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GLOBAL STATUS REPORT

2021

KEY FACTS

- An estimated 25.2 GW_{th} of new solar thermal capacity came online in 2020, with **China, Turkey, India, Brazil and the United States** leading in new installations.
- Residential, commercial and industrial clients in **at least 134 countries operated 501 GW_{th}**, enough to provide heat equivalent to the energy content of 239 million barrels of oil.
- China and Germany took the lead from Denmark in **solar district heating**, thanks to policy support in both countries.
- A new generation of manufacturers of **innovative concentrating collectors** unveiled the first demonstration or commercial projects.

SOLAR THERMAL HEATING

The global solar thermal market continued a gradual decline in 2020, with an estimated 25.2 GW_{th} of capacity added[i] worldwide, down 3.6% from 26.1 GW_{th} in 2019.[1] Most large solar thermal markets were constrained by challenges associated with COVID-19, such as pandemic-related restrictions and postponed investment decisions by commercial clients, including industries and hotels. However, the reduction was smaller than expected due to various stabilising factors.

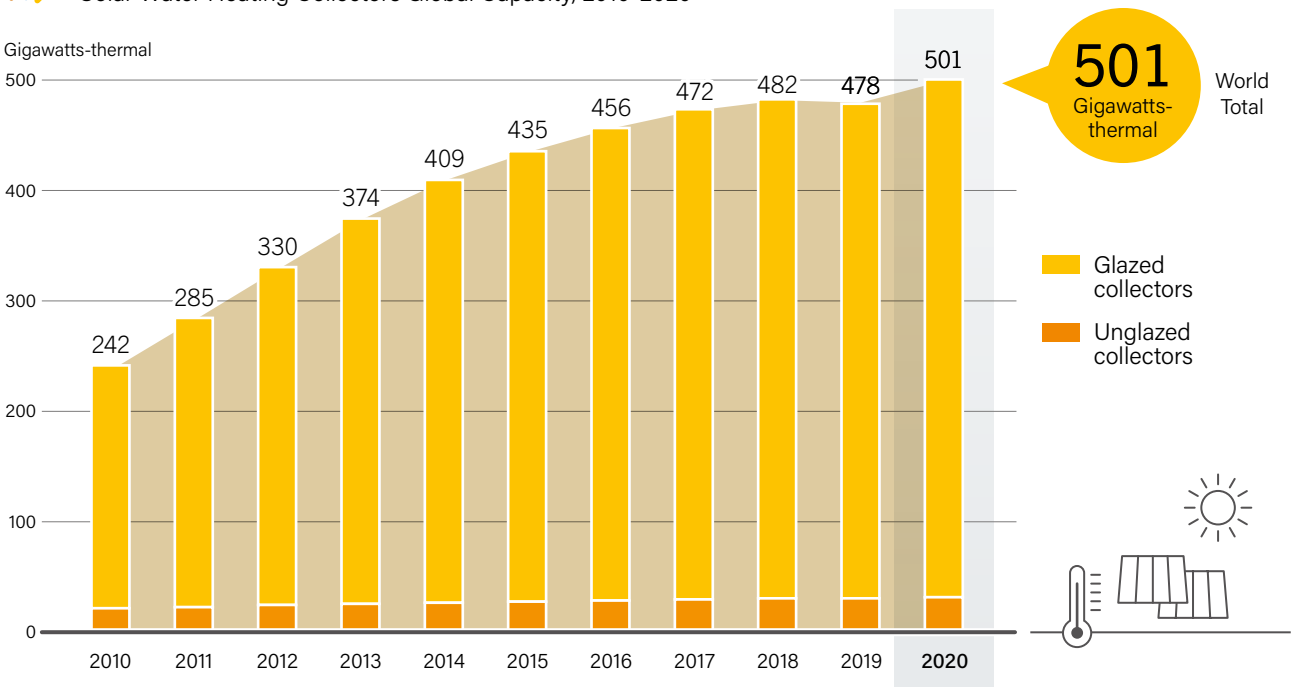
In most of the largest solar thermal markets, continuous business in the construction sector during the pandemic helped maintain a steady demand for systems. In many countries, the effects of trade and travel restrictions on the solar thermal market were offset at least partly by higher demand from residential owners who spent more time at home and invested in infrastructure improvements.[2] In markets that depend strongly on subsidies, changes in policy support in 2020 had a much greater influence (positive or negative) on solar thermal demand than did the pandemic.[3]

By the end of 2020, millions of residential, commercial and industrial clients in at least 134 countries were benefiting from solar heating and cooling systems.[4] The total operating capacity for glazed (flat plate and vacuum tube) and unglazed collectors (used mainly for heating swimming pools) reached an estimated 501 GW_{th} by year's end, up 5% from 478 GW_{th} in 2019[ii].[5] (→ *See Figure 31.*) These collector types provided around 407 terawatt-hours (1,465 petajoules) of heat annually, equivalent to the energy content of 239 million barrels of oil.[6]

i Added capacity or new additions in this section are gross additions, whereas total capacity counts only net additions (replacement of decommissioned systems is not included).

ii Annual additions for China in 2019 were revised (see endnote 1 for this section), and the assumptions for estimating new solar thermal capacity additions beyond the largest 20 markets were adapted for 2019 and 2020 (see endnote 5 for this section), which also had an impact on estimates for total global capacity.

FIGURE 31.
Solar Water Heating Collectors Global Capacity, 2010-2020



Note: Data are for glazed and unglazed solar water collectors and do not include concentrating, air or hybrid collectors. The drop in 2019 was caused by revised annual additions for China in 2019 (see endnote 1 for this section) and new assumptions for projecting total capacity in operation for 2019 and 2020 (see endnote 5 for this section).

Source: IEA SHC. See endnote 5 for this section.

