Austria was the third most active country, as it connected 7 950 m2 of collectors in 2021 including the Nahwärme Friesach plant (5 750 m2, 4 MWth).

UNSER KRAFTWERK GMBH

+ 8.0%

The growth of the solar thermal market in the European Union in 2021

SOLAR THERMAL AND CONCENTRATED SOLAR POWER BAROMETERS

A study carried out by EurObserv'ER

In several key European Union markets the pieces seem to have fallen back into place as solar thermal has returned to growth. The sector took up the opportunities offered by more appropriate aids and benefitted from higher fossil energy and electricity prices. According to EurObserv'ER, the 2021 market returned above the 2 million m² mark, taking all the European Union solar thermal applications together (solar hot water heating, solar, industrial and district heating). This is particularly well-timed for tackling climate change and our dependency on Russian hydrocarbons.

New CSP power plant projects have been announced in Spain, but their construction will be some time in coming, with the result that at the end of 2021, the European Union's meter was stuck at 2 328.8 MW including demonstration plants. At least two power plants were commissioned elsewhere in the world, one with 110 MW and the other with 50 MW of installed capacity – which takes global installed CSP capacity to 6 570.9 MW.

57.2 millions m²

The cumulated surfaces of solar thermal in operation in the European Union in 2021

2 328.8 MWe

Total CSP capacity in operation in the European Union in 2021


NEWHEAT

The Narbonne plant has a 2996 m² solar thermal collector field to replace 2 410 MWh of heat previously supplied by a gas boiler.

SOLAR THERMAL

Following on after 2020, which was a very tough year for the solar thermal sector that suffered particularly badly during the COVID-19 epidemic, the European market returned to growth in 2021. Preliminary estimates point to an installation level of as much as 2 146 901 m², or 8.0% growth compared to 2020 (1 987 345 m²). The year's newly installed surface equates to about 1 502.8 MWth of thermal capacity (up from 1 391.1 MWth in 2020). Incidentally, the glazed surface of a 1 m² solar thermal collector offers 0.7 kWth of thermal capacity. However, this pick-up in the European market's fortunes is patchy and remains largely dependent on incentive systems and regulatory contexts. Another major contributory factor is the 2021 hike in fossil energy (gas and heating oil) and electricity prices, resulting from post-Covid economic recovery. These prices soared again following Russia's invasion of Ukraine in February 2022, which has sucked the European Union into an energy security crisis.

The market data given in table 1 includes systems that use flat glazed and vacuum collectors, geared to domestic hot water production and heating in the residential sector and heat and hot water production for district heating networks and industrial processes. The data also includes non-glazed collectors that tend to be used for heating pools, even if this technology is less diligently monitored by the statistical organizations. Lastly, concentration mirrors used for hot water production are excluded from the data in the same way as hybrid PV-T collectors that use water as the heat carrier.

THE EU SOLAR THERMAL MARKET BOUNCES BACK

While the European Union solar thermal market is looking healthier overall, differences persist in individual countries. The European market leader Germany, which bounced back with vim and vigour in 2020, did no better in 2021 (see inset). After a particularly tough year, the Greek market resurfaced (increasing by 17.9% over 2020 with 359 000 m² installed in 2021), largely driven by thermosiphon systems. As for the Italian market, it is enjoying a huge revival thanks to the rollout of a new, particularly attractive "Superbonus" incentive system. The country's installation level has leapt by 84.4%, from 122 000 to 225 000 m² propelling it into third place in the European Union rankings. The Polish market, aided by municipal tenders backed by a European funding programme, bounced back (with a 17.3% surge) after two years in decline and lies in fourth place with 189 100 m² sold in 2021. The French market (taking mainland and overseas departments and regions together) found renewed growth, increasing by 18.9% to 164 300 m² in 2021. However, we should point out that more than half of the French market – about 90 000 m² – is based in its overseas departments. The mainland roof-mounted solar thermal market (individual solar hot water heaters, combined solar systems, collective hot water systems) recovered (with 16% year-on-year growth) as 53 600 m² of collectors were installed following an 8-year decline. The French market also benefitted from the commissioning of four district heating networks as well as Europe's biggest industrial solar heating project (see below), while no similar installations were connected in 2020. On the other hand, Spain's solar thermal market decline went unchecked, falling a further 18.7% for a total of 152 300 m² (not including PV-T hybrid systems). Undeterred, the ASIT (Spanish Solar Thermal Industry Association) is much more optimistic about 2022, because of the construction sector recovery and higher aid from the PRTR programme managed by the autonomous regions. This year's growth prospects are mainly positive across the EU as the German market is expected to pick up, while Italy's first half-year sales figures are very encouraging.

New showcases for heating networks and industrial heat

The solar thermal district heating network market (SDH for Solar District Heating) is a separate market segment with specific players and collector technologies for much greater surface areas (up to fifteen m² per collector). Denmark has the highest number of solar-based district heating networks. PlanEnergi, a Danish consultancy specializing in renewable energies, claims that by the end of 2021, Denmark had 125 solar thermal district heating networks in service with a combined collector area of 1.6 million m². Only one single network was equipped in 2021 – the 8 013 m² Præstø site, (with 5.6 MWth of capacity). The 2022 edition of the SHC (Solar heating and cooling programme – International Energy Agency) programme's Solar Heat Worldwide publication concurs with this figure. Germany is the No. 2 EU country for solar district heating networks, with 45 sites, most of which are equipped with seasonal storage systems. Sweden comes next with 24 in service, there are 22 in Austria, eight each in France and Poland, seven in Spain, three in the Netherlands, one in both Italy and Latvia.

