+ 11.9 %

The growth of the solar thermal market in the European Union between 2021 and 2022

SOLAR THERMAL AND CONCENTRATED SOLAR POWER BAROMETERS

A study carried out by EurObserv'ER

The energy crisis that is hitting Europe and worsening climate "overheating" has propelled renewable solar thermal heat encompassing all its components to centre stage, wherever it is applied in the individual and collective residential segment, district heating networks or to meet industrial heat requirements. The sector has picked up over the last two years in a much more promising context – that of the sharp rise in energy prices and the determination of the European Union countries to wean themselves off imports of Russian natural gas. According to EurObserv'ER, the solar thermal market recovery triggered in 2021 was confirmed in 2022 with 11.9% growth in the annual installed capacity figure, i.e., 1 660.7 MWth installed. This capacity equates to a collector area of almost 2.4 million m².

Only a single thermodynamic solar power plant (also known as a concentrated solar power plant) was commissioned in Europe in 2022, making it a slow year. The plant in question, the SOLINPAR CSP plant is in Italy, and takes the country's concentrated solar power capacity to 12.4 MW and the European Union's CSP capacity to 2 333.1 MW.

58.8 MILLIONS M²

The cumulated surfaces of solar thermal in operation in the European Union in 2022

2 333.1 MWe

Total CSP capacity in operation in the European Union in 2022

Roof-mounted solar thermal system for district heating at Dettenhausen, Germany.

RITTER

The power plant of the French Lactalis group's whey powder plant at Fromeréville-les-Vallons near Verdun. The plant has a 15 300-m² field of solar thermal collectors which provide 14 MWth of solar capacity and is equipped with a 3 000-m³ hot water storage system.

SOLAR THERMAL

Solar thermal's competitiveness, in all its areas of application, is essentially driven by the price of energy. Furthermore, the situation has completely changed since 2020 with energy prices at record levels in 2022. The rises, stemming from the global hike in wholesale energy prices, started in 2021 as international demand recovered after the COVID-19 pandemic. The situation turned into a crisis aggravated by Russia's invasion of Ukraine and exacerbated by the extreme climate conditions that curbed hydropower production and increased cooling needs. Corrosion and delays to maintenance work because of COVID also had a hand in reducing French nuclear power plant output. The European Union's unity and solidarity have enabled imports of gas from Russia to be slashed and reduced and compensated for mainly by a sharp increase in liquified natural gas sourced from schist gas from the United States, which has consequently driven its price upwards. It is a blessing for solar thermal heat that has been waiting to make its comeback. Solar systems are not only viewed as making a major contribution to climate protection but also to protecting against energy price rises and a way of reducing dependency on energy imports.

THINGS ARE LOOKING UP AGAIN FOR THE EUROPEAN SOLAR THERMAL MARKET

The solar thermal sector's bad old days appear to be behind it once and for all. The recovery initiated in 2021 continued throughout 2022 and even picked up speed. Preliminary solar thermal market estimates for 2022 suggest a newly installed collector area of almost 2.4 million m2 (2 372 443 m²), which translates into 11.9% year-on-year growth (table 1, table 2). This newly installed collector area amounts to about 1 660.7 MWth of thermal capacity (compared to 1 483.8 MWth in 2021), the glazed surface of a 1-m² solar thermal collector has 0.7 kWth of thermal capacity. To put this into perspective, the surface area of the collectors installed over the twelve months equates to 300 times the grassed surface of a football pitch (8 000 m²).

This market data covers systems that use flat plate and vacuum tube collectors, which are technologies geared to domestic hot water production or heating in the residential sector and heat and hot water production for heating networks and industrial processes. The data also includes unglazed collectors that tend to be used for heating pools, even if this technology is less diligently monitored by the statistical organizations. However, concentration mirrors (of the Fresnel or parabolic trough types) used for hot water production are excluded from the statistics presented in tables 1 and 2 data as are hybrid PV-T collectors that use water as the heat carrier). The monitoring results of PV-T collectors that combine photovoltaic technology and solar thermal technology are available in the Solar Heat Worldwide publication, which is the industry reference study on solar heat and was published in May 2023 as part of the International Energy Agency's SHC TCP programme.

News from around the main solar thermal markets

The four leading European Union member country markets (Germany, Greece, Italy, and Poland) all posted double-digit growth.

ANIMA (the Italian mechanical engineering industry associations federation) confirms that once again, Italy enjoyed the highest growth of 50.9% between 2021 and 2022 resulting in 339 500 m². The combination of the Conto Termico programme, which supports renewable heat installations, and the 110% Superbonus for energy efficiency in buildings is a real boon to solar thermal technology.

ENEA (the Italian national agency for new technologies, energy, and sustainable economic development) says that nowadays consumers seeking to take up the Superbonus credit often plump for solar thermal, as this relief comes in the form of a 110% refund on the purchase price of their renewable energy heating system (solar, thermal, heat pump, etc.) credited in five instalments over the year. For consumers who prefer an immediate refund, Superbonus also provides the alternative of up to 100% credit on the price of such a heating system purchased directly through the installer, who in turn becomes the new recipient of the credit. Eligibility for the Superbonus is contingent on moving up at least two classes on the building energy efficiency standard table, through measures such as heat insulation or boiler replacement. The Conto Termico incentive programme finances solar thermal plants of up to 2 500 m² of collectors to a maximum 65% of the investment cost and is geared to private individuals, firms, public bodies, and residential buildings.

In Greece, according to the **EBHE** (the Greek Solar Industry Association), 2022 was an excellent year for installations with at least 419 000 m² installed compared to 359 000 m² in 2021, … or 16.7% growth. This is a jump of 60 000 m² over 2021 and 114 500 m² over 2020. Costas Travasaros, who represents the EBHE and is also the President of **Solar Heat Europe**, believes that the installation market trend remains positive in Greece because of high energy prices and energy security concerns. He adds that the country's improving economy and the increase in the number of new build and renovated dwellings are contributory factors. The country's high equipment level can also be ascribed to the fact that solar systems and thermosiphon systems in particular are commonplace, economically sustainable, and reliable technology.