In addition to the three main types of collectors, other technologies such as hybrid, concentrating and air collectors are available to meet specific heat needs. Because annual additions of these technologies are small, they are not yet included in global and national capacity statistics. By the end of 2020, hybrid – or solar photovoltaic-thermal (PV-T) – technologies provided 635 MW_{th} of thermal capacity (and 232 MW of electric power capacity) for space and water heating.[7] In addition, 566 MW_{th} of concentrating solar thermal capacity provided hot water or steam for industrial and commercial customers at year's end.[8] Around 1 GW_{th} of air collectors for drying and space heating was in operation in 2019 (latest data available).[9]

The leading countries for new glazed and unglazed installations in 2020 were again China, Turkey, India, Brazil, the United States, Germany and Australia.[10] (→ *See Figure 32.*) China dominated the market, accounting for 71% of new global sales, followed by Turkey and India (5% each).[11] Most of the top 20 countries for solar thermal installations (glazed and unglazed collectors) in 2019 remained on the list in 2020; the exceptions were Denmark, the State of Palestine and Switzerland, which were replaced in the rankings by the Netherlands, Morocco and Portugal.[12] The top 20 countries accounted for an estimated 96% of the global market in 2020.[13]

In China, the solar thermal market ended 2020 on a high note, with sales in the second half of the year nearly making up for the delays in construction activity related to COVID-19 during the first six months.[14] Installations in 2020 totalled 18 GW_{th} (25.7 million square metres (m^2) of collector area), resulting in a decline of only 3% from 2019 (compared with a 21% drop in 2019 relative to 2018).[15] At year's end, China's operating capacity was 364 GW_{th}, or 67% of the global capacity in operation.[16]

Germany's green heating policy

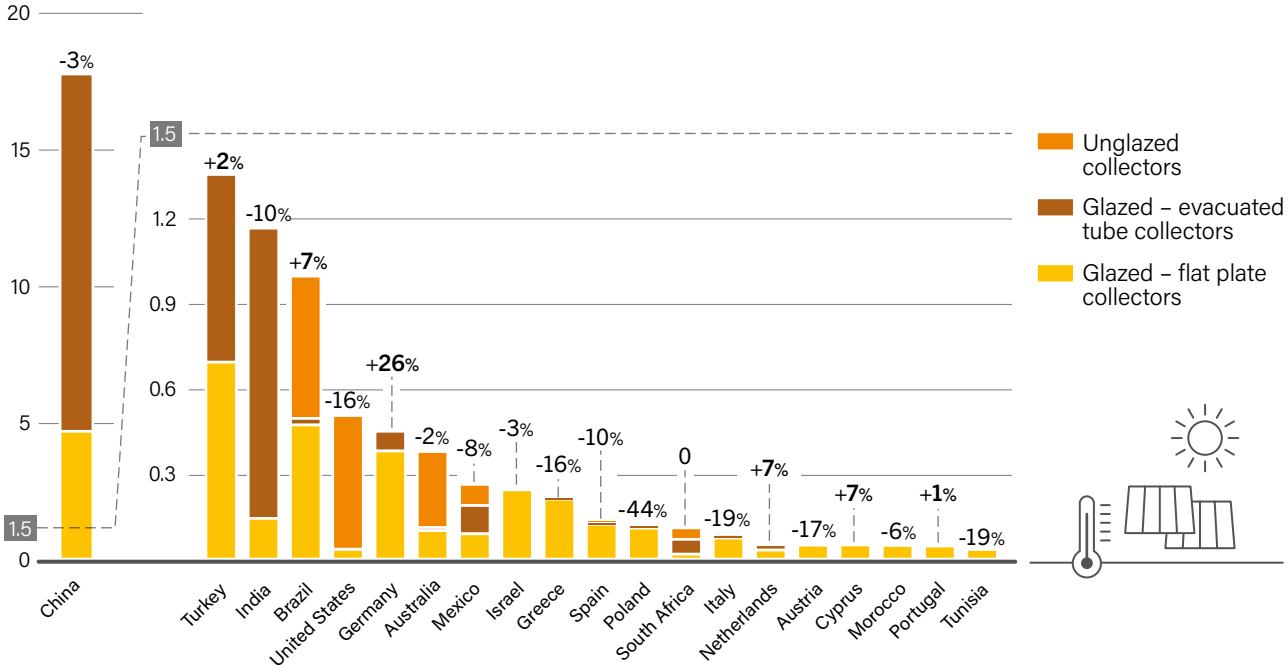
helped drive a 26% increase in sales in 2020.

The large project market in China[i] – covering a wide range of customer groups including industry, large-scale residential projects, agriculture, and public institutions such as hospitals and schools – remained stable and contributed to nearly three-quarters (74%) of total sales in 2020, while the market for small retail solar water heaters made up the remaining 26%.[17] Within the large project market, the most dynamic growth was in the solar space heating segment, totalling 1.7 GW_{th} of newly added capacity, or 10% of all new installations.[18] Prior to 2020, a total of only around 0.6 GW_{th} of solar space heating projects was put online. [19]

i Chinese statistics differ between standardised small residential solar water heaters and "engineered" solar thermal solutions, which are called the "large project market" in the GSR and refer to larger systems used in, for example, industry, agriculture, public institutions and residential housing projects.

FIGURE 32.
Solar Water Heating Collector Additions, Top 20 Countries for Capacity Added, 2020

Gigawatts-thermal



Note: Additions represent gross capacity added. For the Netherlands, the shares of flat plate and vacuum tube collectors were estimated based on actual shares in 2019. For Morocco, the share of collector types was not available.

Source: See endnote 10 for this section.