France was the most active EU country in 2021, as it commissioned four new solar heating networks (at Narbonne, Pons, Creutzwald and Cadaujac) with a combined total of 11 219 m² of collector surface. The biggest plant, at Creutzwald (5 621 m², 4.3 MWth) is operated by La Française de l'Énergie (LFDE). The Narbonne plant has a 2 996 m² solar thermal collector field to replace 2 410 MWh of heat previously supplied by a gas boiler. The plant is owned by Newheat, an ESCO (Energy service company) that owns the equipment and sells on the solar heat. The third largest French district heating network to be built in 2021 is that of the town of Pons (1 661 m², 1.2 MWth) also owned by Newheat and constructed by Savosolar. Given the site's limited available surface area, the collectors are placed on solar trackers to optimize its annual solar yield. This plant will deliver solar heat (about 1 000 MWh per

AFTER 7 YEARS OF DECLINE, THE GLOBAL SOLAR THERMAL MARKET IS BACK TO GROWTH

The 2022 edition of the leading publication in the field, Solar Heat Worldwide (SWH), claims that the solar thermal market grew by 3% in 2021 following consecutive seven years of decline. Global solar thermal capacity reached 522 GWth, supplying solar heat to 109 million residential and business clients across the globe. That amounts to a net increase of 21 GWth or 31 million square metres of collector area in 2021. The global market trend is essentially driven by the Chinese market, which alone accounted for 83% of the global solar thermal capacity sold in 2021 (split 74% for forced circulation systems to 26% for thermosiphon systems). According to a survey by Malaviya Solar Energy Consultancy, another heavyweight, the Indian glazed collector market, grew by 16% or 1.35 GWth (1.93 million m²) sold in 2021 after performing badly in 2020 with 1.16 GWth (1.66 million m²). The solar thermal markets of the United States and Brazil also posted high growth rates in 2021 with 19%, and 28% respectively. According to SWH, the growth in these countries can be attributed to the fact that individuals spent more time at home during the pandemic and invested in solar heating solutions, especially for pools. Sales to business customers in Brazil also increased, boosted by its expanding construction sector and electricity price rises. This contrasts with the South African and Australian markets which bucked the trend and contracted by 12% and 3%.

www.iea-shc.org/Data/Sites/1/publications/Solar-Heat-Worldwide-2022.pdf

Tabl No. 1

Main solar thermal markets outside the European Union (MWth)

Country	Total cumulative capacity in operation in 2021*	Annual installed capacity	
		2020	2021*
China	381 000	17 535	18 000
India	12 700	1 161	1 350
Turkey	18 900	1 351	1 351
Brazil	14 300	992	1 270
United-States	18 200	506	602
Rest of the world	76 900	3 146	2 859
World	522 000	24 691	25 432

** Estimation.* ***Sources: REN21, Solar Heat Worldwide, EurObservER***

annum) to the Pons heating network operated by Dalkia. The smallest of the four district heating networks is at Cadaujac, in the South-west, with 941 m² (720 kW) of collectors. It is a turnkey solar plant built by Savosolar to meet the heat requirements of a residential, eco-responsible district of 510 MWh p.a. The solar production is linked to inter-seasonal geothermal storage, that will enable this district to cover 100% of its heating and domestic hot water needs renewably.

Austria was the third most active country, as it connected 7 950 m² of collectors in 2021 including the Nahwärme Friesach plant (5 750 m², 4 MWth) and also extended the Graz heating network's solar thermal collector field. Only one heating network, that of Mülhausen (5 691 m²), was equipped with solar collectors in Germany in 2021, which is far below the previous year's activity level, when 7 district heating networks for a combined collector area of 31 200 m² were connected. Yet, according to the Solites research institute, eight or nine projects are set to go on stream in 2022 or 2023, with a combined collector area of 38 000 m². The latter include the Greifswald project which, with its 18 000 m² (13 MWth) of collector area, will overtake Ludwigsburg (14 800 m²) to become Germany's biggest solar heating network.

Another specific market segment, that of solar thermal systems for industrial processes, is being carved out. This sector is shaping up with the arrival of increasingly ambitious projects in areas as diverse as the agri-food industry, papermaking and hothouse heating. The largest industrial project to go on stream in 2021 was the Issoudun plant in France. It is France's biggest solar heating system and Europe's most extensive solar thermal system to produce industrial heat with a 13 243 m² field (comprising 893 Savo 15 SG-M, Savosolar-branded collectors). Kyotherm, which specializes in third-party funding of renewable heat projects, owns this plant. The solar unit will supply heat to a malt drying plant operated by Malteries Franco-suisses. Another project formalized early in February 2021 is scheduled to start operating in 2022. Newheat announced that it had signed a contract with the Lactalis group to supply heat, produced by what should become the biggest solar thermal plant in France. The press release states that the unit will have almost 15 000 m² of collectors offering a maximum capacity of about 13 MWth (and production of about 8 000 MWh). The plant, located at Fromeréville-les-Vallons, near Verdun, will supply solar heat to preheat the air of a new lactoserum drying tower (from 15 to 80°C), thereby reducing the site's annual gas consumption by 11% and its CO_2 emissions by 2 000 tonnes. Spain is also actively developing solar thermal systems for industrial uses. Its national energy agency, IDAE, reports that 51 solar heat projects are being funded for a total of 61 MW and that most of them use solar thermal concentration technologies.

A 57.2 million m² solar thermal base by the end of 2021

According to EurObserv'ER, the total surface area of the European Union collector base was 57.2 million m² (40 019.6 MWth) at the end of 2021, which is a 2.4% year-on-year rise. The combined European collector area increased by 1.3 million m². This assessment covers the three main solar thermal technologies (flat glazed collectors, vacuum collectors and unglazed collectors) and makes allowance for the decommissioning assumptions of the oldest installations posited by the experts contacted during the study and the n-1 data published by Eurostat (i.e., 830 000 m² for all the EU-27 countries in 2021). Where official data was not forthcoming, EurObserv'ER based its calculations on the market data collected by applying a twenty-year decommissioning hypothesis for classic glazed collectors. The total collector areas of some countries increased slightly, while in Austria and the Netherlands the collector base contracted through the obsolescence factor.

Table No. 2

Annual installed surfaces in 2020 per type of collectors (in m²) and capacity equivalent (in MWth)

Country	Glazed collectors		Unglazed collectors	Total (m²)	Equivalent capacity (MWth)
	Flat plate collectors	Vacuum collectors			
Germany	544 000	99 000		643 000	450.1
Greece	304 500			304 500	213.2
Spain	177 073	7 539	2 798	187 410	131.2
Poland	159 370	1 830		161 200	112.8
France**	138 160			138 160	96.7
Italy	110 439	11 561		122 000	85.4
Austria	72 210	1 400	1 730	75 340	52.7
Cyprus	74 193			74 193	51.9
Portugal	49 874			49 874	34.9
Hungary+	42 000			42 000	29.4
Netherlands	20 640	9 487	2 621	32 748	22.9
Czechia	15 000	7 000		22 000	15.4
Bulgaria+	20 060			20 060	14.0
Belgium	15 300	2 900		18 200	12.7
Denmark	17 613			17 613	12.3
Romania++	15 960			15 960	11.2
Croatia+	15 800			15 800	11.1
Slovakia+	13 000			13 000	9.1
Ireland	11 114			11 114	7.8
Finland+	7 000			7 000	4.9
Sweden++	4 898			4 898	3.4
Luxembourg+	4 469			4 469	3.1
Lithuania++	1 700			1 700	1.2
Latvia++	1 600			1 600	1.1
Estonia++	1 425			1 425	1.0
Slovenia++	1 400			1 400	1.0
Malta	681			681	0.5
Total EU	1 839 479	140 717	7 149	1 987 345	1 391.1