The Polish solar thermal market posted 11.1% annual growth between 2021 and 2022 (i.e., 210 000 m² installed), which is somewhat poorer than the previous year's performance (17.3%). **SPIUG** (the Polish Association of producers and importers of heating devices) that released these figures, attributes this new major increase mainly to the municipal tenders financed by EU funds but also to the increasing numbers of systems purchased through retail channels. However, SPIUG feels that the retail sales market results are still too low to ensure the stability and viability of solar thermal systems.

Germany's strong market upturn is also encouraging, as it is still the top European Union market for installed surface area. A joint press release published by **BSW-Solar** (the German solar association) and **BDH** (the Federation of German heating industry) asserts that the energy price hikes fuelled the demand for solar heating significantly last year. About 91 000 new solar heating systems were installed in 2022, marking a 12% increase on the previous year. The total gross solar collector area, mainly installed on buildings, was 709 000 m² (10.8 % annual growth between 2021 and 2022), which is comparable with about 100 football pitches. **AGEE-Stat**, the working group on renewable energy statistics for the Federal Ministry for Economic Affairs and Energy uses the same figure. The German solar heating market's growth prospects are right on track. The two organisations point out that the number of funding demands received by **BAFA** (the federal office for Economic Affairs and Export Control) rose by 75% in 2022 over 2021 and a recent representative survey of homeowners suggests keen renewed interest for solar thermal, further abetted by the federal government subsidies of up to 35% of purchasing and installation costs.

France remains in fifth place in the European Union country rankings, largely aided by its overseas territories. According to **Observ'ER** (the renewable energies observatory), it installed 163 300 m² of collectors (including 96 500 m² in the overseas territories). The French market – mainland and overseas territories – expanded by 4.0% according to the Observ'ER calculations. This data does not include the Lactalis industrial solar thermal project (15 300 m²) whose collector field was installed in 2022 but will only start operating in 2023. According to Observ'ER, this expansion can be ascribed to the build-up of the **MaprimRénov'** aid mechanism and the rise in the cost of traditional energies.

The Netherlands' solar thermal market is also gaining momentum, buoyed both by the residential and farming and greenhouse growing segment (flowers, vegetables, etc.) which use massive amounts of gas. According to **Statistics Netherlands**, the market exceeded 42 000 m² (22.4% more than in 2021) on the back of its SDE+ incentive programme.

Despite the energy crisis and Europe's renewable energy-friendly policies, the market performance of the historical solar segment driver countries with significant industrial capacities devoted to the sector were poor. This was a repeat occurrence for Spain (11% market contraction between 2021 and 2022), Austria (14.9% contraction) and even Portugal (8.2% contraction). **ASIT** (the Spanish solar thermal industry association) expects its market to enjoy a sharp upswing from this year onwards thanks to generous financial resources allotted to solar thermal under the PRTR (Recovery, transformation, and resilience) plan managed by Spain's

Autonomous Communities (CCAA) and the construction market's strong recovery. The ASIT annual report, "Informe Annual 2023" gives details of this plan and the CCAA subsidy levels.

More lines on the EU's solar heating network map

Until recently, local authorities and energy service companies focused their attention on biomass and geothermal energy to make their heating networks greener. Heating networks are looking to new energy sources to decarbonise their networks and are working on innovative combinations that blend solar, biomass, heat pump and heat recovery, now that biomass is subject to tensions (procurement, competition for use and harder sustainability criteria in the new RES directive), and that the European forests are suffering from the consequences of climate change.

All the European Union countries are eliminating natural gas from their heating networks as much and as fast as possible as a matter of urgency. According to the **Steinbeis Solites** Research Institute, 2022 was a record year for German solar district heating networks (SDH-Solar district Heating). For the Solnetplus project, the institute surveyed all the projects in service, under construction and on the drawing board (a map of projects is available on the www.solare-waermenetze.de website). Solites counted 33 879 m² of new collector areas dedicated to solar district heating in 2022. This takes the total collector area used by Germany's solar district heating networks to 146 024 m² (30% more than in 2021) and brings the number of SDHs in service to 49. The corresponding thermal capacity exceeds the 100 MWth threshold (102 MWth at the end of 2022). The commissioning of the country's biggest solar thermal system, Greifswald MV (18 732 m²) and the third largest system, namely, Lemgo (9 118 m²) are the main factors behind the sharp rise in 2022. In the same year, Germany also connected the biggest roof-mounted urban heating solar thermal system at Dettenhausen (2 312 m²). Solites expects many new projects in the next few years. Nine projects for a collector area of 28 085 m² are under construction in 2023 or at the advanced project stage and a further 66, equating to 454 550 m² (318 MWth) are under discussion. The biggest project was announced in April 2023 by Stadterke Leipzig that intends to install 65 000 m² of collectors (45.5 MWth) and go on stream in 2025. Germany is also banking on hybrid solar heating networks that combine solar thermal, heat pump and biomass energy technologies. This summer, a citizens' cooperative project in Bracht, a village in North Hesse, will start construction work on a solar heating network that will be coupled with a heat pump and two biomass boilers. A 13 000-m² collector area should offer the network 67% of solar coverage, made possible by a seasonal storage system with an underground basin based on the Danish model. The two biomass boilers will supply a maximum of 25% of the heating requirements and the heat pump, the remaining 8%. In winter, the heat pump will use the seasonal storage system as its heat source on an as needs basis. It will also regulate the temperature in the underground storage tank, thereby reducing the volume required and storage tank construction costs. Construction of the Groningen solar district heating network, in the Netherlands, started in November 2022, with 37 MWth of capacity. It will be the country's biggest network when it starts up in October 2023. A 48 000-m² collector field will be connected to the city's heating network operated by the energy company Warmtestad. Solar energy will cover about 25% of the heating requirements of the connected buildings. The project leaders are the Solarfield project developer, the investor K3 Netherlands and the Swiss collector manufacturer TVP Solar which is the turnkey supplier of the solar field. These three companies have formed a special purpose vehicle, a legal entity, to own and operate the plant and have signed a contract with Warmtestad to sell solar heat for 30 years. As the legal entity owns the solar thermal plant, it will also receive a Feed-in Tariff through the national grant mechanism known as