Although vacuum tube collectors still accounted for 73% of China's newly installed capacity, the market continued to transition from vacuum tubes to flat plate systems.[20] China's market for new vacuum tube collectors contracted 6% in 2020 (to 13.1 GW_{th}), while new flat plate collector area grew 6% (to 4.9 GW_{th}).[21] Sales of flat plate collectors have been driven by building codes mandating the use of solar thermal systems (or heat pumps) in new construction and major renovations as a means to reduce local air pollution.[22] These regulations have increased the demand for both façade- and balcony-integrated applications, where flat plate collectors have been the preferred solution.[23]

Turkey's solar thermal market, the second largest for new sales worldwide, expanded slightly (up 2%) in 2020, following stagnating sales the previous year, resulting in 1.35 GW_{th} of newly installed capacity.[24] The 18.4 GW_{th} of solar thermal capacity in operation at year's end accounted for 4% of the global total.[25] The pandemic affected Turkey's market in two opposing ways. In the residential sector, sales of solar water heaters increased as Turkish residents moved away from urban areas and apartment buildings to villages and individual houses, boosting the renovation business and the prefabricated housing market and triggering solar thermal sales. Meanwhile, sales of solar thermal systems for hotels and resorts declined.[26]

India's demand for glazed collectors fell 10% in 2020 to 1.16 GW_{th} (1.66 million m^2) due to the restrictions on production, sales and installation during the country's full lockdowns in April and May and partial lockdowns over several months.[27] Even so, India again ranked third for annual additions. As in Turkey, Indian solar thermal manufacturers reported opposing trends: for example, precautionary health measures, such as more frequent hot baths, increased the demand for solar water heaters, partly offsetting the negative impact of the pandemic.[28]

Demand from homeowners for **solar water heaters** increased in Turkey, India and Brazil during the pandemic.

The market share of vacuum tube collectors in India grew to 88% of newly installed capacity in 2020 (up from 85% in 2019), mainly because flat plate collector sales declined more strongly (down 24%) due to higher prices resulting from rising material costs.[29] Furthermore, there was a decrease in the number of public tenders that mandated systems certified by the Bureau of Indian Standards, which so far can be fulfilled only by flat plate collectors.[30]

Karnataka state again dominated capacity additions, representing nearly 65% of India's total market (up from 50% in 2019), followed by Gujarat and Maharashtra.[31] The driving force in Karnataka was again a strict policy mandating use of the systems, overseen by local electric utilities that deny grid access to households not equipped with a solar water heater.[32]

Brazil continued its growth trajectory, adding 992 MW_{th} (up 7%) of solar thermal capacity in 2020 despite COVID-19 worries, following a 6% increase in 2019.[33] The pandemic caused demand to fall in the first six months of the year, as commercial clients put plans on hold and wholesalers closed their doors.[34] Sales then rose in the second half of the year, a development attributed in part to the recovery of the residential sector as people spent more time at home and invested in infrastructure improvements (such as solar pool heating and solar hot water systems); commercial clients also took advantage of the lower interest rates available for financing to identify energy-saving solutions that could give them a competitive edge.[35]

For the first time, Brazil's unglazed collector market, aimed mainly at swimming pool heating, pulled ahead of the US market, the long-term leader for this type of collector.[36] Brazil added 498 MW_{th} of new unglazed capacity, followed by the United States (473 MW_{th}) and Australia (266 MW_{th}).[37]

Brazil's strong market in 2020 resulted almost solely from the competitiveness of domestically manufactured solar thermal systems compared to other water heating options, as well as the ongoing reduction in value-added tax (VAT), enjoyed by solar thermal products but not other water heating options.[38] Meanwhile, the implementation of two previously announced policy support programmes was temporarily postponed because of the pandemic.[39] The federal government delayed the launch of the new social housing programme Casa Verde e Amarela, which was to succeed Minha Casa Minha Vida, the main programme behind the increase in Brazil's solar thermal capacity between 2009 and 2014.[40] Law PL 107 from 2019, stipulating the use of solar energy in all municipal and federal government institutions in the city of São Paulo, also did not enter into force.[41]

The United States, the fifth largest market for the three main types of solar thermal collectors in 2020 (with 505 MW_{th}), suffered a sharp decline (down 16%).[42] This resulted from a severe drop in sales of glazed collectors (down 71%) due to COVID-19 restrictions and to the end of a major support scheme, the California Solar Initiative, in July 2020.[43] Meanwhile, demand in the unglazed segment fell only 3%, which led its share in newly added capacity to increase to 94% (from 81% in 2019).[44] The United States continued to rank third globally for total operating capacity, with 18 GW_{th} at the end of 2020.[45]

Australia ranked seventh, following Germany for solar thermal sales, adding 380 MW_{th} of new capacity in 2020, down slightly from 2019.[46] The Australian solar thermal market has been dominated by unglazed collectors, which have fluctuated between 260 MW_{th} and 280 MW_{th} each year since 2013.[47]

Preliminary numbers for glazed collectors suggest a decline in 2020 (down 7%), with new installations totalling around 114 MW_{th}.[48] Sales of glazed collectors contracted, while heat pumps gained a larger share of the residential new-build market; in addition, restrictions on the number of workers allowed at worksites during several months of the pandemic affected solar thermal sales[i].[49]

The European Union (EU-27) remained the second largest regional market after Asia in 2020.[50] However, additions (estimated at 1.4 GW_{th}) were down 15% from 2019.[51] The total capacity in operation in Europe at the end of 2020 was an estimated 37.5 GW_{th}, accounting for 7% of the global total.[52] The four leading countries in 2019 (Germany, Greece, Poland and Spain) saw mixed results in 2020, with strong growth in Germany and declines in Greece, Poland and Spain, resulting largely from changing policies and the impacts of the pandemic.[53]

Germany extended its leading position in Europe and reversed its decade-long market decline, ranking sixth globally for new installations. Annual sales were up 26% in 2020, to reach 450 MW_{th}, or around 83,000 new solar thermal systems for the year.[54] A key driver of growth was the new national support scheme to accelerate decarbonisation of the heat sector, launched at the start of 2020, which covers 40% of the cost of replacing an outdated oil heater with a new solar-supported gas condensing boiler.[55]

A high volume of grant applications in the last quarter of 2020 helped fuel optimism for continued growth in 2021.[56] Germany reached 13.9 GW_{th} in operation at the end of 2020, accounting for 3% of total global capacity.[57]

The solar thermal market in Greece, again the second largest for new additions in Europe, contracted significantly (16%) in 2020 (for the first time since 2013), with only 213 MW_{th} installed.[58]

i The restrictions affected the glazed solar thermal market more than the unglazed market because the glazed market is aligned heavily with new home builds.