+ EurObserv'ER estimation based on Eurostat database. ++ Estimation from Solar heat Europe Solar Heat markets in Europe - Trends and Market statistics 2020.
*** Including 91,352 m² in the overseas departments.* ***Source: EurObserv'ER 2022***

Table No. 3

Annual installed surfaces in 2021 per type of collectors (in m²) and capacity equivalent (in MWth)*

Country	Glazed collectors		Unglazed collectors	Total (m²)	Equivalent capacity (MWth)
	Flat plate collectors	Vacuum collectors			
Germany	542 000	98 000		640 000	448.0
Greece	359 000			359 000	251.3
Italy	207 548	17 452		225 000	157.5
Poland	186 100	3 000		189 100	132.4
France**	164 300			164 300	115.0
Spain	141 500	8 800	2 000	152 300	106.6
Portugal	72 000			72 000	50.4
Cyprus	70 360			70 360	49.3
Austria	64 570	3 810	930	69 310	48.5
Hungary+	42 000			42 000	29.4
Netherlands	34 393			34 393	24.1
Bulgaria+	20 000			20 000	14.0
Czechia	15 210	1 903		17 113	12.0
Romania+	15 960			15 960	11.2
Croatia+	15 000			15 000	10.5
Belgium	10 300	2 900		13 200	9.2
Slovakia+	13 000			13 000	9.1
Denmark	8 013			8 013	5.6
Finland+	7 000			7 000	4.9
Sweden+	5 000			5 000	3.5
Ireland	3 839			3 839	2.7
Luxembourg	3 574			3 574	2.5
Lithuania+	1 700			1 700	1.2
Latvia+	1 600			1 600	1.1
Estonia+	1 425			1 425	1.0
Slovenia+	1 400			1 400	1.0
Malta	1 051	263		1 314	0.9
Total EU	2 007 843	136 128	2 930	2 146 901	1 502.8

+ EurObserv'ER estimation based on the market trend of recent years (these are not sufficiently accurate to be used for percentual change reference in these markets).
** Estimation . ** Including 90 000 m² in the overseas departments.* ***Source: EurObserv'ER 2022.***

MADE IN EUROPE-MANUFACTURED PRODUCTS EXPORTED WORLDWIDE

The European solar thermal industry, which is in the throes of consolidation, has taken advantage of the upturn in European markets and global demand. Solrico, a solar market research and international communication agency focusing on the solar heating and cooling sector, publishes an annual market survey of the main flat solar thermal collector manufacturers (i.e., it excludes the vacuum tube collector manufacturers). According to Solrico, the annual output of the 20 biggest producers, increased by an average of 15% compared to last year, which equates to the manufacture of about 6 million m² collectors. Solrico lists seven Chinese players in its top 20, five of whom are ranked in the top six, but also 10 European players (one Austrian, two German, three Greek, one Slovak, two Spanish and one Polish). However, the output figures are not cited in the report, as the manufacturers are reticent to disclose them. Still, the agency points out that nine of the 10 European players were satisfied with their sales performance, which is borne out by they fact that they have been able to increase their collector production by an average of 21%. This phenomenon is a trend reversal, as last year the average output of these same firms had shrunk by an average of 12%. The Greek players post the most spectacular growth. Costas Travasaros, Solar Heat Europe's President, reports that most of the Greek manufacturers are currently investing in new production lines of both collectors and storage systems. These companies export within Europe, but also to the Middle-East, North Africa, and further afield in Africa, South and North America. EBHE, the Greek solar thermal industry association, reckons that the country's solar collector output doubled in the space of eight years from 540 000 m² in 2014 to 1.19 million m² in 2021, in an article entitled "Greek factories: a new collector every 72 seconds", published on the solarthermalworld.org website on 31 May 2022. Exports, which have tripled over the period, are the main driver for this growth, as domestic demand rose by only 33%. By way of illustration, the manufacturer Papaemmanouel, has built a new factory which will double its production capacity to more than 320 000 m² by the end of 2022 with a production line 80% automated to roll out a collector every 80 seconds. Another Greek company, Sammler, intends to increase its current output level five-fold to more than 250 000 m² thanks to a new automated production line that will finish a collector every 72 seconds. These two companies export most of their output (90% in the case of Papaemmanouel and 85% for Sammler).

Last year a number of European industry players changed hands or shed assets. The most striking reversal is the return of the Austrian firm GREENoneTEC, Europe's leading and the world's No. 3 flat glazed collector manufacturer, to its founder Robert Kanduth who bought back the 51% sold to China's Haier in May 2017. The German manufacturer Bosch Thermotechnik, sold its Brazilian subsidiary Heliotek (acquired in 2012) to its main local rival Pro-Sol. At the very beginning of 2002 (5 January), Italy's Ariston completed its acquisition of the Israeli pioneering solar thermal manufacturer, Chromagen Hot Water Solution. According to the press release, Chromagen, which has two subsidiaries, one in Spain and the other in Australia with 300 employees and a turnover of 125 million dollars, claims to have a network of active distributors in 35 countries. Ariston has a production plant in the Marches of central Italy, and a collector production plant in Pune, India.

