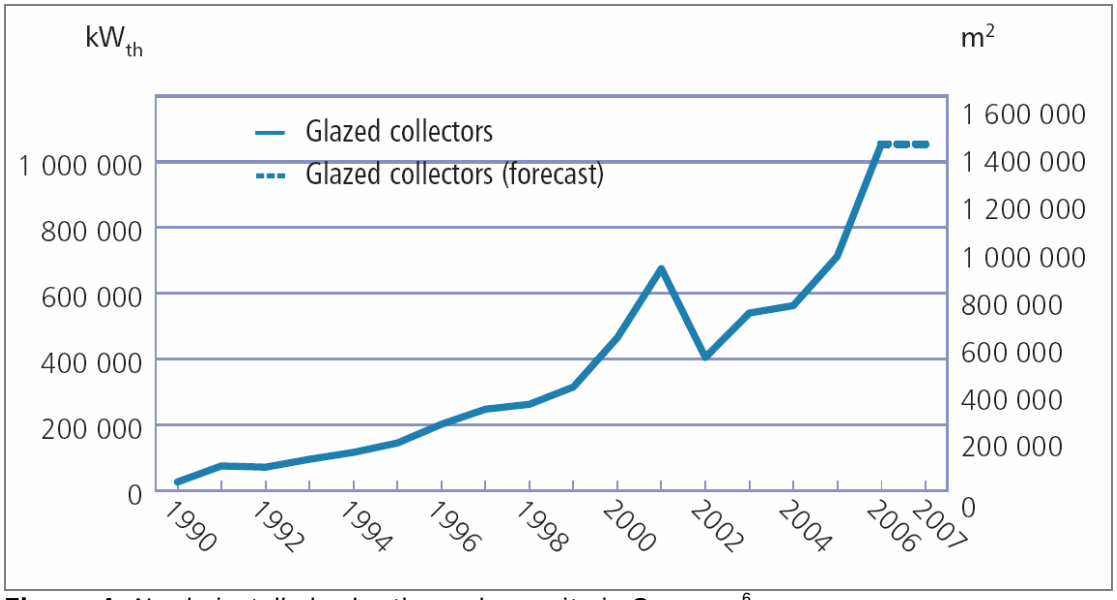

Figure 4: Newly installed solar thermal capacity in Germany[6]

The sales rate of solar thermal systems that provide space heating as well (solar combi systems) has been increasing, accounting right now for approximately 40% of the total solar thermal sales. Nevertheless, the market share of combi systems on the whole of installed solar thermal systems is still quite distinctly below this value.

Currently, federal obligations to cover a certain amount of heat demand by technologies using renewable energies (solar thermal, biomass boilers, heat pumps) for new or refurbished buildings are under discussion and legislative proposals will be prepared soon. It is estimated that the obligations will become effective in the beginning of 2009.[5]

2.2 Austria

The solar thermal market in Austria is every year concluded in a report financed by the Federal Ministry of Transport, Innovation and Technology. The report gives a good overview of the situation in the Austrian market. Figure 5 shows the yearly installed collector area in Austria [m²/year] from 2000 to 2006, divided in unglazed flat plate collectors, evacuated tube collector and glazed flat plate collectors.

[6] ESTIF/ Solar Thermal Markets in Europe (Trends and market statistics 2006) June 2007

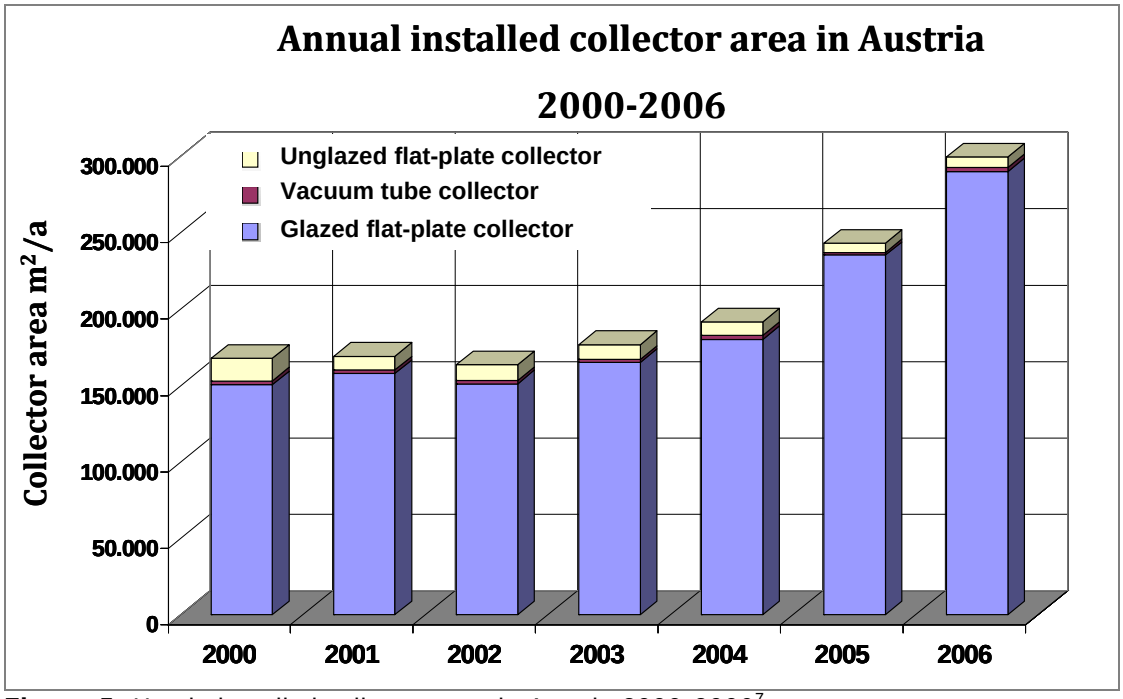

Figure 5: Yearly installed collector area in Austria 2000-2006[7]

The installed collector area in Austria at the end of 2006 is shown in figure 6, whereas it is clearly noticed that 81% of the systems use glazed collectors. This type of collectors provide a high level of flexibility in reference with the system's use (from hot water heating to combi and solar cooling systems), while the rest (evacuate tube and unglazed) are predominantly committed for specific type of installations (industrial, pools etc), which justifies further their small portion in the market pie.

