Imposing of vacuum tubes on piping

-24,2 %

The decrease of the solar thermal market in the European Union in 2017

SOLAR THERMAL AND CONCENTRATED SOLAR POWER BAROMETERS

A study carried out by EurObserv'ER.

Solar thermal energy is no doubt the ultimate physical form for transferring heat to water without emitting greenhouse gases or pollutants. Yet in 2017 the sector struggled to survive in the hot water production and heating market. According to EurObserv'ER, the annual solar thermal collector surface area in the European Union dropped below the 2 million m2 mark, i.e. by 24.2% compared to the previous year's installed surface area. The individual national market figures vary widely, with several countries showing encouraging signs.

Concentrated solar power is another way of harnessing direct sunlight. The technology consists of concentrating the sun's rays using mirrors to heat a fluid to high temperature, produce steam and thus produce electricity. The European Union's installed base has remained at almost the same level since 2014 and stood at 2 314 MW at the end of 2017. The global market whose growth has been sluggish over the past two years (110 MW in 2016 and 100 MW in 2017) should pick up speed from 2018 onwards.

51,4 millions m²

The cumulated surfaces of solar thermal in operation in the European Union in 2017

2 314 MWe

Total CSP capacity in operation in the European Union in 2017

2
SOLAR THERMAL AND CONCENTRATED SOLAR POWER BAROMETERS

SOLAR THERMAL AND CONCENTRATED SOLAR POWER BAROMETERS – **EUROBSERV'ER** – JUNE 2018


Solar thermal panels installed in Amsterdam

While the worst is over, the European solar thermal sector is still in deep water. At European Union level, the market experienced another significant drop in the installed area devoted to hot water production and heating in 2017 **(graph 1)**, the ninth in succession since 2009. EurObserv'ER considers the contraction to be particularly sharp – 24.2% between 2016 and 2017, equating to 1 960 666 m² of installed surface with 1 372 MWth of thermal capacity (2 585 023 m2 in 2016) **(tables 2 and 3)**.
The activity's declining trend can be observed beyond the European Union's borders. Table 1 lists the main country markets outside the EU and in 2017 all of them registered a decrease in installed capacity. Incidentally, once again we note China's might. Its 2017 market in excess of 26 GWth is more than 20 times the size of the sum of all Europe's country totals put together!
Looking at the technologies used, flat plate collectors still account for the bulk of all collectors installed in the European Union (91.9%), followed by vacuum tube collectors (6.4%) and unglazed collectors (1.7%). The latter are mainly used for heating pools. We should point out that hybrid PVT collectors **(see note)** are not included in these indicators because only a handful of European Union niche markets use them.
The individual market situations vary inside the European Union. The Austrian, Greek and Cypriot sectors are very mature with high ownership rates and are strongly geared to replacement. Germany also has a relatively high installation level with 2.3 million systems in service. Solar heat in Denmark is very widely used in district heating. Until the end of 2016, the Danish market was helped by an incentive system and legal obligations that prompted operators to flock to solar thermal in their droves to comply with the environmental performance levels imposed on them. Danish network managers concentrated their investments. As a result, 260 161 m² of collectors went on stream in 2015 followed by 478 297 m² in 2016. However, the 2017 Danish solar thermal market was badly hit by changes to the regulations, and plummeted to only 31 500 m², including 5 000 m² for the individual residential market. **This sharp drop in the Danish market alone (of almost 450 000 m²) puts a slightly different slant on the European Union sector's 2017 overall decline.**
The markets also differ in their use of technology. Southern Europe makes very widespread use of thermosyphon systems, where the hot-water tank is directly connected to roof-mounted collectors. They are less dependent on incentives or public aid. In the North, systems are more complex as a circulating pump has to be coupled to a separate hot-water tank. They cost more to purchase and install, and thus sales rely more on public aid.

HARD TO FIND A PLACE IN THE SUN

All in all, the European solar thermal markets are either finding it hard to stabilize (Spain, Austria, Poland) or are trapped in a downward spiral (Germany, France, Italy and Belgium). Solar thermal heat struggles to survive in the heating and domestic hot water production markets despite its irrefutable energy efficiency and CO_2 balance advantages. This competition is especially rife in the renovation segment and also in new build where regulations are stifling solar thermal's efforts to establish a foothold.
In new build, political choices on whether or not to impose renewable heating in thermal regulations are crucial for the health of the solar thermal business. It is notably the case for Spain and Germany. Additionally, the thermal regulation requirement level is critical for this market's momentum, because in the absence of any renewable obligation, minimum adherence to building standards can be simply achieved by progress made in insulation materials or by incorporating "fossil" or "electric" technologies that are also becoming more energy-efficient. In contrast, thermal regulations for new build that enforce the use of renewable technologies, or a minimum share of renewable energy in building energy consumption, do not necessarily advance the cause of solar thermal solutions (see the paragraphs on France and Italy). In practice, each new build regulation subliminally has one or another heating or domestic hot water production solution in mind.
Furthermore, solar thermal has to fend off stiff competition from other renewable heating production technologies such as air-source heat pumps and thermodynamic water heaters. These sectors enjoy strong growth momentum and also benefit from the trend to electrify heat and cooling production systems. Solar thermal also has to contend with fratricidal competition from solar photovoltaic played off on the basis of available roof space and also, more recently, on the basis of usages. In many countries and regions, achieving network parity promotes self-consumption to meet electricity needs. So, increasingly, system design is extended to cover domestic hot water needs, directly linked to an immersion tank or thermosyphon water heater. Installers in the individual home renovation sector compound this situation by spurning solar thermal as they tend to steer their customers towards less expensive, easier to install systems (to avoid working on the roof). The energy labelling argument, which could have provided the solar thermal sector with an advantage (as solar thermal systems offer the best scores) tends to be understated. Nonetheless, efforts have been made to encourage installers to consider energy labelling through the **LabelPack A+ project** coordinated by Solar Heat Europe and financed by the **European Union's Horizon 2020 Research and Innovation Programme**. The solar thermal sector has also observed that consumers know little or are unaware of energy labelling. They more often than not replace their heating system as a matter of urgency when their old system breaks down in the winter. A new EU-wide promotion campaign (called "#CheckYourHeating") was launched in May 2018 as part of the LabelPackA+ project, targeting owners directly to make them more proactive prescribers when they envisage replacing their heating or hot water production systems.
The solar thermal market has also suffered from public aid cuts in some countries through budget restrictions, or from support systems that are geared to competing technologies. In Germany, the upgrading of aid allocated to solar systems for increased energy efficiency did not have the expected effect on the market. The sector blames the lack of information given to the general public.
The expected growth drivers in the collective sector, solar district heating and industrial heat, are gradually emerging, but they have been too weak to counter the installation volume drop in the individual home sector. Domestic hot water production in the collective sector has the most growth potential because it is based on a huge pool of buildings ripe for redevelopment in Europe and the needs are enormous.

Tabl. n° 1

Main solar thermal markets outside European Union

	Annual Installed capacity (in MWth)		Total cumulative capacity in operation (in MWth)	
	2016	2017	2016	2017
Turkey	1 467	1 348	14 900	16 248
Japan	50	43	2 500	2 543
USA	682	658	17 600	18 258
China	27 664	26 082	324 500	350 582
India	894	1 063	6 700	7 763
Rest of the world	5 903	5 806	105 160	110 966
Total of the world	36 660	35 000	471 360	506 360

Source: REN21, EurObserv'ER

AN INSTALLED BASE OF 51.4 MILLION M2 AT THE END OF 2017

The European Union had a total collector area of 51.4 million m² (35 985 MWth)... a year-on-year rise of 2.1% **(table 4)**. This estimate includes the three main solar thermal technologies (flat glazed collectors, vacuum tube collectors and unglazed collectors) and factors in the decommissioning assumptions provided by the experts contacted during the study and the previous year's Eurostat data. Whenever official data could not be provided, EurObserv'ER based its estimate on the market data collected and applied a decommissioning assumption of 20 years for glazed collectors and of 12 years for unglazed collectors. In 2017, the combined area to date only increased

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by 1.1 million m², which equates to a decommissioning figure of 0.9 million m². This trend will be heightened in the next few years because of the market capacity build-up in the 2000s which peaked at almost 5 million m² in 2008. Unless the market rebounds significantly, this trend will lead to difficulty maintaining the solar heat input for the European Union's targets in a few years' time (see conclusion).

