



Solar
Payback



Accelerating Deployment of Solar Heat for Industrial Process (SHIP)

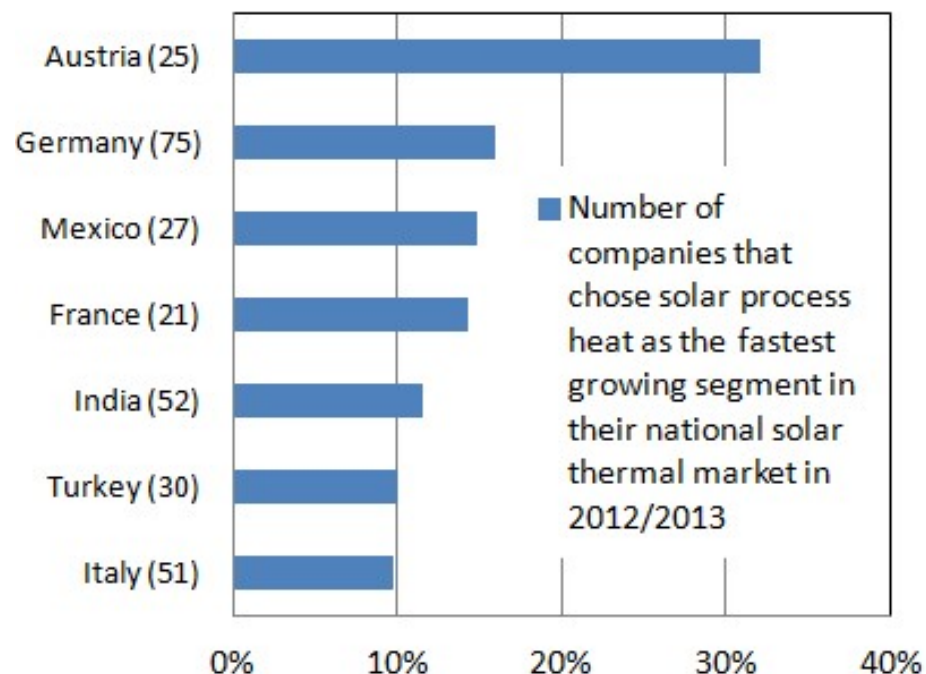
- **Jaideep N. Malaviya**
(Secretary General)
Solar Thermal Federation of India

Key Global Figures of Solar Heating and Cooling (2017)

Total capacity in operation	472 GW _{th}
Growth in total capacity to previous year	4%
Energy Saved	388 TWh energy saved
Climate protection contribution in 2017	41.7 million tons of OIL & 134.7 million tons of CO ₂
Top five countries	China, Turkey, Brazil, India , and United States
(source, Sun & Wind Energy)	

Fastest growing SHIP Countries

- A survey undertaken by Global Solar Thermal Energy Council places **INDIA** as 5th fastest growing solar heat for industrial process (SHIP) and **THE ONLY ONE IN ASIA**