Based on recent surveys (G.Faninger, 2007), 65% of the installed area of solar collectors are applied for domestic hot water preparation and 35% of the installed area solar collectors are applied for space heating. Moreover, only 35% of the installed systems are placed in existing buildings while the rest 65% of the new installed systems refers to installation in newly constructed buildings.[7]

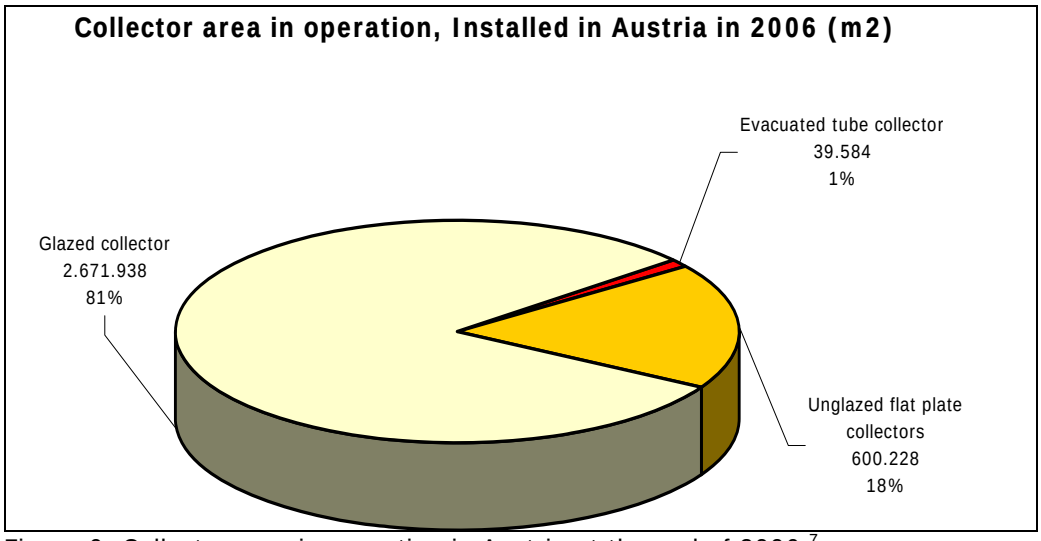

Figure 6: Collector area in operation in Austria at the end of 2006.[7]

[7] Country data provided by AEE INTEC, SOLAIR & SOLARCOMBI+ project partner

2.3 France

The French (without counting the overseas departments) solar thermal market is currently exploding as it presents extremely high growth rates. More specifically, the market in 2006 experienced an increase of about 83% in comparison with 2005. The high growth rate is at some extend justified by the existence of a series of fiscal incentives (payback up to 50% of the equipment price) and tax deductions.

Table 2: The annual French solar collectors market (m2) for newly installed systems

	2000	2001	2002	2003	2004	2005	2006
France	6 350	17 650	23 400	38 900	52 000	121 000	220 000
Overseas dept	24 060	23 350	40 530	43 410			

Table 2 presents the annual number of installed systems in terms of area. Taking into account the 2006 estimation of about 81000m^2 new solar thermal systems at the overseas French departments (EurObserv'ER2007), the French market overall reaches about 210MW_{th} annual solar thermal installed capacity and ranks 3rd, slightly below the Austrian one (Figure 3).

Figure 7 presents the evolution of the French solar thermal market in terms of capacity (kW_{th}) and area (m^2) without the overseas departments. More specifically for 2006, whereas the annual solar thermal market was about 220 000 m², the following distribution per type of system was applicable:

- approximately 35 000 individual solar hot water systems (= 150 000 m²)
- approximately 5 000 solar combined systems (= 51 000 m²)
- approximately 22 000 m² for collective solar hot water systems.

The French market is about to become the second biggest market of Europe, far behind Germany (1.5 millions m² sold in 2006) and currently very close to the Austrian one. [8]