Table No. 1

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 tube 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*	157 000			157 000	109.9
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
Netherlands	34 393			34 393	24.1
Bulgaria	24 296			24 296	17.0
Czechia	17 097	1 903		19 000	13.3
Slovakia	17 000			17 000	11.9
Romania	15 960			15 960	11.2
Hungary	14 000			14 000	9.8
Belgium	10 300	2 900		13 200	9.2
Croatia	12 000			12 000	8.4
Denmark	8 013			8 013	5.6
Finland	8 000			8 000	5.6
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	1 980 726	136 128	2 930	2 119 784	1 483.8

+ 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).
** Revised figures, including 90 000 m2 in the overseas departments.* ***Source: EurObserv'ER 2023***

Table No. 2

Annual installed surfaces in 2022 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 tube collectors			
Germany	524 000	185 000		709 000	496.3
Greece	419 000			419 000	293.3
Italy**	339 500			339 500	237.7
Poland	208 500	1 500		210 000	147.0
France***	163 300			163 300	114.3
Spain	126 500	7 000	2 000	135 500	94.9
Cyprus	73 924			73 924	51.7
Portugal	66 100			66 100	46.3
Austria	56 830	660	1 480	58 970	41.3
Netherlands	24 516	14 960	2 621	42 097	29.5
Czechia	23 167	2 336		25 503	17.9
Bulgaria+	24 296			24 296	17.0
Belgium	15 000	3 500		18 500	13.0
Slovakia+	17 000			17 000	11.9
Romania+	15 960			15 960	11.2
Hungary+	14 000			14 000	9.8
Croatia	12 000			12 000	8.4
Finland+	8 000			8 000	5.6
Sweden+	5 000			5 000	3.5
Luxembourg	3 574			3 574	2.5
Denmark	2 664			2 664	1.9
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
Ireland	1 116			1 116	0.8
Total EU	2 151 123	215 219	6 101	2 372 443	1 660.7

+ 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 . ** For Italy, breakdown not available between Flate plate and vacuum tube collectors. *** Including 96 500 m² in the overseas departments.* ***Source: EurObserv'ER 2023.***

SDE++. This system supports energy produced over 15 years using a wide range of renewable technologies including solar thermal. The Feed-in Tariff is calculated as the difference between the current gas price and a capped price of 85 EUR/MWh. This difference is updated annually and paid over a period of 15 years.
In France, 2022 witnessed the development of two new solar heating networks including that of Salon de Provence (2 000 m²). It was still under construction in 2023 and scheduled to start up later in the year. A public service delegation contract was entered into for this network between SEV, a Groupe Coriance subsidiary, and the Aix-Marseille-Provence Metropolis. It will harness three renewable energy sources: solar energy, solid biomass, with the installation of a 9.9-MW wood chip boiler and an 8-MW "backup" biofuel boiler.
Denmark, the solar energy heating network pioneer, continues to "green" its networks, but is tending to rely more on high-capacity heat pump technology than solar thermal. It has rolled out a special aid mechanism to decarbonise its heating networks. The Danish Energy Agency allotted a budget of 52.1 million DKK (about 7 million euros) for 2022 for funding requests submitted by the 31 October 2022 deadline. A new subsidy cycle was inaugurated in 2023 for 24 million DKK (about 3.2 million euros) and will finance up to 30% of the investment costs in heat pumps or solar thermal, provided that the new plants replace at least 50% of any coal, heating oil or natural gas in the relevant district heating network. The successful bidders will receive a grant geared to the amount of CO_2 eliminated, so the higher the amount of CO_2 eliminated, the higher the grant. PlanEnergi, a research consultancy specialising in heating networks, observes that this mechanism is particularly favourable to projects involving heat pumps. As it stands, only one of the 10 projects to successfully apply for a grant in 2022, was based on solar thermal technology, while the 9 others use heat pumps. Again, according to PlanEnergi, only one solar heating network, the Hørsholm network, was connected in 2022 with 2 664 m² of solar thermal collectors (1.9 MWth). This year, three projects should be connected for a total of 11 910 m² (8.3 MWth)... the Blendstrup (2 000 m², 1.4 MWth), Bjerringbro (8 000 m², 5.6 MWth) and Ærøskøbing (1 910 m², 1.3 MWth) extension (stage 4) heating networks.

Table No. 3

Cumulated capacity of thermal solar collectors installed in the European Union in 2021 and 2022** (in m² and in MWth)*

Country	2021 m²	2021 MWth	2022 m²	2022 MWth
Germany***	22 056 790	15 439.8	22 414 890	15 690.4
Greece	5 175 000	3 622.5	5 442 000	3 809.4
Italy	4 657 622	3 260.3	4 997 122	3 498.0
Austria	4 767 286	3 337.1	4 607 016	3 224.9
Spain	4 359 743	3 051.8	4 505 243	3 153.7
France	3 503 824	2 452.7	3 644 700	2 551.3
Poland	3 195 690	2 237.0	3 405 690	2 384.0
Denmark	2 035 096	1 424.6	2 024 760	1 417.3
Portugal	1 478 955	1 035.3	1 545 055	1 081.5
Cyprus	1 121 667	785.2	1 165 591	815.9
Belgium	748 000	523.6	741 500	519.1
Netherlands	661 854	463.3	662 369	463.7
Czechia****	585 739	410.0	611 242	427.9
Bulgaria	469 834	328.9	494 130	345.9
Sweden	445 000	311.5	434 740	304.3
Hungary	406 000	284.2	420 000	294.0
Ireland	345 211	241.6	346 328	242.4
Croatia	300 000	210.0	312 000	218.4
Slovakia	249 000	174.3	261 500	183.1
Romania	218 910	153.2	234 870	164.4
Slovenia	220 000	154.0	221 400	155.0
Finland	88 000	61.6	94 000	65.8
Luxembourg	77 376	54.2	80 950	56.7
Malta	75 397	52.8	76 711	53.7
Lithuania	27 850	19.5	29 550	20.7
Estonia	21 895	15.3	23 320	16.3
Latvia	21 672	15.2	22 972	16.1
Total EU 27	57 313 411	40 119,4	58 819 649	41 173.8

