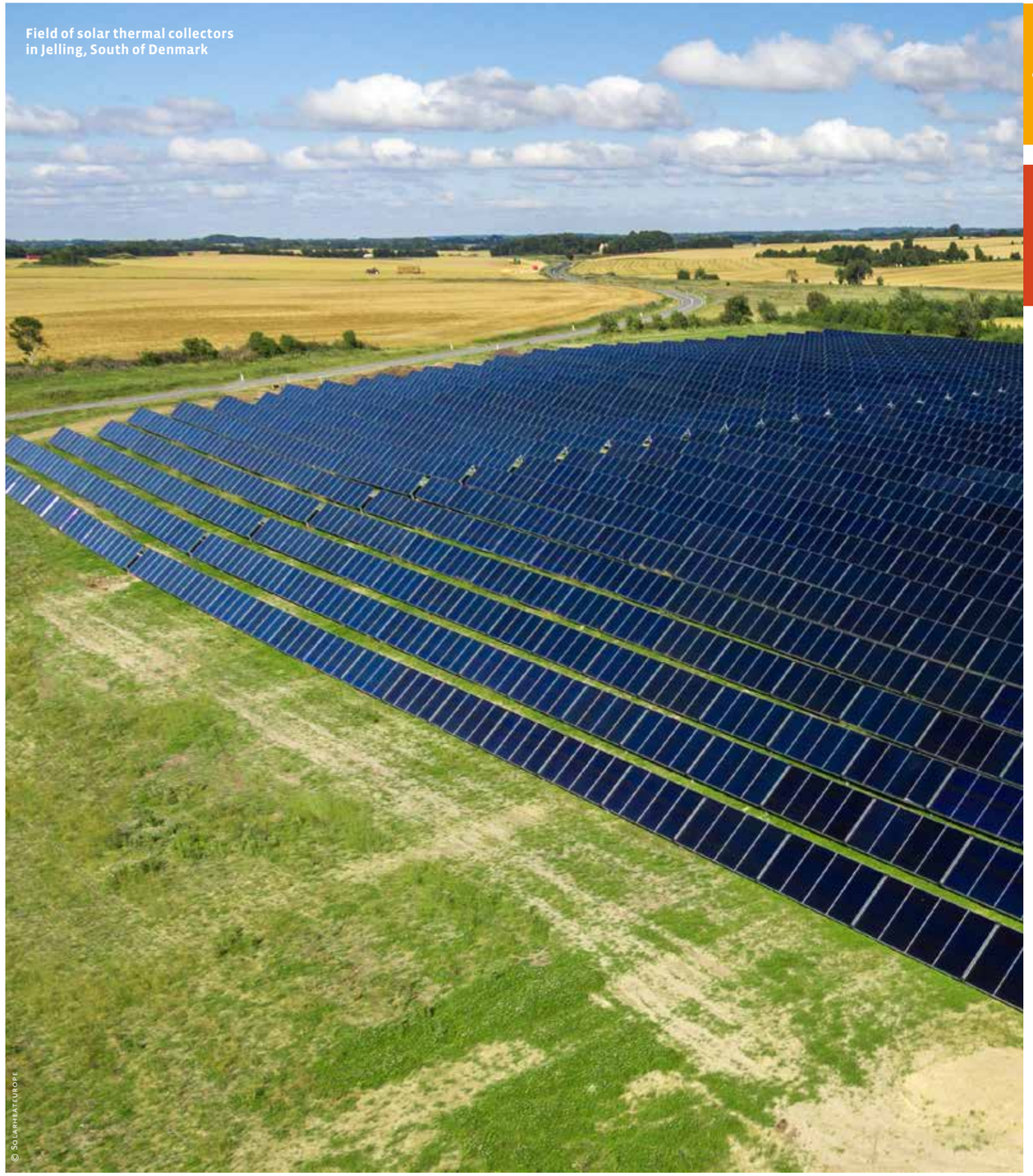


Field of solar thermal collectors in Jelling, South of Denmark

+8.4 %

The increase of the solar thermal market in the European Union in 2018

SOLAR THERMAL AND CONCENTRATED SOLAR POWER BAROMETERS

A study carried out by EurObserv'ER.

At long last, after a sluggish decade of decline, the European Union solar thermal market for hot water production and heating applications appears to have returned to growth. According to EurObserv'ER, the 2018 European market posted a rise of some 8.4% compared to 2017, which equates to 2.2 million m2 of newly-installed surface. However, the amounts of growth vary by country and market segment.

Concentrated Solar Power (CSP) is a blanket term for all the technologies that aim to convert the energy of the sun's rays into very high temperature heat. While the main use of these plants is to generate electricity, CSP can also be used to supply heating networks or be integrated into industrial processes.

53.5 millions m²

The cumulated surfaces of solar thermal in operation in the European Union in 2018

2 314 MWe

Total CSP capacity in operation in the European Union in 2018

SOLAR THERMAL AND CONCENTRATED SOLAR POWER BAROMETERS – **EUROBSERV'ER** – JUNE 2019

As climate warming's repercussions become increasingly evident, solar thermal technology, which harnesses the sun's rays to convert it directly into heat, is finally generating interest. EurObserv'ER reckons that the European market which has been dwindling since 2009, picked up in 2018 ***(graph 1)*** as it grew from 2 to 2.2 million m² (8.4% year-on-year growth) (tables 2 and 3). The market data covers systems that use flat plate collectors, vacuum collectors and unglazed collectors. These technologies are designed to produce domestic hot water, heating, and to produce heat and hot water for district heating networks and industry. In contrast, hybrid PV/T collectors capable of producing electricity and heat simultaneously and concentrating solar collectors (Fresnel mirrors and parabolic trough collectors) for producing heat (industrial or heating networks) are not included in this part of the study.

THE SOLAR THERMAL MARKET AT SIXES AND SEVENS

While EU-wide market growth is positive, piecemeal development characterises the national markets. Poland put in the best performance in 2018. Its sector, which took advantage of the implementation of municipal tenders, made a 180% leap to 310 000 m². Another good piece of news is confirmation that the Greek market grew by 4% in 2018 to 328 500 m², having already increased by 16.2% between 2016 and 2017 (from 272 000 to 316 000 m²). Spain's market picked up slightly (by 2%) confirming the previous year's turnaround when its market decline was limited to 5% between 2016 and 2017. On the downside, some former market drivers continued to slide. A case in point is the German market. While it leads the European Union market rankings with 573 500 m² installed in 2018, it has been unable to stabilise and posted a new 11.8% contraction on its 2017 performance that can mainly be ascribed to declining interest in combined solar systems (that supply both heating and hot water). Likewise, the Italian market has been unable to stabilise and had to contend with a 7.9% decline in 2018 of about 139 000 m² (excluding thermosyphon systems). It is particularly affected by internecine competition from photovoltaic. In metropolitan France, the sector grew overall in 2018 despite the struggle of its individual hot water heater market to beat off competition from thermodynamic water heaters. The French overseas territories, with targeted incentives and substantial state support, are enjoying more momentum.

The European solar heating network and industrial solar heat markets are gradually making ground with new systems identified in Denmark, Germany, Austria, Spain and France. The latest IEA SHC Solar Heat Worldwide 2019 report, puts the collector surface connected in 2018 to European solar heating networks at 83 760 m² (58.6 MWth). The report identifies 15 new solar thermal collector fields (>500 m²) connected to a heating network, six in Denmark (66 800 m² including two extensions to existing networks), six in Germany (9 380 m²), two in Austria (3 010 m²) and one in Turkey (4 575 m²). The biggest heating network system was installed in the Danish city of Aabybro with 26 195 m² (18.3 MWth) of collector surface. In Germany, 2018 also witnessed the connection of the 983-m² (0.7 MWth) Berlin-Köpenick plant to the German capital's heating network. In Austria, a 656-m² (0.46 MWth) collector field was connected to Vienna's heating network. No new heating networks were connected in France in 2018, but industrial heat projects were completed – a food-processing plant at Melville (1 772 m²) and the Condat paper mill (4 032 m²). This contrasts with the Austrian project for the world's biggest solar heating network – "Big Solar Graz" – which was dealt a severe blow as its construction, scheduled for 2019, remains uncertain. Difficulties relating to the roll-out of this project launched in 2015, and disagreements with the Danish company VKR-Arcon Sunmark, led to the collapse of its Austrian developer Solid, a company set up in 1992 that specialized in solar heating and refrigeration systems for the commercial and industrial sectors. The project that was initially designed for 450 000 m² (250 MWth) was subsequently downscaled to 220 000 m². Its 900 000-m³ storage system was intended to cover 15% of the district heating needs of the city of Graz.

