

Background

The Solar Heat Worldwide report has been published annually since 2005 within the framework of the Solar Heating and Cooling Technology Collaboration Programme (SHC TCP) of the International Energy Agency (IEA).

The first edition of the report included data from 35 countries. The database has been extended to 68 countries over the past 15 years. In addition to the increased number of countries, also the degree of detail of the data was significantly improved.

The 2019 edition and all past issues of the report can be downloaded from the following website:

<http://www.iea-shc.org/solar-heat-worldwide>

The goal of the report is to give an overview of the general trends, to highlight special applications and outstanding projects and to document the solar thermal capacity installed in the important markets worldwide. Furthermore, it is the goal to ascertain the contribution of solar thermal systems to the supply of energy and the CO₂ emissions avoided as a result of operating these systems. The collectors documented in detail are unglazed collectors, glazed flat-plate collectors (FPC) and evacuated tube collectors (ETC) with water as the energy carrier as well as glazed and unglazed air collectors.

In this edition of Solar Heat Worldwide for the first time also hybrid Photovoltaic-Thermal (PVT) collectors are included, as PVT collectors got more market relevance in recent years.

PVT collectors convert in a single device solar radiation in electricity and heat and could thus play an important role in the energy supply of the future.

The data were collected from a survey of the national delegates of the SHC TCP Executive Committee and other national experts active in the field of solar thermal energy. As some of the 68 countries included in this report have very detailed statistics and others have only estimates from experts, the data was checked for its plausibility on the basis of various publications.

The collector area, also referenced as the installed capacity, served as the basis for estimating the contributions of solar thermal systems to the energy supply and reductions of CO₂ emissions.

The 68 countries included in this report represent 4.9 billion people, or about 66% of the world's population. The installed capacity in these countries is estimated to represent 95% of the solar thermal market worldwide.

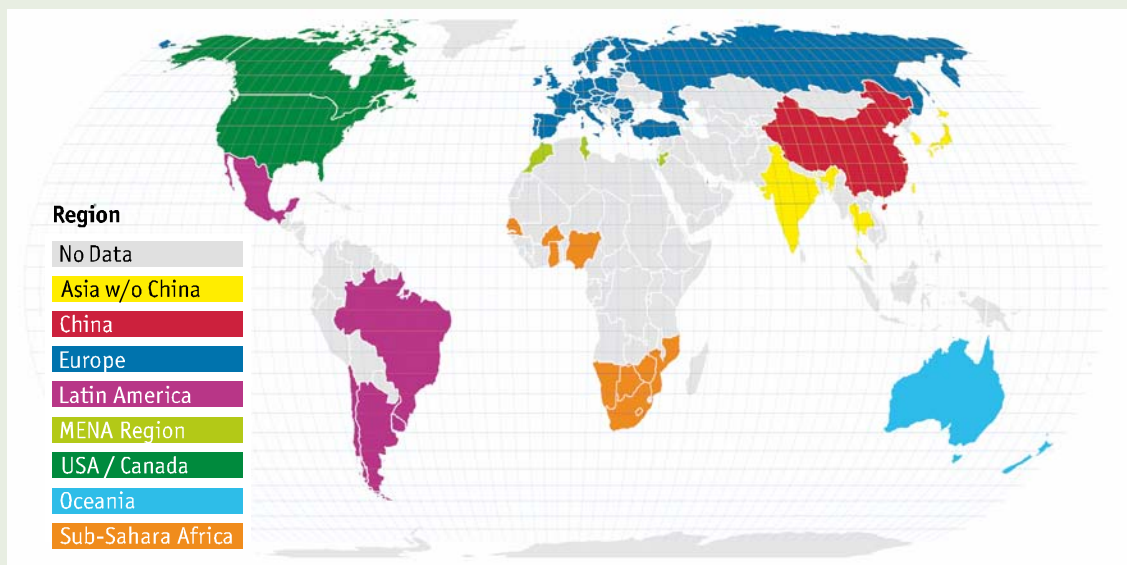


Figure 1: Countries shown in color have detailed market data. Countries shown in grey have estimated market data.

