

Investment Opportunities in Solar Heat for Industry (SHIP)

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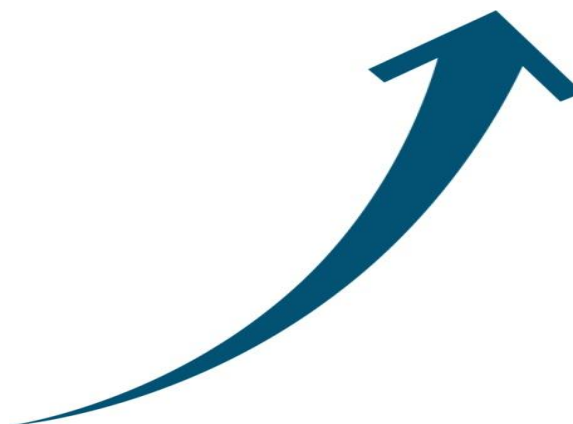
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MOMENTUM

**Fast
growing
demand**

**120 SHIP
systems (2012)**

**> 500 SHIP
systems (2016)**



Source: World map survey Nov/Dec 2016

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

USD 600 million for enhanced oil recovery

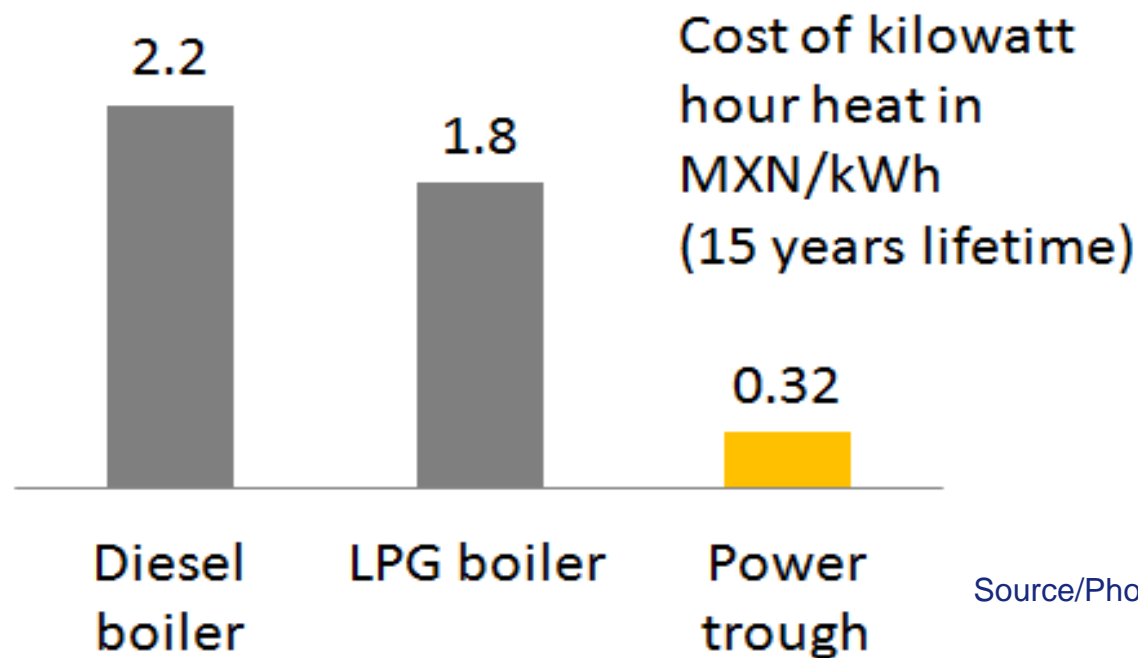


Photos: Glasspoint



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

Katie Struble, Marketing Director at Glasspoint, USA



Source/Photo: Inventive Power

71 suppliers of turnkey solar process heat systems in 22 countries

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Sources: Data from manufacturers, November/December 2016 survey