China, the sector's global leader

At a global scale, solar thermal capacity installed in 2018 is put at 33 300 MWth. China stands out from the field with 24 800 MWth of additional capacity, although this figure is lower than its 2017 effort, primarily because the residential solar water heater market – the sector's main growth segment – is saturated. Turkey and India are also major players with national markets in excess of 1 200 MWth in 2018. At the end of 2017, 130 countries had solar thermal installations with combined capacity put at 472 000 MWth.

Tabl. n° 1

Main solar thermal markets outside the European Union (MWth)

	Annually installed capacity		Total cumulative capacity in operation
	2017	2018	2017
China	26 100	24 800	334 500
Japan	1 348	1 320	16 300
USA	1 063	1 240	7 700
China	860	850	10 400
India	658	625	17 800
Rest of the world including EU	4 571	4 465	85 300
Total	34 600	33 300	472 000

Source: REN21, EurObserv'ER


Field of solar thermal collectors in Logumkloster, South Denmark

A EUROPEAN BASE OF 53.4 MILLION M² AT THE END OF 2018

The total surface of the European Union collector base should consolidate at about 53.5 million m² (37 418 MWth) at the end of 2018 according to EurObserv'ER, i.e. a 2.4% increase on its 2017 level (table 4). This estimate includes the three main solar thermal technologies (flat-plate collectors, vacuum collectors and unglazed collectors) and factors in decommissioning hypotheses for the oldest installations made by the experts contacted when gathering data for the purposes of this barometer (ministries, statistics offices, engineering and design departments and heating manufacturers' associations). Whenever collector base data was not directly available, EurObserv'ER relied on the market data that it had gleaned (sources quoted at the end of this barometer) applying a decommissioning hypothesis of 20 years for flat-plate collectors and 12 years for unglazed collectors and taking the n-1 base data published by Eurostat at the start of 2019 as its base. In 2018, the existing surface to date increased by 1.3 million m², which equates to a 0.9 million-m² decommissioning total. The decommissioning phenomenon should accelerate in the next few years due to the growth in installations during the 2000s that culminated to 4,6 m² of collectors in 2008. In a few years' time this trend will raise the issue of maintaining the European Union solar heat contribution target levels if the market fails to recover significantly and be sustained.

SOLAR BREAKS THROUGH THE POLISH FOG

In 2018, the main respite in the European Union solar thermal market came from Poland, where according to SPIUG (the Association of Manufacturers and Importers of Heating Appliances) the market expanded by a factor of 2.5 and increased from 111 100 to about 310 000 m² (300 000 m² of flat-plate collectors and 10 000 m² of vacuum collectors), thereby setting a new Polish installation record in the sector. The good performance can be ascribed to the implementation of municipal tenders announced in 2017 and decided on at the start of 2018. These local programmes, that are backed by European funds, were instigated to tackle the smog generated by coal-fired domestic heating appliances that widely outnumber other heating appliances. The sector players are concerned about the market's dependence on these tendering procedures once the programmes have run their full course.

They feel that the traditional circuits' lack of structure (sales forces, wholesalers and retail installation networks) could lead to the sector weakening without the possibility of capitalising on the "anti-smog" publicity campaigns set up by the local authorities. According to SPIUG, 80% of current sales are made through municipal investments and up to 20% through traditional distribution channels. Another trend is that while the market segments have developed, the residential share is shrinking in favour of other sectors (commercial, service, heating networks and industrial heat). SPIUG claims that in 2018, residential accounted for 80% of the newly-installed capacity (75% in renovation and 5% in new build), 15% in commercial and 5% in the other sectors (heating networks, industry). In 2017, residential accounted for 88% (71% in renovation and 17% in new build), 10% in commercial and 2% for the other sectors.

SOLAR THERMAL AND CONCENTRATED SOLAR POWER BAROMETERS – **EUROBSERV'ER** – JUNE 2019

THE GREEK MARKET IS RIDING HIGH

The other good news is confirmation that the Greek market is robust. According to Costas Travasores, the executive secretary of EBHE (the Greek Solar Industry Association), it made 4% growth, or 328 500 m² sold in 2018. This compares to 316 000 m² in 2017 (16.2% more than in 2016, the year when 272 000 m² was installed) the Greek solar market is still vibrant. The EBHE points out that more collector surface was installed than the collector surface Greece decommissioned (i.e. 233 400 m² scrapped in 2018), which means that the solar thermal base in service continues to increase. It has risen from 4 595 900 m² in 2017 to 4 691 000 m² in 2018. The equipment level is very high in Greece with 0.437 m² per inhabitant (Table 5). As in 2017, the EBHE ascribes this growth to a set of favourable elements, starting with the drop in system prices due to keen competition between players, multiplication of distribution grids as e-commerce builds up steam, the arrival of major DIY retailers on this market such as Leroy Merlin,

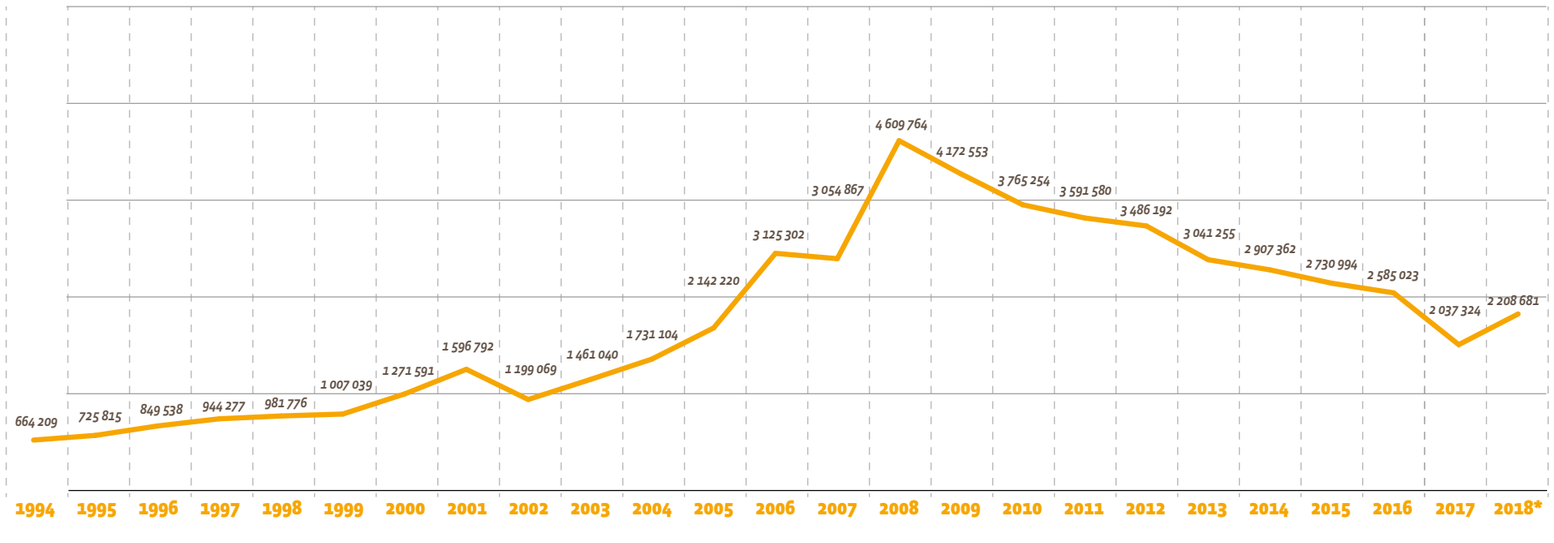

Solar thermal panels on a residential building in France

PHOTOTHEQUE SOLEM

the entry of new private labels working with OEM partners and a slight improvement in the Greek economy. Costas Travasores also highlights the country's solar thermal industry's increasing export volumes, which boost Greece's competitivity, vitality and optimism. The surface area of exported collectors has increased by 20%, rising from 264 103 m² in 2017 to 216 908 m² in 2018. Yet, the EHBE is slightly less optimistic about 2019. The market could suffer from two election periods in May and October, which traditionally curb investment decisions but more to the point, it fears that the government will decide to reduce VAT on electricity and gas from 13 to 6% while continuing to apply 24% VAT on solar thermal systems.