The drop was caused by reduced sales during lockdowns in the first half of the year, when shops were closed and internet sales were insufficient to offset the decline in direct sales.[59]

Spain came in third place in Europe in 2020, ahead of Poland (due to a large market decline in Poland, rather than to expansion in Spain). The Spanish solar thermal market fell 10% (adding 131 MW_{th}), in line with the year's housing market decline, whereas Poland's market plunged 44%, with 113 MW_{th} added.[60] The contraction in Poland was attributed to the pandemic and to a phasing out of the emission reduction programme, which aimed to improve local air quality by subsidising renewable heating systems purchased and distributed by municipal administrators.[61]

Although most solar thermal capacity continued to be installed for the purpose of water heating in individual buildings, the use of **solar thermal technology in district heating** expanded further during 2020, and in an increasing number of countries. The vast majority of new solar district heating capacity added was again (in descending order) in China, Germany and Denmark.

In China, the solar district heating market shifted in 2020 from being purely state-financed to being partly commercial, with large orders from the housing industry. Whereas in 2019, three publicly funded solar district heating systems were commissioned in Tibet (totalling 52 MW_{th}), in 2020 only one such plant (7.9 MW_{th}) was erected, at a college in Lhasa.[62] Across China, newly installed solar thermal capacity for space heating (for both district heating and heating of large buildings) increased by a significant 1.7 GW_{th}, due to green heating policies aimed at replacing coal boilers in the country's north to improve air quality.[63] For this new capacity, the statistics do not differentiate between central space heating projects for blocks of flats or larger buildings (which would be considered solar district heating) and decentralised space heating units for rural, single-family houses.[64]

Germany passed Denmark for new installations of solar district heating by bringing online six new plants (totalling 22 MW_{th}) in 2020, following the completion of five new systems (totalling 7.1 MW_{th}) in 2019.[65] The 2020 additions included Germany's then-largest solar district heating plant, in Ludwigsburg, with a solar capacity of 10.4 MW_{th}.[66] By year's end, the country had 41 solar district heating plans in operation totalling 70 MW_{th} of capacity.[67] Five additional plants, with a combined capacity of 22.5 MW_{th}, were being planned or in the installation phase and were expected to come online in 2021; they included a 13.1 MW_{th} system in Greifswald that, once operational, will overtake the Ludwigsburg plant to become the country´s largest solar district heating plant.[68]

The strong market in Germany was driven by supportive framework conditions, including grants from two programmes: the Municipal Climate Change Showcase Programme and Heat Networks 4.0. The Municipal Showcase Programme has provided grants since January 2020 to cover up to 80% of the investment cost of municipal activity in the areas of greenhouse gas reduction, smart infrastructure and wastewater treatment.[69] Heat Networks 4.0 has provided support to utilities since mid-2017 for feasibility studies and the construction of fourth-generation district heat networks[i], where at least half of the heat injected into the grid must come from renewables.[70] Thanks in part to these programmes, German utilities increasingly consider solar heat to be an economically feasible alternative, promising stable heat prices over a period of 25 years, compared to the volatile prices of natural gas and biomass.[71]

Denmark continued to lead globally for total district heating capacity, with more than 1 GW_{th} in operation at the end of 2020.[72] However, the country brought online only one small solar district heating plant and three extensions during the year, increasing total capacity by 10 MW_{th}.[73] This is down sharply from 2019, when 10 new district heating plants and 5 extensions were added for a total of 134 MW_{th}.[74] The market contraction was due to increasing competition from heat pumps, driven by policy changes.[75] As of mid-June 2019, solar heat was no longer eligible to fulfil the energy savings mandates for utilities, whereas heat pumps were included in the mandate until the end of 2020.[76] At the beginning of 2020, the Danish Energy Agency also began providing grants for heat pumps, triggering additional demand.[77]

The top markets for
solar industrial heat
in 2020 were China, Mexico and Germany.

i Fourth-generation heat networks operate at lower temperatures of around 60 degrees Celsius (°C) to reduce heat losses, extend pipe lifetimes and create the best conditions for injecting heat produced with renewable sources.

Demand for new solar district heating systems increased in other existing European markets as well. In France, the market picked up in response to an attractive investment grant for large solar heat systems.[78] At the start of 2020, France had only a handful of solar district heating plants, with the largest commissioned in 2018 (1.6 MW_{th}) in Châteaubriant; by the end of 2020, three additional systems were under construction with a combined capacity of 7.4 MW_{th}, including a 4.2 MW_{th} field in Narbonne that will be France's largest solar district heating plant when it comes online in 2021.[79]

Austria's subsidy scheme for large and innovative solar thermal projects again saw results in 2020, with the inauguration of three new solar district heating fields totalling a combined 4.7 MW_{th}.[80] This represented a change from 2019, when no solar district heating plants were commissioned in Austria.[81] A much higher budget for the subsidy scheme, starting in April 2021, is expected to drive up demand for large-scale applications in the coming years.[82]