In France, the Viessmann plant at Faulquemont in Moselle, which has historically specialized in solar thermal collector and hot water tank production, has decided to expedite the robotization of its site. After investing in a folding and laser cutting machine in 2020, the site acquired a new stamping and folding production line in 2021, and four robots in the sheet metal for hot water tanks and solar thermal collector sectors. Another five robots have been added

Table No. 4

Cumulated capacity of thermal solar collectors installed in the European Union in 2020 and 2021** (in m² and in MWth)*

Country	2020 m²	2020 MWth	2021 m²	2021 MWth
Germany	21 415 690	14 991.0	21 784 790	15 249.4
Greece	4 991 000	3 493.7	5 175 000	3 622.5
Austria	4 916 776	3 441.7	4 767 286	3 337.1
Italy	4 457 525	3 120.3	4 672 525	3 270.8
Spain	4 235 816	2 965.1	4 393 316	3 075.3
France	3 397 750	2 378.4	3 524 000	2 466.8
Poland	3 006 690	2 104.7	3 195 690	2 237.0
Denmark	2 051 096	1 435.8	2 032 959	1 423.1
Portugal	1 406 955	984.9	1 478 955	1 035.3
Cyprus	1 102 430	771.7	1 142 790	800.0
Belgium	740 300	518.2	748 819	524.2
Netherlands	669 416	468.6	665 638	465.9
Czechia	568 626	398.0	585 739	410.0
Bulgaria	445 538	311.9	465 538	325.9
Sweden	451 000	315.7	434 030	303.8
Hungary	392 000	274.4	434 000	303.8
Ireland	347 484	243.2	351 323	245.9
Croatia	288 000	201.6	303 000	212.1
Slovakia	232 000	162.4	245 000	171.5
Romania	218 910	153.2	234 870	164.4
Slovenia	222 914	156.0	224 314	157.0
Finland	80 000	56.0	85 500	59.9
Luxembourg	73 802	51.7	77 376	54.2
Malta	74 084	51.9	75 397	52.8
Lithuania	26 150	18.3	27 850	19.5
Latvia	21 700	15.2	23 300	16.3
Estonia	20 470	14.3	21 895	15.3
Total EU 27	55 854 122	39 097.9	57 170 900	40 019.6

** All technologies included unglazed collectors.* **Source: EurObserv'ER 2022.**

Solar thermal installations convert the sun's rays into heat to produce domestic hot water. They can cover 70% of a dwelling's hot water needs.

SUPERBONUS BOOSTS THE ITALIAN MARKET

The combination of the Conto Termico support programme for renewable heat installations, and the 110% Superbonus for energy efficiency in buildings propelled Italy into achieving a record year for solar thermal in 2021. Its industry association, ANIMA, claims that about 225 000 m² of solar thermal collectors were installed during 2021, compared to 122 000 m² in 2020 – a 84.4% leap in just twelve months. The extent of this performance is all the more impressive as the Italian market had been steadily withering away for nigh on a decade. The «Superbonus» is a key plank of the Italian "Piano nazionale di Ripresa e Resilienza" recovery plan that combines economic growth and the decarbonisation of housing. Accordingly, the Italian government decided, in July 2020, to increase the " Ecobonus" tax credit for energy renovation work undertaken by homeowners and extend its scope of application. The new "Superbonus" tax credit enables consumers to benefit from a 110% refund on the purchase price of their renewable energy heating system (solar, thermal, heat pump, etc.) spread over five annual tax breaks. Consumers who prefer an immediate refund are eligible to benefit from a Superbonus discount of up to 100% on the purchase price of a heating system directly via the system installer, who in turn becomes the new credit holder. The Superbonus can only be granted to those leapfrogging at least two building energy efficiency classes through measures such as heat insulation or boiler replacement.

The Conto Termico incentive programme – open to homeowners, businesses, public bodies and residential building owners – can be used to finance a solar thermal plant of up to 2 500 m² of collectors with aid capped at 65% of the investment cost. The GSE (Gestore dei servizi energetici) that manages the Conto Termico has set up an online tool to record the allotted funds and number of systems financed (biomass, heat pump, solar thermal, etc.). From its implementation in 2016 through to 5 May 2022, the system has funded 380 solar systems in the public sector and 130 240 solar thermal systems in the private sector. However, the mechanism is largely untapped, as despite the fact that it has an annual budget of 900 million euros, only € 302.7 m was used in 2020 and € 326.5 m in 2021. Nonetheless, the take-up of the mechanism has risen in 2022 as already € 275.6 m had been used by 1 May. ANIMA feels that the market should continue to grow, provided that the current incentive framework is maintained. It is also believed that other sectors such as tourism could benefit from the "Recovery and Resilience Plan" which is eligible for 80% tax credit on renovation work until 2024.

THE GERMAN MARKET IS EXPECTED TO PICK UP IN 2022

AGEE-Stat data shows that the country installed 640 000 m² during 2021, which means that the new installation area matched its 2020 level (643 000 m²). This data reflects that of the heating industry federation (BDH), that early in February announced the installation of 81 000 new solar heating systems for 641 000 m² of collectors (compared to 83 000 systems sold in 2020). However, the sector views these as mixed results. While they confirm the general public's renewed interest in solar thermal they remain below the industry sector's expectations given the current spate of heating appliance renewals. As it happens, the slight contraction in solar thermal system sales runs counter to the surge in heating appliance sales (all types) in Germany that rose by 10% between 2020 and 2021, with 929 000 units sold. The BSW published a paper on solar thermal in 2022 aimed at the country's new governing coalition in an attempt to reverse this trend. The association welcomes the new targets to achieve 50% of climate-neutral heat by 2030, as well as the intention "to use all appropriate roof surfaces for solar energy" in the future. The BSW stresses that supplying heat harnessing solar thermal energy can make a significant and immediate contribution to reducing de CO2 emissions and reckons that it would be "relatively easy" to develop a potential of more than 100 TWh of useful heat annually in the areas of domestic hot water production, space heating and industrial processes. The association calls on the government to move accelerated expansion of solar thermal energy expansion to the top of its political agenda and use instruments such as solar obligations. A press release issued on 3 February 2022 by the two heating and solar industry associations BDH and BSW (predating Russia's invasion of Ukraine), expected a growth spurt in 2022 because of the increase in the prices of gas and CO2.

in 2022. The Faulquemont plant has annual production capacity of 140 000 collectors (flat glazed and vacuum tube collectors) which makes it one of the largest manufacturing facilities in Europe. In 2021, Viessmann launched a new vacuum tube collector (Vitosol 200-T type SPX) for eco-districts, industrial processes and district heating networks. It comes in two sizes, a 5.05 m² version to be assembled on site and a 10.3 m² version, delivered preassembled for rapid installation by crane. Viessmann is now positioned on this new market segment for large collectors, in the company of players such as Finland's Savosolar, whose catalogue features three types of collectors (the 14.83 m² Savo 15 DG collector, the 14.83 m² Savo 15 SG collector and the 12.07 m² Savo 12 SG collector) and Austria's GREENoneTEC that relocated its Arcon-Sunmark branded GK HT 13.6 large area collector (13.61 m² gross area) production lines within Austria that it acquired in 2020. Since 2021, The Austrian company has been manufacturing and distributing this collector, under the Arcon-Sunmark brand on a robotized, in-house GREENoneTEC line in its Sankt Veit an der Glan plant. The GREENoneTEC catalogue includes the GK3003 range available in two standard dimensions, 8 and 13 m² and the GK 3002 series, available in 5 to 10 m².