NEWS FROM AROUND THE MAIN EUROPEAN MARKETS

The German market contracts sharply

The German market held onto its European Union market leadership in 2017. AGEE-Stat, the Working Group on Renewable Energy-Statistics for the German Economics and Energy Ministry (BMWi), claims that the country installed about 650 000 m² of collectors in 2017 (equivalent to 455 MWth of thermal capacity), 573 000 m² of flat glazed collectors, 57 000 m² of vacuum tube collectors and 20 000 m² of unglazed collectors. These figures show that the installed area contracted by 15.1% in the course of 12 months (766 000 m²). The drop also corroborates the remarks made last year by the sector's players. The MAP incentive programme which was upgraded in 2015, and the new energy efficiency stimulation programme "Anreizprogramm Energieeffizienz (APEE)" implemented on 1 January 2016, that aimed to help fund heating system replacement or modernisation in the interests of efficiency, were too weak to reverse the solar thermal market's downward trend. They ascribe it to the cost of gas-fired heating which is still very competitive and also to increasing competition from other renewable energy heating systems. Another grievance, observed in other countries, is the installers' growing disdain for solar thermal solutions, as they prefer solutions that are faster and therefore more profitable to install.

The market decline resulted in limiting the contribution of solar inputs. Primary energy output increased by 2.2% between 2016 and 2017 (from 670.7 to 685.5 ktoe). AGEE-Stat now puts the surface area of decommissioned collectors at more than half the newly-installed area, i.e. 330 000 m². Germany's solar thermal collector area to date is put at 19.4 million m². The German solar energy association's breakdown is a little higher with an estimated installed base of 20.6 million m², comprising 2.3 million installations and annual CO_2 savings of about 2 million tonnes.

The Greek market improves

The Greek market's sharp upturn contrasts with the difficulties of the other main European markets. According to Costas Travasores, the Executive Secretary of EBHE (Greek Solar Industry Association), the Greek market grew to 316 000 m² in 2017 compared to 272 000 m² in 2016 (16.2% growth). EBHE ascribes this growth to a series of favourable elements, starting with the fall in system prices due to keen competition between the players. Other factors are the proliferation of distribution grids as cybercommerce grew, the arrival of major DIY chains onto the market such as Leroy Merlin, the appearance of new private labels working with OEM partners and slight improvement in Greece's economy. However, the Greek market is special in that home solar thermal equipment levels are already very high and that the market is primarily one of replacement. According to EBHE, the installed area in service at the end of 2017 was 4 596 000 m², which is similar to its 2016 level, with an assumed mean system service life of 20 years.

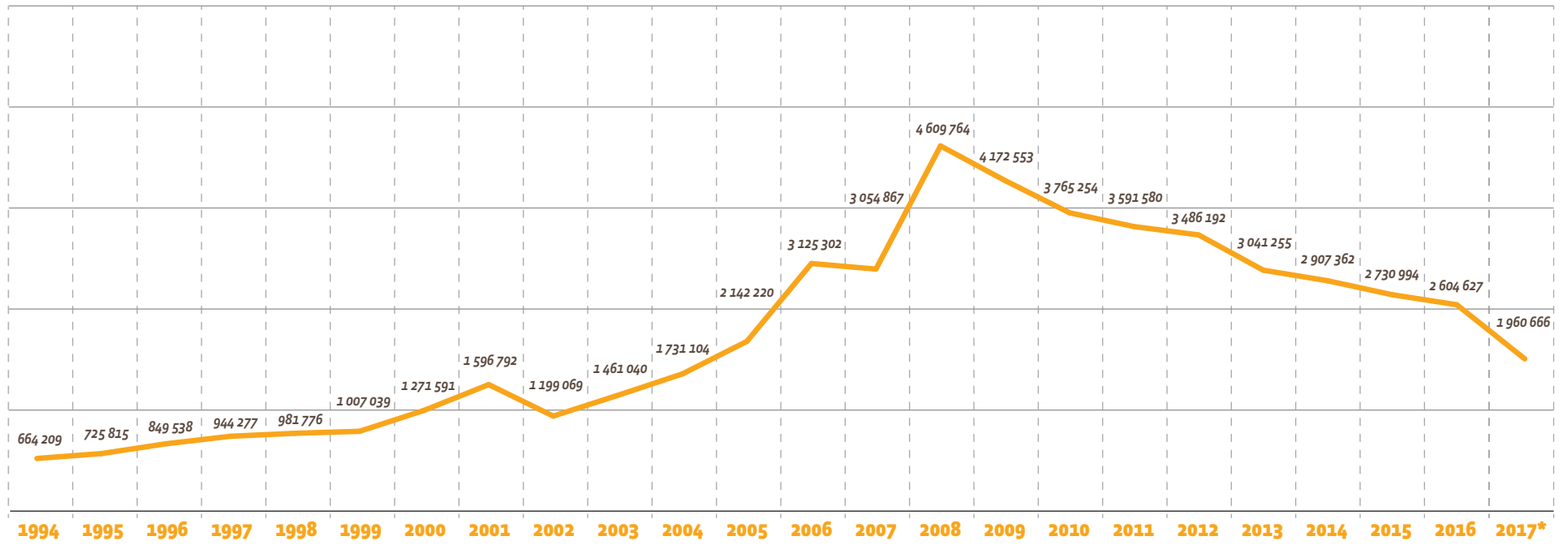
The Spanish market buckles, but so far has not collapsed

According to the 2018 annual ASIT (Spanish Solar Thermal Association) survey, 201 505 m² of collectors (equating to 141 MWth of thermal capacity) were installed in Spain. The figure is slightly down (5%) on the 2017 findings. The installed base is put at 2 875 MWth, i.e. more than 4 million m² in area. The Spanish solar thermal market is highly dependent on the new construction sector because of the enactment of Royal Decree No. 314 dating back to 2006 of a new building regulation as part of its technical building code (CTE). The text

Part of a solar thermal collector field connected to a Danish district heating network.

Graph. n° 1

Evolution of annually installed surfaces in the European Union since 1994 (in m²)



*Member states included at the date of their accession. * estimation* **Source: EurObserv'ER 2018.**

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introduced the obligation to install renewable hot water production systems in new buildings and for solar thermal, an obligation to cover 30–70% of the building's domestic hot water needs. This framework rapidly led the sector to peak in 2007 (when 641 419 dwellings were built) and 2008 (615 072 dwellings) only to plummet when the Spanish property bubble burst, exacerbated by the global financial crisis. However, the construction market made a turnaround in 2017 after slipping for 9 years in a row (45 289 dwellings were built in the first 10 months of 2017), which mechanically triggered a solar thermal market upturn in new build.

ASIT claims that the CTE-related market segment grew by 15% between 2016 and 2017, rising from 150 665 to 173 294 m². Yet the pick-up in new-build activity could not match the drop in unsubsidised system sales (14 136 m² in 2017 down from 44 680 m² in 2016), or those subsidised under regional programmes…10 075 m² in 2017 (14 855 m²) in 2016. Industrial and service sector systems accounted for a total collector area of 4 000 m² – twice the 2016 figure. Hence the market decline can only be attributed to the renovation market, for the public aid reductions are proving too much to withstand.

The ASIT survey has very precise details on the types of collectors sold on the Spanish market. Flat glazed collectors accounted for 51% of the installed surface (103 486 m²), prefabricated thermosyphon systems accounted for 43% (87 180 m²), vacuum tube collectors for 4% (7 187 m²) and unglazed flexible collectors for 2% (3 652 m²).

The Spanish industry believes it is resilient enough to rebound but asks the authorities to face up to their responsibilities and introduce measures to meet its 2011–2010 Renewable Energies Plan (PER) targets of a total of 10 million m² installed by the end of 2020. ASIT thinks that only half of this target will be installed by then.