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. * Estimations.* **Source: EurObserv'ER 2019.**

HOUSING CONSTRUCTION RELAUNCHES THE SPANISH MARKET

The annual ASIT survey claims that 205 530 m² (which equates to 144 MWth) was installed in Spain in 2018, i.e. a 2% increase on the previous year's performance, so halting the market's steady decline since 2015 and thereby confirming the turnaround observed in 2017. Looking at the technology used, flat-plate collectors dominate sales (109 028 m², 6% more than in 2017), ahead of prefabricated collectors (82 938 m², 5% less), vacuum collectors (9 698 m², 35% more) and unglazed collectors (3 866 m², 6% more). This return to growth can primarily be attributed to better housing construction figures. Their increase makes a direct impact because of Spain's thermal regulations (Technical Building Code – TBC) which enforce a solar thermal contribution in all new-build constructions. The "TBC" market segment expanded by 4% over the previous year (from 173 294 to 180 000 m²), with growth proportional to the increase in the number of new housing units completed in 2018 compared to 2017 (about 62 000 compared to 54 610). In addition to new build, regional grants from the autonomous communities contributed to a further 15 000 m², to which should be added 6 000 m² of unsubsidised systems and 4 500 m² in the service and industrial segment. While this recovery is a positive sign, the sector players are disappointed that the results are far below the political ambitions formulated in the Renewable Energy Plan (PER 2011–2020). The projection of overall results obtained by the sector, by the end of 2018, should lead to a maximum figure of 5 million m² in service by the end of 2020, i.e. half the plan's intended 10 million m² target. The Spanish sector, which has a structured industry, with manufacturing capacity put at 1.3 million m², is very enthusiastic at the idea of achieving such large market volumes and urges the public authorities to implement regulatory and financial measures to achieve it within the next 4 years. Spain's industry currently operates at 15% of production capacity, namely, 203 300 m² produced in 2018 (3% more than in 2017), 136 200 m² of which went to exports.

SOLAR HEATING LOSES ITS SHINE IN GERMANY

The European market's main black spot remains Germany's inability to stem the decline of its solar thermal sector, despite the implementation of generous incentives (of up to 3 600 euros for a system including a new boiler). According to data published by AGEEstat (the Working Group on Renewable Energy Statistics), Germany installed 573 500 m² of solar thermal collectors in 2018... roughly 71 000 systems. This surface breaks down into 505 000 m² of flat-plate collectors and 68 500 m² of vacuum collectors, the market for unglazed collectors was not assessed in 2018. In 2017, AGEEstat put the annual installed surface at 650 000 m² (573 000 m² flat-plate collectors, 26 000 m² of vacuum collectors and 20 000 m² of unglazed collectors). The contraction in installed surface between 2017 and 2018 is thus 11.8%, and 8.9% if we only include glazed collectors (to avoid statistical bias as in 2018 unglazed collectors were not factored in). There are several reasons for this decline. According to solar energy consultant Dietmar Lange, the ratio between individual hot water production systems and combined systems (hot water and heating) has gradually been inverted as the m² share of CESI has overtaken that of combined systems. While individual hot water production system sales have remained relatively stable, the combined systems market (which uses more collectors) has plummeted... meaning that the German market's contraction is exclusively due to less interest in combined systems. Dietmer Lange claims that the individual hot water production system market is held together by the latest renewable heat act (EEWärmeG) which stipulates that part of the energy demand for heating and hot water applications in private and public buildings must be met by renewable sources. The latter include geothermal energy, ambient heat (heat pumps), solar ray energy and biomass. In the case of solar thermal, the total consumption share of building heat must be at least 15% (in the interests of simplicity, the surface of installed solar collectors must be at least 4% of the useable surface for individual and semi-detached houses and 3% for multi-occupied buildings). Investors who prefer not to use renewable energies can meet the obligation through energy-saving measures. To do so, annual consumption of primary energy and thermal insulation of the residential building must be 15% better than the values stipulated by the German thermal regulation (Die Energieeinsparverordnung – EnEV) which sets the building energy consumption requirements.

Competition from new, more efficient gas-fired condensing boilers, that still benefit from a relatively low gas price is main reason for the declining market for combined systems. This is compounded by the rising internecine competition between the solar thermal and photovoltaic technologies, which generally treats photovoltaic with partiality when they compete for useable roof space, especially as photovoltaic can top-up hot water production in the case of self-consumption. Lastly, solar thermal is also challenged by heat pumps whose sales, according to the BDH, increased by 8% between 2017 and 2018, with 84 000 units sold, and primarily those that use air-wa-

ter technology (11% increase, with 60 500 units sold). Air-water technology has a very high European energy label score for heating and hot water production appliances.

THE OVERSEAS TERRITORIES AND THE MULTI-OCCUPANCY SEGMENT COME TO THE FRENCH MARKET'S RESCUE

If we consider the French market all together, i.e. metropolitan France and the overseas territories, the installed solar thermal collector surface has risen sharply. According to Observer, these volumes increased by 27,4% in 2018 to reach 156 122 m² but not all market segments enjoy this momentum. The overseas territories are the main driving force, and especially Guadeloupe where according to the Observatoire Régionale de l'énergie et du Climat, 18 000 solar hot water heaters were installed in 2018 (7 000 in 2017), and also Reunion Island, where according to the regional observatory Horizon Réunion, 9 682 solar hot water heaters were installed (7 920 in 2017), leaving aside collective installations. The introduction of energy insecurity CEEs (Energy Saving Certificates) is behind the strong growth in Guadeloupe. It has resulted in an offer priced at 1 euro for installing a DHW heater and roof insulation for individuals with the lowest earnings. EDF has run a successful programme Agir Plus on Reunion Island (which can be combined with tax credit) whose premium doubled in 2017 from € 600 to 1 200 for 300-litre hot water tanks and from € 300 to 600 for lower capacities. All of this has been boosted by active communication by the French utility (advertising campaigns, radio spots). Under the Eco-solidaire scheme, Reunion Island also funds solar water heaters for energy-insecure households with enough aid to cover installation costs. Taken together the 2018 overseas territories market approached the 100 000-m² threshold (95 418 m²) which is 52.6% more than in 2017. For its part, the metropolitan market (France plus Corsica) expanded by 7.3% in 2018 to reach 60 704 m² (including 5 500 m² of unglazed collectors). This growth comes from additional activity in the collective segment (excluding pools), which grew to 35 204 m² in 2018 (35.9% more than in 2017). About 30 000 m² of this was installed in multi-occupied and service industry buildings and 5 204 m² in industrial heat production. Much of the progress made in the multi-occupied building segment was driven by the commissioning of the successful bids for Ademe's calls for projects that focus on major solar thermal installations (district heating, industrial heat). So, the food-processing site at Melville (1 172 m² of collectors) and the Condat paper mill (4 032 m²) were fitted out in 2018. The major installation sector is bound to expand through this calls for projects mechanism with 5 more successful bids waiting to be carried out (for a total of 38 714 m²) – 3 projects in the food-processing sector including the Malteries Franco-Suisses site (15 600 m²), Lactosol (15 317 m²) and Fromagerie des Chaumes (2 511 m²) as well as two solar heating networks (Narbonne with 2 872 m² and Pons 2 414 m²). This contrasts with the struggling individual market segment (individual solar hot water heaters and combined systems) in metropolitan France, which now resembles a niche market. The figures for 2018 post 20 000 m² compared to 25 365 m² in 2017, which amounts to a further 21.2% and tenth consecutive drop. Individual solar hot water heaters

Tabl. n° 2

Annually installed surfaces in 2017 per type of collectors (in m²) and capacity equivalent (in MWth)