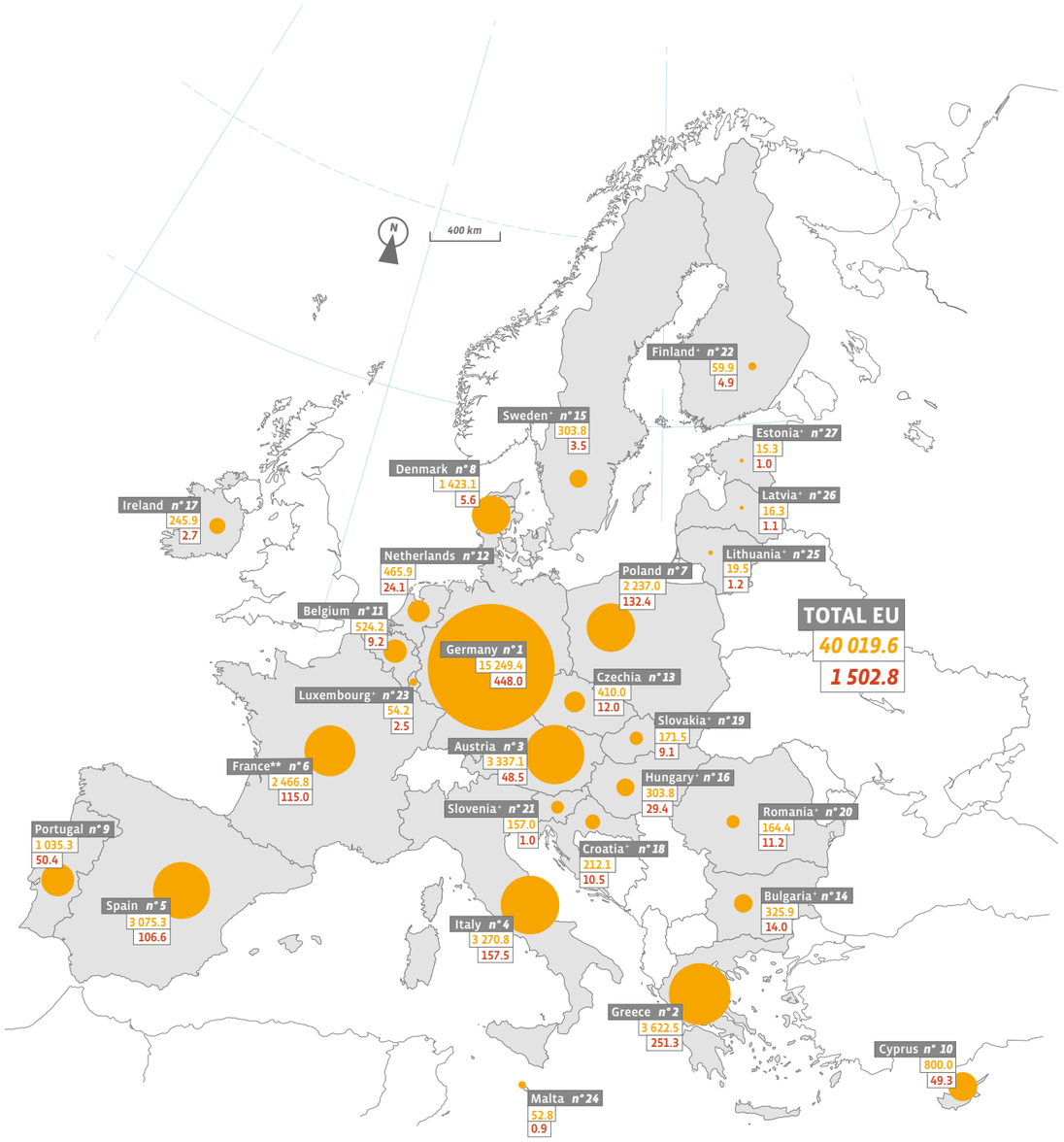
Table No. 5

Solar thermal capacities in operation per capita (m²/inhab. and kWh/inhab.) in 2020***

Country	m²/inhab.	kWth/inhab.
Cyprus	1.275	0.893
Austria	0.534	0.374
Greece	0.485	0.339
Denmark	0.348	0.244
Germany	0.262	0.183
Malta	0.146	0.102
Portugal	0.144	0.101
Luxembourg	0.122	0.085
Slovenia	0.106	0.074
Spain	0.093	0.065
Poland	0.084	0.059
Italy	0.079	0.055
Croatia	0.075	0.053
Ireland	0.070	0.049
Bulgaria	0.067	0.047
Belgium	0.065	0.045
Czechia	0.055	0.038
France***	0.052	0.036
Slovakia	0.045	0.031
Hungary	0.045	0.031
Sweden	0.042	0.029
Netherlands	0.038	0.027
Estonia	0.016	0.012
Finland	0.015	0.011
Latvia	0.012	0.009
Romania	0.012	0.009
Lithuania	0.010	0.007
Total EU	**0.128**	**0.089**

** All technologies included unglazed collectors. ** Estimate. *** Overseas departments included.*
Source: EurObserv'ER 2021.

Solar thermal capacity installed in the European Union at the end of 2021* (MWth)



Key

40 019.6 — *Total solar thermal capacity installed at the end of 2021 (MWth).*

1 502.8 — *Solar thermal capacity installed during the year 2021 (MWth).*

** Estimation. ** Including 90 000 m² in the overseas departments. + EurObserv'ER estimation based on the market trend of recent years*
Source: EurObserv'ER 2022.

SOLAR THERMAL AND CONCENTRATED SOLAR POWER BAROMETERS – **EUROBSERV'ER** – JULY 2022

The largest industrial project to go onstream in 2021 was the Issoudun plant in France, with a 13 243 m² collector field (comprising 893 Savo 15 SG-M, Savosolar-branded collectors).