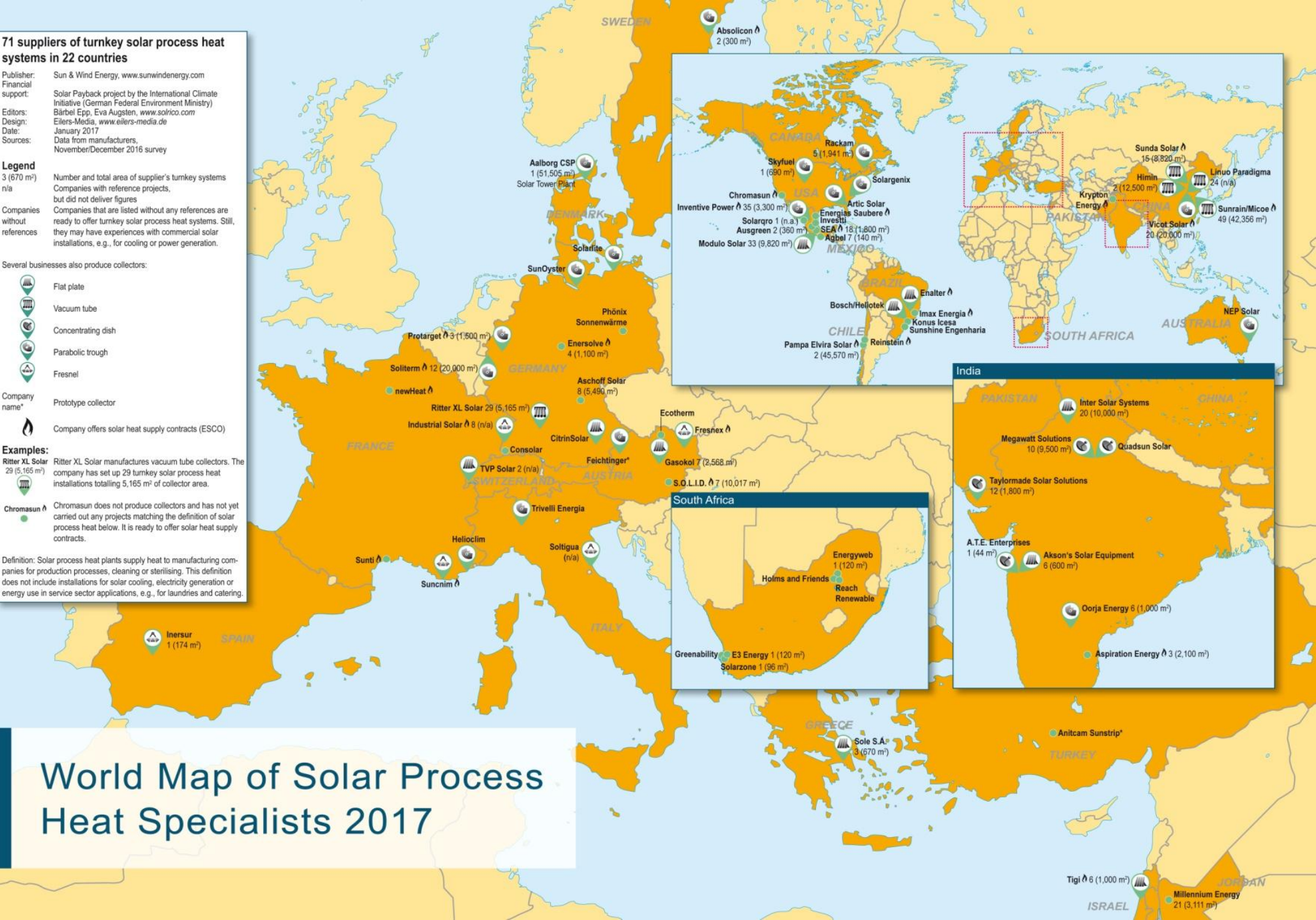
Legend
3 (670 m²)
n/a
Number and total area of supplier's turnkey systems
Companies with reference projects, but did not deliver figures
Companies that are listed without any references are ready to offer turnkey solar process heat systems. Still, they may have experiences with commercial solar installations, e.g., for cooling or power generation.

- Several businesses also produce collectors:
- Flat plate
 - Vacuum tube
 - Concentrating dish
 - Parabolic trough
 - Fresnel
- Company name*
 Company offers solar heat supply contracts (ESCO)

Examples:
Ritter XL Solar 29 (5,165 m²)
The company has set up 29 turnkey solar process heat installations totalling 5,165 m² of collector area.

Chromasun Chromasun does not produce collectors and has not yet carried out any projects matching the definition of solar process heat below. It is ready to offer solar heat supply contracts.

Definition: Solar process heat plants supply heat to manufacturing companies for production processes, cleaning or sterilising. This definition does not include installations for solar cooling, electricity generation or energy use in service sector applications, e.g., for laundries and catering.