Country	Glazed collectors		Unglazed collectors	Total (m²)	Capacity equivalent (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**	117 076		5 500	122 576	85,8
Poland	107 200	3 900		111 100	77,8
Austria	99 770	1 060	630	101 460	71,0
Portugal+	55 105			55 105	38,6
Cyprus	53 718			53 718	37,6
Belgium	30 200	5 200		35 400	24,8
Denmark	31 500			31 500	22,1
Netherlands	21 150	6 162	2 621	29 933	21,0
Bulgaria+	24 000			24 000	16,8
Czechia	16 500	7 500		24 000	16,8
Slovakia+	24 000			24 000	16,8
Croatia+	22 700			22 700	15,9
Ireland	11 254	9 049		20 303	14,2
Hungary	12 000	5 000	180	17 180	12,0
Romania*	7 200	9 600		16 800	11,8
United Kingdom+	7 467	2 471		9 938	7,0
Finland+	5 000			5 000	3,5
Luxembourg	3 600			3 600	2,5
Sweden	2 867	341		3 208	2,2
Lithuania*	750	1 250		2 000	1,4
Latvia*	1 350	250		1 600	1,1
Slovenia*	1 300	250		1 550	1,1
Estonia*	900	600		1 500	1,1
Malta	518	130		648	0,5
Total EU 28	**1 884 631**	**120 110**	**32 583**	**2 037 324**	**1 426,1**

*Figures for countries marked with an * are Solar Heat Europe/ESTIF estimations, the data marked with a + were estimated by EurObserv'ER extrapolated from the solar collectors surface of the Eurostat database. ** included 62 546 m2 in overseas departments* ***Source: EurObserv'ER 2019.***

Tabl. n° 3

Annually installed surfaces in 2018 per type of collectors (in m²) and capacity equivalent (in MWth)

Country	Glazed collectors		Unglazed collectors	Total (m²)	Capacity equivalent (MWth)
	Flat plate collectors	Vacuum collectors			
Germany	505 000	68 500		573 500	401,5
Greece	328 500			328 500	230,0
Poland	300 000	10 000		310 000	217,0
Spain	191 966	9 698	3 866	205 530	143,9
France**	150 622		5 500	156 122	109,3
Italy	139 000			139 000	97,3
Austria	99 734	1 038	617	101 389	71,0
Denmark	61 000			61 000	42,7
Cyprus*	56 404			56 404	39,5
Portugal*	55 000			55 000	38,5
Netherlands	28 089	5 409	2 621	36 119	25,3
Belgium	25 000	4 900		29 900	20,9
Czechia	16 500	7 500		24 000	16,8
Slovakia*	24 000			24 000	16,8
Croatia*	22 700			22 700	15,9
Bulgaria*	20 000			20 000	14,0
Romania*	7 200	9 600		16 800	11,8
Hungary*	12 000	4 000		16 000	11,2
Ireland	13 041			13 041	9,1
United Kingdom*	5 300	1 700		7 000	4,9
Finland*	4 000			4 000	2,8
Luxembourg	3 418			3 418	2,4
Sweden*	2 800	300		3 100	2,2
Slovenia*	1 300	250		1 550	1,1
Malta	486	122		608	0,4
Lithuania*	n.a.	n.a.		0	0,0
Estonia*	n.a.	n.a.		0	0,0
Latvia*	n.a.	n.a.		0	0,0
Total EU 28	**2 073 060**	**123 017**	**12 604**	**2 208 681**	**1 546,1**

** EurObserv'ER estimation. ** included 95 418 m2 in overseas departments.*
Source: EurObserv'ER 2019 .

SOLAR THERMAL AND CONCENTRATED SOLAR POWER BAROMETERS – **EUROBSERV'ER** – JUNE 2019

Solar thermal collectors for residential application in Lahti, Finland

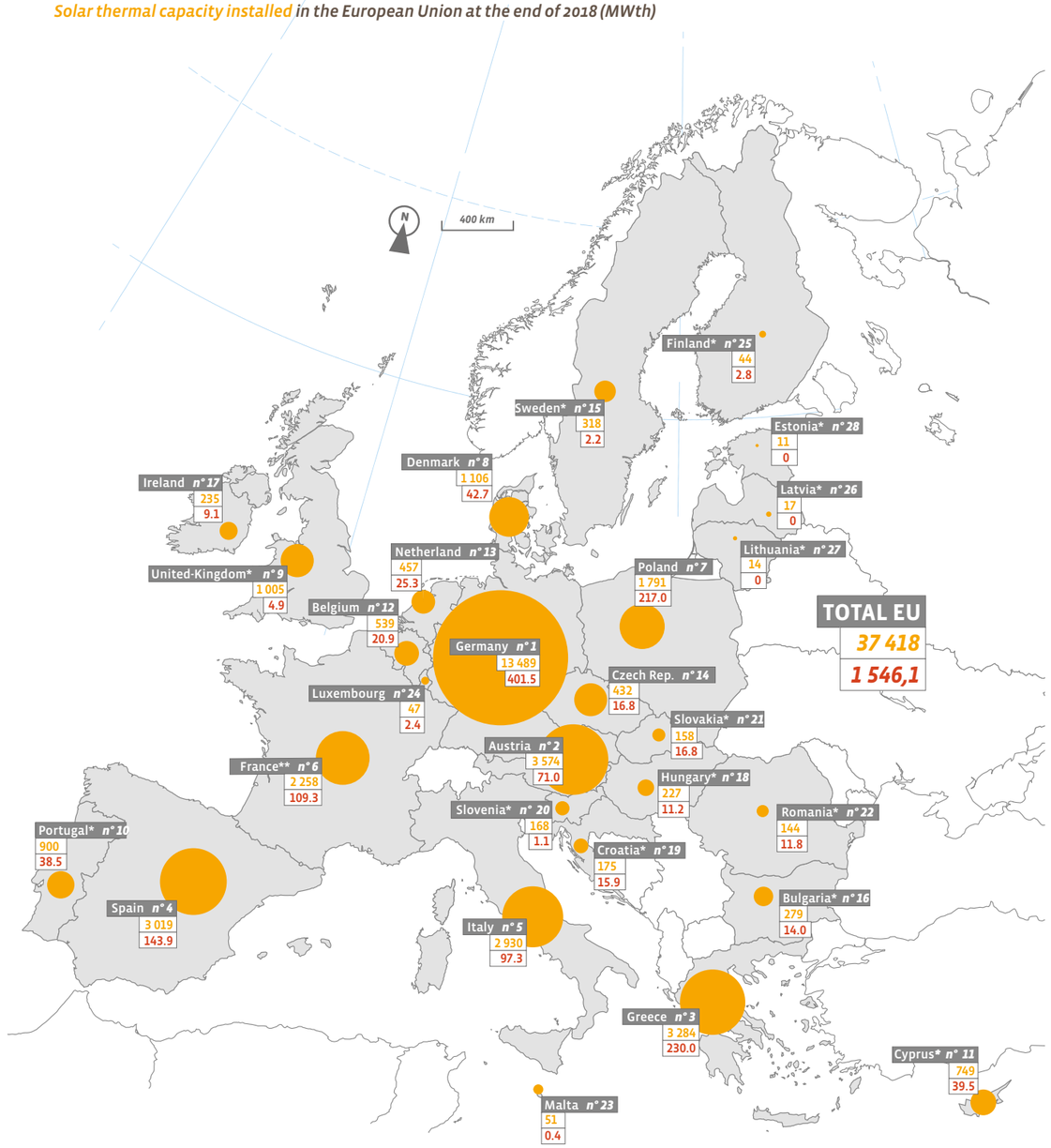
have been unable to make inroads into the new build segment, as they are heavily challenged by thermodynamic water heaters (TWH or dual-purpose HPs) and by photovoltaic, whose technologies are also better geared to the 2012 thermal regulations.

WHAT ARE THE INDUSTRIAL OPENINGS FOR SOLAR THERMAL?