Tabl. n° 2

Annual installed surfaces in 2016 per type of collectors (in m²) and power equivalent (in MWth)

Country	Glazed collectors		Unglazed collectors	Total (m²)	Equivalent power (MWth)
	Flat plate collectors	Vacuum collectors			
Germany	677 000	67 000	22 000	766 000	536,2
Denmark	478 297			478 297	334,8
Greece	271 400	600		272 000	190,4
Spain	201 793	7 076	3 321	212 190	148,5
Italy	186 647	25 043		211 690	148,2
France**	114 894		5 500	120 100	84,1
Poland	111 700	3 700		115 400	80,8
Austria	109 600	1 440	760	111 800	78,3
Belgium	39 000	7 500		46 500	32,6
Portugal*	45 300	800		46 100	32,3
Czech Republic	22 000	9 000		31 000	21,7
Netherlands	20 137	5 179	2 621	27 937	19,6
Croatia*	19 000	2 500		21 500	15,1
Ireland	11 204	8 564		19 768	13,8
Hungary*	13 050	5 592	188	18 830	13,2
Cyprus*	18 000	600		18 600	13,0
Romania*	6 800	11 000		17 800	12,5
United Kingdom	10 900	3 010		13 910	9,7
Slovakia	8 000	1 600		9 600	6,7
Bulgaria*	5 100	500		5 600	3,9
Finland*	3 000	1 000		4 000	2,8
Luxembourg	3 759			3 759	2,6
Sweden	2 763	336	75	3 174	2,2
Slovenia	2 300	400		2 700	1,9
Lithuania*	800	1 400		2 200	1,5
Estonia*	1 000	1 000		2 000	1,4
Latvia*	1 500	300		1 800	1,3
Malta	614	154		768	0,5
Total EU 28	2 385 558	165 294	34 465	2 585 023	1 810

** no data available, Observ'ER estimation based on the 2015 Estif market figure. **included 48 994 m2 in overseas departments*
Source: EurObserv'ER 2018.

The Italian market keeps sliding

The Italian market's downward trend was confirmed in 2017. Data released by Assotermica (Association of manufacturers of equipment and components for heating systems), the market dropped to 151 000 m² (167 000 m² in 2016 and 186 000 m² in 2015). The association ascribes this drop to reasons that are shared by many other European markets, namely fierce competition from other renewable technologies – primarily heat pump and photovoltaic – and the lack of visibility of energy labelling that is unfair to solar thermal solutions. Another reason, which comes as a paradox, is a thermal regulation that is too stringent. It claims that the requirement to cover at least 50% of energy needs by using renewable energies has led property developers to favour heating solutions such as heat pumps, biomass heating appliances or connection to a heating network, rather than installing an individual solar water heater coupled to a gas-fired boiler. Although this configuration is relevant for producing domestic hot water, it cannot single-handedly meet the regulation's demands to cover all the building's energy needs, including its cooling needs.

Solar thermal burns off the Polish fog

The market analyses made by SPIUG (Association of Manufacturers and Importers of Heating Appliances), show that Polish municipal information campaigns and incentive programmes to improve the air quality and promote low-emission heating appliances such as HPs and solar thermal collectors are starting to produce results. These local programmes are mainly financed by European funds and were introduced to combat the "fog" generated by coal-fired heating systems that are still very prevalent in the country. According to information available

Tabl. n° 3

Annual installed surfaces in 2017 per type of collectors (in m²) and power equivalent (in MWth)

Country	Glazed collectors		Unglazed collectors	Total (m²)	Equivalent power (MWth)
	Flat plate collectors	Vacuum collectors			
Germany	573 000	57 000	20 000	650 000	455,0
Greece	312 840	3 160		316 000	221,2
Spain	190 666	7 187	3 652	201 505	141,1
Italy	151 000			151 000	105,7
France**	114 591		5 500	120 091	84,1
Poland	110 000	3 000		113 000	79,1
Austria	99 770	1 060	630	101 460	71,0
Portugal*	45 300	800		46 100	32,3
Belgium	30 200	5 200	0	35 400	24,8
Denmark	31 500	0	0	31 500	22,1
Netherlands	21 150	6 162	2 621	29 933	21,0
Czech Republic	16 500	7 500		24 000	16,8
Croatia*	19 000	2 500		21 500	15,1
Ireland	11 254	9 049	0	20 303	14,2
Cyprus*	18 000	600		18 600	13,0
Romania*	6 800	11 000		17 800	12,5
Hungary	12 000	5 000	180	17 180	12,0
United Kingdom	9 938			9 938	7,0
Slovakia	8 000	1 600		9 600	6,7
Bulgaria*	5 100	500		5 600	3,9
Finland*	3 000	1 000		4 000	2,8
Luxembourg	3 600			3 600	2,5
Sweden	2 867	341		3 208	2,2
Slovenia*	2 300	400		2 700	1,9
Lithuania*	800	1 400		2 200	1,5
Estonia*	1 000	1 000		2 000	1,4
Latvia*	1 500	300		1 800	1,3
Malta	518	130		648	0,5
Total EU 28	1 802 194	125 889	32 583	1 960 666	1 372

** no data available, Observ'ER estimation based on the 2016 Estif market figure ** included 63 526 m² in overseas departments.*
Source: EurObserv'ER 2018 .

PVT takes hold in France

Another technology, using hybrid water or air collectors is gradually establishing a foothold in a few European markets, primarily France and Switzerland. In France, PVT air and water technologies have taken a significant share of the market, encouraged in renovation by their eligibility for a 30% tax credit (up to 400 euros per m2 for hybrid water collectors for up to 10 m2, and up to 200 euros per m2 for hybrid air collectors for up to 20 m2). This solution should also make its way into new build because it fully meets the requirements of the new E+C- label which is the precursor to the forthcoming thermal regulation due to replace the current RT 2012. EurObserv'ER puts the PVT collector market for 2017 at 3 500 m2 (75% for PVT water installations and 25% for PVT air installations). In Austria, according to AEE Intec data, PVT collectors have made their debut with 732 m2 installed in 2017 giving a 2 059 m2 area installed to date.
Hybrid PVT water collectors are photovoltaic panels equipped with a water heat exchanger that cools down the photovoltaic part while producing hot water. Hybrid collectors have the advantage over equivalent photovoltaic capacity and individual solar water heater for the same 4-m2 shell of optimizing solar electricity production because they cool the panels (by 5–10% more) but do not offer the same hot water savings (about 20% less) according to the www.photovoltaique.info website.

in April 2018, the market slipped very slightly to about 113 000 m² (115 400 m² in 2016) after dropping sharply once the NFOSiGW (National Fund for Environmental Protection and Water management) funding for solar thermal dried up.
However, SPIUG notes that the available statistics are not entirely in phase with the more positive information provided by the market players, which points to improved sales in 2018. SPIUG feels that there no broader incentive programme that would kick-start solar thermal more squarely. In 2017, the Polish heating market was very buoyant as a whole, primarily because of the increase in home construction.

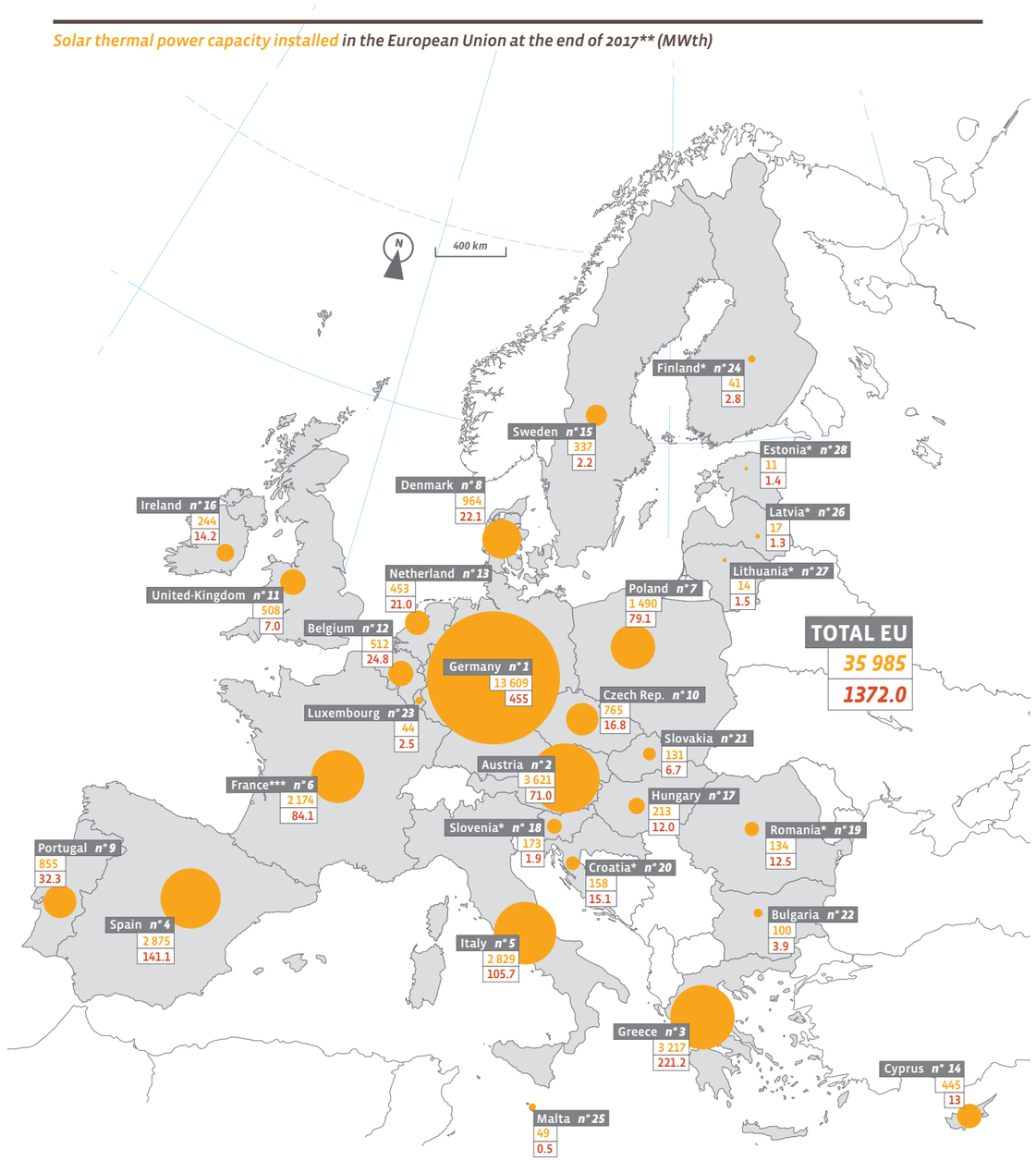
The Austrian market on the replacement threshold