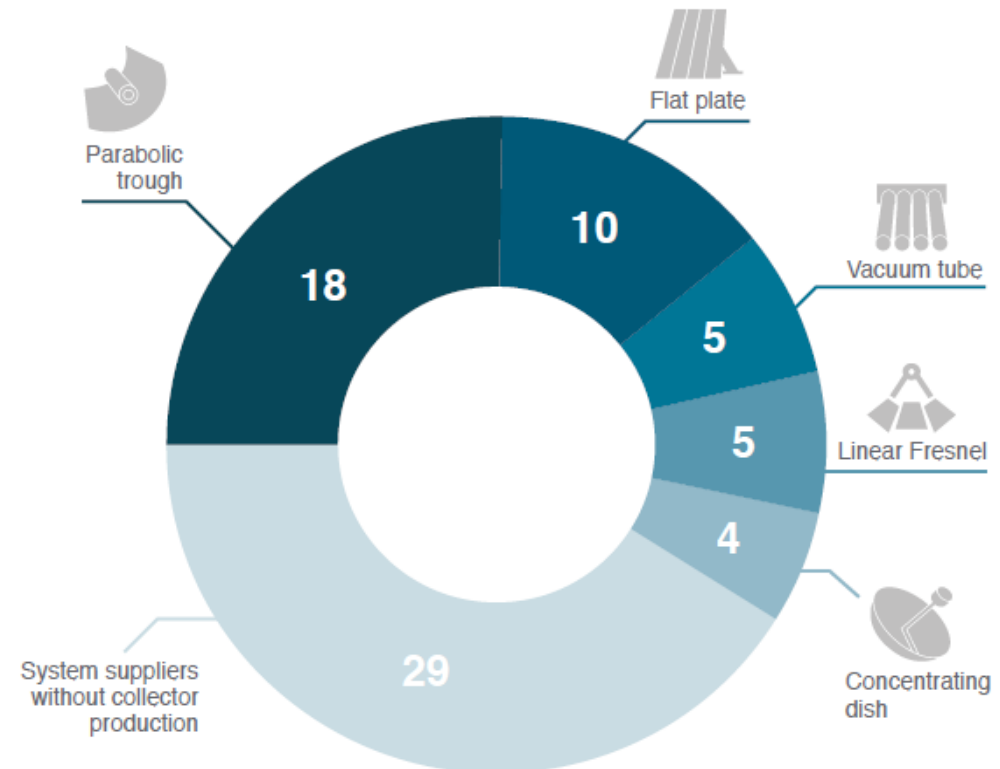


World Map of Solar Process Heat Specialists 2017

29 suppliers are ready-to-offer (startups or enlarging portfolio)

24 companies offer heat supply contracts

42 produce inhouse-collectors



Source: World map survey Nov/Dec 2016

49	Sunrain Group China
35	Inventive Power Mexico
33	Modulo Solar Mexico
29	Ritter XL Solar Germany
24	Linuo Paradigma China
21	Millennium Energy Industries, Jordan
20	Vicot Solar Technology China
20	Inter Solar Systems India
18	SEA Sistemas de Ecotecnias Ambientales, Mexico
15	Sunda Solar Energy Technology, China
12	Soliterm Group Germany
12	Taylormade Solar Solutions, India
10	Megawatt Solutions India
8	Aschoff Solar Germany
8	Industrial Solar Germany

SHIP industry hub in China, Mexico, India and Germany

Austria
S.O.L.I.D.