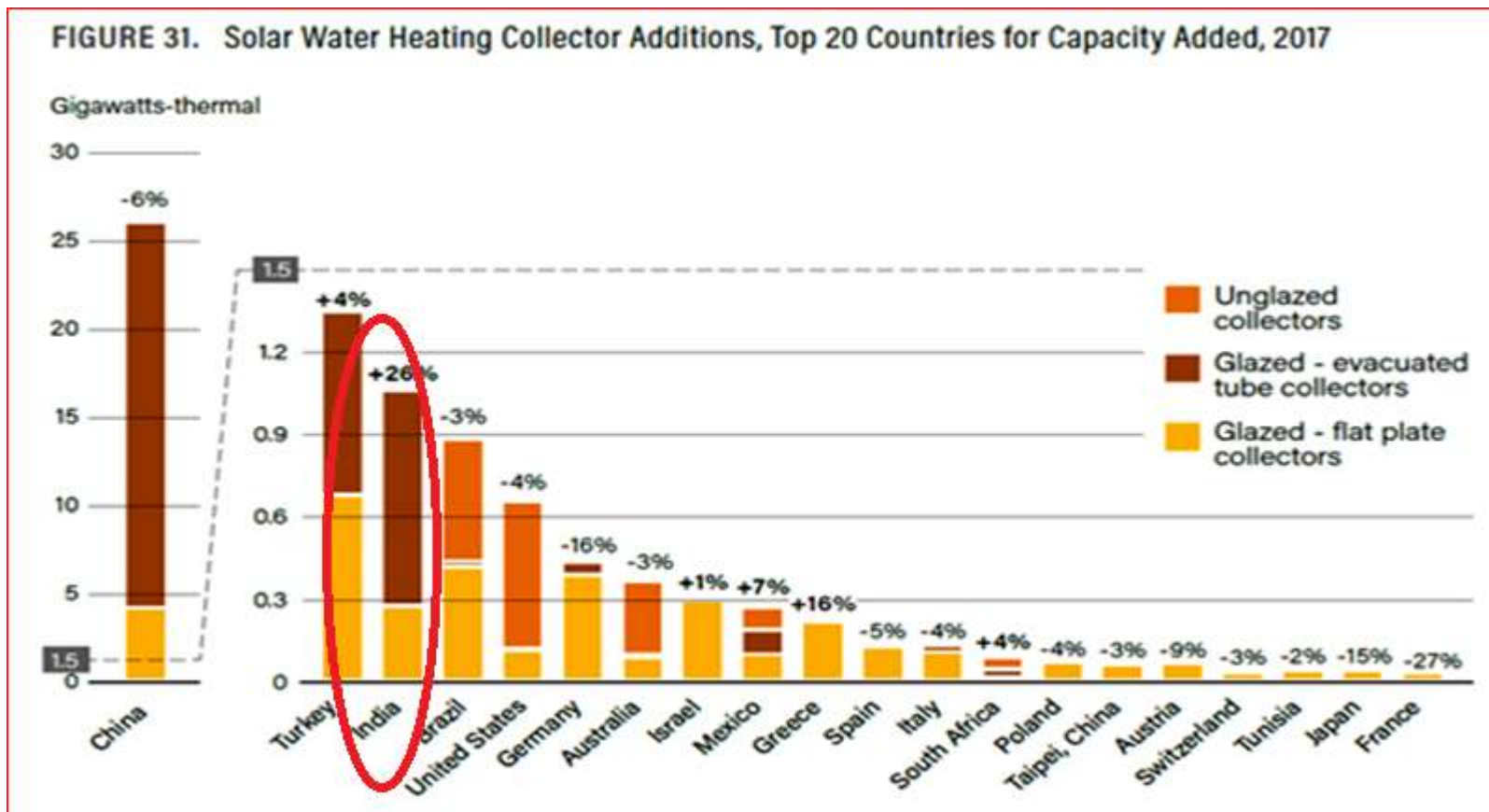


4

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India 4th Largest Global Solar Thermal Market



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Achievements in solar thermal heating

- Close to 17,93,626 m² collector area in place
- Amongst the top 5 leading countries in terms of installed capacity
- **ONLY COUNTRY IN THE WORLD WITH HIGHEST STEAM COOKING SYSTEMS**
- **ONLY COUNTRY WITH WIDE APPLICATIONS FOR HIGH TEMPERATURE SOLAR HEAT i.e. Process Heat and Cooking**
- Of the top ten companies supplying solar process heating plants, two are parabolic dish suppliers from India.

6

Industrial Process Heat Overview

- ❑ Industrial sector consumes 38% of total energy
- ❑ 15 million tones fuel oil/year for heat up to 250 °C alone in industries & 5,000 trillion kWh of electricity for heating
- ❑ About 20,500 MW of power generated through diesel generator sets for space cooling/refrigeration
- ❑ India has reasonably good DNI in several areas, and solar thermal systems that work at efficiencies 50-70% viable
- ❑ Target to reduce burden on foreign exchange for importing fuel
- ❑ Need to accelerate the growth of SHIP and commercial establishments by removing barriers & develop market through required measures