Austria is like Greece in that its solar thermal system equipment level is particularly high, so the Austrian market is largely geared to old system replacement. Data released by AEE Intec shows that the Austrian market contracted by 9.2% on its 2016 level, to 101 460 m² (99 770 of flat glazed collectors, 1 060 m² of vacuum tube collectors and 630 m² of unglazed collectors). Another 320 m² of solar thermal air collectors and 732 m² hybrid PVT collectors should be added to these figures. If we factor in the decommissioning assumptions, the in-service surface of glazed collectors remained generally stable at 4.8 million m², in contrast to that of unglazed collectors which fell by almost 40 000 m² to 378 291 m². The decommissioning of unglazed collectors reduced the total solar thermal surface in service to below the 5.2 million m² threshold, with the concomitant slip in solar thermal heat's contribution from 50 874 toe in 2016 to 50 659 toe in 2017.

In France, the overseas territories market outperformed the mainland market

The solar thermal market on the French mainland has contracted further. According to Observ'ER, the sector a shrank by 21% on its 2016 performance in mainland France and struggled to make 51 065 m² of solar thermal collectors (25 900 m² for the collective sector, 21 450 m² for individual solar water heaters, 3 715 m² combined systems and 5 500 m² for unglazed collectors). The mainland market is now smaller than the overseas territories market, which in 2017, according to Observ'ER, rose to 63 526 m² (a 29.7% improvement on 2016). According to the General Commission on Sustainable Development, solar thermal accounted for two-thirds of the renewable energy used there to produce heat, compared to less than 1% on the mainland. As a result of the Overseas Territories market buoyancy, the French market stabilized at 120 000 m².
Panel manufacturers consider that installers' failure to recommend solar systems in the renovation sector is curbing market expansion. The tax credit system (30% in 2018), introduced to encourage home energy performance improvements plays into the hands of other electric and renewable technologies. Individual solar water heaters face stiff competition from thermodynamic water heaters as they do in many other countries. Although photovoltaic power is ineligible for tax credit, its installation through self-consumption systems in the South of France is gaining popularity as a solution to meet the demand for hot water.
Furthermore, individual solar water heaters will not break into the new build scenario despite the 2012 thermal regulation obligation to incorporate a renewable energy, as the constructors tend to turn to cheaper-to-install technologies such as thermodynamic water heaters (88 891 units sold in 2017, whose market has grown by 10%) or the roof-mounted installation of two solar photovoltaic collectors working for self-consumption, to comply with the minimum regulatory obligation level.
Rollover of the RT 2012 waiver in the collective sector, authorizing more energy to be used for multi-occupancy dwellings (57.5 kWh/m² p.a. instead of 50 kWh/m² p.a.) and the lack of any obligation to incorporate renewable technologies in new build, have practically ousted renewable heat from this segment. The industry players do not expect to rebound with the introduction of the E+C- label, in preparation for the new thermal regulation. They believe that as it stands, the label promotes photovoltaic technology, be it

Solar thermal power capacity installed ***in the European Union at the end of 2017** (MWth)***



Key

35 985 *Total solar thermal capacity installed at the end of 2017* (MWth)*

1 372.0 *Solar thermal capacity installed during the year 2017** (in MWth)*

** No data available, estimation based on the 2015 ESTIF market figure. ** Estimate (latest available information at the end of May 2018).*
**** included 63 526m² in overseas departments.*
Source: EurObserv'ER 2018.

in individual homes or multi-occupancy blocks, using all the roof area.
However, the sector's prospects are not entirely gloomy. In the renovation segment, Uniclima hopes for an upturn with the Climate-Energy contribution and a more clement economic context. The Climate-Energy Contribution (CCE), introduced by the 2014 Finance Act, is a tax measure intended to put a price on carbon. It aims to limit the use of high-carbon energies by making them more expensive and thus encourage consumers to adopt more efficient and environmentally-friendly heating systems. In 2017, the CCE rose to €30.5 excl. tax per tonne of CO_2 from €22 in 2016. Heavy fuel oil is obviously hard hit. The domestic consumption tax has risen from €6.88 per 100 kg in 2016 to €9.54 in 2017 (a 38.7% rise). The energy transition law for green growth sets goals for the carbon component of domestic taxes at €56 per tonne in 2020 and €100 per tonne in 2030. Major heat consumers (of industrial heat, district heating) will also factor this scheduled increase into their calculations on new projects and so these markets are likely to open up to solar heat.
Another glimmer of hope, the government launched on June 28, 2018 a mobilization to accelerate the deployment of solar energy "Place to the sun". For the solar thermal component, the government plans in the individual to increase aid from 2019 for hot water and heating and prepare the requirement for a minimum renewable heat rate in all new buildings, as well as to better take into account the solar contributions in thermal regulation.

THE SOLAR THERMAL INDUSTRY

China has taken solar thermal's global top spot

In the space of two years, the solar thermal market's development has had an impact on the competitive environment of the panel producers. According to Solrico, a research agency specialising in the solar sector, the 2015 leader of the top 5 worldwide solar companies was Austrian (GREENoneTEC), the second and fifth were Chinese (Fivestar and Sunrain), the third Brazilian (Soletrol) and the fourth German (Bosch Thermotechnik). In 2017, the top four players in the same ranking are Chinese, with Bosch Thermotechnik ranked fifth. Incidentally, while GREENoneTEC is ranked second, it now flies the flag of the Chinese company Haier, which acquired a 51% stake in it in May 2018.
Haier is not only banking on establishing a foothold in the European market but also taking up GREENoneTEC's large glazed collector expertise. The buyout is symbolic in more ways than one. Firstly, as the individual home market is clearly slowing down, it shows the interest now required by solar companies in the ability to supply equipment for large-scale projects if they are to enter the collective installation, industrial process and district heat segments. Furthermore, GREENoneTEC will act as a commercial intermediary for Haier products in Europe, which include heat pumps and air-conditioners. Thus, GREENoneTEC could become a more generalist heating and air-conditioning player, like its major European competitors.
There are many European firms outside this leading pack in the 2017 top 20 global flat glazed collector producer ranks. The Germans, such as Vaillant, Thermosolar, Viessmann and even Bosch Thermotechnik have seen their activity slow down because Germany, their main market, is too sluggish. Other European companies have bucked this trend and increased production after entering new markets essentially located outside the European Union. Sales by the Greek company Dimas Solar have increased 12% thanks to the North African market. The Italian, Ariston has pursued opportunities in the Caribbean and the Middle-East and enjoyed 14% growth. The pie chart by table no. 6 shows the 2017 distribution by output of the top 10 European solar thermal firms. Solrico has made this breakdown available through its research work. However, it can only give estimated company rankings because many of them were reticent to disclose their production figures in absolute terms.
It is becoming increasingly clear to the industry players that the sector's new growth drivers are large-scale projects such as solar thermal integrated into industrial processes. Typically, solar heat provides heat or steam that may rise to temperatures in the hundreds of degrees for industrial production lines. A Solrico study based on the European Solar Payback project findings, identified 110 solar thermal projects applied to processes across the globe in 2017, i.e. 192 580 m2. The study came to total figure of 635 installations applied to an industrial process. In 2017, this segment was boosted by Mexico, with 36 new installations, followed by India with 22 and China with 19 installations. In Europe, only 2 installations of this type were completed in France. This outlet, which is still embryonic in Europe, is financially viable yet requires direct subsidies to back it. There are still many curbs in its way, the first being industry's unawareness of this solution and excessively long ROI payback times. An alternative to this barrier could be third-party financing, whereby a firm supplies the thermal installation and bears the equipment installation cost. It then sells on the heat to the industrial concern at a competitive price through a long-term contract.
Another growth opportunity is continuing to expand – that of solar thermal farms connected to heating networks. A strong indication of this sector's development is that new farm size records are made every year. The solar thermal barometer for 2017 put the spotlight on the 70 000-m2 Vojens farm in Denmark. But since then the town of Silkeborg (also in Denmark) has taken the record for the