** All technologies included unglazed collectors. ** Estimation. *** The German official figures have been revised including unglazed collectors, i.e. 437,190 m2 of unglazed collectors in 2021 and 432,190 m2 of unglazed collectors in 2022. **** In Czechia unglazed collector not included in official statistics.* ***Source: EurObserv'ER 2023.***

The Marrewijk Amaryllis project in De Lier, the Netherlands comprises 1 567 m² of flat-glazed collectors that supply heat to an amaryllis flower growing hothouse.

Industrial solar thermal has good prospects, but isn't exactly booming

Few large-scale industrial heat installations (>1 000 m²) were inaugurated in Europe in 2022. The reason for this may be the COVID-19 epidemic which led to the collapse of the gas price in 2020, that curbed contractualization. As project development time is fairly long (2-3 years), there was just a trickle of newly commissioned plants in 2022. A couple of the biggest installations to start up were the Marrewijk Amaryllis project in De Lier, the Netherlands. The Next source B.V engineering firm runs this facility that consists of a 1 567-m² field of flat-glazed collectors that supply heat to an amaryllis flower growing hothouse. Construction of Europe's biggest industrial solar thermal plant site was completed in 2022 and it is scheduled to go on stream in 2023. It is the whey powder plant of the French Lactalis group, at Fromeréville-les-Vallons near Verdun in the Grand-Est region. The project is led by Newheat, an ESCO energy service enterprise, which will sell the solar heat. The plant has a 15 300-m2 field of solar thermal collectors which provide 14 MWth of solar capacity and a 3 000-m³ hot water storage system. Annual production is expected to be about 8 000 MWh, which should avoid 2 200 tonnes of CO_2 emissions p.a. The project will supply solar heating to preheat the air in a new whey drying tower (15–80°C), thus reducing the site's gas consumption by 11%, and its CO_2 emissions by 2 000 tonnes p.a.
The Boortmalt group, the world's leading malt concern, plans to equip its Badass Barley Malt production site in Croatia with a solar thermal plant, riding high on the success of its first solar thermal malt drying installation (commissioned in 2021 on its Malterie Franco-Suisse industrial site at Issoudun, France). The project sheet presented by Newheat shows that the solar thermal plant will have a collector area of 23 400 m². It will be coupled to a 4 000 m³ seasonal storage tank and two heat pumps to preheat the air used for drying the malt. Newheat states that this ground-breaking industrial project will bring these technologies together for the first time at such a scale that more than 50% of the heating needs of an industrial site will be supplied competitively. The project known as DECARBOMALT is co-financed by the European Commission's Innovation Fund (20 billion euro budget for the period 2020-2030), dedicated to the demonstration of innovating low carbon emission technologies. Commissioning is scheduled for 2024 Q1. As many projects are in development, players such as Newheat and TVP Solar are expecting the real rush for high-capacity industrial solar thermal heat to arrive in 2024-2025.

58.8 million m2 of collectors in service

EurObserv'ER puts the total European Union collector area at the end of 2022 at 58.8 million m² (41.2 GWth), which equates to a 2.6% year-on-year increase. This area has increased by 1.5 million m² to date. The assessment covers the three main solar thermal technologies (flat plate glazed collectors, vacuum tube collectors and unglazed collectors) and factors in decommissioning allowance for the oldest installations included by the experts contacted for the purpose of the study and the n-1 data published by Eurostat (i.e., 866 205 m² decommissioned for all the EU-27 countries in 2022). It is worth noting that a few countries exclude non-glazed areas from their calculations, because installations using this technology are not systematically monitored. However, Germany has reinstated an estimate of the non glazed collector area for two years – 437 190 m² for 2021 and 432 190 m² for 2022 – which has created the slight difference from the previous estimate.

A BREATH OF FRESH AIR FOR EUROPE'S INDUSTRY

The solar thermal industry has players positioned on different market segments representing highly diverse products and technologies We find thermosiphon system specialists for example, suited to the Mediterranean climate, players specialized in forced circulation solar thermal systems and others positioned on the very large collectors segment (up to 15 m²) dedicated to solar heating networks or major industrial installations, where the field consists of a handful of players including Savosolar of Denmark, Germany's Viessmman and Ritter XL, Austria's GreenOneTec and TVP Solar of Switzerland.
The forced circulation solar thermal systems sector has undergone severe consolidation as a result of the uninterrupted market decline from 2009 to 2020. An article penned by Jens Peter Meyer and published on the https://solarthermalworld.org website entitled "Strongly downsized, but crisis-ridden solar collector industry in Germany" explains that the number of manufacturers of fixed collectors, namely flat, vacuum tube, and air tube collectors in the biggest European market, has almost halved. Of the 38 German firms that featured in the 2015 Solricoin global

FREEPIK

Thermosiphon solar hot water system on a house's roof

solar thermal industry map, only 23 were still manufacturing in 2022. Four of them have moved over to manufacturing OEM collectors, six have ceased collector production and four have ceased trading. Most German firms have had to diversify their portfolios to cope with the market slump, and work with photovoltaic, heat pumps and even PVT. Others, like Viessmann, have diversified into Germany's highly active solar heating network segment. Players such as Vaillant and KBB have decided to stop manufacturing collectors and outsource 100% of the production to OEM manufacturers. Other players are still manufacturing and designing their own flat glazed collectors, such as Wagner Solar, Viessman, Narva, Ritter Energie, Grammer and Solvis. The market recovery in Germany and Europe comes as a real breath of fresh air for its players who can at last make the most of their production lines.