Chile
Pampa Elvira Solar

China
Sunrain Group
Vicot Solar Technology
Himin Solar
Linuo Paradigma

Turnkey
suppliers that
sold SHIP
systems with
a total of
more than
10,000 m²

Denmark
Aalborg CSP

India
Inter Solar Systems

Germany
Soliterm Group

Source: World map survey Nov/Dec 2016

New strategic partnerships



Sunrain & Arcon-Sunmark

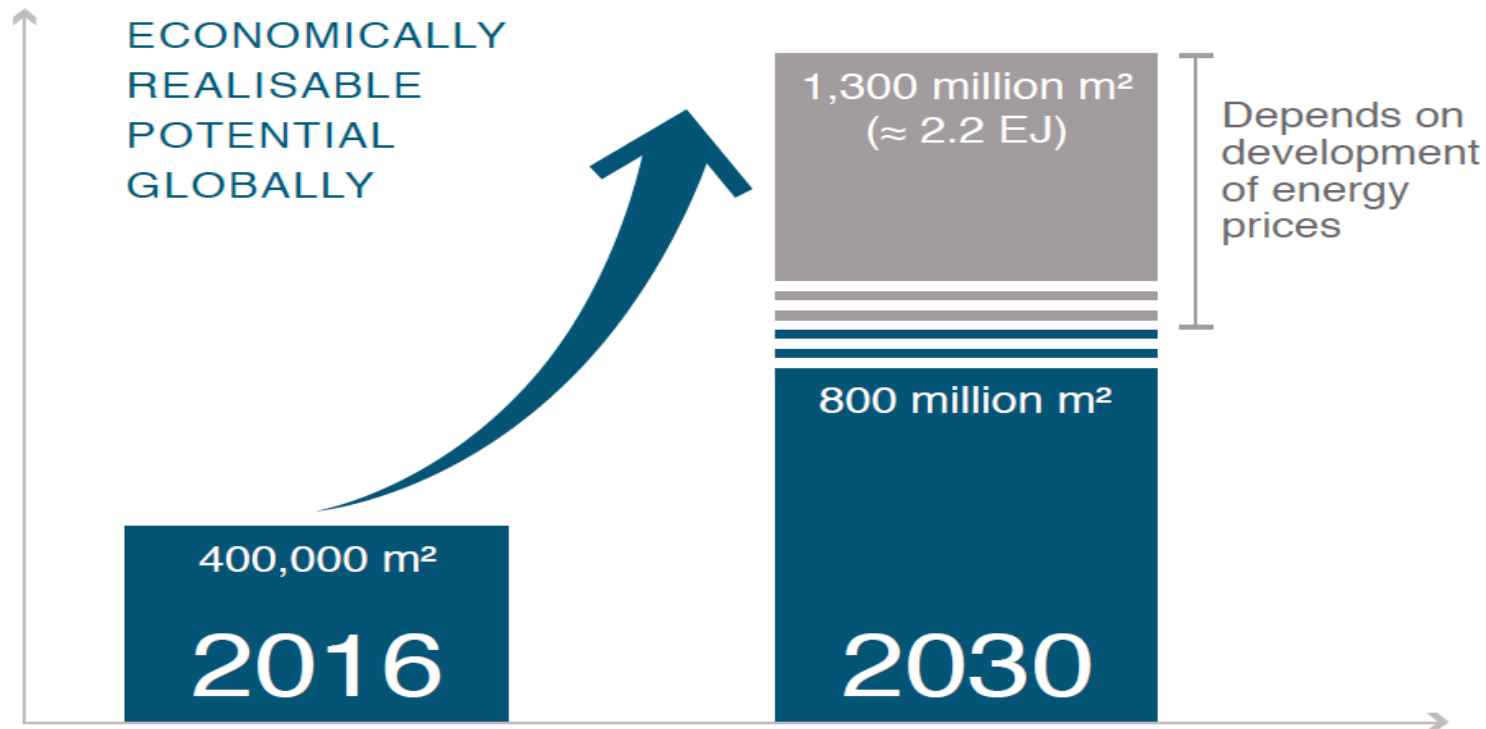