Tabl. n°4

Cumulated capacity of thermal solar collectors installed in the European Union in 2016 and 2017**(in m² and in MWth)*

	2016		2017	
	m²	MWth	m²	MWth
Germany	19 122 000	13 385	19 442 000	13 609
Austria	5 210 202	3 647	5 172 185	3 621
Greece	4 477 375	3 134	4 596 000	3 217
Spain	3 905 928	2 734	4 106 950	2 875
Italy	3 891 000	2 724	4 042 000	2 829
France***	3 018 040	2 113	3 105 000	2 174
Poland	2 016 000	1 411	2 128 880	1 490
Denmark	1 369 000	958	1 376 750	964
Portugal	1 176 000	823	1 222 100	855
Czech Republic	1 137 542	796	1 093 443	765
United Kingdom	715 252	501	725 190	508
Belgium	705 000	494	731 700	512
Netherlands	652 205	457	646 575	453
Cyprus	647 824	453	636 424	445
Sweden	485 000	340	482 000	337
Ireland	331 891	232	348 196	244
Hungary	287 296	201	303 942	213
Slovenia	245 000	172	247 700	173
Romania	174 000	122	191 800	134
Croatia	204 500	143	225 500	158
Slovakia	177 000	124	186 600	131
Bulgaria	137 500	96	143 100	100
Luxembourg	59 550	42	63 150	44
Finland	55 000	39	58 200	41
Malta	69 856	49	70 504	49
Latvia	22 720	16	24 520	17
Lithuania	17 950	13	20 150	14
Estonia	14 120	10	16 120	11
Total EU 28	50 324 751	35 227	51 406 679	35 985

*All technologies including unglazed collectors. ** Estimate. *** Overseas department included .* ***Source: EurObserv'ER 2018.***

Tabl. n° 5

Solar thermal capacities in operation per capita (m²/inhab. and kWh/inhab.) in 2017***

Country	m²/inhab.	kWth/inhab.
Cyprus	0,745	0,521
Austria	0,590	0,413
Greece	0,427	0,299
Denmark	0,239	0,168
Germany	0,235	0,164
Malta	0,160	0,112
Slovenia	0,120	0,084
Portugal	0,119	0,083
Luxembourg	0,107	0,075
Czech Republic	0,103	0,072
Spain	0,088	0,062
Ireland	0,073	0,051
Italy	0,067	0,047
Belgium	0,064	0,045
Poland	0,056	0,039
Croatia	0,054	0,038
Sweden	0,048	0,034
France***	0,046	0,032
Netherlands	0,038	0,026
Slovakia	0,034	0,024
Hungary	0,031	0,022
Bulgaria	0,020	0,014
Latvia	0,013	0,009
Estonia	0,012	0,009
United Kingdom	0,011	0,008
Finland	0,011	0,007
Romania	0,010	0,007
Lithuania	0,007	0,005
Total EU 28	0,100	0,070

** All technologies included unglazed collectors. ** Estimate. *** Overseas departments included.*
Source: EurObserv'ER 2018

biggest farm hooked up to a heating network, with 156 694 m² connected. The same company, Arcon-Sunmark of Denmark, developed both projects.

Doubt as to whether the solar heat contribution can be maintained

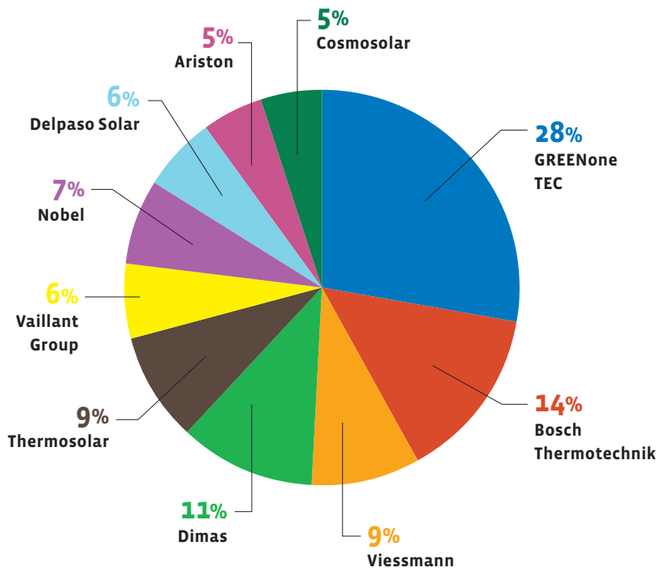
The European market's trend decline has been unabated since 2009 and has gradually widened the gap from the National Renewable Energy Action Plan (NREAP) targets **(graph 3)**. This decline now throws doubt on whether the contribution of solar heat inputs to the European renewable energy targets can be maintained in the next few years because of the decommissioning of old installations. The market level is now lower than it was in 2003 (2.1 million m²). The capacity and area of decommissioned installations will increase mechanically every year because of the market surge twenty years ago. Once out of service, the growth in solar heat's input will decline and could even plummet if the European market does not really recover.

However, on paper, the intentions are there for all to see and likely to kick-start the sector within the next decade. On 14 June 2018, a milestone was reached on the forthcoming renewable energy directive that will set the roadmap through to 2030. The European Parliament and European Council representatives finally forged an agreement on a 32% renewable target of total final energy consumption, which is a great improvement on the 27% initially proposed by the European Commission. Nevertheless, the clause has a built-in provision to revise the target in 2023.

With regard to heating and cooling, the provisional agreement provides for a sub-target of indicative increase of 1.3% per year for renewable energies calculated over the 5-year period starting from 2021. Another important text, the directive amendment on building energy performance is now a given because it was adopted by the 28-member countries on 14 May 2018. The basic tenet of this directive is that buildings account for 40% of energy consumption and that three-quarters of them are poorly insulated. The text obliges the member countries to adopt a "long-term national renovation strategy" for their public and private residential and non-residential building stock, with an 80–95% emission reduction target for 2050. The country strategies must define goals for 2030, 2040 and 2050 to measure their progress. The directive proposes to back the quality of renovation work and the efficiency of the energy savings obtained with financial measures, which is likely to state a strong case for solar thermal solutions. □

Graph. n° 2

Production share as of 2017 among representative European solar thermal collectors manufacturers



Tabl. n° 6

Representative European solar thermal collector manufacturers

Company	Country	Activity
GREENoneTEC	Austria	Flat plate and vacuum tube collectors
Bosch Thermotechnik	Germany	Heating equipment supplier / Flat plate collector manufacturer
Viessmann	Germany	Heating equipment / solar thermal
Dimas	Greece	Flat plate collectors manufacturer
Thermosolar	Germany	Flat plate and vacuum tube collectors
Vaillant Group	Germany	Heating equipment supplier / solar thermal
Nobel	Bulgaria	Flat plate collectors manufacturer
Delpaso Solar	Spain	Flat plate collectors manufacturer
Ariston	Italy	Flat plate collectors manufacturer
Cosmosolar	Greece	Flat plate collectors manufacturer and heating equipment supplier
Wolf *	Germany	Flat plate and vacuum tube collectors manufacturer and heating equipment supplier
Cosmosolar *	Greece	Flat plate collectors manufacturer and heating equipment supplier

