Investment Opportunities in Solar Heat for Industry (SHIP)

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MOMENTUM
Fast growing demand

120 SHIP systems (2012)

> 500 SHIP systems (2016)

Large investments

Satisfied investors

**USD 350,000 for Tannery in Vietnam**
“Our customers are increasingly looking for eco-friendly suppliers”

*Tom Schneider, Co-founder ISA TanTec*

**USD 221,600 for body and hair production in Mexico**
“The solar water preheating system increased the efficiency of our emulsion production by 40% by reducing production time in our core process.”

*Luis Martinez Lavin, CEO, Industrias Lavín de México*

Photos: ISA TanTec / Industrias Lavín de México
27.5 MW Heat for Copper Mine in Chile

“Consistent solar heat temperatures increased copper cathode quality”

Ian Nelson, General Manager of Pampa Elvira Solar (operator of the plant)

Photos: Pampa Elvira Solar
Large investments

USD 600 million for enhanced oil recovery

The construction of Miraah in Oman is ahead of schedule and under budget

Katie Struble, Marketing Director at Glasspoint, USA
Cost of kilowatt hour heat in MXN/kWh (15 years lifetime)

- Diesel boiler: 2.2
- LPG boiler: 1.8
- Power trough: 0.32

Source/Photo: Inventive Power
Growing number of turnkey system / solar heat suppliers

- 29 suppliers are ready-to-offer (startups or enlarging portfolio)
- 24 companies offer heat supply contracts
- 42 produce inhouse-collectors


IEA SHC Solar Academy
Growing number of turnkey system / solar heat suppliers

SHIP industry hub in China, Mexico, India and Germany

| Turnkey suppliers that sold SHIP systems with a total of more than 10,000 m² |
|---------------------------------|---------------------------------|---------------------------------|---------------------|
| Sunrain Group                   | S.O.L.I.D.                       | Solitern Group                  | Denmark             |
| China                            | Chile                            | Germany                           | Aalborg CSP         |
| Inventive Power Mexico          | Pampa Elvira Solar                | India                             | India               |
| Mexico                           |                                 | Inter Solar Systems              | Inter Solar Systems |
| Modulo Solar Mexico             |                                 | Sunda Solar Energy Technology,   | China               |
| Germany                          |                                 | China                             | Sunrain Group       |
| Ritter XL Solar Germany         |                                 | Solitern Group                    | Vicot Solar Technology |
| Linuo Paradigma China           |                                 | Germany                           | Himin Solar         |
|                                 |                                 |                                   | Linuo Paradigma     |
| Millennium Energy Industries,   |                                 |                                   |                     |
| Jordan                           |                                 |                                   |                     |
| Vicot Solar Technology China    |                                 |                                   |                     |
| Inter Solar Systems India       |                                 |                                   |                     |
| SEA Sistemas de Ecotecnias      |                                 |                                   |                     |
| Ambientales, Mexico             |                                 |                                   |                     |
| Sunda Solar Energy Technology,  |                                 |                                   |                     |
| China                            |                                 |                                   |                     |
| Solitern Group                  |                                 |                                   |                     |
| Germany                          |                                 |                                   |                     |
| Taylormade Solar Solutions,     |                                 |                                   |                     |
| India                            |                                 |                                   |                     |
| Megawatt Solutions India        |                                 |                                   |                     |
| Aschoff Solar Germany           |                                 |                                   |                     |
| Germany                          |                                 |                                   |                     |
| Industrial Solar Germany        |                                 |                                   |                     |

Growing number of turnkey system / solar heat suppliers

New strategic partnerships

Sunrain & Arcon-Sunmark

Greenonetec & Haier

CSP Aalborg & SaltX Technology

Photos: Arcon-Sunmark, Greenonetec
Huge potential

GROWTH PATH FOR SHIP UP TO 200 °C

ECONOMICALLY REALISABLE POTENTIAL GLOBALLY

1,300 million m²
(≈ 2.2 EJ)

800 million m²

400,000 m²

2016

2030

0.001 Exajoule

Depends on development of energy prices

IRENA REMAP 2013
### 44 EJ heat demand globally up to 400 °C

<table>
<thead>
<tr>
<th>INDUSTRY</th>
<th>LOW below 150 °C</th>
<th>MEDIUM 150 to 400 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical</td>
<td>3.1 EJ</td>
<td>4.0 EJ</td>
</tr>
<tr>
<td>Food and beverage</td>
<td>3.3 EJ</td>
<td>2.2 EJ</td>
</tr>
<tr>
<td>Machinery</td>
<td>1.5 EJ</td>
<td>0.6 EJ</td>
</tr>
<tr>
<td>Mining</td>
<td>1.1 EJ</td>
<td>0.7 EJ</td>
</tr>
<tr>
<td>Textile</td>
<td>0.4 EJ</td>
<td>0.9 EJ</td>
</tr>
<tr>
<td>Wood</td>
<td>0.4 EJ</td>
<td>0.2 EJ</td>
</tr>
</tbody>
</table>

IEA / IRENA
Status 2014
Low: below 150 °C
Medium: 150 to 400 °C

Huge potential
Momentum of SHIP: a summary

- Fast growing sector: tripling of SHIP systems since 2012
- Large investment: business cases around the world
- Growing number of specialised turnkey solar process heat/system suppliers
- Huge potential: 0.001% of the industrial heat demand up to 400 °C is delivered by solar
BUT
Great efforts are needed

Vicious circle of low deployment rates

- High upfront investment costs plus low energy prices
- Long payback periods
- Little visibility of existing systems
- Low awareness

Small number of plants
Great efforts are needed

**Asking turnkey SHIP Suppliers**

- **54%** mention difficulties with securing funds as one of the main retarding factors.
- **63%** believe that huge efforts are needed to make solar process heat projects bankable.
- **79%** see heat supply contracts / ESCO models as an important means to increase deployment.
Great efforts are needed

Three ways to break the vicious circle

Greatly step up communication efforts to raise awareness of SHIP among potential customers in industry.

Support financing models (e.g. ESCO) to reduce risks and initial costs to small and medium industrial investors.

Implement measures for raising energy prices (e.g. carbon tax) or stipulating a renewable quota in certain industries.
Learn More

Download the brochure (English, Spanish, Portuguese) and the world map from www.solrico.com → solar payback
and after 1 August from www.solar-payback.com
Thanks for your attention!

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