(Source: Natural Earth 2019 / AEE INTEC

<http://www.naturearthdata.com/downloads/10m-cultural-vectors/10m-admin-0-countries/>)

Summary

This report is split into two parts. The first part ([Chapters 3 - 4](#)) gives an overall overview of the global solar thermal market development in 2018. In addition, general trends are described and detailed 2018 data on successful applications, such as solar assisted district heating, solar heat for industrial processes and hybrid photovoltaic-thermal systems, are documented.

The second part ([Chapters 5 - 8](#)) presents detailed market figures for the year 2017 from 68 countries around the globe. The concluding chapter of the second part gives an overview of the levelized cost of solar heat for different applications.

Global solar thermal market developments and status in 2018

Although the global solar thermal market fell again by 3.9% in 2018, the significant slowdown in the market decline in some countries and the very positive growth figures in nine of the top 20 countries worldwide point to a turnaround in the market for solar thermal energy. If this trend continues, global market growth can again be expected in 2019.

The cumulated solar thermal capacity in operation by end of 2018 was 480 GW_{th} (686 million square meters). Compared to the year 2000 the installed capacity grew by a factor of 7.7.

The corresponding annual solar thermal energy yield in 2018 amounted to 396 TWh, which correlates to savings of 42.6 million tons of oil and 137.5 million tons of CO₂.

Despite these achievements, the global solar thermal market has faced challenging times in recent years. This is especially evident in the large markets in China and Europe where the traditional mass markets for small-scale solar water heating systems for single-family houses and apartment buildings are under market pressure from heat pumps and photovoltaic systems. The applications mentioned above still represent more than 90% of the worldwide annual installations, even if the number of megawatt-scale systems for district heating as well as for industrial applications are increasing from year to year.

By the end of 2018 about 339 large-scale solar thermal systems (>350 kW_{th}; 500 m²) connected to district heating networks and in residential buildings were in operation. The total installed capacity of these systems equaled 1,200 MW_{th} (1,747,200 m²), excluding concentrating systems that add 177,950 m². Denmark is still the leading European country for large-scale systems for district heating, adding 54% of the new installed collector area worldwide (excluding parabolic trough collectors). About 87% of the installed collector area for large scale systems added outside Europe in 2018 is installed in China.

In 2018, seventeen large-scale solar thermal systems with about 85,100 m² (60 MW_{th}) were installed in Europe. Of these installations in 2018, six are in Denmark (66,800 m²), six in Germany (9,380 m²), two in Austria (3,010 m²) and one in Turkey (4,575 m²).

Outside Europe, 27 MW_{th} (38,260 m²) were installed, excluding seven concentrating systems in China and two in Mexico respectively, that added a collector area of 20,490 m².

In China most of the installed systems for district heating have been installed in Tibet including the 2018 extension of an existing system with 9,000 m² parabolic trough collectors in Shenza and the second largest system installed for district heating in 2018 in Langkasi with a collector area of 22,275 m². In South Africa, the first solar district heating network was installed in 2018 with a collector area of 557 m². In Mexico, Denmark and China parabolic trough collector fields have been installed in the last few years for district heating (China and Denmark) as well as for large buildings (Mexico). These parabolic trough systems add to a total collector area of 177,950 m².

Solar heat for industrial processes (SHIP) continues to be a growing niche market worldwide. A number of promising projects have been implemented in the last couple of years ranging from small-scale demonstration plants to very large systems with 100 MW_{th} capacity. At least 741 SHIP systems, totaling 662,648 m² collector area (567 MW_{th}), were in operation at the end of the year 2018.

In 2018, suppliers of industrial solar heat technology commissioned 108 new systems. In 2017, 107 units with a collector area of 190,700 m² were installed. If the exceptionally large Miraah plant¹ (148,000 m², 100 MW_{th}) constructed in Oman in 2017 is excluded then the newly installed collector area of SHIP plants increased from 44,580 m² (31.2 MW_{th}) in 2017 to 53,654 m² (37.6 MW_{th}) in 2018.