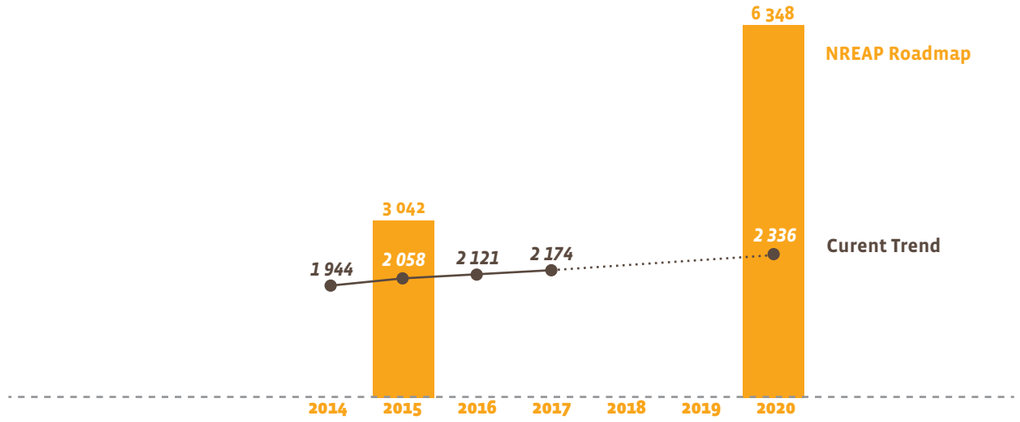
Source: EurObserv'ER 2018.

Solar thermal plant in Dronninglund, Denmark

Sources: AGEE-Stat (Germany), AEE INTEC (Austria), Assotermica (Italy), EBHE (Greece), SPIUG (Poland), ASIT (Spain), Uniclima (France), Observ'ER (France), PlanEnergi (Denmark), Ministry of Industry and Trade (Czech Republic), Statistics Netherlands, ATTB (Belgium), STA (United Kingdom), SEAI (Ireland Republic), STATEC (Luxembourg), NSO (Malta), University of Miskolc (Hungary), Solar Energy Association of Sweden, REN 21, solarthermalworld.org, Solar Thermal Federation of India, Observ'ER (Others).)

Graph. n° 3

Comparison of the current trend against the NREAP (National Renewable Energy Action Plans) roadmap (in ktoe)



Source: EurObserv'ER 2018

SOLAR THERMAL AND CONCENTRATED SOLAR POWER BAROMETERS – **EUROBSERV'ER** – JUNE 2018

PART 2: CONCENTRATED SOLAR POWER

Thermodynamic or concentrated solar power plants (CSP) cover all the technologies that convert the energy of the sun's rays into heat at very high temperatures and harness it either as electricity or heat. There are several type of plants – tower plants with stationary heliostats that concentrate the radiation onto a receiver at the top of the tower, plants that use Fresnel collectors where rows of flat mirrors concentrate the radiation onto a tube-shaped receiver, parabolic trough collectors that concentrate the rays onto a tube and parabolic collectors where a parabolic-shaped mirror reflects the sun's rays onto a convergence point.

4 845 MW of CSP capacity in the world

Most of the CSP development currently takes place in those countries, such as China, Australia, South Africa, the Gulf states and North Africa, whose exposure to the sun offers high potential. According to the Spanish Association of Solar Thermal Electricity Industry, Protermosolar, website, global capacity of these plants was put at 4 845 MW at the end of 2017. Only one single commercial-sized installation was commissioned during the year, namely the Xina Solar One (100 MW) plant in South Africa. This additional capacity should be viewed against that of 2016 when three plants were hooked up to the grid – Bokport (50 MW) and Khi Solar One (50 MW) in South Africa and SunCan Dunhuang (10 MW) Phase I in China.

The number of plants currently under construction is much higher – 22 scattered across the globe for total capacity of 1 625 MW – and should lead to a significant increase in global installed capacity from 2018 onwards. China, with nine projects, is currently the most active country on this front with: Qinghai Supcon Delingha 50MW, Dunhuang 100 MW, Hami 50 MW, Gansu Akesai 50 MW, Chabei Molten Salt Parabolic Trough 64 MW, Yumen Town East 50 MW, Gansu Yumen East town 50 MW, Urat Middle Banner 100 MW and Yumen Thermal Oil Parabolic 50 MW. Two projects have been identified in Morocco (NOOR II 185 MW and NOOR III 150 MW), two in South Africa (Kathu Solar Park 100 MW and Ilanga I 100 MW), two in Israel (Ashalim1 CSP project, 121 MW and Ashalim2 CSP project, 110 MW), two in Saudi Arabia (ISCC Duba 1 50 MW, Waad Al Shamal ISCC Plant 50 MW), one in Kuwait (Shagaya CSP Project 50 MW), one in India (Dadri ISCC Plant 14 MW), one in Mexico (Agua Prieta II, 12 MW) and one in France (Ello 9 MW). Another 18 longer-term projects will add 2 245 MW capacity (785 MW in China, 700 MW in Dubai, 360 MW in South Africa and 250 MW in India).

2 314 MW in the European Union

The market slowed right down after the flurry of installations concentrated in Spain from 2007 to 2014. At the end of 2017, the grid connection of the Ottana CSP plant (0.6 MW) in Sardinia moved the European Union concentrated solar power capacity tally slightly higher to 2 314.3 MW, includes pilot plants and demonstrators **(table 6 and graph 3).** A few projects are expected in 2018, including a 9-MW project in France and a 1-MW demonstrator in the Sicilian town of Mellili. Four larger projects (Solecaldo 41 MW at Aidone, Sicily; Reflex Solar Power 12.5 MW at Gela, Sicily; Lentini 55 MW Sicily and the San Quirico 10-MW hybrid CSP solar project in Sardinia) are likely to be completed by 2020–2021, but their inves-

CSP projects to supply district heating networks

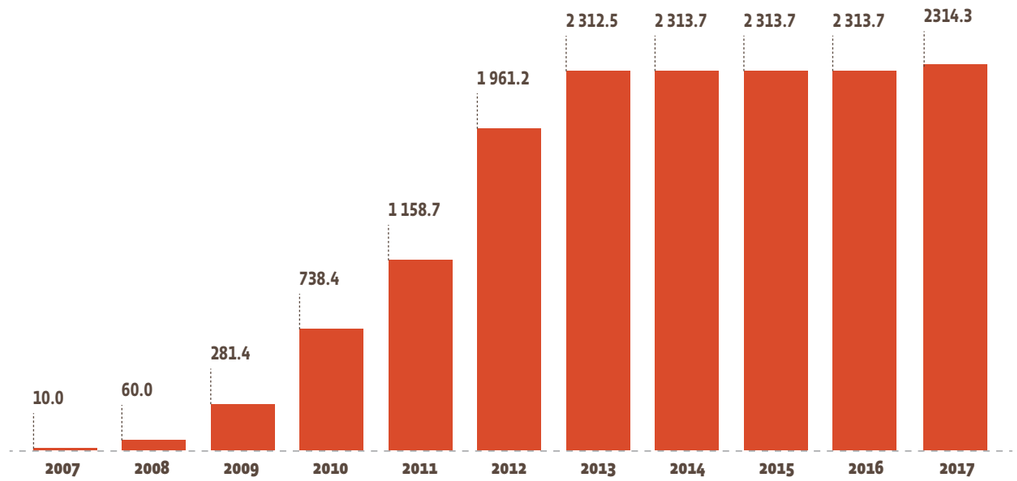
CSP technology can also produce heat for industry or district heating. We can only tentatively gauge this market's growth potential. Meanwhile, new innovative projects using concentrating mirror technology are emerging to supply district heating networks, usually in conjunction with another renewable energy, namely biomass. In Northern Denmark, the Danish developer Aalborg CSP commissioned a project combining a CSP plant and an ORC biomass plant in the municipality of Brønderslev on 18 March 2018. The installation with 16.6 MWth of thermal capacity can produce both heat and electricity. The solar part uses 26 929 m2 of parabolic trough collectors. The project aims to demonstrate the relevance of using this concentration technology in Northern Europe both to supply heating networks and as a backup source for producing electricity. The same developer has already worked on projects in Denmark that combine flat glazed collector technology with parabolic trough mirrors. An example of this is the town of Taars, which has a 4 039-m2 CSP plant with 5 972 m2 of ground-mounted flat glazed collectors. It supplies the district heating network with 31% of its needs, delivering 6 082 MWh of heat.