[8] Country data provided by TECSOL, SOLAIR & SOLARCOMBI+ project partner

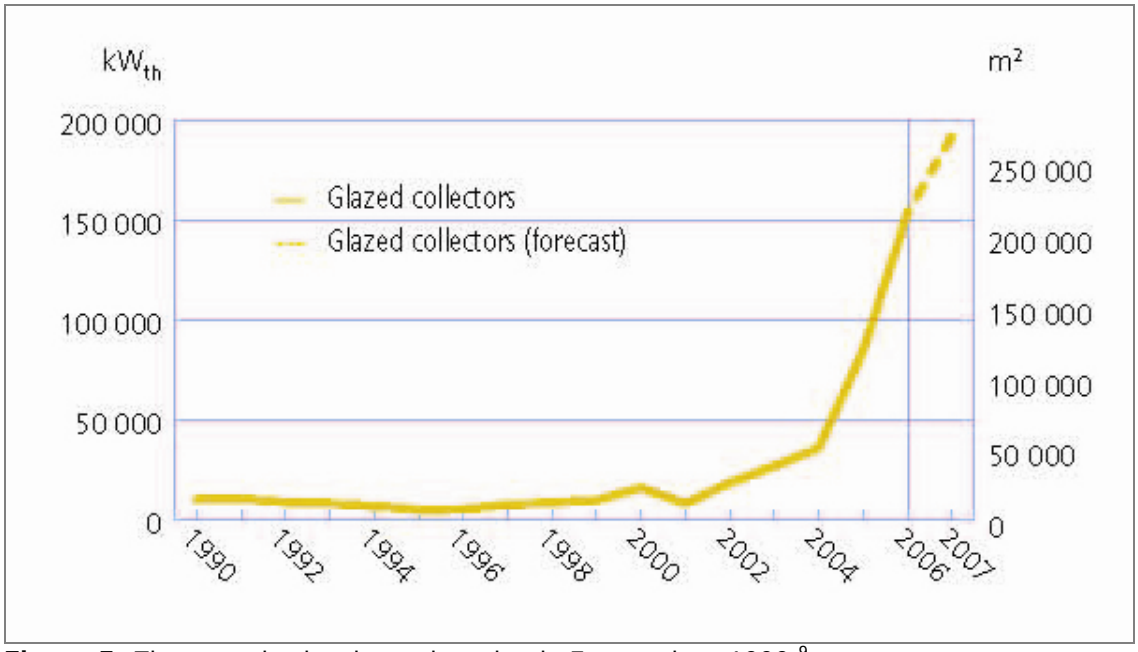

Figure 7: The annual solar thermal market in France since 1990.[9]

2.4 Italy

In spite of the fact that the Italian market has been considered quite undeveloped in the past, right now it is demonstrating a very impressive growth rate, having a size comparable to countries like Austria, France or Spain. This was revealed by a new systematic market survey performed during the first months of 2007 by a panel of independent experts with the support of ESTIF and other market players.

Figure 8 shows that the new capacity installed in Italy during 2006 was actually 130 MW_{th} (186.000 m^2). As the underestimation of the market was systematic in recent years, this figure cannot be compared with those of previous years. The diagram to the left includes a retroactive re-evaluation of the market development.

This market opening with the high growth rates is expected to continue since fiscal incentives are now in place (tax deductions) and the foreseen mandatory use of solar thermal systems in the new constructions, which is also expected to come into force very soon, will promote further the use of those systems.

However, even with the corrected market data and the various fiscal incentives and regulatory mechanisms, it will take years of effort from industry and policy makers before Italy can achieve levels per capita comparable to its neighbours Austria and Greece.[10]

[9] ESTIF

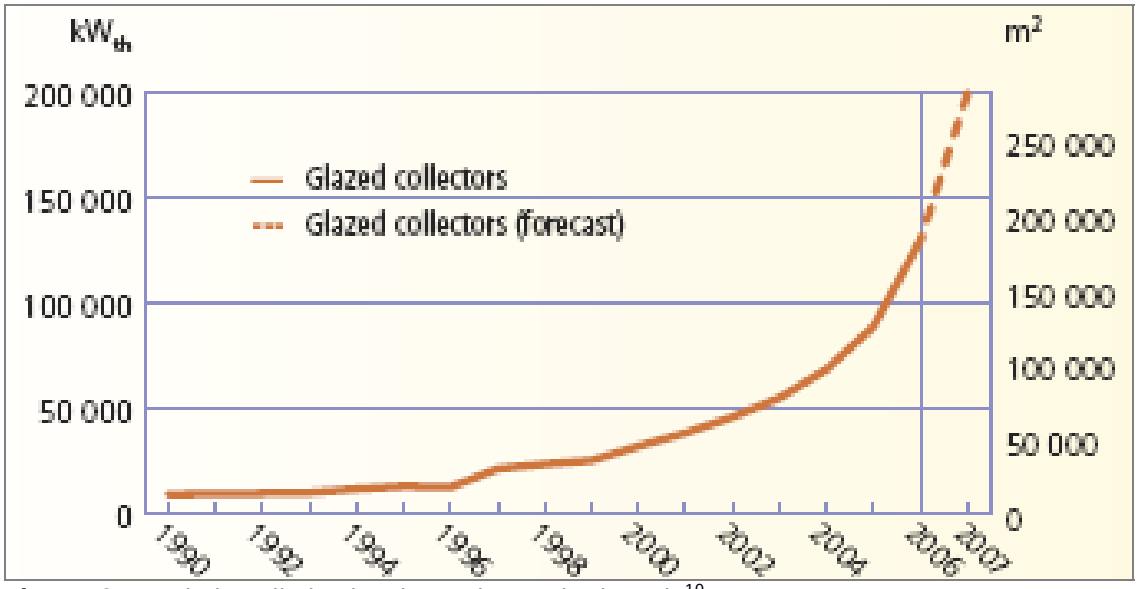

Figure 8: Newly installed solar thermal capacity in Italy[10]

2.5 Spain

Solar thermal energy in Spain is mainly used in domestic or residential buildings. Further installations of large solar thermal systems (from now LSTS) are situated in hotels, hospitals, sports centres, and there are also installations in schools, offices and industry. At the beginning of 2007, the new "Technical Code of the Construction" has been published in Spain. It obliges all new constructions to the installation of solar energy systems for domestic hot water preparation, a regulatory measure which is expected to give a further boost to the Spanish solar thermal market.

In 2004 around 20.000 m^2 of solar thermal collectors were installed in Andalusia, which holds the largest volume of Spain's solar thermal collectors. Out of these, approximately 17% were LSTS.

In total and by the end of 2005, it was reported that approximately 100.000 m^2 of solar collectors are in operation in Spain. This surface refers to LSTS, i.e. solar thermal systems with a collector surface larger than 30 m^2. These refer mainly to the type of forced circulation for hot water production, although there are also some installations devoted to space heating.

The main problems concerning LSTS installations in Spain are building integration, as well as project development and maintenance of the installation. Surprisingly, as manifested by surveys, another topic that should be considered is the reported scepticism about the usability of solar energy from a part of the population, considering the competition from other systems (conventional) with the same use.