SOLAR HEAT GOES ON THE OFFENSIVE

The energy security crisis spurred the European Union into presenting its REPowerEU battle plan on 18 May. The plan aims to end the EU's dependency on Russian fossil fuels, that are being used as an economic and political weapon and combat the climate crisis. In addition to economic and energy procurement diversification measures, it provides for increasing the renewable energy target within the framework of the "Fit for 55 package" from 40 to 45% in 2030, as well as launching several initiatives such as the "EU solar energy strategy". The Commission points out in the latter that solar photovoltaic and solar thermal technologies can be rapidly rolled out and will enable household and businesses to combat climate change while reducing their energy bills. While the plan highlights photovoltaic technology, major common measures apply to all solar technologies such as the European initiative for solar roofs combined with a legal obligation to phase in the installation of solar panels on new public and business buildings or on new residential buildings. The possibility for Member States to apply reduced rates of VAT on energy-efficient and low-emission heating systems such as solar water heating systems is mooted. The EU's solar energy strategy also emphasizes that the energy demand covered by solar heat (likewise for geothermal heat) should increase threefold at least by 2030, which corresponds about 114 GWth of thermal capacity. The European Parliament and Council have yet to endorse these proposals.

The solar thermal industry, long overshadowed by solar photovoltaic, is determined to go back on the offensive and fully play its role in decarbonizing heating requirements. In a piece published on 16 June, Costas Travasaros reiterates that neither the energy security crisis nor the climate change crisis can be solved unless the decarbonisation of heat is made a priority. It must be simultaneously based on two main vectors – renewable electricity and renewable heat.

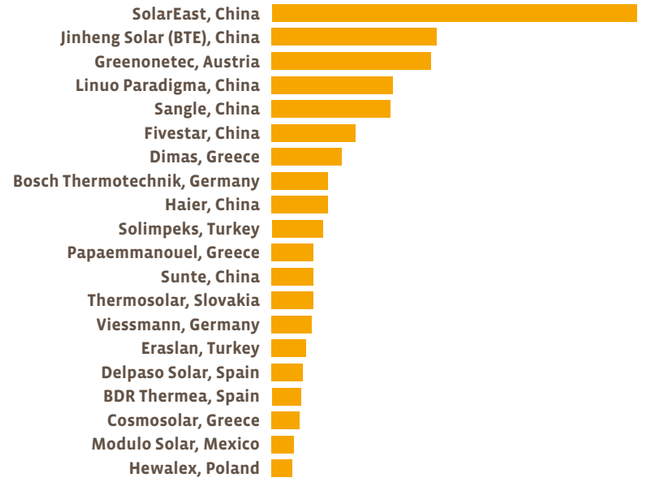
Costas Travasaros acknowledges that significant efforts are being rolled out to promote the electrification of heat, but that does not necessarily imply the decarbonisation of heat because the electricity produced in Europe is far from being decarbonized. Efforts aiming to electrify heating and cooling must be in line with the promotion of renewable energy production as opposed to being used to increase the electricity demand unsustainably, which would only block electricity production. According to Solar Heat Europe's President, renewable heat is the crucial element for heat decarbonisation and this simple fact tends to be overlooked in energy debates across the EU, and particularly in Brussels.

Furthermore, Solar Heat Europe which sees itself as a driving force, published its new roadmap "*Energising Europe with Solar heat, A solar Thermal Roadmap for Europe*" on 20 June 2022 during the "*Heat decarbonisation: A strategic imperative for the EU*" event in Brussels. This document unveils new ambitions for the sector and presents an overview of the contributions to energy decarbonisation that the sector can make.

According to the roadmap, if suitably strong measures are taken, solar thermal has the potential to achieve 140 GWth of installed capacity by 2030. This figure exceeds the European strategy aim for solar energy more than threefold. In more detail, it provides for 73 GWth of capacity in 2030 in the building segment, which equates to average per capita capacity of 0.16 kWth, which is the ratio currently observed in Germany. Moreover, a potential 32 GWth could be added to the district heating network segment in 2030 (i.e., 16% of the derived heat produced by fossil energies in 2019) and a potential 36 GWth could be achieved for industrial heat in 2030. That could cover more than 10% of the agri-food sector's consumption that mainly consists of low to medium-temperature heat. Total solar thermal capacity could then reach 140 GWth in 2030, and 500 GWth from 2035 onwards (190 GWth in buildings, 110 GWth in district heating networks and 200 GWth of solar heat in industrial processes). The solar thermal players backing this roadmap have decided to strike hard and make an impression on the political decision makers. They commit to producing and installing all the solar heat capacity planned by the IEA and IRENA for 2050, by 2035. By doing so, more than 400 TWh of fossil fuel in Europe would be replaced, which is similar to the total amount of fossil gas produced annually in the European Union. According to the authors, achieving more than 400 TWh of direct heat by 2035 will call for full mobilisation of the solar thermal industry, and unreserved support from the EU institutions, the Member States and the private sector. □

Graph. No. 1

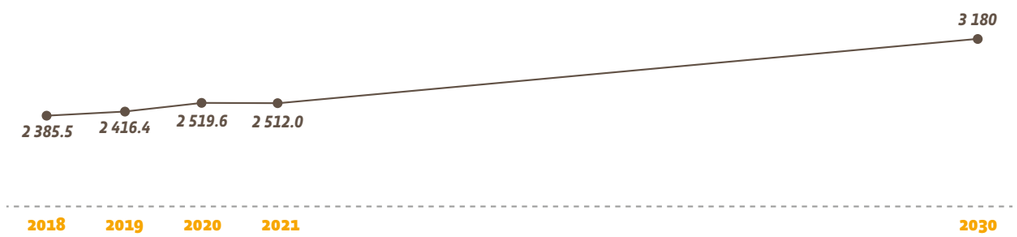
Ranking of the largest flat plate collector manufacturers worldwide (Collector area produced in 2021 in m²)



Source: Manufacturers' information market survey by solrico in March/April 2022, www.solrico.com

Graph. No. 2

EurObserv'ER projection of solar thermal heat consumption in the EU 27 (in ktoe)*



Final energy consumption and gross heat production in the transformation sector. Note: A drop in solar heat production measured in some countries such as Germany, Austria and Denmark, certainly linked to less sunshine, explains the slight drop in 2021 at European Union level.* ***Source: EurObserv'ER 2022.*

CONCENTRATED SOLAR THERMAL POWER

Thermodynamic solar or concentrated solar thermal plants (abbreviated as CSP for concentrated solar power) cover all the technologies that aim to transform solar radiation energy into very high temperature heat to convert it into electricity. The three main technologies are tower plants, whose heliostat fields (devices fitted with reflectors to track the sun) concentrate the sunlight onto a receiver at the top of a tower, parabolic trough plants comprising parallel line-ups of long half-cylindrical reflectors that revolve around a horizontal axis to track the sun and concentrate its rays on a horizontal tube and Fresnel plants comprising rows of flat reflectors that pivot, tracking the sun to redirect and concentrate the sun's rays permanently on an absorbing tube. One of the features of thermodynamic plant technology is its ability to smooth their electricity production using heat buffer storage. This storage is usually in the form of molten salts heated in a tank that keeps them at high temperature.