In Spain, CSP, which is usually devoted to electricity production, has also extended its scope of application to supply district heating networks. In February 2018, Alcalá Ecoenergías signed a contract for the construction of Spain's first major hybrid solar-biomass heating network at Alcalá de Henares. The installation will be equipped with a 30-MW biomass boiler and a 12-MW CSP plant, which will supply heat to about 12 000 homes. The choice of which CSP technology will be used is as yet undecided but will be made between parabolic trough mirrors or Fresnel linear collectors. The network, which could be up and running by the end of 2019, will benefit from Proyectos Clima Agreement funding (which will provide 10 euros in aid for each tonne of CO2 avoided), a 20% investment aid from the PAREER CRECE incentive system, and contributions from the IDAE and the European Regional Development Fund. Alcalá Ecoenergías claims that the 38 million-euro project (€ 32 million for the biomass plant and € 6 million for the solar part) should be amortized within a decade and reduce the users' energy bill by 15–30%.

Certification of a concentrated solar plant by a TÜV SÜD agent

Graph. n° 4

European Union concentrated solar power capacity trend (MWe)



Source: EurObserv'ER 2018

tors are waiting for publication of the new decree that will set out the payment terms (see § on Italy). For this reason, the commissioning dates are pending **(table 7)**.

CSP SIDE-LINED IN SPAIN

Construction of the CSP sector started in Spain after publication of Royal Decree 436/2004 which introduced the pricing conditions required for investments in this type of plant. The first plant (PS 10) was commissioned in 2007. The pricing conditions were retroactively changed several times through to 2014. Sector development finally ground to a halt in 2012 when the incumbent right-wing government announced its moratorium, refusing to maintain the subsidies granted to renewable installations. During the period from 2007–2013, Spain constructed 49 commercially viable and one prototype plant (Puerto Errado 1), with a combined capacity of 2 303.9 MW.

Since 2014, Spain's CSP plants have run entirely on solar energy after the initial option of using up to 15% natural gas as top-up energy was discarded. This measure has had no effect on their output for they have run consistently above 5 TWh without any operating difficulties. Red Eléctrica de España says that output reached 5 348 GWh in 2017, rising from 5 071 GWh in 2016 and 5 085 GWh in 2015. According to Protermosolar, the CSP plants currently in service can cover electricity demand peaks of up to 10% with an average contribution level of 8% during the summer.

Spain's situation is unlikely to alter in the next few years despite the moratorium's end. The call for new "technologically neutral" tenders since 2017 has forced CSP to bow out for the time being in the face of competing technologies such as solar photovoltaic.

THE TIMING IS WRONG FOR PLANT COMMISSIONING IN FRANCE

France will commission its first commercially-sized CSP plant this summer at Llo in the Eastern Pyrenees. The eLLO project will be the first Fresnel plant to have a storage system. It will have 9 MW of capacity... enough to cover the electricity needs of more than 6 000 homes, i.e. about 20 GWh p.a. The plant is built on a 36-hectare site and equipped with 95 200 mirrors assembled in 23 800 collectors covering 153 000 m². Its output will be stored in nine 90 tonne, 120-m³ of steam accumulators each at 80 bar to provide four hours of storage. Construction, which kicked off in October 2016, has taken almost two years and required investment of about €60 million. The plant will be eligible for an "anachronistic" Feed-in Tariff of €0.349 per kWh which was obtained when the first CRE call for bidding was made in 2011. SUNCNIM, the project designer, says that the project's capacity level and storage technology are now unsuitable for the global electricity market. The industrialist now prefers to concentrate on the thermal part of CSP plants with a view to supplying heat to industry, primarily the oil sector, in countries with high sunshine levels.

PROJECTS STILL AT A STANDSTILL IN ITALY

Emilio Conti, of Anest (the Italian National Association of Thermodynamic Solar Energy) says that the 2017 market was more or less stagnant. The sector is still waiting for payment term details in a new decree for >5-MW plants that should have been published at the end of 2017. It should take up the elements contained in the 23 June 2016 decree and have kicked off the construction of 118.5 MW of capacity that has already received authorisation. Three projects in Sicily (55 MW at Carlentini, 41 MW at Aidone and 12.5 MW at Gela) and one in Sardinia (a 10-MW hybrid CSP/Biomass plant at San Quirico) are now held up. Two

Tabl. n° 7

Concentrated solar power plants in operation at the end of 2017. **(Source: EurObserv'ER 2018)**

Project	Technology	Capacity (MW)	Commisionning date
Spain			
Planta Solar 10	Central receiver	10	2007
Andasol-1	Parabolic trough	50	2008
Planta Solar 20	Central receiver	20	2009
Ibersol Ciudad Real (Puertollano)	Parabolic trough	50	2009
Puerto Errado 1 (prototype)	Linear Fresnel	1,4	2009
Alvarado I La Risca	Parabolic trough	50	2009
Andasol-2	Parabolic trough	50	2009
Extresol-1	Parabolic trough	50	2009
Extresol-2	Parabolic trough	50	2010
Solnova 1	Parabolic trough	50	2010
Solnova 3	Parabolic trough	50	2010
Solnova 4	Parabolic trough	50	2010
La Florida	Parabolic trough	50	2010
Majadas	Parabolic trough	50	2010
La Dehesa	Parabolic trough	50	2010
Palma del Río II	Parabolic trough	50	2010
Manchasol 1	Parabolic trough	50	2010
Manchasol 2	Parabolic trough	50	2011
Gemasolar	Central receiver	20	2011
Palma del Río I	Parabolic trough	50	2011
Lebrija 1	Parabolic trough	50	2011
Andasol-3	Parabolic trough	50	2011
Helioenergy 1	Parabolic trough	50	2011
Astexol II	Parabolic trough	50	2011
Arcosol-50	Parabolic trough	50	2011
Termesol-50	Parabolic trough	50	2011
Aste 1A	Parabolic trough	50	2012
Aste 1B	Parabolic trough	50	2012
Helioenergy 2	Parabolic trough	50	2012
Puerto Errado II	Linear Fresnel	30	2012
Solacor 1	Parabolic trough	50	2012
Solacor 2	Parabolic trough	50	2012
Helios 1	Parabolic trough	50	2012
Moron	Parabolic trough	50	2012
Solaben 3	Parabolic trough	50	2012
Guzman	Parabolic trough	50	2012
La Africana	Parabolic trough	50	2012
Olivenza 1	Parabolic trough	50	2012
Helios 2	Parabolic trough	50	2012
Orellana	Parabolic trough	50	2012
Extresol-3	Parabolic trough	50	2012
Solaben 2	Parabolic trough	50	2012
Termosolar Borges	Parabolic trough + HB	22.5	2012
Termosol 1	Parabolic trough	50	2013
Termosol 2	Parabolic trough	50	2013
Solaben 1	Parabolic trough	50	2013
Casablanca	Parabolic trough	50	2013
Enerstar	Parabolic trough	50	2013
Solaben 6	Parabolic trough	50	2013
Arenales	Parabolic trough	50	2013
Total Spain		2 303.9	
Italy			
Archimede (prototype)	Parabolic trough	5	2010
Archimede-Chiyoda Molten Salt Test Loop	Parabolic trough	0.35	2013
Freesun	Linear Fresnel	1	2013
Zasoli	Linear Fresnel + HB	0.2	2014
Rende	Linear Fresnel + HB	1	2014
Ottana	Linear Fresnel	0,6	2017
Total Italy		8.15	
Germany			
Jülich	Central receiver	1.5	2010
Total Germany		1.5	
France			
La Seyne-sur-Mer (prototype)	Linear Fresnel	0.5	2010
Augustin Fresnel 1 (prototype)	Linear Fresnel	0.25	2011
Total France		0.75	
Total European Union		**2314,3**	