Nowadays, the solar thermal market in Spain is experiencing a steady growth: 15% in 2005, 17% in 2006, while the installed squared metres of solar thermal collectors in Spain were multiplied by a factor more than 3 between 1990 and 2006. With the new legal framework and the expansion of the use in all the new buildings, it is foreseen that the growth rate will be further increased (as

[10] ESTIF/ Solar Thermal Markets in Europe (Trends and market statistics 2006) June 2007

projected at figure 9) and could result of about 1million m^2 of annually installed solar thermal systems and thereby reach the size of the German market. [11]

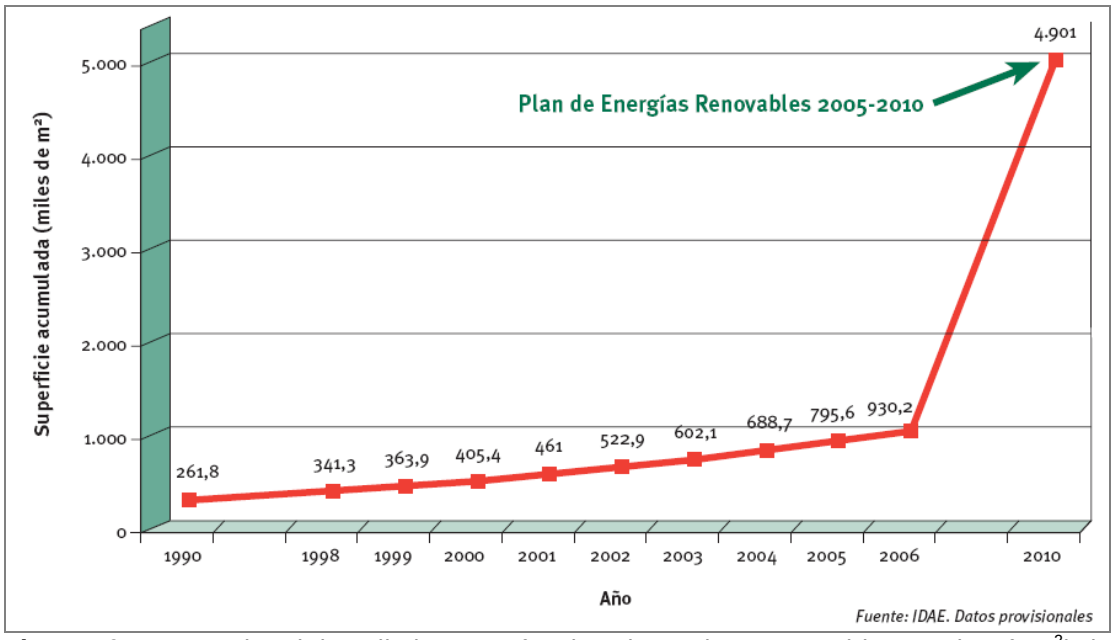

Figure 9: Accumulated installed area of solar thermal systems (thousands of m^2) in Spain[12]

2.6 Greece

Despite the limited amount of solar cooling installations in Greece, the Greek solar market is one of the more advanced worldwide. Greece is 4th in installations per capita in the world, following Cyprus, Barbados Islands and Austria. Additionally, it has one of the most successful solar thermal industries, supplying both the Greek and the European market (about 50% of the Greek manufactured solar thermal systems are exported).

Greece continues to be a reliable value in terms of solar thermal energy, with, according to EBHE (Association of Greek Solar Industrialists), 240 000 m^2 installed solar thermal systems in 2006, i.e. 9.1% growth with respect to 2005.

Greece is a stable market mainly centred on thermosiphonic systems and on an installation replacement market. Local suppliers are nevertheless trying to develop new applications like heating through combined systems and collective hot water in hotels.

In Greece, the promotion of solar energy for private individuals is made via a tax deduction of 20% of investment costs, without other subsidies or regulatory measures (nevertheless with the expected transposition and implementation via regulatory measures of the EPBD it is foreseen the mandatory use of solar thermal systems). Business firms when establishing new activities (factories, production line) can also benefit from either tax deductions that can go from 60%

[11] Country data provided by Aiguasol, SOLAIR project partner
[12] IDAE

to 100% or apply for subsidies which refer to the initial cost and vary according to the different regions between 40% and 60% of the eligible costs.[13]

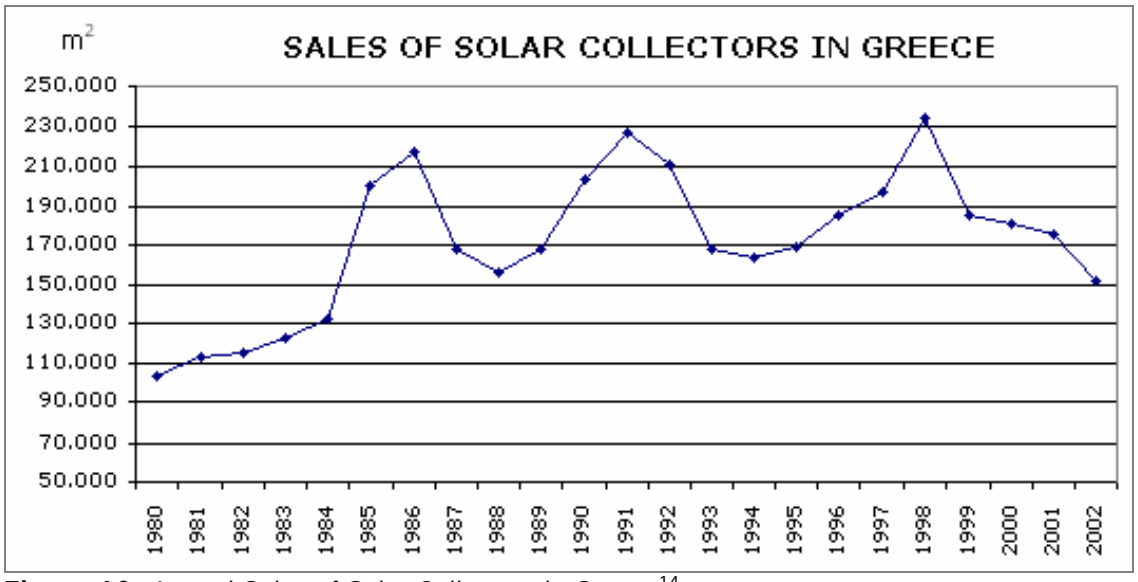

Figure 10: Annual Sales of Solar Collectors in Greece[14]