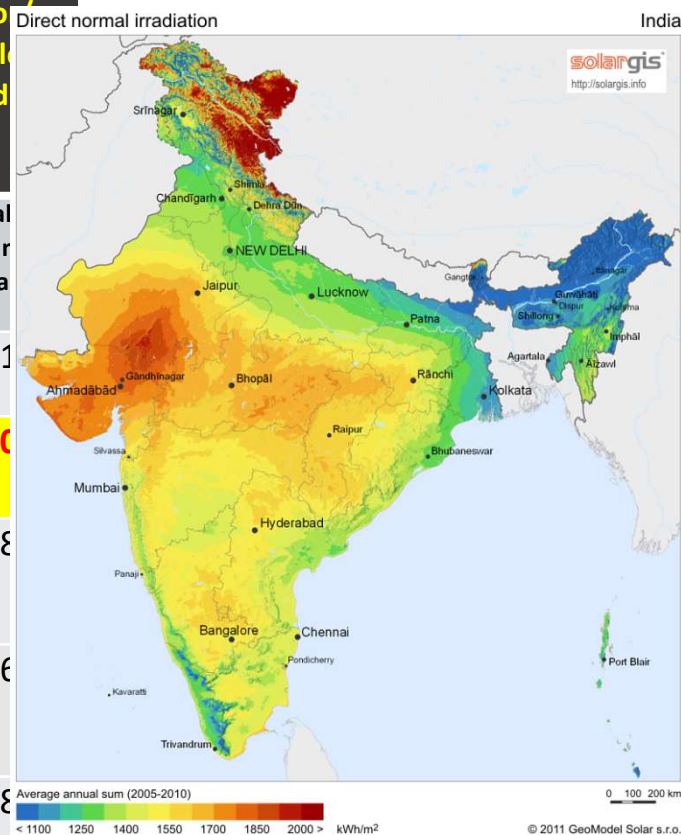
7

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Industrial Process Heat Overview and Direct Normal Incidence (DNI) Map

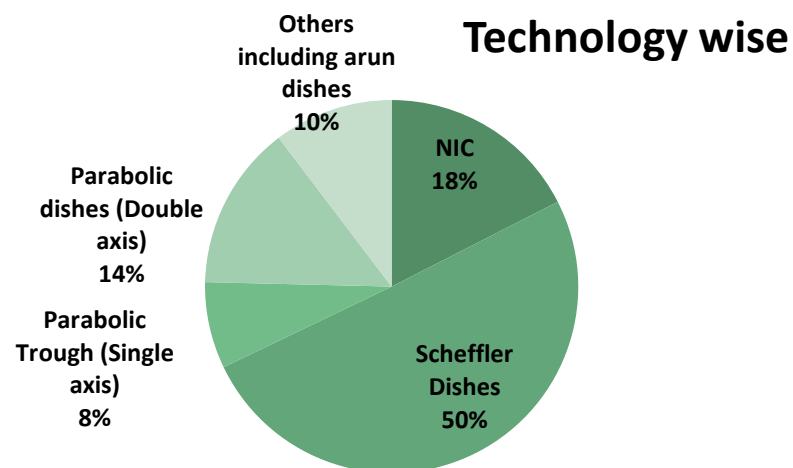
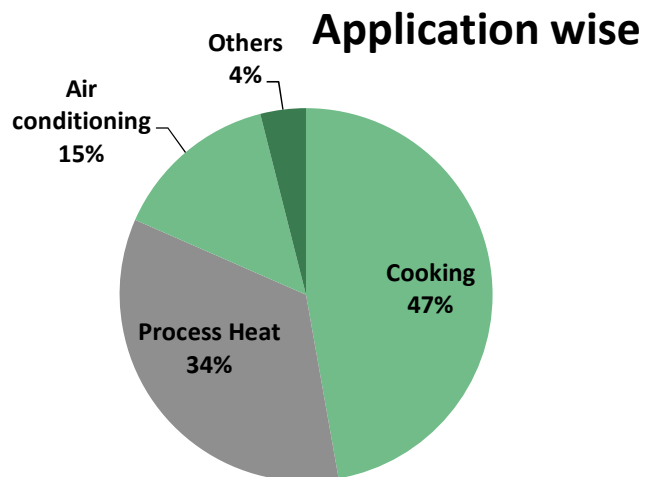
Region	Indicative avg DNI/ m ² /day (In kWh)	Fixed focus elliptical dish/ Non evacuated heat receiver PTC	Evacuated heat receiver PTC/ LFTR	Fresnel reflector/ Parabolic based d
		Annual Heat delivery million kCal	Annual Heat delivery million kCal	Annual delivery r kCal
Leh Ladakh	6.5	0.63	0.72	0.11
Gujarat Rajasthan & western M.P.	6.0	0.62	0.70	0.10
North- West including Himalayas	4.5	0.34	0.39	0.58
North – East & eastern part of Orissa & A. P.	4.0	0.34	0.39	0.56
Southern & Central	5.0	0.49	0.54	0.78



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Solar Concentrator Process Heat & Cooking Systems

No. of Projects (until March 2019)	Cumulative Size of Installation (m ²)	Total installation in MW _{th} equivalent
244	65,436.12	43.62



Industries needing process heat upto 300°C

Food processing & Dairy	Pharmaceutical
Breweries	Textiles(Spinning & weaving, Finishing)
Rubber	Chemicals & Fertilizers
Pulp & paper	Refining
Tobacco	Ceramic tile & pottery
Electroplating	Desalination
Pharmaceutical	Plaster of Paris
Steel re-rolling	Cement
	Mining