GLOBAL CSP CAPACITY STOOD AT 6 570.9 MW AT THE END OF 2021

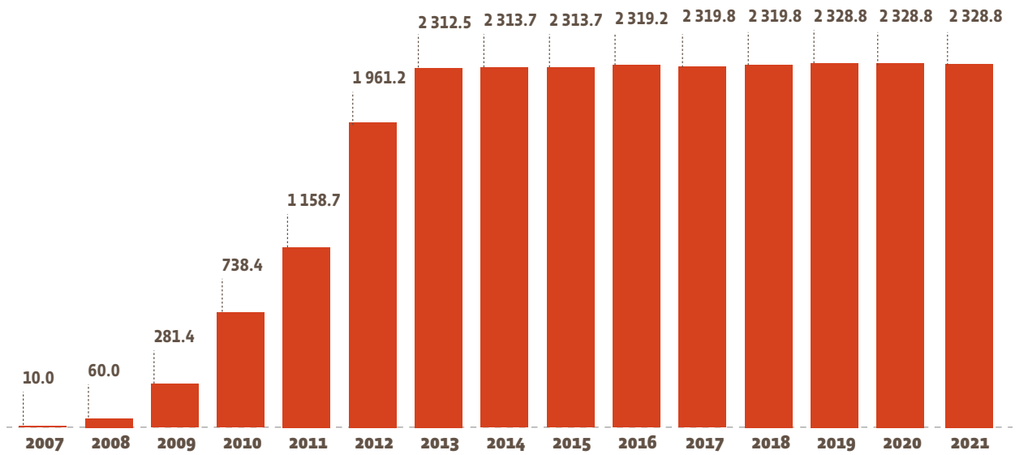
According to the calculations made by EurObserv'ER, at least two plants were commissioned during 2021, which takes global CSP capacity to at least 6570.9 MW at the end of 2021. The most powerful plant is the Atacama 1 tower plant in Chile, called "Cerro Dominador" inaugurated on 8 June 2021 by a consortium formed by Abengoa, Acciona and EIG Global Energy Partners. Its design capacity is 110 MW and it comprises 10 600 mirrors that reflect the sun's rays to the top of a 252-m high tower where a storage tank containing molten salts is placed that will be heated to a temperature of over 560°C. A special feature of this plant is that it has a 17.5-hour storage system, which will enable it to be operated 24 hours around the clock, with enough capacity to supply a city with 380 000 inhabitants. The second project which was completed in 2021 is the Chinese Hami Tower CSP plant (50 MW) whose construction began in October 2017. This plant can also produce electricity 24 hours a day. At the beginning of 2022, China announced that as part of its pilot programme aimed at 1.3 GW of CSP capacity to be installed by 2030, only 500 MW of projects had met the deadline, to which must be added the Hami Roxer CSP plant. China points out that it now plans to start the construction of 11 new projects with storage systems by 2024 each with 100 MW of capacity, including 8 tower plants, 2 Fresnel plants and a tower plant with a secondary reflector, whose technology is based on a floor-mounted receiver.

NEW PROJECTS ANNOUNCED IN THE EUROPEAN UNION

We will have to hold our breath for some time before new concentrated solar plants are built on European soil. If we include the demonstration plants, the meter is still stuck at 2 328.8 MW, as the last plant went on-grid in 2019 (the Ello 9-MW Fresnel demonstration plant in the Pyrénées-Orientales).
The net maximum capacity figures released by Eurostat record 2 306 MW at the end of 2020 (2 304 MW in Spain and 2 MW in Germany). The reason for the calculation difference is that some countries' statistics do not include their demonstrator plants. European CSP capacity is overwhelmingly concentrated in Spain, whose officially installed CSP capacity is 2 304 MW (i.e., 99% of the EU total). Red Eléctrica de España reports the net output of Spain's plants at 4 705 GWh in 2021, up 3.7% from its 2020 figure of 4 538 GWh in 2020. This performance equates to 88% of the best year for output, 2017, which was 5 347 GWh. Gross electricity output, which includes the plants' own electricity consumption, is a little higher, as it was measured at 5 176 GWh in 2021 compared to 4 992 GWh in 2020, while the record was set in 2017 with 5 883 GWh delivered, according to Eurostat.
Allusions to new projects are beginning to be made in Spain after years of waiting. On 18 November 2021, SENER launched the Solgest-1 project for the first hybrid CSP- photovoltaic plant with molten salt storage. The plant, with its 150 MW of installed capacity, will be sited in the municipal district of Fuentes de Andalucía, in Seville province, which also accommodates the Gemasolar tower plant that has been operating since 2011, constructed by SENER. The new CSP plant will have 110 MW of capacity, 6 hours of storage capacity and will be linked to a 40-MW photovoltaic plant whose purpose is to generate electricity during the day. The parabolic trough plant will use SENER Through technology, designed and manufactured by SENER. Additionally, it will have a molten salt heat storage system that will provide more than 1900 MWh of heat storage capacity. The plant's maximum grid injection capacity will be 98 MW. Incidentally, in June 2022, Acciona Energía let slip that it was also working on a hybrid CSP-photovoltaic project in Badajoz province. It is the Solbio 1 project, slated to have 135 MW of capacity. The plant will straddle the municipalities of Usagre, Villagarcía de la Torre, Higuera de Llerena and Llerena. Its technical features are as yet undisclosed.
These projects will be presented for the 3rd round of REER (Régimen Económico de Energías Renovables) renewable energy tenders that target 500 MW of capacity, including 200 MW set aside for CSP plants. The draft tender was published on 30 December 2021 with an original launch date set for 6 April 2022. It was postponed to integrate the changes suggested by

Graph. No. 3

European Union concentrated solar power capacity trend (MWe)



Source: EurObserv'ER 2022.