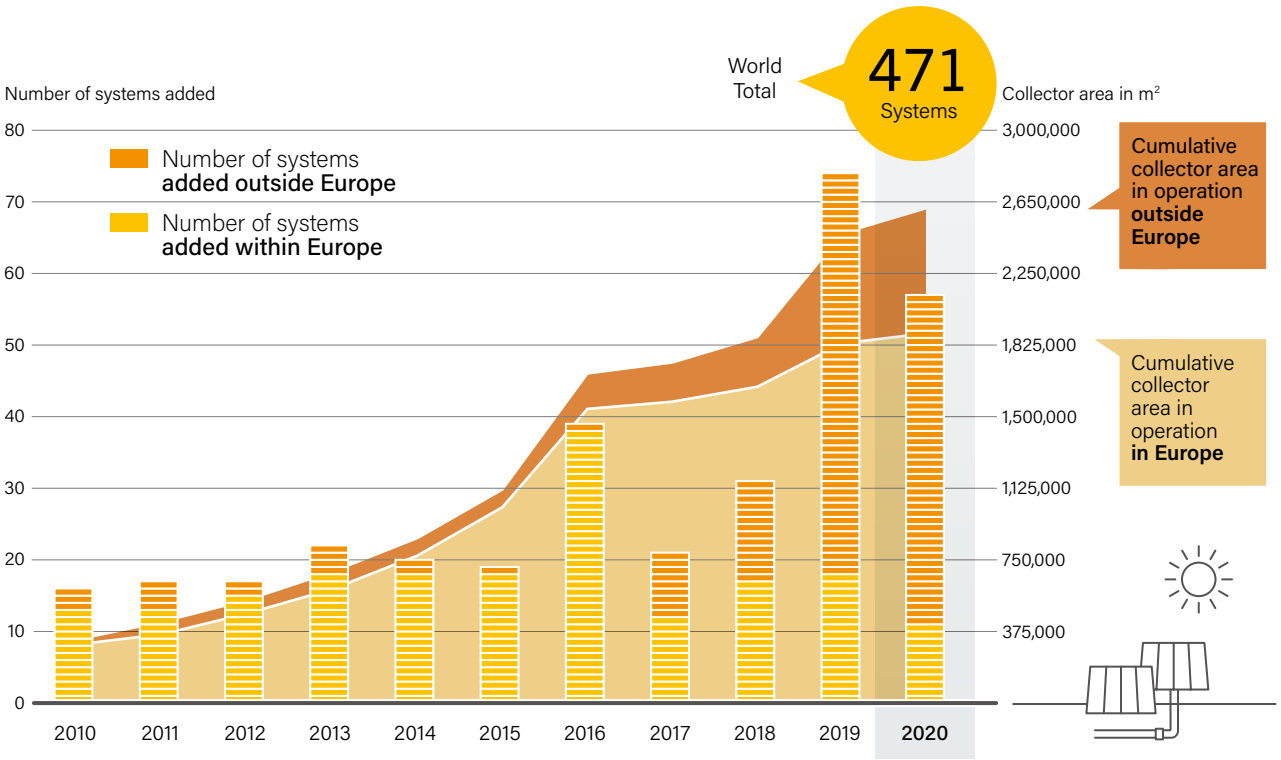
Sweden also had a new plant under construction at the end of 2020. Once completed in 2023, the 1.5 MW_{th} solar district heating plant in Härnösand, north of Stockholm, will be the country's largest solar district heating field using concentrating collectors.[83]

The global solar district heating market also diversified into new markets in both Europe (Croatia, Kosovo and Serbia) and Asia (Mongolia, driven by public funding for pre-feasibility and feasibility studies). In Mongolia, the European Bank for Reconstruction and Development (EBRD) funded a study on 20 different renewable and energy efficiency options for decarbonising the district heating grid for over 1 million people in the capital city of Ulaanbaatar; among the options is a 49 MW_{th} solar district heating plant.[84]

With support from the EU project KeepWarm, pre-feasibility studies for the integration of solar fields in district heating networks with a total capacity of 37.5 MW_{th} were carried out in the Croatian cities of Samobor, Velika Gorica and Zaprešić.[85] Solar district heating also attracted more attention in Serbia and Kosovo during 2020 because of the continued support from the EBRD for (pre-) feasibility studies.[86] In early 2021, feasibility studies were under way in Pančevo (Serbia) and Priština (Kosovo) for at least 70 MW_{th} of solar district heating plants.[87] The Serbian towns of Bor and Novi Sad had completed pre-feasibility studies, and Novi Sad's municipal council was proceeding with the next planning step.[88]

In addition to solar district heating, **central solar hot water systems** for large residential buildings, hospitals, sport clubs and prisons sold well in Brazil, China and Turkey during 2020. In total, at least 57 large solar thermal systems of at least 350 kilowatts-thermal (500 m^2) each, used either for district heating or for central hot water, were added globally in 2020.[89] These capacity additions of 93 MW_{th} brought the total number of large collector fields to at least 471 systems (1.8 GW_{th}) by year's end (including glazed and concentrating solar thermal collectors).[90] (→ *See Figure 33*).

FIGURE 33.
Solar District Heating, Global Annual Additions and Total Area in Operation, 2010-2020



Note: Includes large-scale solar thermal installations for residential, commercial and public buildings. Data are for solar water collectors and concentrating collectors.

Source: See endnote 90 for this section.

The additions in 2020 appear to represent a decline from the 74 large systems reported by technology suppliers as commissioned in 2019.[91] However, one large Chinese project developer, which was responsible for 36% of the plants completed in 2019, failed to report any large systems for 2020 despite completing several projects; this suggests that the world market remained more or less stable in 2020.[92]

Also during the year, several international organisations published a joint report emphasising the need to decarbonise industrial heat demand.[93] However, this urgent call for carbon-free heat solutions did not appear to stimulate demand for the use of new solar thermal systems to provide process heat for industry. Only 74 **solar heat for industrial processes (SHIP)** projects, with a total capacity of 92 MW_{th}, came online in 2020, down from 86 projects and 251 MW_{th} in 2019.[94] Multiple factors contributed to the relative decline: for example, the pandemic delayed the closing of contracts and the installation of ordered projects, and India's SHIP market declined in 2020 following the expiry in March of the national support programme for solar concentrating systems.[95] In the United States, Glasspoint, which was responsible for a large share of the global SHIP capacity added in 2019 (180 MW_{th} of solar steam capacity commissioned in Oman), closed its doors in May 2020.[96]