Greenonetec & Haier



CSP Aalborg & SaltX Technology

Photos: Arcon-Sunmark, Greenonetec

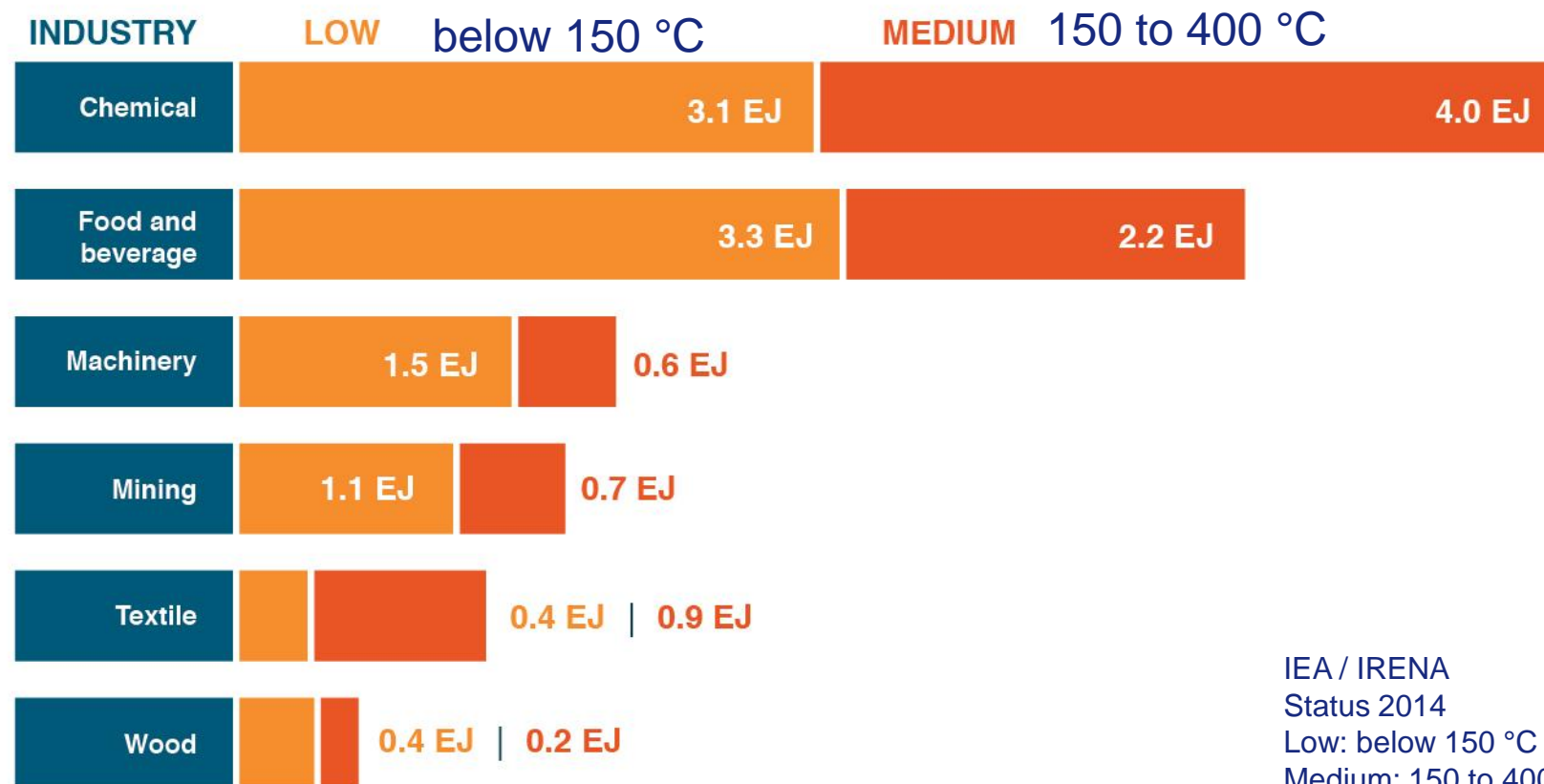
GROWTH PATH FOR SHIP UP TO 200 °C



0.001 Exajoule

IRENA REMAP 2013

44 EJ heat demand globally up to 400 °C



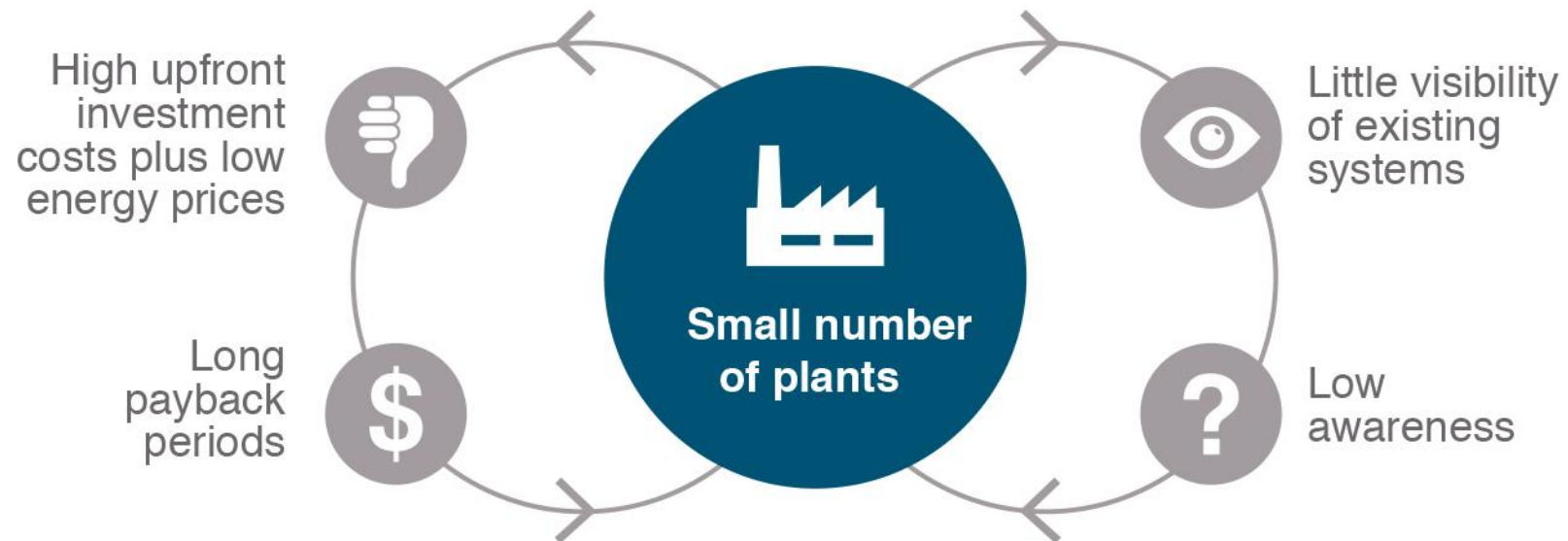
IEA / IRENA
 Status 2014
 Low: below 150 °C
 Medium: 150 to 400 °C