10

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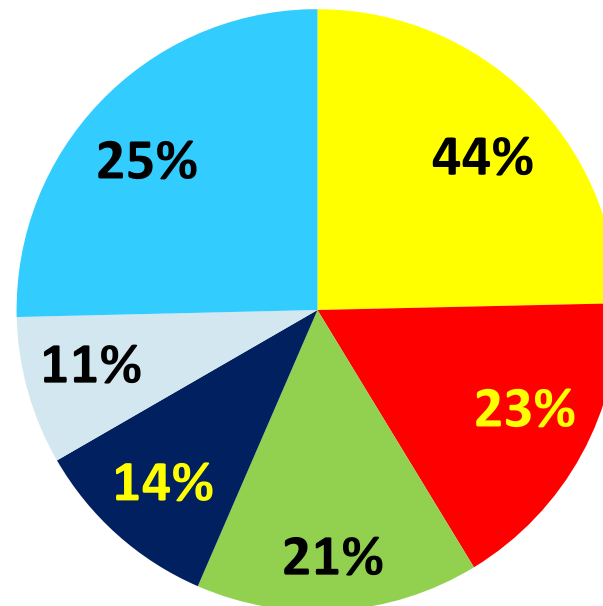


E.g. Temperature requirements in Food Processing

Industry	Process	Temperature (° C)
Dairy	Pressurization	60–80
	Sterilization	100–120
	Drying	120–180
	Concentrates	60–80
	Boiler feed water	60–90
Tinned food	Sterilization	110–120
	Pasteurization	60–80
	Cooking	60–90
	Bleaching	60–90
Flours and by-products	Sterilization	60–80
Tea	Pre-heating	80–90
	Drying	110–120

11

Survey Findings



- Food Processing
- Dairy
- Textile
- Engineering
- Pharmaceutical
- Others

12

STFI undertook survey amongst leading manufacturers and Consultants and concluded that achieving 100,000 m² **annually** and even up to **25,000 m²** if right policy framework and market demand is created

Solar Thermal Technologies



**Fixed Focus Elliptical
Solar Dish (Scheffler)**

**Fresnel Reflector Based
Dish**



**Linear Fresnel Reflector
Concentrator**

**Compound Parabolic
Concentrator**



**Parabolic Trough
Concentrator**



Paraboloid Dish



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Solar Heating Technologies for Industry



There is more final energy consumption of heat in industry than there is electricity consumed worldwide.

Photos: Cape Brewing Company, Zehnder Group, Inventive Power, CSP-F Solar



Best Ideas to Accelerate SHIP Market



- Create demand worth 1,00,000 m² in 3 years through tenders in large scale PSU's and identified potential industries.
- Renewable Heat Obligation (RHO) policy be debated
- Encourage EScO model as it ensures proper life cycle operation
- Mandatory standards be implemented on PRIORITY
- Subsidy linked to performance, MWth or MTOE avoided.
- Assess claimed output to the DNI of that area.
- Concessional loan to industries to scale up operations
- Mention of solar heating in PAT curriculum, BEE
- Massive capacity building workshops
- Operate a Helpline to resolve queries

15

Challenges Ahead



- **Engineering challenges in existing technology**
- **Lack of accurate Direct Normal Irradiance (DNI) data**
- **Heat Demand to Area constraint**
- **Demand-Supply management**
- **No solutions to cheaper storage**

16

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More Reading and Knowledge Sharing

www.cshindia.in

www.solarthermalworld.org

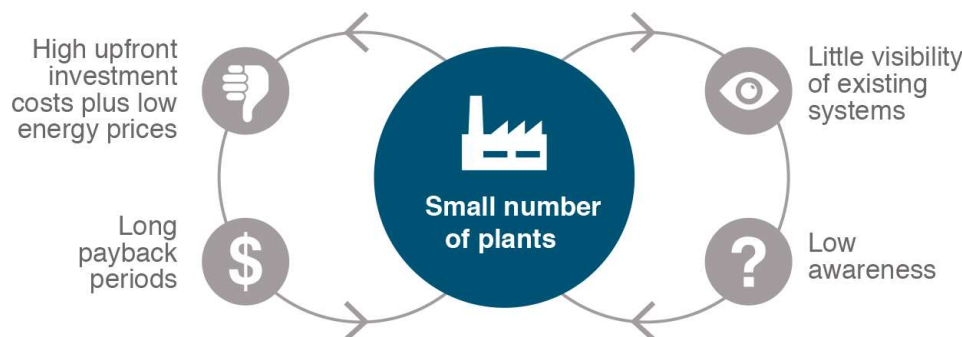
www.solar-payback.com

17

Solar Payback: Objectives

- **Increase awareness** of the technical and economic potential of SHIP-technology
- **Increase willingness to invest** in and to promote this promising technology in four partner countries: Brazil, India, Mexico and South Africa
- **Break the vicious circle** of small deployment rates

18



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