While the European solar thermal industry grapples with the residential market, it is stepping up its reorganisation and strengthening its "new growth drivers". The first of them is solar thermal applied to industrial processes. According to the IEA, the industrial sector accounts for more than 30% of Europe's energy needs and mainly depends on fossil energy sources to cover them. The needs are diverse, ranging from low-temperature hot water (40°C) to high-temperature steam (>250°C). Solar thermal has the technologies to provide solutions to all these specific needs (glazed solar collectors, vacuum tubes, and even CSP technologies such as parabolic trough collectors and Fresnel mirrors). Construction of a site touted as the world's third largest solar thermal plant to supply an industrial site kicked off at the end of 2018 in France. The site in question is a malthouse. This project is feasible because it won a call for projects launched by the French Environment and Energy Management Agency (Ademe). The 15 000 m² installation, for 12 MWth, will produce 8.7 GWh of heat per annum, which is enough to cover 10% of the malthouse's needs. The site's industrial processes include a barley or wheat drying stage, with hot air that gradually rises in temperature from 50 to 85°C and the solar plant, which is ground-based, will preheat the air for this process. Kyotherm, the investor specialised in renewable heat production projects is the project bearer in an ESCO (Energy Service Company) role. It will make the solar investment and will operate the facilities to sell on the produced heat to the industrial client through a long-term energy supply contract. Other actors involved in the project are Sunoptimo, for collector design, NewHeat, which will be responsible for the technical aspects of project management and Dalkia, responsible for integrating solar thermal in the current installations. Premiums and low-interest loans provided by Ademe will cover 60–65% of its CAPEX (i.e. 5.5–6 million euros). The European Union, like France also seeks to develop this avenue and thus instigated the INSHIP project on 1 January 2017 which should roll out over four years. With its 28 partners, it aims to guide research and innovation, to raise the technological barriers preventing this type of project from widescale reproduction. Its research priorities are separated along the lines of the various temperature stages required by industry, namely 80°C – 150°C, 150°C – 400°C and 400°C – 1 500°C.

Solar thermal is also set to play a role in supplying district heating networks. The relevance of this idea is supported by many reports and analyses. In December 2018, Technavio published its "Global District Heating Market 2018–2022" report,

Solar thermal capacity installed **in the European Union at the end of 2018 (MWth)**



Key

37 418 *Total solar thermal capacity* **installed at the end of 2018 (MWth)**

1 546,1 *Solar thermal capacity* **installed during the year 2018 (in MWth)**

** EurObserv'ER estimation.*
*** Overseas departments included.*
Source: EurObserv'ER 2019.

dedicated to the heating network market. According to the survey, the global market should expand by 43.2 billion dollars, or 4% per annum by 2022. Capacity based on renewable energies should increase by 7.4%. Thus, the value of the renewable energy market dedicated to heating networks should rise from 21 billion dollars in 2017 to 30 billion dollars in 2022... the five major players being Russia, China, the Ukraine, Poland and Germany. In Europe, Danish consultancy PlanEnergi has assessed the possibility of supplying solar energy to the heating networks of 2 480 small towns in 22 European countries. It emerges that many towns have enough land to mobilise to enable solar supply to meet 20% of the heat demand. Furthermore, in 93% of the cases where solar thermal could play a role, the heat could be produced at a cost of less than 50 euros per megawatt-hour. According to PlanEnergi, the ten countries with the highest potential for low-cost deployment of solar thermal to supply their heating networks are Poland, the UK, Sweden, Denmark, Slovakia, Romania, Germany, Hungary, Austria and the Czech Republic. In Austria, the solar association (Austria Solar) wants to involve its citizens in setting up and financing urban solar heating projects. To do so, it has published a guide – "Public Participation models for solar district heating". The guide lists the various possible methods of capital injection by individuals for projects, such as crowdlending and setting up citizens' cooperatives. This approach should propel solar thermal to join the momentum already espoused by many other renewable energy sources, starting with solar photovoltaic. Thus, expertise with a high level of citizen involvement in projects of this ilk already exists, which will help get them off the ground, not only because of the financial leverage, but also because social acceptability is managed better.

Lastly, solar thermal is deployed in the cooling market. It entails using solar energy not only to produce heat, but also to produce cooling. The Spanish company Veolia has coordinated a project to test an installation called HyCool, based on Fresnel collectors supplied by the Austrian company Fresnex and "coolers" supplied by the German company Fahrenheit. HyCool was launched in May 2018 and will be tested for three years on two pilot sites. The first is a pre-prepared meal company that requires temperatures of 6–8°C for production and 10–12°C in its delivery area. The second site is more complex. It is a unit of the Swiss group Givaudan based in Spain, which produces flavours and fragrances. The solar heat will be used to produce to meet 100% of the cooler units' steam needs.

Tabl. n°4

Cumulated capacity of thermal solar collectors installed in the European Union in 2017 and 2018**(in m² and in MWth)*

	2017		2018	
	m²	MWth	m²	MWth
Germany	19 091 390	13 364	19 269 490	13 489
Austria	5 168 157	3 618	5 105 155	3 574
Greece	4 595 900	3 217	4 691 000	3 284
Spain	4 106 950	2 875	4 312 450	3 019
Italy	4 050 666	2 835	4 185 946	2 930
France***	3 094 442	2 166	3 225 000	2 258
Poland	2 248 300	1 574	2 558 300	1 791
Denmark	1 542 384	1 080	1 579 324	1 106
United Kingdom	1 428 000	1 000	1 435 000	1 005
Portugal	1 231 105	862	1 286 105	900
Cyprus	1 043 860	731	1 070 264	749
Belgium	750 600	525	769 956	539
Netherlands	650 271	455	652 218	457
Czechia	593 442	415	617 442	432
Sweden	472 000	330	454 415	318
Bulgaria	378 000	265	398 000	279
Ireland	322 616	226	335 657	235
Hungary	308 000	216	324 000	227
Croatia	226 700	159	249 400	175
Slovenia	238 750	167	240 300	168
Slovakia	201 000	141	225 000	158
Romania	189 000	132	205 800	144
Malta	72 250	51	72 858	51
Luxembourg	63 150	44	66 568	47
Finland	60 000	42	63 200	44
Latvia	24 520	17	24 520	17
Lithuania	20 150	14	20 150	14
Estonia	16 120	11	16 120	11
Total EU 28	52 187 723	36 531	53 453 638	37 418

** All technologies, including unglazed collectors. ** Estimate. *** Overseas departments included. Source: EurObserv'ER 2019.*

6% OF THE EUROPEAN DEMAND FOR HEAT IN 2030?

Even if the solar thermal market's belated return to growth is confirmed in 2019 and 2020, it will fall short of what the European Union countries require to achieve their targets for 2020 (i.e. 6.45 Mtoe). According to EurObserv'ER, solar heat's contribution will only rise to 2.6 Mtoe by this timeline (graph 3).

The main barrier to sector development is the initial investment, because in the case of solar thermal, the main part of the energy bill over an installation's 20-year service life is at the time of purchase. Despite the very competitive energy production costs put at 2 euro cents per kWh for producing hot water via a thermosyphon system and less than 3.5 euro cents per kWh for a heating network in Denmark by Solar Heat Europe, investment in equipment remains an obstacle to market development. Another identified curb is that changes of heating and hot water production systems are rarely programmed. They are usually undertaken as a matter of urgency following the breakdown of an existing system. When the problem is serious and a replacement is required, the fastest option encourages resorting to a solution of the same type, which makes it harder to migrate to renewable energy systems. Thus, efforts must be made preventively in sales to help consumers plan for the replacement of their system. One of the sector's main challenges is thus to take part in the modernisation of the existing boiler base. The sector players stress that adding solar thermal collectors to a heating system is always an advantage in energy efficiency terms. Andreas Lücke, the general director of BDH, the German heating industry association claims, "When combined with solar thermal energy, condensing boilers, heat pumps and wood-fired central heating become hybrid systems that lead to energy savings of up to 40%". The public authorities' role is surely to encourage consumers to make this step forward. The two main avenues open to public authority action are active communication campaigns and creating equal conditions for competition between the technologies.