By year's end, at least 891 SHIP systems totalling more than 792 MW_{th} were supplying process heat to factories worldwide.[97] The top markets in 2020 were again China (30 new projects), Mexico (16) and Germany (10), followed distantly by India and Spain (3 each).[98] China's demand for solar industrial heat was triggered by government support policies to activate the economy after the pandemic, which helped drive an increase in the reported number of new projects from 26 in 2019 to 30 in 2020.[99]

Solar industrial heat plants in Mexico are cost competitive with fossil fuels such as liquefied petroleum gas (LPG), fuel oil and diesel, suggesting the potential for further market growth.[100] In many other countries, however, achieving competitiveness against oil and natural gas depends on investment support subsidies for SHIP systems or the elimination of fossil fuel subsidies.[101] In Germany, continued funding since 2012 resulted in the commissioning of 10 new plants (totalling 1.5 MW_{th}) in 2020.[102] Only one or two industrial solar heat systems were commissioned each in Austria, Belgium, Cyprus, Italy, Malaysia, Morocco, the Netherlands, Niger and Turkey.[103]

Although many solar technology suppliers reported delays in installation and construction, some megawatt-size plants were successfully commissioned in 2020. The top plants for new capacity demonstrated the variety of collector types typically used for SHIP plants globally. The largest new installation, at 10.5 MW_{th}, used flat plate collectors to heat the greenhouses of a freesia farm in the Netherlands.[104] The largest plant with vacuum tube collectors (4.6 MW_{th}) supplies heat in China to a factory in Sanya in Hainan province.[105] The largest SHIP plant with concentrating collectors (3.9 MW_{th}), used for drying agricultural products, started operation in May 2020 in Ganzhou, Tibet (China).[106] Two 3.5 MW_{th} plants also came online – one in Tibet with vacuum tube collectors for greenhouse heating, and one in Turkey with parabolic trough collectors providing heat to a packaging factory.[107]

Hybrid or PV-T collectors, which are solar thermal collectors mounted beneath solar PV modules to convert solar radiation into both electrical and thermal energy, have supplied only niche markets in recent years; thus, their capacity is not included in global and national capacity statistics. Since PV-T collectors have begun to gain popularity in a number of countries in recent years, market data are included in this report for the first time.[108] In 2020, 36 manufacturers globally reported PV-T capacity of at least 60.5 MW_{th} (connected to 24 MW-electric), up strongly from 46.6 MW_{th} in 2019.[109]

The largest markets in new PV-T additions in 2020 were, in order of capacity added, the Netherlands, China, France, Ghana and Germany.[110] Demand among residential and commercial clients in these countries has been driven by the ability to produce both heat and electricity from the same roof space, therefore generating a higher yield per area.[111] In the Netherlands, China and Germany, subsidy schemes also have played a role in triggering demand.[112]

SOLAR THERMAL HEATING INDUSTRY

The global solar thermal industry experienced mixed results in 2020. Most large manufacturers reduced production volumes due to disruptions in the movement of labourers and goods during several months of the pandemic.[113] However, a small number of producers profited from growing demand triggered by new support policies (as in Germany) and from continuously high national demand from the construction industry and solar mandates in some provinces (as in China).[114]

China's solar thermal industry, which saw virtually no impact from COVID-19, continued two major trends from previous years: a high share of large systems for domestic commercial clients, and increasing domestic sales of flat plate collectors.[115] Consequently, Chinese companies again dominated the list of the world´s largest manufacturers of flat plate collectors, holding the top six positions: in the lead was SunEast Group (including the Sunrain and Micoe brands), followed by Jinheng Solar (with its export brand BTE Solar), Haier (the majority owner of the Austrian company Greenonetec[i] until December 2020), Linuo Paradigma, Sangle and Fivestar.[116]

Excluding Greenonetec, which had no sales in China, the other six Chinese flat plate collector producers increased their combined sales volume 12% in 2020, growing faster than the domestic flat plate collector market overall (up 6%).[117] Industry consolidation in China continued, with only large solar equipment manufacturers implementing the rising number of solar space heating projects and responding to central procurement offers for solar water heating equipment for big construction projects.[118] Outside China, the combined sales volumes of the 14 largest flat plate collector manufacturers fell 9% on average in 2020, buffered slightly by strong sales growth in Germany.[119]

Global leaders in large solar heat project development also were affected by declines in the number of contracted projects and setbacks in project development in 2020. Arcon-Sunmark, the market leader in solar district heating from Denmark, closed its collector factory and stopped project development in mid-June, after several years of high fluctuations in turnover and low margins in contracted projects.[120] The company continued to operate a small maintenance unit to fulfil its long-term service and warranty contracts with clients.[121]

Despite the demise of Arcon-Sunmark's manufacturing and development division, the company's know-how and assets remained partly available in the sector. Greenonetec (Austria) acquired the production line for large-scale collector panels, targeting the growing solar district heating market in Europe.[122] In addition, Viessmann (Germany) engaged a team of Arcon-Sunmark's planners and sales experts to strengthen its commercial solar heat project development unit, and Solareast Group (China) bought shares in the company's Asian business.[123]

US-based Glasspoint closed its doors as well in 2020, due in part to uncertainty resulting from the COVID-19 pandemic. In March, the company was forced into liquidation after existing shareholders from the oil industry decided to halt the additional funding that was required to keep it operational.[124] Glasspoint had been in charge of installing the world's largest solar steam-producing plant in Oman, which reached a capacity of 360 MW_{th} in early 2020.[125] The company's difficulties started in 2019, when implementation of a 850 MW_{th} solar steam-producing project in the Belridge oilfields of California was delayed due to a lack of financing; this was followed by a halt in the extension of the Oman project because the client did not approve the third phase at the beginning of 2020.[126]

Medium-sized European technology suppliers signed a number of new contracts during 2020 using improved business models that help to reduce the risk and the heat costs for clients investing in large-scale solar heat systems; these included solar heat contracts and sales of complete production lines. NewHeat (France) secured a bank loan of EUR 13 million (USD 16 million) in September for a pool of five large commercial solar heat systems in France, totalling 28 MW_{th}.[127] As an energy service company, NewHeat offers solar heat contracts to two industrial sites and three district heating utilities.[128]

COVID-19 restrictions **slowed installation work** on solar industrial heat plants already under contract.

i In December 2020, Greenonetec founder re-acquired the 51% ownership stake that was sold to Chinese Haier in May 2017.