Photovoltaic Thermal (PVT) collectors and systems have been included for the first time in this edition of the Solar Heat Worldwide report. This chapter takes a look at the PVT market worldwide with a special focus on Europe.

By the end of the year 2018 a cumulated PVT collector area of 1,075,247 m² was installed. In the European Market, France is the market leader with an installed collector area of 442,504 m² followed by Germany with 109,380 m². Outside of Europe the main PVT-manufacturer in Israel reported a cumulated manufactured collector area of 575,000 m² by the end of 2018.

Market status worldwide in 2017

By the end of 2017, an installed capacity of 473.5 GW_{th} corresponding to a total of 676 million square meters of collector area was in operation in the recorded 68 countries. These figures include unglazed water collectors, flat plate collectors, evacuated tube collectors, and unglazed and glazed air collectors.

The vast majority of the total capacity in operation was installed in China (334.5 GW_{th}) and Europe (54.3 GW_{th}), which together accounted for 82.1% of the total installed capacity. The remaining installed capacity was shared between the United States and Canada (18.9 GW_{th}), Asia excluding China (13.3 GW_{th}), Latin America (13.6 GW_{th}), the MENA² countries (Israel, Jordan, Lebanon, Morocco, the Palestinian Territories and Tunisia) (7.0 GW_{th}), Australia and New Zealand (6.7 GW_{th}), and Sub-Saharan African countries Botswana, Burkina Faso, Cape Verde, Ghana, Lesotho, Mauritius, Mozambique, Namibia, Senegal, South Africa and Zimbabwe (1.6 GW_{th}). The market volume in the 68 documented countries is estimated to account for 95% of the total installations.

With a global share of 71%, evacuated tube collectors were the predominant solar thermal collector technology followed by flat plate collectors with 22.6%, unglazed water collectors with 6.1% and glazed and unglazed air collectors with 0.3%.

The top 10 countries – those with the highest market penetration per capita – were China, the United States, Turkey, Germany, Brazil, India, Australia, Austria, Israel and Greece.

The leading countries in cumulated glazed and unglazed water collector capacity in operation in 2017 per 1,000 inhabitants were Barbados (540 kW_{th}/1,000 inhabitants), Cyprus (440 kW_{th}/1,000 inhabitants), Austria (413 kW_{th}/1,000 inhabitants), Israel (397 kW_{th}/1,000 inhabitants), Greece (300 kW_{th}/1,000 inhabitants), Australia (276 kW_{th}/1,000 inhabitants), the Palestinian Territories (269 kW_{th}/1,000 inhabitants), China (242 kW_{th}/1,000 inhabitants), Turkey (201 kW_{th}/1,000 inhabitants) and Denmark (199 kW_{th}/1,000 inhabitants).

Newly installed capacity worldwide in 2017

By the end of 2017 a capacity of 34.6 GW_{th}, corresponding to 49.5 million m² of solar collectors, was installed worldwide. This means a decrease in new collector installations of 5.1% compared to the year 2016. This downward trend, however, is less than the 13.6%

1 For details of this plant see the 2018 edition of Solar Heat Worldwide at <http://www.iea-shc.org/solar-heat-worldwide>

2 Middle East and North Africa

in the year 2015/16 and initial 2018 data show a continued slowing of this downward trend as markets rebound driven mainly by the growth in large-scale and solar process heat installations and the recovering market in China.

The main markets in 2017 were again China (26.1 GW_{th}) and Europe (2.8 GW_{th}), which together accounted for 83.3% of the overall new collector installations. The rest of the market was shared between Latin America (1.2 GW_{th}), Asia excluding China (1.2 GW_{th}), the United States and Canada (0.7 GW_{th}), the MENA countries (0.4 GW_{th}), Australia (0.4 GW_{th}), and the Sub-Sahara African countries (0.1 GW_{th}). The market volume of “all other countries” is estimated to amount for 5% of the new installations (1.7 GW_{th}).