In Greece, three types of solar water heaters have known considerable development, the thermosiphonic ones, the large central solar systems and the compact collector systems. In 2005 the installed collector area was about 3.050.000 m². [ESTIF, 2005], whereas the estimation for 2007 was 3.560.000 m^2. More than 95% of it was for production of domestic hot water, mainly of thermosiphonic type (99.5% of the national market share). The rest of the installations are large scale for sanitary hot water, solar air conditioning and space heating.

The 2007 figures, indicate approximately 2600 MWh per annum (second larger figure after Germany) production by the solar thermal systems, which corresponds to 2.210 ton CO_2 emissions less for each year and roughly 1million households that have install and operate a solar system that can provide up to 80% of the needed energy for hot water.[15]

2.7 Cost of Typical Solar Thermal Systems

According to the Institute of Energy of the European Commission's Joint Research Centre, the vast majority of solar-thermal systems, 90% of installed capacity in Europe, is for the supply of domestic hot water – single family house units, the remaining being an equal share of domestic hot water – multi-family house units, and, single family house combi-systems that deliver both heating water and space heating. The application mix however varies between countries. The average turn-key cost of a solar-thermal system today is about €1100/kWth for

[13] SOLAR THERMAL BAROMETER – JUILLET 2007 & CRES reports
[14] CRES, European Solar Thermal Industry Federation (ESTIF)
[15] CRES, Greek Solar Thermal Handbook, 2006

pumped systems in central and northern Europe, and, €600/kWth for thermosiphon systems, which are used typically in southern Europe.[16]

In specific for each country, the following table presents the system price (for a typical collector area) of the most common solar thermal systems for domestic water heating.

Table 3: Average cost for ST for DHW production

Participating Country	Typical collector area in m²	System price in € (incl. installation & VAT)	Comments
Italy[17]	3,0	1500	*thermosiphonic system*
Greece[18]	2,4	1500	*thermosiphonic system*
Spain[17]	4,0	2.200	*thermosiphonic system*
Germany[19]	6,0	5.000-6.000	4 person household, pumped system
Austria[20]	6,0	4.200	pumped system
France[21]	3,0-5,0	3.800-5.000	200-300lt storage tank
Sweden[22]	5,0	3000	DHW tank with electric back-up heater

[16] Report on the Hearing of the Solar Thermal European Technology Platform/ European Commission, Joint Research Center Directorate-General, Institute for Energy, Energy Systems Evaluation Unit
[17] NEGST project, WP1: Theoretical Evaluation of Promising System: Drainback Solar Water Heating System
[18] CRES, Solar Thermal Department
[19] Bundesverband Solarwirtschaft (BSW) e.V., Dipl.-Phys. Rafael Wiese Manager BSW Office for rural electrification
[20] DWH for one & two family houses STESCOS project, Market Analysis -Austria
[21] http://www.bienchezmoi.com/solaire.php
[22] ESTIF/ Sun in Action II –A Solar Thermal Strategy for Europe, 2003

3 Solar Cooling Installations

According to the data from the synergy among IEE SOLACOMBI+ & SOLAIR projects, 107 Solar Cooling Systems are currently installed at the participating countries (N/A data for Sweden), 3 of which are in the residential sector. The installed systems per country are presented in the following figure and were given by the national project partners.