The solar thermal sector's potential remains very high as shown by the "Renewable Energy Prospects for the European Union" report, published by IRENA (the International Renewable Energy Agency) in 2018 and produced in conjunction with the European Commission. The report studied the most cost-effective renewable energy solution mixes likely to accelerate the deployment of renewable energies by 2030. The conclusions indicate that alongside solar photovoltaic, the use of solar thermal in buildings and industry is one of the most relevant solutions to explore if the renewable energy sources' share is to grow. This would even lead to outstripping the current target of 32% by 2030 and achieving 34%. In the case of a reference scenario where the renewable energy share only reaches 24% of the total heat demand in 2030, solar thermal's contribution would be just 3%. In the most ambitious case, the REmap scenario, the renewable energy share would reach 34% of the heat demand while solar thermal's contribution would be 6.2%. In this last case, IRENA has projected that solar thermal energy in buildings and

Tabl. n° 5

Solar thermal capacity in operation per capita (m²/inhab. and kWh/inhab.) in 2018***

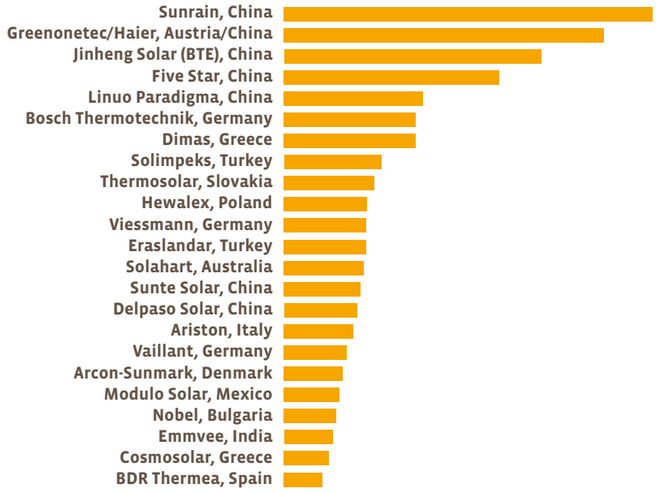
Country	m²/inhab.	kWth/inhab.
Cyprus	1,238	0,867
Austria	0,579	0,405
Greece	0,437	0,306
Denmark	0,273	0,191
Germany	0,233	0,163
Malta	0,153	0,107
Portugal	0,125	0,087
Slovenia	0,116	0,081
Luxembourg	0,111	0,077
Spain	0,092	0,065
Ireland	0,069	0,049
Italy	0,069	0,048
Belgium	0,068	0,047
Poland	0,067	0,047
Croatia	0,061	0,043
Czechia	0,058	0,041
Bulgaria	0,056	0,040
France***	0,048	0,034
Sweden	0,045	0,031
Slovakia	0,041	0,029
Netherlands	0,038	0,027
Hungary	0,033	0,023
United Kingdom	0,022	0,015
Latvia	0,013	0,009
Estonia	0,012	0,009
Finland	0,011	0,008
Romania	0,011	0,007
Lithuania	0,007	0,005
Total EU 28	0,104	0,073

** All technologies, including unglazed collectors. ** Estimate. *** Overseas departments included.*
Source: EurObserv'ER 2019

industry would probably reach 691 PJ (192 TWh) of energy production, which would result in 269 MWth (384 million m²) of installed capacity. Of this total, solar thermal energy in buildings could generate 571 PJ (158 TWh) alone, which equates to 222 MWth (371 million m²) of installed capacity. □

Graph. n° 2

Ranking of the largest flat plate collector manufacturers worldwide (Collector area produced in 2018 in m²)



Chinese based companies trust the 5 top places of the ranking of flat plate manufacturers.

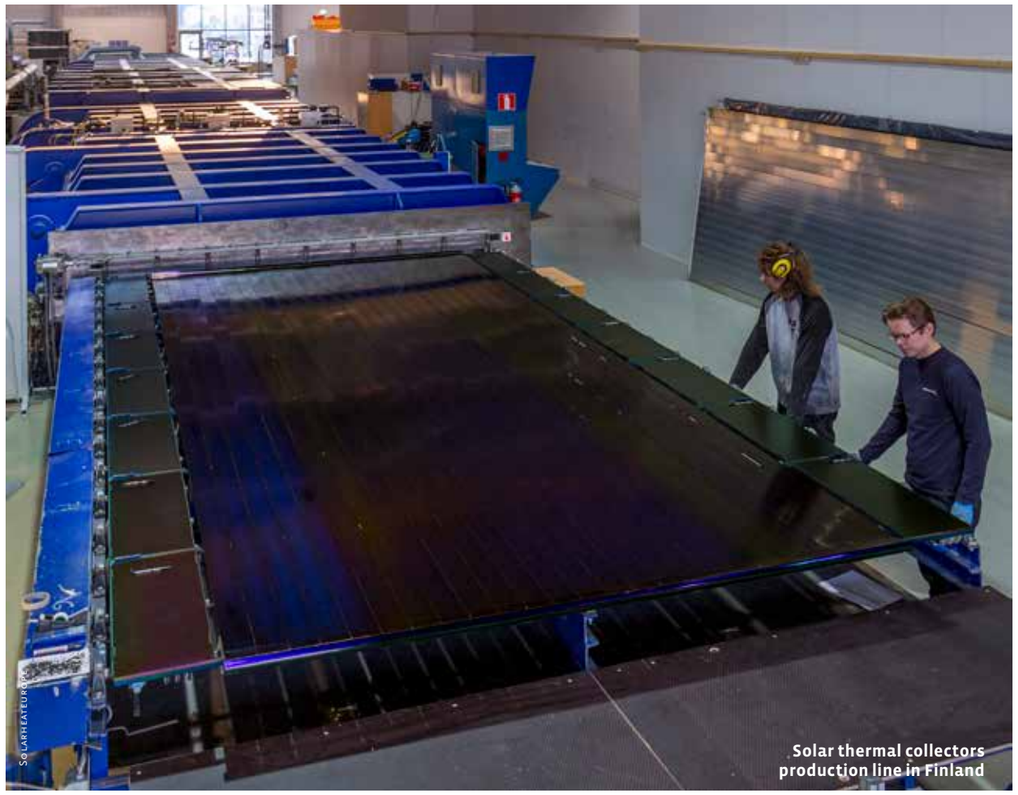
Source : Manufacturers' information market survey by solrico in February/March 2019, www.solrico.com

Tabl. n° 6

Representative European solar thermal collector manufacturers

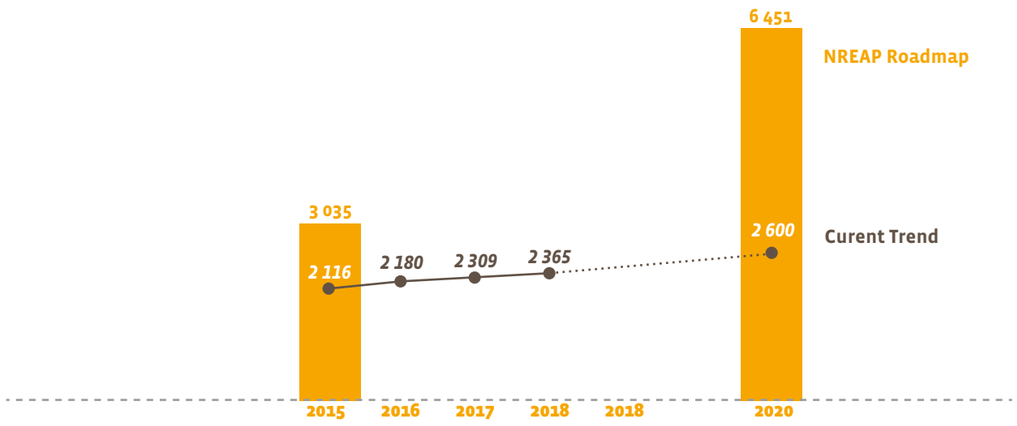
Company	Country	Activity
GREENoneTEC	Austria / China	Flat plate and vacuum tube collectors
Dimas	Greece	Flat plate collectors manufacturer
Bosch Thermotechnik	Germany	Heating equipment supplier / Flat plate collector manufacturer
Solimpeks	Turkey	Flat plate collectors manufacturer
Thermosolar	Slovakia	Flat plate and vacuum tube collectors manufacturer
Eraslanlar	Turkey	Flat plate collectors manufacturer
Hewalex	Poland	Flat plate collectors manufacturer
Viessmann	Germany	Heating equipment supplier / solar thermal
Delpaso Solar	Spain	Flat plate collectors manufacturer
Ariston	Italy	Flat plate collectors manufacturer
Vaillant Group	Germany	Heating equipment supplier / solar thermal
Arcon-Sunmark	Denmark	Flat plate collectors manufacturer
Nobel	Bulgaria	Flat plate collectors manufacturer
Cosmosolar	Greece	Flat plate collectors manufacturer and heating equipment supplier
BDR Thermea	Spain	Heating equipment supplier / solar thermal

Source: EurObserv'ER 2019.


