Global industrial solar heat market: challenges, trends and outlook

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IEA SHC Solar Academy webinar June 2023
Annual surveys since 2017

Suppliers of Turnkey Solar Process Heat Systems

<table>
<thead>
<tr>
<th>Supplier Category</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar supplier without references</td>
<td>4</td>
</tr>
<tr>
<td>Solar supplier with collector production and</td>
<td>10</td>
</tr>
<tr>
<td>without references</td>
<td></td>
</tr>
<tr>
<td>Solar supplier with references</td>
<td>16</td>
</tr>
<tr>
<td>Solar supplier with collector production and</td>
<td>41</td>
</tr>
<tr>
<td>references</td>
<td></td>
</tr>
</tbody>
</table>

Surveys since 2022 thanks to the German research project Modulus

Varvara Lavillat

Find the most recent survey results here: https://solarthermalworld.org/modulus/

https://www.solar-payback.com/suppliers/
2022: more SHIP systems than ever

Number of SHIP projects commissioned per year

<table>
<thead>
<tr>
<th>Year</th>
<th>Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>107</td>
</tr>
<tr>
<td>2018</td>
<td>99</td>
</tr>
<tr>
<td>2019</td>
<td>86</td>
</tr>
<tr>
<td>2020</td>
<td>85</td>
</tr>
<tr>
<td>2021</td>
<td>71</td>
</tr>
<tr>
<td>2022</td>
<td>114</td>
</tr>
</tbody>
</table>

Source: annual SHIP surveys since 2017
Diversity of SHIP systems in growing

Distribution of collector type area in the SHIP World market 2022
[30 MW in total]

Only seven SHIP plants among 114 with operating temperatures above 100 °C
### Diversity of SHIP systems in growing

<table>
<thead>
<tr>
<th>SECTOR</th>
<th>LOW</th>
<th>MEDIUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>• Greenhouse heating</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Drying</td>
<td></td>
</tr>
<tr>
<td>Buildings</td>
<td>• Space heating</td>
<td>• Cooking</td>
</tr>
<tr>
<td></td>
<td>• Showering</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Cleaning</td>
<td></td>
</tr>
<tr>
<td>District heating</td>
<td>• Feeding into new, forth generation heat networks</td>
<td></td>
</tr>
<tr>
<td>Industry</td>
<td>• Feeding into existing heat networks</td>
<td>• Distilling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pulping</td>
</tr>
<tr>
<td>Collector Type</td>
<td>• Washing</td>
<td>• Boiling</td>
</tr>
<tr>
<td></td>
<td>• Heat treatment</td>
<td>• Pasteurising</td>
</tr>
<tr>
<td></td>
<td>• Drying</td>
<td>• Bleaching</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Dyeing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Sterilising</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Nitrate melting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Drying of paint</td>
</tr>
</tbody>
</table>

Collector Type
- Air Collector
- Flat plate Evacuated flat plate
- Vacuum tube CPC
- Small parabolic trough/linear Fresnel without evacuated receiver
- Concentrating dish
- Large parabolic trough/linear Fresnel with evacuated receiver
Gas shortage in Europe and peaking energy prices in 2022

Good funding situation in some European markets (Austria, France, Netherlands, Germany, Spain) and United States

Commitment of multinational cooperations to reduce their carbon footprint of production (Heineken, Asahi, Carlsberg, Mayr-Melnhof Graphia, Pepsico, Boortmalt)

Emission Trading System within Europe and national carbon pricing mechanisms

European supply chain due diligence law (in force since January 2023)
Mood on the SHIP market 2022

Do you agree with the following statements regarding trends in the global SHIP market?

- Peaking energy prices in 2022 have triggered demand for SHIP
- Public financial support is still an important requirement for selling SHIP

High interest but slow decision making

Only 22% of the listed SHIP Turnkey suppliers were satisfied with the business development in 2022
Highlights from 2023

Photos: Aura, Muni Seva Ashram, Azteq

New Heat’s 10.5 MW SHIP plant in France almost finalised ....
A look into the future

Funding from Natural Resources Canada…

Source: Istock
21 project developers contributed contracted projects and projects under planning:

- Austria: Alexe Simona- greenXcloud, Heliovis, Solid Solar Energy Systems
- Belgium: Azteq
- Canada Rackam
- France: New Heat
- Germany: Industrial Solar, Protarget
- India: Quadsun
- Israel: Tigi
- Mexico: Flemming Jørgensen, Inventive Power, Modulo Solar
- Netherlands: G2Energy, Solho
- Spain: Solatom, Tecnosol
- Sweden: Absolicon
- Switzerland: TVP Solar
- USA: Glasspoint, Solar Dynamics
51 projects were reported with different status of planning

<table>
<thead>
<tr>
<th>STATUS</th>
<th>Realisation potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signed LOI</td>
<td>30%</td>
</tr>
<tr>
<td>Signed MOU</td>
<td>30%</td>
</tr>
<tr>
<td>Ordered engineering study</td>
<td>60%</td>
</tr>
<tr>
<td>Submitted application for subsidies</td>
<td>60%</td>
</tr>
<tr>
<td>Approved subsidy / financing</td>
<td>60%</td>
</tr>
<tr>
<td>Signed EPC contract for collector field</td>
<td>100%</td>
</tr>
<tr>
<td>Signed heat delivery contract</td>
<td>100%</td>
</tr>
<tr>
<td>Construction started</td>
<td>100%</td>
</tr>
<tr>
<td>First heat to client delivered</td>
<td>100%</td>
</tr>
</tbody>
</table>
Solar Industrial Heat Outlook 2023-2026

Cumulated SHIP capacity in MW
Forecast for cumulated SHIP capacity in MW
Capacity additions to SHIP plant in Oman in MW
Annual SHIP capacity additions in MW

Source: annual industry surveys between 2016 and 2023
SHIP = Solar Heat for Industrial Processes
*2023: Contractually secured projects where the first heat is to be delivered in 2023
**2024-2026: Project capacities are weighted according to their probability of realisation
The conversion factor of 0.7 kW/m² aperture area is used for most projects.
Projects in China are not considered in this chart.
Solar Industrial Heat Outlook

- 2016: 291 MW
- 2019: 652 MW
- Forecast: more than doubling of capacity
- 2023 onward: 1,695 MW

Doubling of capacity
Concentrating collectors are on the rise

Heat delivery contracts dominate the future SHIP market

Source: annual industry surveys between 2016 and 2023 without projects in China
*2024-2026: project capacities are are weighted according to their probability of realisation
Concentrating collectors are on the rise

Heat delivery contracts dominate the future SHIP market

Source: annual industry surveys between 2016 and 2023 without projects in China
*2024-2026: project capacities are are weighted according to their probability of realisation
Location of announced weighted SHIP capacity for 2023 onward
[Total 374.7 MW]

- India: 6.9 MW
- Europe (including Turkey): 149.9 MW
- USA: 63.6 MW
- Arabic countries: 151 MW
- Mexico: 3.3 MW
72 turnkey SHIP suppliers are currently depicted on the world map

74 % of the listed companies produce collectors in-house or on-site

Status: April 2023; Source: Modulus / solrico
Turnkey suppliers with more than 10 reference projects at the end of 2022

Status: April 2023; Source: Modulus / solrico

1. Módulo Solar
   - Mexico
   - 132

2. SolarEast Group
   - China
   - 93

3. Linuo Paradigma
   - China
   - 75

4. G2 Energy
   - Netherlands
   - 74

5. Inventive Power
   - Mexico
   - 72

6. Vicot Solar Technology
   - China
   - 30

7. Ritter XL Solar
   - Germany
   - 29

8. Millennium Energy Industries
   - Jordan
   - 23

9. Solitem
   - Germany
   - 21

10. Sunoptimo
    - Belgium
    - 20

11. Cona Solar
    - Austria
    - 20

    - Austria
    - 17

13. Next Source
    - Netherlands
    - 17

14. Sunda
    - China
    - 16

15. Himin
    - China
    - 15

16. Casolar
    - Mexico
    - 14

17. Tigi
    - Israel
    - 10

18. Sunnergy
    - Mexico
    - 10
Industry hubs in Mexico USA and Europe

A wide-spread industry: location of the 72 SHIP suppliers listed on the world map in 2023.
News articles about the most recent SHIP Supplier Surveys: https://solarthermalworld.org/modulus/

Check out the SHIP Supplier World map: http://www.solar-payback.com/suppliers/

Use photos of SHIP plants for your presentations: https://www.solar-payback.com/gallery/gallone_en.php

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And further questions and comments to: Bärbel Epp: epp@solrico.com