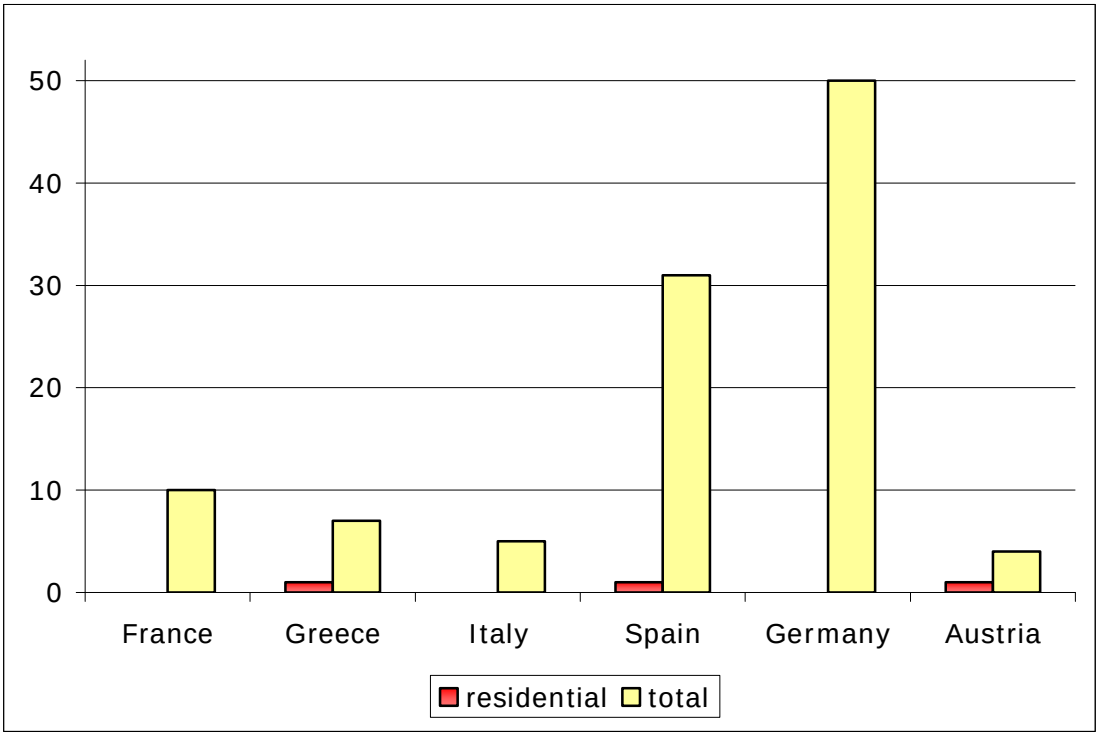

Figure 11: Volume of Installed SAC systems in the participating countries

3.1 France

At the moment, there are 8 installations of absorption solar cooling systems in France[23]. They are considered being demo installations and are located at the following sites:

- GICB at Banyuls-sur-mer (dept: 66). It is the most famous and elder solar cooling system in France, it is in use since 1991.
- CSTB at Sophia-Antipolis (dept: 06)
- DIREN at Basse Terre (Guadeloupe)
- Technifroid at Port (Reunion)
- GIVAUDAN factory at Argenteuil (dept: 95)
- Offices KRISTAL at Saint-Denis (Réunion)
- Residence du lac at Maclas (dept: 42)
- Museum HARIBO at Uzès (dept: 30)

[23] Source: TECSOL / SOLAIR & SOLARCOMBI+ project partner

Additionally, there are also 2 solar cooling systems that are using the DEC technology (not experimental), which are the following:

- ASDER at Chambéry (dept: 73)
- University of La Rochelle (dept: 17)

3.2 Greece

In the residential sector there is only one solar cooling installation in Greece. This is placed at the offices/multi-house flats of SolEnergy, a company that imports, manufactures and installs solar thermal systems. The system uses a combination of 78.6m² flat plate solar thermal collectors with a 35kW absorption chiller and two 180m³ cold and hot water storage tanks. The system is also configured to operate with a small desiccant system.

In Greece there are currently 6 more installations of solar cooling systems[24]. The largest and oldest commercial application is the installation in SARANTIS S.A cosmetics industry at Oinofita Viotias. This is also the largest solar cooling installation in the world, with total collector area of 2.700 m^2, driving a 700 kW solar cooling system operating with adsorption chiller technology. The system was installed in August 1999 and has been awarded the "Energy Globe Award 2001"as the world's third best investment for sustainable energy in the year.

The remaining installations of solar cooling systems in Greece are the following:

- "LENTZAKIS A.E." hotel in Rethimno Crete (Total: 600 m² flat plate collectors, 448 m² for solar cooling, 105 kW absorption chiller),January 2002, commercial application.
- "Rethymno Village" hotel in Rethimno Crete (Total: 647 m² flat plate collectors, 448 m² for solar cooling, 105 kW absorption chiller),September 2000, commercial application.
- National Center for Scientific Research (N.C.S.R.) "Demokritos" in Athens (160 m² flat plate collectors, 35.2 kW absorption chiller), research application.
- American College – Athens, (30 m² vacuum tube collectors, 7kW Vapor Thermal Compression chiller), 1988, research application.
- PENA – CRES, Lavrio (10m² flat plate collectors, 1500m³/h DEC cooling machine), 2007, research application.

3.3 Italy

Solar cooling in Italy is still in the demonstration stage. No reference market exists and the few running installations cannot give a clear indication and picture about the technology market trends. However, at least two different concepts in the residential sectors have been proposed recently[25], which namely are the small scale central air conditioning type and the large scale central air conditioning system. Installations that incorporate both concepts are already available in Milan. In the small scale solution, a newly developed LiBr absorption chiller of 4.5 kW was adopted. The small capacity chiller is of the type of a single effect dry cooled system. In the large scale installation, a LiBr absorption chiller of 70 kW was used. The large capacity chiller in contract to the small one, is of a double

[24] Source: CRES/ SOLAIR & SOLARCOMBI+ project partner
[25] Source: Ambiente Italia/ SOLAIR project partner

effect wet cooled type. In both cases, absorption chillers are driven by vacuum tube collectors and indoor cooling is provided through fan-coils.

At present, five installations are known in the non residential sectors. The most common solar cooling technology is single effect LiBr chiller wet cooled, coupled with both flat plate and evacuated tube collectors. For this type of technology, cooling capacity ranges from 15 to 300 kW and collector area from 138 to 425 m^2. Quite distinct from all other systems, is the small all air system that is installed in Palermo. This is a hybrid desiccant and evaporative cooling system in which the desiccant wheel is regenerated through solar heat and a vapour compression heat pump cools the process air and pre-heats the regeneration air.[26]

Table 4: Solar cooling non-residential installations in Italy [26]

Location	Application	Technology	Cooling capacity	Collector area
Bolzano	Office	ET collector LiBr wet cool.	300 kW	425 m2
Bolzano	Office	FP collector LiBr wet cool.	15 kW	150 m2
Trento	Office	Flat plate coll. LiBr wet cool.	108 kW	240 m2
Salerno	Restaurant	ET collector LiBr wet cool.	35 kW	138 m2
Palermo	University	Flat plate DEC + VCC	1250 m2/h	22 m2

3.4 Spain

At the end of 2006 there was only one installation in the Spanish residential sector. The name of the project is Climatewell Almería, located in the city of Vícar. It is a 10 kW absorption system, working with a FPC surface of 32,1 m^2. The back-up heating system for this house is of 20 kW. This installation is designed for space cooling and heating, domestic hot water and swimming pool heating.