In April 2021, Kyotherm (France), which specialises in financing renewable heat projects, commissioned, together with its subcontractors (among others NewHeat, Savosolar of Finland and Sunoptimo of Belgium), Europe's largest solar industrial heat plant, a 10 MW_{th} project for a malting facility in France.[129] Kyotherm, with its network of solar thermal project developers, continued contractual negotiations with commercial heat consumers in the United States and India, with the first contracts expected to be signed in 2021.[130]

In early 2021, Absolicon (Sweden) signed its 13th letter of interest thus far, with a potential buyer for its complete parabolic trough collector production line, which has a typical annual capacity of 100,000 m^2.[131] The purchasers intend to invest in new production lines and are located around the globe, including in Ecuador, Ghana, India, Kenya, Mexico, Spain, Turkey and Uruguay.[132] With this strategy, Absolicon aims to reduce technology costs by enabling its buyers to produce solar collectors close to a large number of potential heat customers in sun-rich countries.[133]

Concentrating solar heat solutions are commonly used to produce temperatures above 100°C, even though other collector types, such as high-vacuum flat plate collectors, are able to reach temperatures up to 180°C.[134] Such systems use concentrating collector technologies with smaller dimensions (length and width) than for concentrating solar thermal power plants and provide heat for processing as well as for steam networks in hospitals or district heating. An increasing number of collector manufacturers have met the challenge of providing such high-temperature solutions. By the end of 2020, 23 solar industrial heat suppliers based in China, Europe, Mexico and North America were producing concentrating collectors, dominated by parabolic trough producers (14 companies) then Linear Fresnel (7) and concentrating dish (2) producers.[135]

A new generation of developers and manufacturers of innovative concentrating collector technologies established in recent years revealed their first demonstration or commercial projects in 2020. These technology providers rely on a wide range of concepts aimed at further lowering the cost of energy by reducing the quantity of material input per unit and by improving performance. The largest new producer, established in 2016, is WuCheng Energy based in Inner Mongolia, China, which signed contracts in 2021 to build a commercial 82 MW_{th} district heating plant with parabolic trough collectors in the northern Chinese city of Handan, slated to start construction in summer 2021.[136]

Solarflux Energy Technologies (US) relies on a dish receiver that, as of early 2021, had been shipped to China, India, Mexico, Qatar and the United States to be used in demonstration projects (totalling 650 m^2).[137] Four other start-ups – Skyven Technologies (US), True Solar Power (Spain), Umbral Energia (Mexico) and Heliac (Denmark) – were developing new solar collectors that consist of a heliostat array focusing on a receiver.[138] Concentrating collector companies in the technology prototype stage included Alto Solution (France), with a new parabolic trough unit, and Heliovis (Austria), which is developing a concentrator housed in an inflatable cylindrical foil-walled tunnel.[139]

Increasing awareness of solar thermal technologies by end-customers in the Russian Federation fuelled optimism in 2020 for investing in solar component factories. During the year, St. Petersburg saw the ramping up of two factories by privately owned Russian companies: the engineering firm Silagnis started producing heat pumps and solar collectors, and Solar Fox increased its manufacturing volume of solar air collector units.[140]

A strong and committed supply chain of around 80 turnkey SHIP suppliers offered solar heat solutions to industrial clients in 2020, despite the challenges of the pandemic.[141] Four out of five companies confirmed that the pandemic delayed the closing of SHIP contracts in 2020, because of economic uncertainty among potential customers.[142] Three out of four suppliers also confirmed that COVID-19 restrictions slowed installation work on plants already under contract.[143] Consequently, only 15 of the around 80 SHIP suppliers commissioned at least one project during the year, compared to 25 companies that put up at least one plant in 2019.[144]

Linuo Paradigma (China) was the 2020 market leader in both new projects and newly added SHIP capacity, reporting 22 projects totalling 58 MW_{th} in 2020.[145] High demand in China was triggered by government support policies to activate the economy, which helped industrial clients invest in SHIP plants.[146] Modulo Solar (Mexico) realised the second largest number of SHIP plants, with 13 new small systems that totalled 0.8 MW_{th}.[147] The second largest company for SHIP capacity in 2020 was SunEast Group (China), which reported the completion of five systems with a total of 8 MW_{th}.[148]

Project developer Kyotherm had to postpone (to 2021) the commissioning of its 10 MW_{th} SHIP plant at a malting factory in central France because of travel restrictions in Europe during the pandemic.[149] Similar restrictions affected other manufacturers, such as VSM Solar (India) and Absolicon (Sweden), which were unable to execute confirmed orders.[150] Although the number and capacity of new SHIP plants were down in 2020, the large number of delayed plants under contract fuels hope that the market will increase again in 2021.[151]