Solar thermal collectors production line in Finland

Graph. n° 3

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



Source: EurObserv'ER 2019

CONCENTRATED SOLAR POWER

GLOBAL ELECTRICITY CAPACITY AT 5 663 MW

Most of the current CSP development work is going on in countries whose sunlight conditions are highly advantageous such as China, India, Australia, South Africa, the Gulf states and North Africa. In the latest update of the Protermosolar database (Spanish Association for the Promotion of the Thermosolar Industry), the global capacity of these plants was put at 5 663 MW by the end of 2018 (4 704 MW by the end of 2017). In 2018, 11 new plants were commissioned across the world, most of which had a storage system. We draw attention to the South African plants – Ilanga I (100 MW, 5 hours storage) and Kathu Solar Park (100 MW, 4.5 hours storage), both using parabolic troughs. As for China, three new projects went on-grid: the CGN Delingha parabolic trough plant (50 MW, 9 hours storage) and the Shouhang Dunhuang (100 MW, 11 hours storage) and Supcon Delingha (50 MW, 6 hours storage) tower plants. India, which has added no additional capacity since 2014, inaugurated the Dhursar Fresnel plant (100 MW, no storage) in 2018. In the Middle-East, Saudi Arabia connected the Waad Al Shamal ISCC parabolic trough plant (50 MW, no storage) and Kuwait the Shagaya parabolic trough plant (50 MW, 10 hours storage). Lastly Morocco commissioned the Noor II and Noor III plants. Noor II is a 200-MW parabolic trough plant (7 hours storage), while Noor III is a 150-MW tower plant (7 hours storage). Protermosolar has added to its list the French Ello de Suncnim Fresnel plant (9 MW, 4 hours storage), which has been at test stage since the end of 2018. Its official commissioning is scheduled in 2019. Protermosolar's figures suggest that the above plants commissioned in 2018 should add about 1 000 MW of capacity (959 MW to be precise). This flurry of construction should be followed by 2 166 MW of capacity currently under construction across the globe. In 2019, new projects for 1 045 MW are awaited in China and the Middle-East. The significant drop in production costs has paved the way for this positive thrust. The latest IRENA Renewable Power Generation Costs report published in 2018 claims that the Levelized Cost of Energy (LCOE) of CSP projects has fallen to 18.6 ¢ per kWh (about 16.4 euro cents per kWh), which is a 26% drop on its 2017 level and 46% drop on the 2010 level. IRENA forecasts that the LCOE could shortly fall by 6–10 ¢ per kWh as tender mechanisms encourage lower costs. Installation costs fell by 28% in 2018, settling at a mean of $ 5 204 per kW, which is half of the cost borne by projects installed in 2011. The load factor for new projects also rose sharply, by about 45% in 2018 (39% in 2017), helped by technological advances on the storage front. IRENA feels that CSP will play an essential role in the renewable energy mix, given its capacity to supply controllable renewable energy, by supplementing variable energy sources like solar photovoltaic and wind energy.

THE EUROPEAN MARKET IS DORMANT

The European Union market has been dormant ever since the end of wave of installations, that was concentrated in Spain between 2007 and 2014. There was no change in 2018, so the meter is stuck at 2 314.3 MW, including pilot facilities and demonstrators ***(Graph 3 and table 7)***. This capacity is predominantly concentrated in Spain where the installed capacity officially amounts to 2 303 MW (i.e. 99% of all European Union capacity). Furthermore, Spain's sunshine conditions in 2018 were poorer than in 2017, when its output broke a sector record. According to grid operator REE (Red Electrica de España), nett output was measured at 4 424 GWh in 2018 compared to 5 348 GWh in 2017 (5 071 GWh in 2016). The prospects for 2019 are better. Over the first 5 months of the year, output had already risen to 2 026 GWh according to REE, which is an 8% increase over the same period in 2018. In 2019 the sector broke three monthly output records in February (262 GWh), March (475 GWh) and May (741 GWh). Protermosolar claims that this data justifies the confidence deserved by

A multifaceted technology that is complementary to others

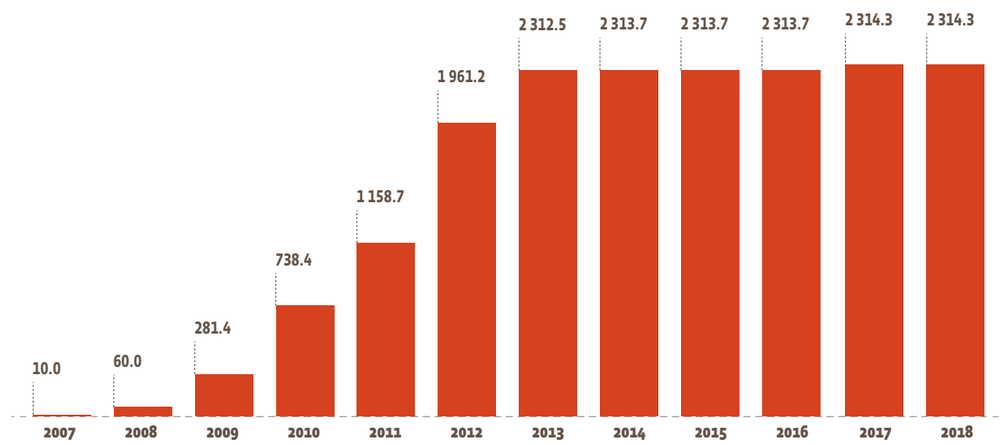
The various concentrated solar power technologies include tower plants whose heliostats concentrate the sun's rays on a receiver at the top of a tower, Fresnel collector plants whose rows of flat mirrors concentrate the sun's rays on a tube receiver, parabolic trough plants whose collectors concentrate the sun's rays on a tube and parabolic collectors that use a parabolic mirror to reflect the sun's rays onto a convergence point. CSP has the advantage of being able to even out its output thanks to its thermal buffer storage, which usually takes the form of molten salts heated in a tank to keep them at high temperature, thus extending operating time by ten hours or so. Hybridization of CSP plants with other renewable energy sources (biomass, photovoltaic, geothermal…) or with natural gas may offer benefits in terms of services provided to the grid. Hybridization between CSP and PV in particular enables the synergies of their technologies to be harnessed because the energy generated during the day comes from photovoltaic collector fields at extremely competitive cost, whereas from sundown, when photovoltaic production wanes and the prices and demand for electricity peak, the CSP plant comes into its own by drawing on its storage capacities.


Concentrated solar power plant in Italy

© CSPE

Graph. n° 3

European Union concentrated solar power capacity trend (MWe)



Source: EurObserv'ER 2019.

this technology and the relevance of proposing more extensive deployment of CSP over the next decade. An example is the Spanish National Integrated Energy and Climate Plan (PNIEC) project to achieve the targets by the 2030 timeline (see further on). The association pleads for storage systems to be equipped to installations that have none, in addition to developing new CSP plants to complement the expansion of photovoltaic projects. A common strategy would make it easier to integrate renewable energies into the system, by optimising the existing and future transmission infrastructures and thus contributing to grid stability.