The experience in Spain on solar cooling systems, increased significantly between 2002 and 2004: during this period, the number of SC plants was nearly doubled. The following list was updated until the end of 2006 and includes most of the plants with cooling capacity > 20 kW[27], numbering in total 30 installations.

Table 5: Solar cooling non-residential installations in Spain [27]

Country	Name of the project	Town	Type
Spain	Social & Cultural Centre Clara Campoamor	Barakaldo	Auditorium
Spain	Education Department Regional Government	Toledo	Office
Spain	Fabrica del Sol Building	Barcelona	Office
Spain	Fundacion Metropoli Building	Madrid	Office
Spain	Daoiz y Velarde Sport Centre	Madrid	Sport centre
Spain	Inditex head offices	Arteixo	Office

[26] Source: Ambiente Italia/ SOLAIR project partner
[27] Source: Aiguasol Enginyeria SCCL / SOLAIR project partner

Spain	Nursing home	Fustinana	Retired people house
Spain	University Rovira i Virgili CREVER	Tarragone	Office
Spain	Viessmann Head Offices	Madrid	Office
Spain	Belroy palace Hotel	Benidorm	Hotel
Spain	University of Sevilla	Seville	Labo
Spain	University of Carlos III	Madrid	Labo
Spain	Laia hotel	Derio	Hotel
Spain	CARTIF, Boecillo Technology Park	Valladolid	Office
Spain	Siemens Controlmatic	Cornelia del Vallès	Office
Spain	National Institute of airospacial Techniques	Huelva	Laboratory
Spain	FONTEDOSO	El Oso	Industry
Spain	Stella-Feuga	Santiago de Compostela	Office
Spain	Pompeu i Fabra Library	Mataro	Library
Spain	Ikerlan	Vittoria	Laboratory
Spain	Fagor Electrodomésticos	Basauri ?	Canteen
Spain	Rotartica	Basauri	Office
Spain	Gamesa Solar	Tarragone	Office
Spain	Tknika Educiation Department of Goverment	Renteria	Office
Spain	University of Malaga	Malaga	Office
Spain	IES Agustí Serra	Sabadell	Office
Spain	AIIC Asturias	Asturias ?	Office
Spain	Cener Offices	Pamplona	Office
Spain	TRASLUZ	Madrid	Office
Spain	Isofoton Offices	Málaga	Office

3.5 Germany

Solar cooling systems in the residential sector are not present in Germany so far. For detached houses, the capacity of the chillers available some years ago (minimum: 35 kW), was too large and therefore haven't succeeded to penetrate the local market for residential cooling.

Solar thermally driven or assisted cooling systems still have not penetrated the market generally (residential & non-residential sectors) until now. The realised systems are thus pilot or demonstration installations. The dominating purpose of use of the installed systems is office cooling.

A review on installed systems revealed – with some uncertainty – the following basic data (including installations in the public sector as well):

- number of installations: approx. 50
- installed cooling capacity: approx. 3 MW
- installed collector area: approx. 6500 m²

Desiccant cooling systems have a small share with approx. 14% of the installed cooling capacity; the remaining 86 % of the installations are chilled water systems. The technology applied uses rotating dehumidification units; one system is a pilot installation using liquid desiccant cooling technology (lithium-chloride).

Due to a few large installations with adsorption technology, this type of chillers covers approx. 60% of the installed capacity, but only 20% of the number of installations. The reason is that in the past the smallest unit available showed a capacity of 70 kW. The largest installations with adsorption chillers are:

- solar assisted adsorption cooling of the Landesamt für Umweltschutz, Augsburg.
  Adsorption chiller: 352 kW
  Solar thermal collector: 2,000 m² flat-plate
- solar assisted adsorption cooling of the FESTO Technology Center, Esslingen/Berkheim.
  Adsorption chiller: 1,050 kW
  Solar thermal collector: 1,220 m² evacuated tube
- solar assisted adsorption cooling at the Stadtwerke Remscheid.
  Adsorption chiller: 105 kW
  Solar thermal collector: 150 m² flat-plate.

According to the market situation of absorption chillers applicable for solar cooling, many of the systems installed with this type of chillers is equipped with units in the size of 35 to 70 kW capacity (chillers of company Yazaki). Recently, new small-size chillers have entered the market, contributing to systems in the capacity range of 5 kW to 15 kW. These installations have currently a share of approx. 10% of the installed capacity. Since three or more actors on the market are going to install complete installations under competing conditions, the number of the new solar driven installations in this capacity range is not very clear. Nevertheless, a distinctive growth of this capacity range may be expected for applications in small office buildings or residential solar cooling systems. [28]

3.6 Austria

There is only one (known to the SC+ Austrian partner) solar cooling plant in the residential sector in Austria. This plant is installed in a one-family house in Thening in Upper Austria. The cooling chiller is a SorTech adsorption chiller with a nominal cooling capacity of 5.5 kW. 38 m² solar collector area is installed on the roof of the building and the solar energy is applied for heating in winter, hot water production and heat for the adsorption chiller in summer.

There is no existing market for solar cooling in the residential sector. There are three solar cooling plants operating in the commercial sector in Austria. The first is a system, which delivers cool energy to a wine storage in Leutschach, in the federal state Styria. This system was taken into operation in the summer of 2003. The driving energy in this system is heat from solar energy and biomass (wood chips or log wood). Refrigeration is needed in a winery during the time of fermentation of the grape juice in large steel tanks, for the cooling and dehumidification of the wine bottle storage and for the tartar (wine crystal) stabilization. An ammonia-water chiller with separate heat exchangers for solar and biomass heat was developed and designed for the use in this wine cooling project. The Styrian company “PINK” constructed the ammonia-water absorption chiller, which was installed with a capacity of 10 kW. The solar thermal collectors have an area of 100.8 m² (70.5 kW) and the buffer a volume of 2 m³.