SOLAR THERMAL HEATING

1 Revised gross additions for 2019 included in this GSR (26.1 GW_{th}) are significantly lower than those published in GSR 2020 (31.3 GW_{th}) for two reasons: First, the Chinese Solar Thermal Industry Federation (CSTIF) adjusted downwards its number for China's new additions in 2019, from 22.75 GW_{th} (a preliminary figure, available as of early 2020) to 20 GW_{th}. Second, data for new additions in China are based on produced collector area, rather than on annual installations in China; as a result, export volumes have been included in China's national statistics for 2020 and earlier years. In past editions of the GSR, this has resulted in a double counting of some collector area because the majority of coated vacuum tubes installed worldwide are purchased from China. The one exception is Turkey, which imposed a high import tax on Chinese vacuum tubes in July 2011, resulting in high national vacuum tube production capacities that supply most of national demand. To correct the newly added solar thermal capacity in China, newly added vacuum tube collector capacities in large solar thermal markets outside of China and Turkey were subtracted from the produced collector volume in China for 2019 and 2020. The result has been a further reduction to the number for China's additions during 2019 (relative to data in GSR 2020). Because China dominated global gross additions in 2019 and 2020, downwards adjustments to China's additions also had a downwards effect on the data published for annual global sales (see endnote 5), from M. Spörk-Dür, AEE – Institute for Sustainable Technologies (AEE INTEC), Austria, personal communication with Renewable Energy Policy Network for the 21st Century (REN21), April 2020.

2 Increasing demand from residential customers during the pandemic was reported for India, Brazil and Turkey, from B. Epp, solrico, Bielefeld, Germany, personal communication with REN21, April 2021.

3 Changes to support policies increased demand significantly in Germany and the Netherlands in 2020, whereas the expiration of support policies in India, Poland and the United States resulted in strong declines in solar thermal capacity additions during the year, from Ibid.

4 Solarthermalworld.org reported on solar thermal sales activities in at least 134 countries worldwide during 2008-2020, from Ibid.

5 **Figure 31** based on the following sources: Global solar thermal capacity is based on the latest market data from the largest 20 solar thermal markets in terms of added capacity listed in order of their additions: China, Turkey, India, Brazil, United States, Germany, Australia, Mexico, Israel, Greece, Spain, Poland, South Africa, Italy, Netherlands, Cyprus, Austria, Morocco, Tunisia and Portugal, which represented 95% of cumulative installed capacity in operation in 2019. Added capacities in other countries for which new additions are available until 2019 (but not yet for 2020) were projected according to national trends over the 2018-2019 period. The rest of the world – meaning those countries without detailed solar thermal market information in 2019 and previous years – accounted for an estimated 5% of the global market volume excluding China in 2019 and 2020. Until 2018, the rest of the world was considered to be 5% of the global market including China, which overestimated its market share, from Spörk-Dür, op. cit. note 1; W. Weiss and M. Spörk-Dür, *Solar Heat Worldwide. Global Market Development and Trends in 2019, Detailed Market Figures 2018* (Gleisdorf, Austria: International Energy Agency (IEA) Solar Heating and Cooling Programme (SHC), 2020), http://www.iea-shc.org/solar-heatworldwide.

6 Spörk-Dür, op. cit. note 1. Equivalence of 407 terawatt-hours (TWh) and 239 million barrels of oil equivalent from Kyle's Converter, http://www.kylesconverter.com.

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9 The total installed capacity of air collectors declined to 1 GW_{th} at the end of 2020 (1.1 GW_{th} at the end of 2019) due to 0.05 GW_{th} of air collector technology that went out of operation in 2020 after a lifetime of 20 years, from Spörk-Dür, op. cit. note 1.

10 **Figure 32** based on the latest market data available for gross additions of glazed and unglazed water collectors (not including concentrating collectors), at the time of publication, for countries that together represent 96% of the world total. Data from original country sources include gross national additions and were provided to REN21 as follows: D. Ferrari, Sustainability Victoria, Melbourne, Australia; W. Weiss, AEE INTEC, Vienna, Austria; D. Johann, Brazilian Solar Thermal Energy Association (ABRASOL), São Paulo, Brazil; H. Cheng, Shandong SunVision Management Consulting, Dezhou, China (5% were subtracted from the Chinese additions reported by Cheng, because the figures included vacuum tube collectors that were manufactured in China and exported to other countries). The 5% subtracted represents the average share of China's produced vacuum tube collector area that was exported to other key markets in the years 2015 to 2019 (for countries where final new additions were available); P. Kastanias, Cyprus Union of Solar Thermal Industrialists (EBHEK), Nicosia, Cyprus; A. Liesen, BSW Solar, Berlin, Germany; C. Travasaros, Greek Solar Industry Association (EBHE), Piraeus, Greece; J. Malaviya, Solar Thermal Federation of India (STFI), Pune, India; E. Shilton, Elsol, Kohar-yair, Israel; F. Musazzi, ANIMA, the Federation of Italian Associations in the Mechanical and Engineering Industries, Milan, Italy; N. Jaeger, Holland Solar, Utrecht, Netherlands (preliminary estimation for the Netherlands, share of flat plate and vacuum tubes were applied as in 2019 – latest data available); T. Kousksou, University of Pau and the Pays de l'Adour, Pau, France (for Morocco; share of vacuum tube and flat plate collectors was not available); D. Garcia, Solar Thermal Manufacturers Organisation (FAMERAC), Mexico City, Mexico; P. Dias, Solar Heat Europe, Brussels, Belgium (for Portugal); J. Staroscik, Association of Manufacturers and Importers of Heating Appliances (SPIUG), Warsaw, Poland; K. Kritzinger, Centre for Renewable and Sustainable Energy Studies, University of Stellenbosch, Stellenbosch, South Africa; P. Polo, Spanish Solar Thermal Association (ASIT), Madrid, Spain; A. Baccouche, ANME, Tunis, Tunisia; K. Ülke, Bural Heating, Kayseri, Turkey; B. Heavner, California Solar & Storage Association (CALSSA), Sacramento, California, United States, all personal communications with REN21, February-April 2021.

11 Global additions from Spörk-Dür, op. cit. note 1. For country additions, see endnote 10.

12 Epp, op. cit. note 2.

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14 B. Epp, "China sees strong growth in demand for solar space heating", Solarthermalworld.org, 9 February 2021, https://www.solarthermalworld.org/news/demand-clean-space-heating-rebounds-germany.

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