It is too early for Spain's industry to bank on the Iberian market to relaunch its production, but the presence of players such as Baxi a subsidiary of the BDR Therma group and Delpaso Solar make it a bastion of European collector manufacturing that exports all over the world. According to ASIT, Spain's collector production capacity is about one million m², but actual output in 2022 was 206 200 m² (20% of its potential), 58 000 m² of which were installed in Spain and 148 200 m² exported (compared to 139 500 m² in 2020

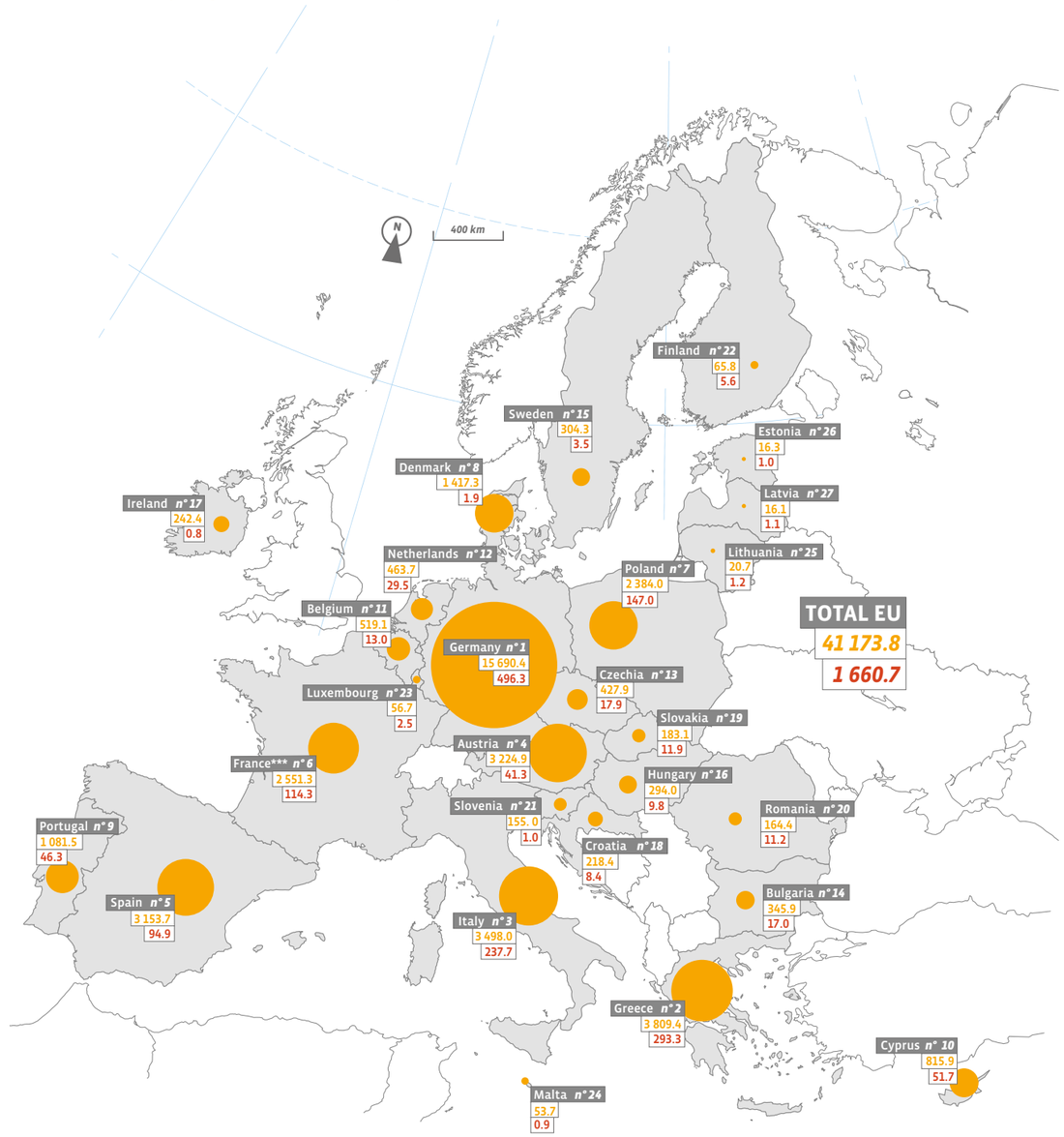
Table No. 4

Solar thermal capacities in operation per capita (m²/inhab. and kWh/inhab.) in 2022***

Country	m²/inhab.	kWth/inhab.
Cyprus	1.288	0.902
Greece	0.520	0.364
Austria	0.513	0.359
Denmark	0.345	0.241
Germany	0.269	0.189
Portugal	0.149	0.104
Malta	0.147	0.103
Luxembourg	0.125	0.088
Slovenia	0.105	0.074
Spain	0.095	0.066
Poland	0.090	0.063
Italy	0.085	0.059
Croatia	0.081	0.057
Bulgaria	0.072	0.051
Ireland	0.068	0.048
Belgium	0.064	0.045
Czechia	0.058	0.041
France***	0.054	0.038
Slovakia	0.048	0.034
Hungary	0.043	0.030
Sweden	0.042	0.029
Netherlands	0.038	0.026
Estonia	0.018	0.012
Finland	0.017	0.012
Romania	0.012	0.009
Latvia	0.012	0.009
Lithuania	0.011	0.007
Total EU	0.132	0.092

** All technologies included unglazed collectors. ** Estimate. *** Overseas departments included.*
Source: EurObserv'ER 2023.

Solar thermal capacity* installed in the European Union at the end of 2022 (MWth)**



Key

41 173.8 *Total solar thermal capacity installed at the end of 2022 (MWth).*

1 660.7 *Solar thermal capacity installed during the year 2022 (MWth).*

** All technologies included unglazed collectors. **Estimation. *** Overseas departments included for France*
Source: EurObserv'ER 2023.