Of the top 10 markets in 2017, positive market growth was reported from India, Australia, Israel and Mexico.

With a share of 71.8% of the newly installed capacity in 2017, evacuated tube collectors are still by far the most important solar thermal collector technology worldwide. In a global context, this breakdown is mainly driven by the dominance of the Chinese market where around 83.6% of all newly installed collectors in 2017 were evacuated tube collectors. Nevertheless, it is notable that the share of evacuated tube collectors decreased from about 82% in 2011 to 71.8% in 2017, and in the same time frame flat plate collectors increased the share from 14.7% to 23.7%.

In Europe, the situation is almost the opposite compared to China with 71% of all solar thermal systems installed in 2017 being flat plate collectors. In the medium-term, the share of flat plate collectors, however, has decreased from 81.5% in 2011 to 71.0% in 2017 due to growth of the evacuated tube collector markets in Turkey, Poland, Switzerland and Germany. Overall, the share of evacuated tube collectors in Europe increased the share in Europe from 15.6% in 2011 to 28% in 2017.

In terms of newly installed solar thermal capacity per 1,000 inhabitants in 2017, Israel took the lead followed by Cyprus, Barbados and Greece. China ranked fifth followed by Australia, Turkey, Austria, the Palestinian Territories and Switzerland.

Distribution by system type and application

The thermal use of the sun’s energy varies greatly from region to region and can be roughly distinguished by the type of solar thermal collector used, the type of system operation (pumped solar thermal systems, thermosiphon systems) and the main type of application (swimming pool heating, domestic hot water preparation, space heating, others such as heating of industrial processes, solar district heating and solar thermal cooling).

Worldwide, more than three quarters of all solar thermal systems installed are thermosiphon systems, and the rest are pumped solar heating systems. Similar to the distribution by type of solar thermal collector in total numbers, the Chinese market and Asia excluding China influenced the overall figures the most.

In general, thermosiphon systems are more common in warm climates, such as in Africa, South America, southern Europe and the MENA countries. In these regions thermosiphon systems are more often equipped with flat plate collectors, while in China the typical thermosiphon system for domestic hot water preparation is equipped with evacuated tubes.

The calculated number of water-based solar thermal systems in operation was approximately 118 million by the end of 2017. The breakdown is 63% used for domestic hot water preparation in single-family houses, 28% attached to larger domestic hot water systems for multifamily houses, hotels, hospitals, schools, etc., and 6% used for swimming pool heating. Around 2% of the worldwide installed capacity supplied heat for both domestic hot water and space heating (solar combi-systems). The remaining systems ac-



A 0.7 MW_{th} solar thermal system supplies heat to the Berlin district heating network.

Photo: Arcon-Sunmark

counted for around 1% and delivered heat to other applications, including district heating networks, industrial processes and thermally driven solar cooling applications.

Compared to the cumulated installed capacity, the share of swimming pool heating was less for new installations (6% of total capacity and 3% of newly installed capacity). A similar trend can be seen for several years now for domestic hot water systems in single-family homes: 63% of total capacity in operation and 44% of new installations in 2017 make this kind of system the most common application worldwide, but it is showing a decreasing trend.

By contrast, the share of large-scale domestic hot water applications is increasing (28% of total capacity and 51% of newly installed capacity). It can be assumed that this market segment took over some of the market shares from both swimming pool heating and domestic hot water systems in single-family homes.

The share of solar district heating and solar process heat applications is steadily increasing despite it still only representing 3% of the global market.

Employment and turnover

Based on a comprehensive literature survey and data collected from detailed country reports, the number of jobs in the fields of production, installation and maintenance of solar thermal systems is estimated to be 672,000 worldwide in 2017.³

The worldwide turnover of the solar thermal industry in 2017 is estimated at € 15.2 billion (US\$ 16.9 billion).

³ Background information on the methodology used can be found in the Appendix, [Chapter 9.4](#)