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other plants are in the final authorisation stage – the Flumini Mannu plant (55 MW) in the Sardinian communities of Villasor and Decimoputzu and the 10-MW 3QP plant at San Severo in the Puglia.
Eight <5-MW plant projects have been accepted by the Italian grid operator (GSE) to cover an expected 20 MW. Seven of them are in Sicily and one in Sardinia. Anest suggests that Calliope PV Srl at Trapani, Sicily (4 MW), Stromboli Solar Srl also at Trapani (4 MW), Solin Par Srl at Partanna (4.3 MW) and Bilancia PV Srl at Mezzojuso (4 MW) near Palermo will probably be the first to start.
In the meantime, the sector has had to make do with connection of the small 600-kW Fresnel-type plant at Ottana, Sardinia (with 9 000 m² of mirrors) on 5

Tabl. n° 8

Concentrated solar power plants under developement at the beginning of the year 2018

Project	Project's holders	Location	Capacity [MW]	Technology	Commercial date of operation expected
Italy					
Flumini Mannu	FLUMINI MANNU LTD	Villasor (Sardinia)	55	Parabolic Through	n.a
Lentini	LENTINI LTD	Carlentini. Melilli (Sicily)	55	Parabolic Through	n.a
Solecaldo	MF ENERGY	Aidone (Sicily)	41	Linear Fresnel	n.a
Reflex Solar Power	REFLEX SOLAR POWER	Gela (Sicily)	12,5	Parabolic Through	n.a
CSP San Quirico	SAN QUIRICO SOLAR POWER	San Quirico (Sardinia)	10	Parabolic Through (hybride)	n.a
San Severo	3SP	San Severo (Puglia)	10	Central receiver	n.a
Not known	SOL.IN.PAR	Partanna (Sicily)	4,2	Not known	n.a
Bilancia 1	TRINACRIA SOLAR POWER	Palermo (Sicily)	4	Linear Fresnel	n.a
Calliope	TRINACRIA SOLAR POWER	Trapani (Sicily)	4	Linear Fresnel	n.a
Stromboli Solar	TRINACRIA SOLAR POWER	Trapani (Sicily)	4	Linear Fresnel	n.a
Not known	Solar Energy SRL	Belpasso (Sicily)	1,2	Not known	n.a
Archimede	ARCHIMEDE SRL	Melilli (Sicily)	1	Parabolic Through	2018
Non connu / Not known	ESSECV S.R.L.	Francofonte (Sicily)	1	Not known	n.a
ENAS	ENAS	Noragugume (Sardinia)	0,7	Not known	n.a
Total Italy			203,6		
France					
eLLo	Suncnim	Llo, Pyrenees	9	Linear Fresnel	2018
Total France			9		
Cyprus					
Helios Power	Infinia	Larnaca	50,8	Dish Stirling	n.a.
Total Cyprus			50,8		
Greece					
Maximus Dish project	Infinia	Florina	75	Dish Stirling	n.a.
MINOS CSP tower	Nur Energy	Crete	50	Central receiver	n.a.
Total Greece			125		
Spain					
PTC50 Alvarado	Acciona Energia	Alvarado. Badajoz	50	Central receiver (power tower) - Hybride	n.a.
Total Spain			50		
Total European Union			438,4		

Company in liquidation. ***Source: EurObserv'ER 2018.***

Construction of the concentrated solar plant Andasol II, Spain

Paul Langrock

Concentrated solar plant Andasol III, in La Calahorra, Spain

October 2017 and the first to use an ORC Organic Rankine Cycle. A second 1-MW parabolic-trough demonstrator, also connected to an ORC system is under construction at Mellili, Sicily. The Feed-in Tariff for 250 kW to 5 MW installations is € 296 per MWh. An "integration factor" is added if the plant is equipped with a storage system, which in the case of the Mellili plant adds a further € 45 per MWh (giving a total of € 341 per MWh).

The major CSP market players in Europe are Spanish (see table 9), yet they are currently selling off their assets. In February 2018, Acciona started negotiating with the British firm, ContourGlobal, to sell five of its CSP projects in Spain. The sale cost about 1.10 billion euros for 250 MW of capacity. Acciona decided on this course of action to reduce its 760 million-euro debt. As a result of this disposal, it has no CSP assets in Europe. Its only connection to this technology will be indirect ownership of the 64-MW Nevada Solar One CSP farm in the USA. Likewise, Iberdrola announced that it wanted to sell off its 50-MW Puertollano farm in Spain's Castilla-La Mancha region. The Spanish daily, El Economista, puts the price of this asset at € 100–150 million. The sale is part of a general asset-shedding move to raise three billion euros.

Full steam ahead for the industry's R&D efforts

While few projects are coming to fruition in Europe, concentrated solar power still stimulates companies through research and development. The European Union funds the Capture project launched in 2015 through its H2020 programme. Capture aims to reduce CSP project costs, thereby enhancing its competitiveness. It is a technology-driven project, in which each solar park component will be developed to improve its efficiency and reduce the mean cost of producing the energy. The challenge is to construct a CSP installation in Southern Spain comprising several towers and 4 heliostat fields, three of which will be based on Brayton cycles. The latter is a thermodynamic gas intercooled cycle. Thirteen companies from six European countries are taking part in the project, which shows that CSP projects are not about to disappear in Europe and that the sector can still supply several GW to the Union. However, projects of this type call for collaboration between the member countries.

The future for European CSP is uncertain

The outlook for European sector growth by 2020 will be much lower than the member countries' National Renewable Energy Action Plan targets **(graph 4)**. The next three years are unclear because publication is pending of decrees offering better payment terms that will give the green light to the only confirmed projects, all in Italy.

On the eve of the new renewable energy directive, new major Europe CSP projects could still be implemented. The sector's representatives, such as Luis Crespo of Protermosolar remind us that CSP could play a major role in an increasingly interdependent and interconnected grid. They highlight the sector's strengths stemming from long-lasting storage capacities capable of securing part of the European countries supplied, primarily in Central Europe, where only variable capacity technologies such as wind energy and solar photovoltaic are likely to be developed. Luis Crespo also points out that the new European Renewable Energy Directive will encourage cross-border exchanges. Investments will be made where the best resources are. He holds that CSP's future role in the new targets for 2030 will depend on countries' ability to coordinate their investments geographically on the basis of the complementary characteristics of all renewable energies to provide Europe with a robust, inexpensive and emission-free electricity production system. □

Sources: Protermosolar (Spain), REE (Spain), ANEST (Italy).

The next barometer will cover biofuels.

Tabl. n° 9

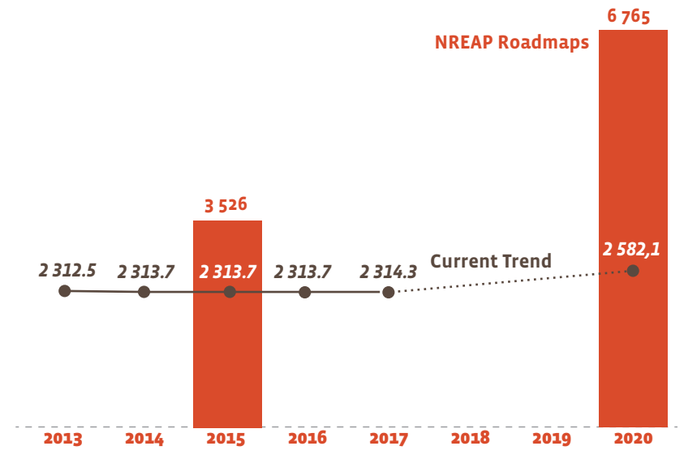
Main European CSP project developers

Company	Country	Activity	MW developed or under construction (2016)
Ibereolica	Spain	Engineering - EPC - O&M - Project developer	300
Magtel Renewables	Spain	Promoter - Project developer - EPC - O&M - Engineering - Consulting	n.c.
Abengoa	Spain	Promoter - Project developer - EPC - Engineering - O&M - Components	651
Cobra	Spain	Promoter - Project developer - EPC - Engineering - O&M	567
Acciona Energy	Spain	EPC - Project developer - Promoter	314
Torresol Energy	Spain	Promoter - Project developer - O&M - Engineering	67
Hyperion	Spain	Promoter - Project developer - O&M	103
FCC Energia /Enerstar	Spain	Promoter - Project developer	100
Samca	Spain	Promoter - Project developer - O&M	100

Source: EurObserv'ER 2018 (based on company information)

Graph. n° 4

Comparison of the current trend against the NREAP (National Renewable Energy Action Plans) roadmap (in MW)



Source: EurObserv'ER 2018

This project is funded by the European Union under contract n° ENER/C2/2016-487/SI2.742173