The EU development project situation has changed very little (table 8). In France, the Ello plant in the Eastern Pyrenees has been operating since the end of October 2018 but will not go on-grid until 2019; thus, its output will be included in the 2019 statistics. Four larger projects (Solecaldo 41 MW at Aidone, Sicily; Reflex Solar Power 12.5 MW at Gela, Sicily; Lentini 55 MW, Sicily and the hybrid solar CSP project 10 MW at San Quirico, Sardinia) are still on track for completion by 2020–2021, but investors are waiting for publication of the decree defining the remuneration terms of the future energy output. The commercial commissioning date is suspended for the time being. The only project left in the running in Cyprus is the EOS project, at Alassa, near the city of Limassol. According to the Energy Ministry and the developers, the project initially planned for 2018 should come on stream no later than the end of 2021. This tower plant project is somewhat exceptional as it will have two 25-MW generators yet only one 25-MW capacity tranche effectively guaranteed. The plant has been designed to run at this capacity for 24 hours thanks to a storage system but can also operate for 12 hours at a capacity of 50 MW.

At the same time, CSP technology is looking for new outlets in industrial and heating network applications. In this segment it is in direct competition with flat-plate collector technology, in a niche market that should pick up steam with the new orientation of the European RES directive. Denmark has pioneered this technology by commissioning a project developed by AalborgCSP combining a CSP installation with an ORC biomass plant which was commissioned on 30 December 2016. The project, whose thermal capacity is 16.6 MWth, can produce both heat and electricity. The solar part uses a 26 929-m2 area of parabolic trough collectors. In France, Helioclim delivered France's biggest CSP plant in January 2018 to supply a heating network for the Saint Christol d'Albion (84) military defence base. The heat production system of this relatively small (560 kW) 6-km long network comprises 750 m² of mirrors associated with a wood-fired heating plant. In Spain, Alcalá Ecoenergías signed a contract in February 2018 for the construction of Spain's first big hybrid solar-biomass heating network. The site will be equipped with a 30-MW biomass boiler and a 12-MW CSP plant. Start-ups like the Spanish firm Solatom are concentrating on the small installation market. The firm has developed a 14.5-kW turnkey system based on Fresnel mirror technology to supply heat to small industrial plants. The target sectors range from dairy, textile and chemical industries to industrial laundries and sewage treatment plants.

Tabl. n° 7

Concentrated solar power plants in operation at the end of 2018. **(Source: EurObserv'ER 2019)**

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		2 314.3	

Source: EurObserv'ER 2019

SOLAR THERMAL AND CONCENTRATED SOLAR POWER BAROMETERS – **EUROBSERV'ER** – JUNE 2019

NEW AMBITIONS FOR 2030 TO BE CONFIRMED

By 2020, the European sector's growth prospects will be far below the targets set by the member countries national renewable energy action plans ***(graph 4)***. Every year it becomes clearer that if the European sector is to be relaunched, it will not occur before the next decade because of project delays. Its future is currently being debated by the Member States with preliminary indications coming from National Energy and Climate Plan (PNEC) projects. This is because, according to the Union of Energy governance rules, which came into force on 24 December 2018, the EU countries were obliged to draw up PNEC plans for 2021–2030 and submit a draft plan to the European Commission before 31 December 2018 followed by the final plans before 31 December 2019.
The first documents posted on the European Commission website suggest that the future of Europe CSP sector will be largely concentrated in Spain. The Spanish PNIEC project has the merit of giving a medium- and long-term horizon to the sector, with a 4 803-MW installed collector base in 2025 in its "target scenario" (for output of 13 953 TWh) and 7 303 MW installed collector base in 2030 (for output of 22 578 TWh), which equates to 5 GW of capacity on top of the current base (equating to 17.6 TWh of additional output). That would take

Tabl. n° 8

Concentrated solar power plants under developement at the end of 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	n.a
San Severo	3SP	San Severo / Puglia	10	Central receiver	n.a
Non connu / 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
Non connu / Not known	Solar Energy SRL	Belpasso / Sicily	1.2	Not known	n.a
Archimede	ARCHIMEDE SRL	Melilli / Sicily	1	Parabolic Through	n.a
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		
Cyprus					
Eos Project	Solastor	Alassa	50	Central receiver	2021
Total Cyprus			50		
France					
eLLo	Suncnim	Llo, Pyrenees	9	Linear Fresnel	2019
Total France			9		
Greece					
MINOS CSP tower	Nur Energy	Crete	50	Central receiver	n.a.
Total Greece			50		
Total European Union			312.6		

Source: EurObserv'ER 2019

Solar research center in Austria

Tabl. n° 9

Main European CSP project developers

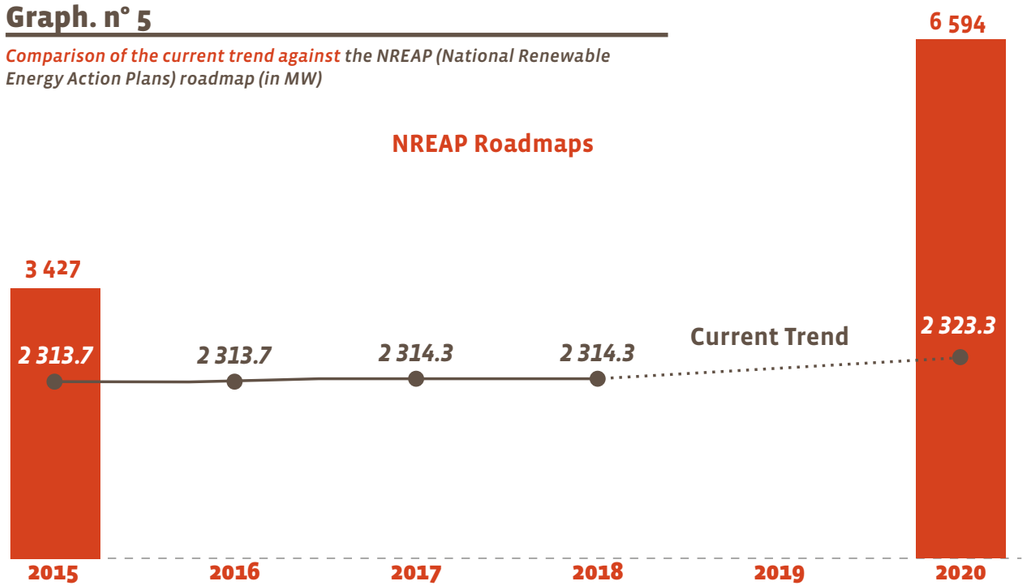
Company	Country	Activity	MW developped or under construction
Abengoa	Spain	Promoter - Project developer - EPC - Engineering - O&M - Components	620
Cobra	Spain	Promoter - Project developer - EPC - Engineering - O&M	480
Acciona Energy	Spain	EPC - Project developer - Promoter	314
Ibereolica	Spain	Engineering - EPC - O&M - Project developer	300
Torresol Energy	Spain	Promoter - Project developer - O&M - Engineering	120
FCC Energia /Enerstar	Spain	Promoter - Project developer	120
Hyperion	Spain	Promoter - Project developer - O&M	103
Samca	Spain	Promoter - Project developer - O&M	100

Source: EurObserv'ER 2019 (based on an extensive desk research).

the CSP contribution alone to 6.7% of the country's electricity output, which is similar to that of nuclear energy (7.3%). While less ambitious, the Italian PNEC project also demonstrates that Italy still intends to count on the CSP sector with 250 MW in 2025 and 850 MW in 2030. Turning to the other countries whose sunshine conditions are conducive to harnessing CSP technologies, the Greek project is lower with 70 MW (for output of 260 GWh). For the time being, Cyprus and Portugal are not currently planning any additional projects. Initially, the European Union's CSP electrical capacity could contribute up to 8.3 GW by 2030. CSP technology has proven its reliability and ruggedness, its capacity to contribute to balancing the grid, but it will have to confirm its current cost-lowering trajectory if it is to achieve a suitable installation level. □

Graph. n° 5

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



Source: EurObserv'ER 2019

Sources: AGEE Stat (Germany), EBHE (Greece), ASIT (Spain), PlanEnergi (Denmark), Assotermica-Anima (Italy), Observ'ER (France), SPIUG (Pologne), Statistics Austria, ATTB (Belgium), CBS (Netherlands), Ministry of Industry and Trade (Czechia), SEAI (Ireland Rep.), STATEc (Luxembourg), NSO, Malta, IEA SHC, Solar Heat Europe, EurObserv'ER, Protermosolar

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Concentrated solar power plant on military field in Vaucluse, France

The next barometer will cover biofuels.