The latest project, which was connected to the grid in April 2021 is the Chilean Atacama 1 Cerro Dominador plant. This 110 MW tower plant has a special feature. Its storage system offers 17.5 hours or storage that enables it to operate 24 hours round the clock with sufficient capacity to supply the electricity needs of 380 00 inhabitants.

SOLAR THERMAL AND CONCENTRATED SOLAR POWER BAROMETERS – **EUROBSERV'ER** – JULY 2022

Tabl. No. 7

Concentrated solar power plant in operation at the end of 2020.

Project	Technology	Capacity (MWe)	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	
FRANCE			
La Seyne sur mer (prototype)	Linear Fresnel	0.5	2010
Augustin Fresnel 1 (prototype)	Linear Fresnel	0.25	2011
SUN CNIM (Ello project)	Linear Fresnel	9	2019
Total France		9.75	
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	
DENMARK			
Aalborg-Brønderslev CSP project	Hybrid. Parabolic Trough	5.5	2016
Total Denmark		5.5	
GERMANY			
Jülich	Central receiver	1.5	2010
Total Germany		1.5	
Total European Union		2 328.8	

*HB (Hybrid Biomass). *Pilots and prototypes included* ***Source: EurObserv'ER 2022.***


CERRO DOMINADOR

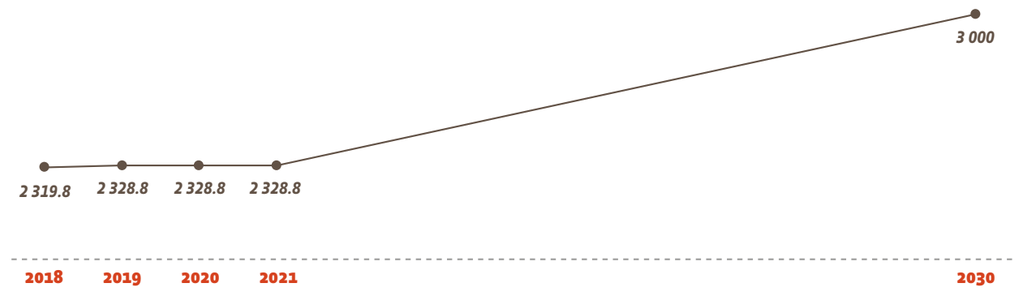
the interested parties and Spain's National Commission on Markets and Competition (CNMC). The draft stipulated that the CSP plant projects should include provision for 6 hours of storage, which made hybridization with photovoltaic, biomass or biogas possible. Protermosolar's Secretary-General, Gonzalo Martín, says that it has yet to be clarified whether or not the 200 MW stipulation will be adhered to. He feels that hybridization with photovoltaic runs the risk of cannibalising half of this provision. Maintaining the 200 MW set aside for new plants is crucial to preserving Spain's solar thermal industry, to prevent the hypothetical hybridization with photovoltaic from "cannibalizing" this capacity. It is also important that solar thermal plants with about 100 MW of design capacity are authorized, as Spain's currently operating 50-MW plants, whose size was capped by the regulations of the time, are small compared to other international projects twice their size. It was hoped that these tenders would be published before May 2022, to give the companies at least three months to prepare their bids, but by mid-June, the final text that would enable them to prepare their projects had not been released. Few projects are currently likely to materialize outside Spain. China's Cosin Solar (formerly Supcon Solar), which is very active in its domestic market, signed an EPC contract in 2019 for the MINOS project in Greece (50 MW) with CGGC INTERNATIONAL LTD. The project was still in the financing phase in June 2022.

CSP IS PART AND PARCEL OF THE EU'S SOLAR ENERGY STRATEGY

While the European CSP sector rose from the ashes, it had to plead its case in Brussels as the latter appeared to have side-lined it in its strategy for combatting climate change and its response to the energy security crisis. In a letter addressed to the Commission last April, the Spanish Association for the Promotion of the Solar Thermal Industry alerted it to the danger of the dearth of concentrated solar energy in the new European strategy. For Protermosolar, the Public Consultation process for contributing to the new European Union solar energy strategy was too narrowly focused on photovoltaic and did not address the real functional capacities offered by today's solar thermal technology. Protermosolar regretted that concentrated solar power energy's potential was insufficiently addressed in terms of storage and its capacity to supply large amounts of energy by day and by night. The association also invited the Commission to better assess the possibility of hybridizing the two solar technologies, photovoltaic and solar thermal, as a competitive solution to provide electricity systems with flexibility. The sector also complained about the lack of incentives proposed to promote research into complementary renewable technologies, nor the renovation of existing solar thermal plants by adding storage systems to those that have none, and the absence of defined national aims. These grievances have been partly addressed. In its communication that presents its strategy for solar energy, the Commission points out that given that the variable renewable energy share is increasing in the electricity system, tenders should also support technologies founded on renewable energies that can reduce grid stability and system integration costs. Concentrated solar power (CSP) with heat storage and solar photovoltaic with batteries are examples of technologies that can provide these benefits. It also states that CSP could supply heat for industrial processes from 100° to >500°C. The EU will continue its support for research and innovation through Horizon Europe and will provide financial support for innovation in solar thermal and concentrated solar power technologies. Thus, concentrated solar power has its part to play in solving Europe's crises. Renewable energies are never stronger or more relevant than when they are playing as a team. □

Graph. No. 5

EurObserv'ER projection of the evolution of CSP capacity installed in the EU 27 (in GW)



Source: EurObserv'ER 2022.

Sources: AGEE-Stat, BSW (Germany) EBHE (Greece), Ministry for the Ecological Transition (Spain), PlanEnergi (Denmark), ENS (Denmark), Assotermica-Anima (Italy), Observ'ER (France), SPIUG (Poland), AEE Intec (Austria), Statistics Austria, ATTB (Belgium), Statistics Netherlands, EBHEK (Chypre), Ministry of Industry and Trade (Czechia), SEAI (Ireland), NSO (Malta), IEA SHC, Solar Heat Europe, EurObserv'ER, Protermosolar.

The next barometer will be about ocean energy

Funded by the European Commission