Greifswald, Germany's biggest solar thermal system (18 732 m²)

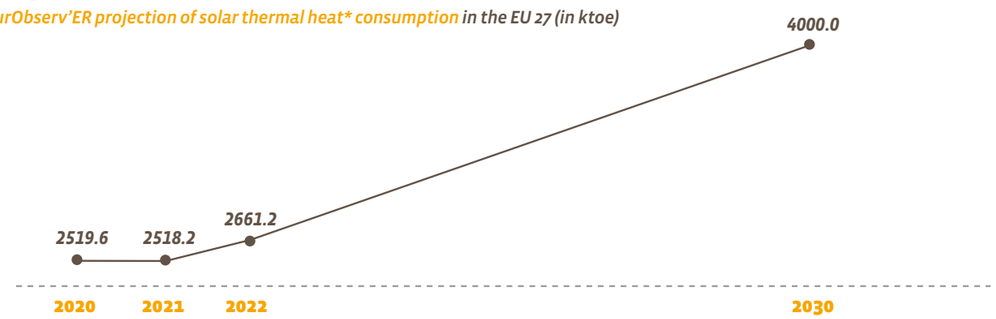
and 147 883 m² in 2021).
The Greek solar thermal industry that specializes in thermosiphon systems, was largely unscathed by the decline of the European Union market during the 2010s, because it profited from the market segment's strong global growth, not only in Europe, but also in the Middle East, the Maghreb, Africa, South and North America. Greece's solar thermal manufacturers post the most spectacular growth figures of Europe. EBHE, the Greek solar thermal industry association, reckons that the country's solar collector output has more than doubled in the space of eight years from 540 000 m² in 2014 to 1.19 million m² in 2021. Costas Travasaros maintains that not only did Greek output stand at about 1.4 million m² in 2022, but that it is still export-driven and that Greek industrialists are continuing to invest in new production capacities

The stakes are high

«Solar heat and solar power combined with heat pumps can replace natural gas boilers for heating residential or commercial spaces. Solar energy in the form of electricity, heat or hydrogen can replace natural gas consumption in industrial processes.» This European Commission assertion made in the RePowerEU plan clearly demonstrates the key role it intends to give solar heating for weaning Europe off Russian natural gas and for decarbonization. These are no meagre ambitions. The Solar Heat Europe roadmap presented in June 2022 unveiled new ambitions for the sector together with an overview of the contributions that the sector can make towards decarbonizing energy. According to this roadmap, solar thermal has the potential to reach 140 GWth of installed capacity by 2030, or 73 GWth in 2030 in the building segment, 32 GWth in the district heating segment and 36 GWth for industrial heat if strong measures are applied. That is just over three times more than the European Strategy goal for solar energy. According to EurObserv'ER, the installation pace will clearly pick up speed from 2024-2025, but the Member States will have to be much more determined than they are currently if they are to reach these installation levels, especially as the decommissioning of installations over 20 years old will clearly accelerate as the end of the decade approaches. Another element that will come into play in the second half of the decade will be the effective rollout of the RePowerEU plan proposal for the obligation to install solar panels on new public and commercial buildings from 2026 onwards and on new residential buildings from 2029 onwards. The ubiquity of solar roofs in new build should breathe new life into the renovation segment.
European ambitions for solar were reaffirmed in the draft "Net zero industry Act" announced in March 2023, that again places solar thermal alongside photovoltaic in the list of strategic industrial sectors to be preserved and developed if the successful decarbonization of Europe is to be achieved. The "Net Zero Industry Act" sets out a raft of measures to boost the European ecosystem of manufacturing low-carbon technology products, and specifically aims to intensify the manufacture of essential technologies to achieve climate neutrality (net zero emissions) in 2050. Europe already has a dense, solid manufacturing base for all the solar heating market segments and is even a net global exporter. According to Solar Heat Europe, the sector is already worth at least 1.79 billion euros of sales and 18 400 direct jobs. It reckons that the Net-Zero Industry Act will be crucial in promoting the sector, maintaining Europe's leadership of the solar thermal industry, and strengthening its global competitivity. The RED 3 directive revamp received its final approval from the European Council on 20 June 2023 after a disagreement between France and the other European Union countries on the nuclear energy share of certain targets was resolved. Under the terms of the political accord of 30 March 2023, industry must increase its use of renewable energies by 1.6% per annum, while the 2030 renewable energy target for buildings is set at 49%. The RES share of heating and cooling systems should increase by 0.8% p.a. until 2026 and by 1.1% p.a. between 2026 and 2030. Given the enormity of the decarbonization requirements, the stricter biomass sustainability criteria should give more leeway to the solar thermal, heat pump and geothermal energy sectors. □

Graph. No. 1

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 2023.*

Table No. 5

Representative European manufacturers of solar thermal systems and collectors

Company	Country	Business units
GreenOneTec	Austria	- Flat plate collectors OEM - Large area collectors up to 13.6m² - Thermosiphon solar system - Large scale solar thermal project
Dimas	Greece	- Flat plate collectors OEM - Thermosiphon tanks OEM - Absorbers OEM - Thermosiphon solar system
Bosch Thermotechnik	Germany	- Forced circulation solar system (Flat plate collector)
Papaemmanouel	Greece	- Thermosiphon solar system and forced circulation system
ThermoSolar	Germany	- Forced circulation solar system (flat plate collector)
Viessmann	Germany	- Forced circulation solar system (flat plate and vacuum tube collectors) - Large area vacuum tube collectors up to 10.3 m²
Delpaso Solar	Spain	- Forced circulation solar system (Flat plate collector)
BDR Thermea	Spain	- Forced circulation and thermosiphon solar system (Flat plate collector)
Cosmosolar	Greece	- Thermosiphon solar system and forced circulation system
SavoSolar	Denmark	- Large area flat plate collectors (14,6m²) - Turnkey solar thermal plant (SDH, Industry)

Source: EurObserv'ER 2023.

