Solar Heat Worldwide
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Werner Weiss, Monika Spörk-Dür
AEE – Institute for Sustainable Technologies
Global solar thermal capacity in operation and annual energy yields 2000-2022

Figure 2: Global solar thermal capacity in operation and annual energy 2000-2022

- Orange: Global solar thermal capacity in operation [GWth]
- Blue: Global solar thermal energy yield [TWh]

115 million solar thermal systems installed worldwide
The worldwide market declined by 9.3% in 2022

Figure 3: Annual installed collector capacity and net additions

- Orange: Annually installed capacity of water collectors [GW_{th}]
- Blue: Water collectors NET additions [GW_{th}]
The decline is justified by a market slump in China of 12.4% and India saw a drop in their solar thermal market from 16% growth in 2021 to -21% in 2022.
145% market growth in Lebanon 2022

Countries with Largest Solar Thermal Market Growth in 2022

Figure 6: Reporting countries with the highest growth rates in 2022

* preliminary data based on Uniclima Report
Large-scale solar thermal heating systems

Photo: Absolicon Solar Collector AB, Sweden
By the end of 2022, 571 large-scale documented solar thermal systems (>350 kW_{th}, 500 m²) were in operation. The total installed capacity of these systems equaled 2,148 MW_{th}, corresponding to 3.1 million m² collector area.

Figure 8: Large-scale systems for solar district heating and large residential, commercial and public buildings worldwide – annual installations and cumulated area in operation in 2022


- Green: Cumulated collector area in operation in Europe [m²]
- Blue: Cumulated collector area in operation in China [m²]
- Pink: Cumulated collector area in operation "Other countries" [m²]
- Light green: Number of systems installed in Europe [-]
- Purple: Number of systems installed in China [-]

* Other countries:
  - MENA countries: Dubai, Jordan, Kuwait, Morocco, Saudi Arabia, Tunisia, UAE
  - Latin America: Brazil, Colombia, Mexico
  - Asia excl. China: Cambodia, Japan, Kyrgyzstan, India, Russia, South Korea, Thailand, Turkey
  - Plus: Australia, Canada, South Africa, USA
Figure 9: Large-scale systems for solar district heating – capacities and collector area installed and number of systems by the end of 2022

Data sources: Daniel Trier - PlanEnergi, DK, Jan-Olof Dalenbäck - Chalmers University of Technology, SE, Sabine Putz - IEA SHC Task 55, AT, Bärbel Epp - solrico.com, DE.

9 Usually, countries report single systems that are documented regarding project name, country and installed collector size. In 2021 and 2022 China reported total collector area and average system size for solar district heating systems.
Highlights
Solar District Heating 2020

China reported the installation of 171,068 m² collectors for district heating and 25 other large-scale systems, with an average of 6,945 m² per plant, corresponding to about 25 installed systems in 2022.

In Germany, eight systems were installed with a total collector area of 44,923 m², primarily for solar district heating systems.

2022 was a record year for solar district heating networks in Germany.

Figure 7: In Germany, 49 solar district heating networks with 146,204 m² in operation in March 2023
Source: Steinbeis Research Institute Solites
Solar district heating plant in Lemgo, Germany, consists of 9,181 m² vacuum tube collectors

Photo: Stadtwerke Lemgo GmbH / Viessmann
At least 1,089 SHIP systems\(^*)\) with 1.22 million m\(^2\) collector area related to a capacity of 856 MW\(_{th}\) are in operation worldwide.

It should be noted in addition to the number of SHIP plants reported, a larger number of SHIP plants have been built in China, but there is no detailed data available.

For 494 of the 1,089 systems detailed information is available in a SHIP database. This database is an online portal operated by AEE INTEC. Link: [http://ship-plants.info/](http://ship-plants.info/)

These 494 SHIP systems account for a total collector area of 1,071,706 m\(^2\) and a thermal capacity of 645 MW\(_{th}\). Only the data of these 494 SHIP systems are presented in the following figures.

\(^*)\text{Source: Solrico}\)
In 2022, at least 114 new SHIP systems*) with a capacity of 30 MWth were installed worldwide

*Source: Solrico

Photo: SOLID Solar Energy Systems, Austria
PVT - Photovoltaic-Thermal Systems

PVT system integrated into a flat roof of a detached house in Germany
Photo: EVO Deutschland GmbH
Figure 16: Distribution of the total installed collector area by economic region in 2022
Source: AEE INTEC
Global market development of PVT collectors 2017 - 2022

Figure 17: Global market development of PVT-collectors from 2017 to 2022
Source: AEE INTEC
PVT Market development in 2022

France -90%
Netherlands -43%

Italy +414% (2,568 m²)
Germany +126% (19,089 m²)
Switzerland +103% (4,840 m²)
Spain +52% (5,862 m²)
Distribution of newly installed PVT collector area worldwide by collector type

Figure 18: Distribution of newly installed PVT collector area worldwide by collector type in 2021 (left) 2022 (right)
Source: AEE INTEC
Outlook 2023 and beyond

Photo: ALT ENER PRO PTY LTD, South Africa
Increased demand in solar district heating

Solar thermal energy offers a cost-effective way to make urban district heating systems CO2 neutral. As shown by plants already installed, solar heat can be provided at costs between 20 and 50 €/MWh under favorable conditions. This is significantly lower than the prices end customers currently pay for district heating.
Increased demand is expected in solar district heating

**Germany**
Nine solar district systems representing (19.6 MW\textsubscript{th}) are under construction or in an advanced planning stage. Another 66 systems with a collector area of 454,550 m\textsuperscript{2} (318 MW\textsubscript{th}) are under concrete discussion.

**Netherlands**
A large-scale solar district heating system with 48,000 m\textsuperscript{2} (33.6 MW\textsubscript{th} capacity) will be completed in 2023 in the city of Groningen.

**Western Balkan** countries Serbia and Kosovo.
A solar plant with a 58,000 m\textsuperscript{2} collector area (40.6 MW\textsubscript{th} capacity) and a 408,000 m\textsuperscript{3} seasonal storage are planned for the district heating of Pristina, the capital city of Kosovo.
Two district heating plants are planned for Serbia. The feasibility study for a 35,000 m\textsuperscript{2} (24.5 MW\textsubscript{th} capacity) plant in the city of Pancevo is completed. And a solar district heating plant in the range of 45 to 136 MW\textsubscript{th} is planned for the city of Novi Sad in combination with a seasonal storage.
A new dimension is opening up in China

Handan Bay Water World Resort
The 114,000 m² (79.8 MW_{th}) parabolic trough collector system supplies the hotel’s HVAC and hot water systems, indoor swimming pool, and ice and snowmaking system for an indoor ski slope. Commissioning is scheduled for the end of the second quarter of 2023.
Positive outlook also for SHIP plants

The multi-MW plants in the EU currently under construction and whose commissioning is planned for 2023 promise a sevenfold increase*. These include the chemical site in Turnhout, Belgium, with 2.5 MWth capacity, and two systems at breweries in Spain with 28.5 MWth and 4 MWth, respectively.

A solar plant for a malting plant with 23,400 m² flat plate collectors in combination with a 5,000 m³ hot water storage tank is being implemented in Croatia with the support of the European Innovation Fund. Commissioning is

The first GW-scale SHIP plant
By far, the largest solar process heat plant is in the planning stage in Saudi Arabia.

1.5 GW th solar steam project for an alumina refinery
https://www.iea-shc.org/solar-heat-worldwide