The second system has a WEGRACAL chiller with 15 kW from the company EAW, which delivers cold energy for space cooling for an office building in Sattledt, Upper Austria. The system was taken into operation in the summer of 2005. The

[28] Source:Fraunhofer-ISE/ SOLAIR & SOLARCOMBI+ project partner

solar thermal system has a flat plate collector area of 40 m² (28 kW). The cooled area in the office building is approx. 350 m².

The third solar cooling plant is installed in the office building in St.Veit an der Glan in the federal state Carinthia. The 1,234 m² cooled office area has a peak cooling load of 40 kW. The cooling energy is distributed via water in an air duct. The chiller used is an absorption chiller from the company Yazaki with 35 kW nominal chilling capacity. The solar thermal system, delivering heat to the chiller contains of 77m² collector area oriented towards the south-west with an inclination angle of 80°.[29]

[29] AEE INTEC/SOLAIR & SOLARCOMBI+ project partner

4 Solar Thermal forecasts & trends

ESTIF's first forecasts for 2007 indicate a somewhat more moderate growth this year. With an expected 17 % growth, the EU market for newly installed capacity would end at 2,47 GWth (2,5 million m^2 of collector area). According to ESTIF, this is mainly due to a drop in sales figures in the first quarter of this year in the German market, whereas the sales figures are expected to remain steady and no growth rate is expected.

However, the ST sector still holds a significant potential in expanding the market initially in southern Europe and other Mediterranean countries where solar-thermal systems achieve higher energy yields due to the higher solar radiation. Gradually, the market will expand northwards provided that sufficient financial incentives are offered to users. In addition, learning effects and the creation of economies of scale will result in the reduction of system costs that will make the technology more attractive to users. Experts from the European Solar Thermal Technology Platform (ESTTP) claim that if the installed solar-thermal capacity reaches 70 GW in 2010 and 200 GW in 2030, system costs for small scale forced circulation units installed in central Europe will reach €400/KW_{th} in 2030.[30]

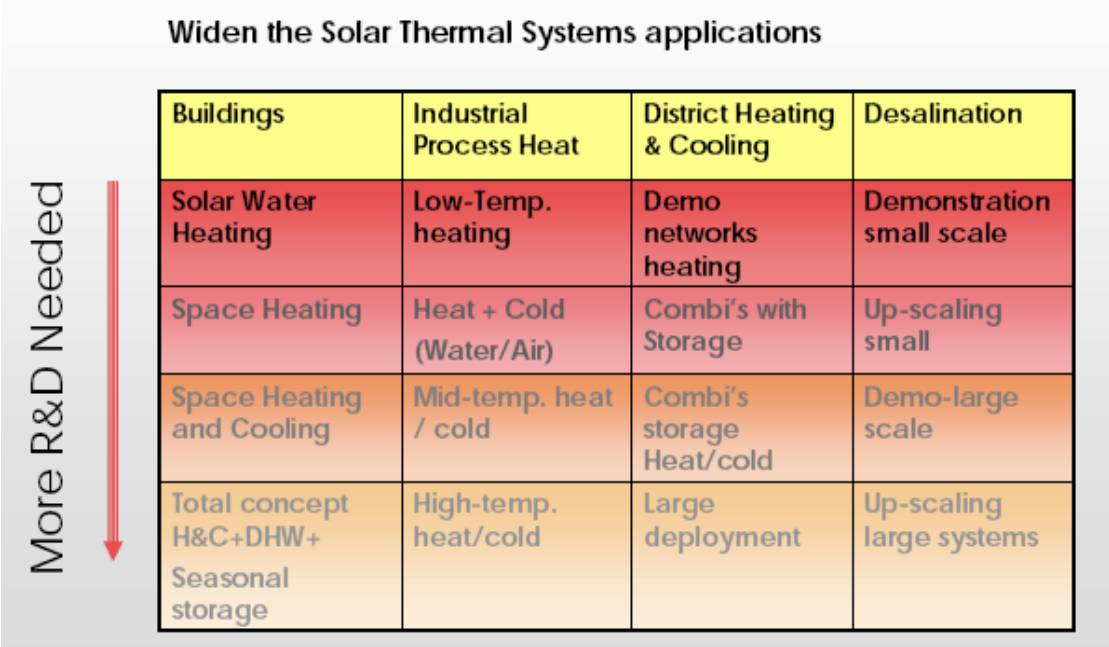

Figure 12: Solar Thermal Applications in correlation with the needed level of R&D [31]

More specifically, the sector believes that there is a very big potential for the expansion of the market in the building sector, for space heating and cooling/air-conditioning applications, depending on the local climatic conditions. The Platform experts stated that, provided that energy efficiency and energy savings measures can halve domestic heat demand, solar-thermal technology can meet all the needs of new and well retrofitted houses in terms of space heating and hot water.

The technology that allows a house to rely fully on solar-thermal systems for its heat needs has already been demonstrated; and it was claimed that this technology is currently cost-competitive to heating by fossil fuels, especially when

[30] JRC-EU/Report on the Hearing of the Solar Thermal European Technology Platform, June 2007
[31] ESTTP FOCUS GROUP 3/ Solar Thermal Deployment, Strategy and Scenario's (Market & Policy) Roadmap ESTTP, January 2008

solar collectors are integrated to facades and building roofs (if energy cost are calculated over the lifetime of the solar thermal system).

Further improvements in technology, that include the development of new solar facade systems that will incorporate collectors, vacuum insulation and advanced (e. g. phase change) storage media, combined with intelligent heat management systems will improve further the cost-competitiveness of such 'solar houses'.[32]

[32] Report on the Hearing of the Solar Thermal European Technology Platform/ European Commission, Joint Research Center Directorate-General, Institute for Energy, Energy Systems Evaluation Unit