SOLAR THERMAL AND CONCENTRATED SOLAR POWER BAROMETERS – **EUROBSERV'ER** – JULY 2023

CONCENTRATED SOLAR THERMAL POWER

Concentrated solar power (CSP) plants cover all the technologies devised to transform solar radiation energy into very high temperature heat for onward conversion into electricity. There are tower plants, whose heliostat fields (devices fitted with reflectors to track the sun) concentrate 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. There are also 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. A fourth, less widespread category, consists of parabolic plants with a parabolic reflector that reflects the sun's rays onto a convergence point, as the reflector's base is automatically orientated opposite the sun to track it. One CSP technology feature is the plants' ability to smooth out electricity production using a thermal storage buffer. This storage is usually achieved by heating molten salts in a tank to keep them at high temperature.

6 318.2 MW OF INSTALLED CSP CAPACITY ACROSS THE GLOBE AT THE END OF 2022

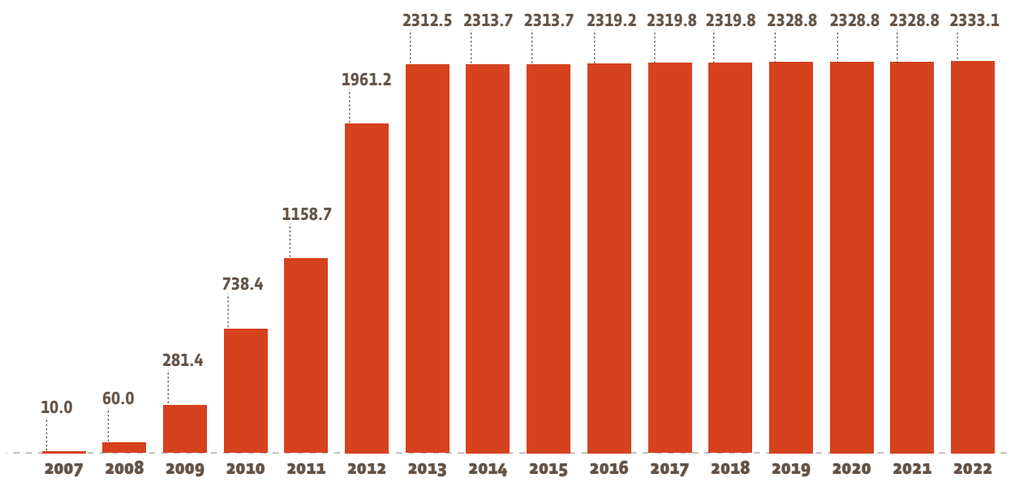
According to the csp-guru database compiled by Richard Thonig and Alina Gilmanova in conjunction with the SolarPACES secretariat that presents an update on the concentrated solar thermal power market as of 1 January 2023, 115 CSP plants were officially running in the world with 6318.[2] MW of combined capacity to date. Only one project was commissioned in 2022, making it a slack year. The plant in question was the Italian SOLINPAR CSP at Partanna (Sicily) owned by the Italian SOL.IN.PAR srl company. This Fresnel-type CSP plant with 4.26 MW of electrical capacity, was constructed by FATA spa of the Danieli group. The total solar field area is 83 000 m² (roughly 10 football pitches), where 126 linear Fresnel-type solar collectors have been installed arranged in 9 loops. The plant has a 180-MWh thermal molten salts storage system designed to operate for about 15 hours at full load even in the absence of sun rays. The plant can produce electricity for more than 1 400 families (about 30% of the municipal area's population). It is planned to couple the plant with a 5.6-MW photovoltaic collector field and so provide 9.86 MW of combined electrical capacity.

The SOLINPAR CSP project takes Italy's 2022 CSP capacity to 12.4 MW and that of the European Union to 2 333.1 MW. Spain, with 2 303.9 MW, is the only European Union country to have developed its CSP sector on an industrial scale. Red Electrica de España, claims that Spain's net CSP electricity output in 2022 was 4.1 TWh (4.7 TWh in 2021), which is an average performance equating to 77% of the record output of 2017.

According to csp-guru, 2023 and 2024 should be much livelier, with 8 further plants in addition to the Italian one as of 1 January under construction or about to be commissioned, for combined capacity of 1 357 MW (4 in 2023 and 4 in 2024). The counter started running again from the first quarter of 2023. The ACWA Power Company, listed on the Saudi stock exchange, announced that the 100-MW tower plant of its Noor Energy 1 project was

Graph. No. 2

European Union concentrated solar power capacity trend (MW)



Source: EurObserv'ER 2023.

The Italian SOLINPAR CSP plant at Partanna (Sicily) is of the Fresnel type with 4.26 MW of electrical capacity. The total solar field area is 83 000 m² (roughly 10 football pitches), where 126 linear Fresnel-type solar collectors have been installed arranged in 9 loops. The plant has a 180-MWh thermal molten salts storage system designed to operate for about 15 hours at full load even in the absence of sun rays.

Tabl. No. 6

Concentrated solar power plant in operation in the European Union at the end of 2022*

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
Solinpare CSP- Partanna	Linear Fresnel	4.26	2022
Total Italy		12.41	
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		2333.1	