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

Vicious circle of low deployment rates



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

Three ways to break the vicious circle



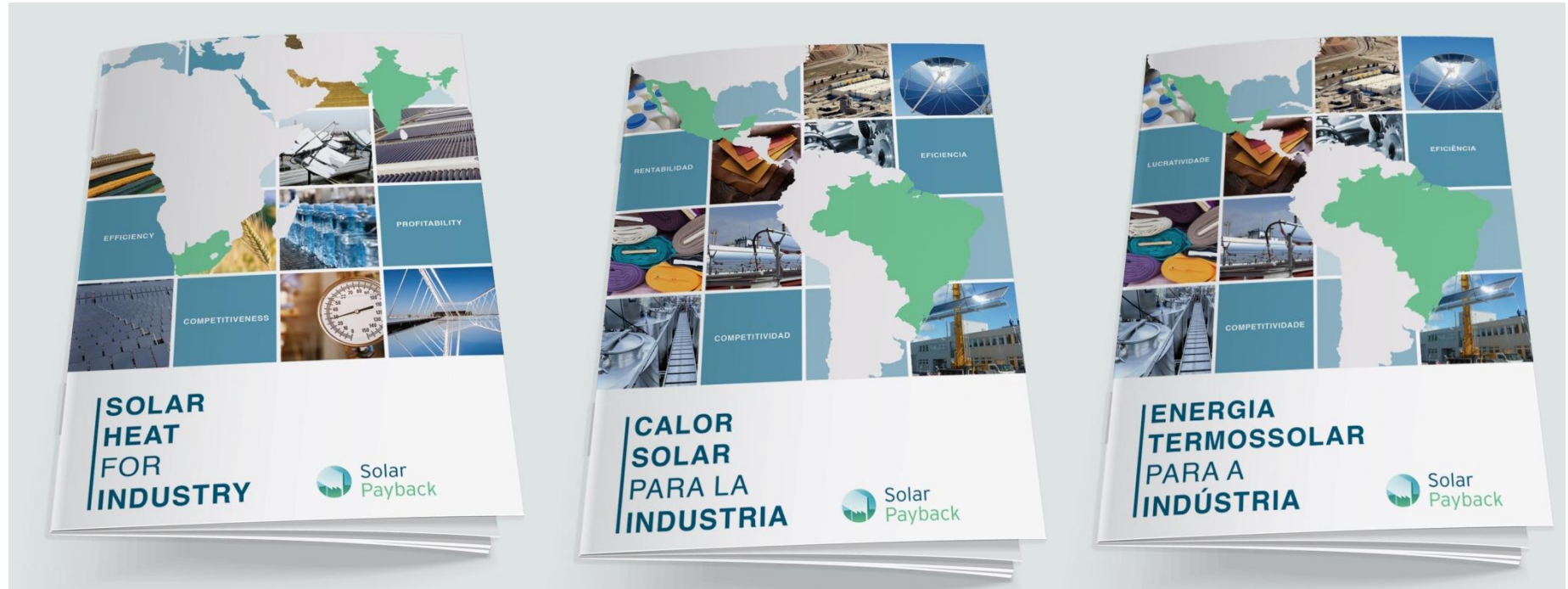
Greatly step up communication efforts to raise awareness of SHIP among potential customers in industry.



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.



Download the brochure (English, Spanish, Portuguese) and the world map from www.solirico.com —→ solar payback and after 1 August from www.solar-payback.com



Thanks for your attention!

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