*HB (Hybrid Biomass). *Pilots and prototypes included.* ***Source: EurObserv'ER 2023.***

commissioned on 20 February 2023 in Dubai. In addition to the tower plant, claimed to be the world's tallest (262 metres), the NOOR 1 project should also commission a 600-MW parabolic trough type tower and a 250-MW solar photovoltaic power plant in 2023, bringing the combined capacity to 950 MW. Another CSP plant, the Saudi Green Duba ISCC project will be ready to deliver electricity in 2023 Q3. It is a hybrid solar-gas plant with 605 MW of combined capacity, which will have a 565-MW combined cycle gas plant back-to-back with a parabolic trough plant with about forty MW of capacity. The German company SBP supplied the solar field, while the plant has been constructed by the Spanish-Saudi consortium of INITEC Energia and SSEM (Saudi Services for Electro Mechanic Works). At the very end of 2023, the Redstone project should also come on stream in Northern Cape Province, South Africa – a 100-MW tower plant. The plant, owned by Eskom Holdings SOC Ltd, is equipped with a 12-hour storage system that will be able to supply stable electricity reliably to more than 200 000 South African households during peak demand periods, even after sundown.
The last plant scheduled to start up in 2023 is China's Jinta Zhongguang Solar project, a hybrid solar project that combines a 100-MW CSP plant with a 600-MW solar photovoltaic collector field. Cosin Solar developed the 100-MW CSP tower plant which is coupled to a 9-hour thermal molten salts storage system and is designed to produce 1 370 GWh of electricity p.a. The combustion of 480 000 tonnes of standard coal will stop and CO_2 emissions will be reduced by 1 310 000 tonnes. The project, whose construction began on 25 March 2022, will go on grid at full capacity before the end of December 2023. A further four projects are under construction – all in China and all four are hybrid CSP plant projects … two CSP/PV and two CSP/PV/wind. In detail they are CEIC Dunhuang (100 MW Fresnel + 600 MW PV), Huidong New Energy Akesa (110 MW tower type +640 MW), Three Gorges Henderson Energy Guazhou (2x50 MW tower type + 200 MW PV + 400 MW wind and CNNC Yumen (100 MW Fresnel + 400 MW PV + 200 MW wind). The Chinese market is steadily expanding with many new tenders being developed. According to an update released in June 2022 by CSP Focus, 14 projects, mostly hybridized with photovoltaic were either under construction, or being examined in the provinces of Qinghai, Gansu, Jilin and in Tibet.

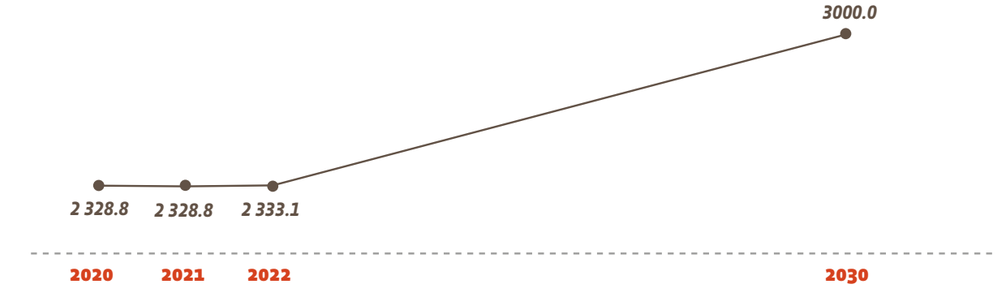

DANIELI GROUP

EUROPE'S FUTURE WILL ENTAIL HYBRIDIZATION AND PAYMENT FOR STORAGE

CSP's future in Europe will go down the hybridization route. That is the gist of the message sent to the European Union's authorities by the industry organisations that promote concentrated solar energy, such as Spain's Protermosolar. The latter entreated the European Commission to make a closer evaluation of the possibility of hybridizing the two solar technologies, photovoltaic and solar thermal as a competitive solution to provide electricity systems with flexibility, when it was drawing up the European Strategy for solar energy. One great advantage of CSP is that it can be the perfect complement to photovoltaic. Some plants, primarily in China, are betting on hybrid designs that only generate power by photovoltaic technology in the daytime and with energy stored by CSP during nighttime. In Spain, new regulations have introduced the hybridization concept of the connection point to maximize the existing grid's actual capacity. This regulation means that an existing plant can be hybridised with another plant provided that the connection capacity is adhered to. The most advanced of Spain's hybrid CSP/PV projects, that of Solgest 1 has entered a new stage. The central government has effectively approved the environmental impact declaration of the Solgest-1 CSP project, which paves the way for a construction announced for the end of 2023. It is a hybrid project involving a 110-MW parabolic trough plant coupled with a 40-MW photovoltaic power plant. The CSP plant will have a thermal molten salts storage system with two tanks making for 1 900 MWh of storage capacity. According to the developer, this hybrid plant will be able to produce electricity 24 hours round the clock, by injecting it into the grid, via a high voltage (220-kV) evacuation line to the Carmona substation, in Seville. The site will be located at the Fuentes de Andalucía facility, where the Gemasolar tower plant constructed by Sener, has been running since 2011.
An opportunity has already been missed to revive Spain's CSP sector. One year late, the government launched its first tenders with capacity quotas for technologies in October 2022, setting aside 200 MW for solar thermal. Unfortunately, the solar thermal section of the tender was rejected as the bid prices were higher than the reserve price. New tenders for a volume of 200 MW, expected for 2023 (followed by another in 2025), should be launched, giving the sector an opportunity to get new projects off the ground. David Trebolle, Protermosolar's Secretary-General, stresses that the main challenge of future tenders will be "to work on a new design that will enable the reserve prices to be adapted to the real costs of the technology, and consideration of backup technologies with renewable, synchronous nighttime scope. The market, on its own, does not offer incentives for investment nor revenue stability to cover the costs of renewable technologies with storage capable of providing the back-up that the electricity system needs, especially at night." The sector also regretted the lack of incentive to encourage research into complementary renewable technologies, and the renovation of existing solar thermal plants by adding the storage systems they do not have. According to Protermosolar, storage capacity could be doubled in Spain as only 19 of the 49 CSP plants constructed, have provision for storage. □

Graph. No. 3

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



Source: EurObserv'ER 2023.

Sources: 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), STATAC (Luxembourg),IEA SHC, Solar Heat Europe,EurObserv'ER, Protermosolar, csp-guru, SolarPACES.

The next barometer will be about biogas

Funded by the European Commission

This barometer was prepared by Observ'ER in the scope of the EurObserv'ER project, which groups together Observ'ER (FR), TNO (NL),Renewables Academy (RENAC) AG (DE), Fraunhofer ISI (DE), VITO (Flemish Institute for Technological Research) (BE) and Statistics Netherlands (NL). This document has been prepared for the European Commission however it reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

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