

Introduction of solar thermal collectors as add-on to coal-fired power plants in Indonesia

Presentation by Rüdiger Wolf,
Sustainable Heat & Power Europe GmbH



1. INTRODUCTION TO SOLAR THERMAL ENERGY
2. TECHNOLOGIES
3. ENERGY DATA INDONESIA
4. SOLAR THERMAL ADD-ON
5. SMALL SCALE SOLAR THERMAL APPLICATIONS
6. BUSINESS ACTIVITIES OF SHP EUROPE

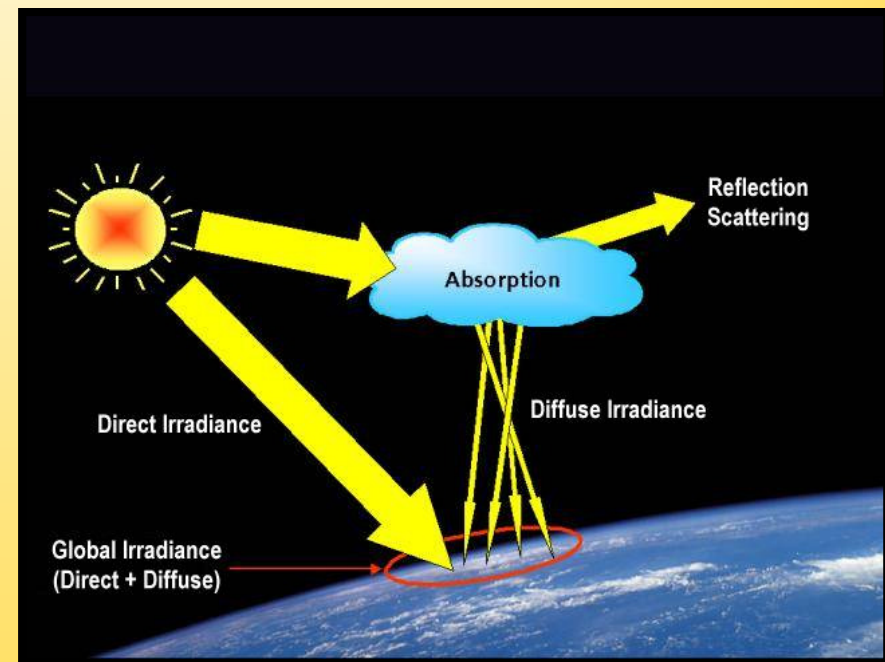


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1. Introduction to Solar Thermal Energy

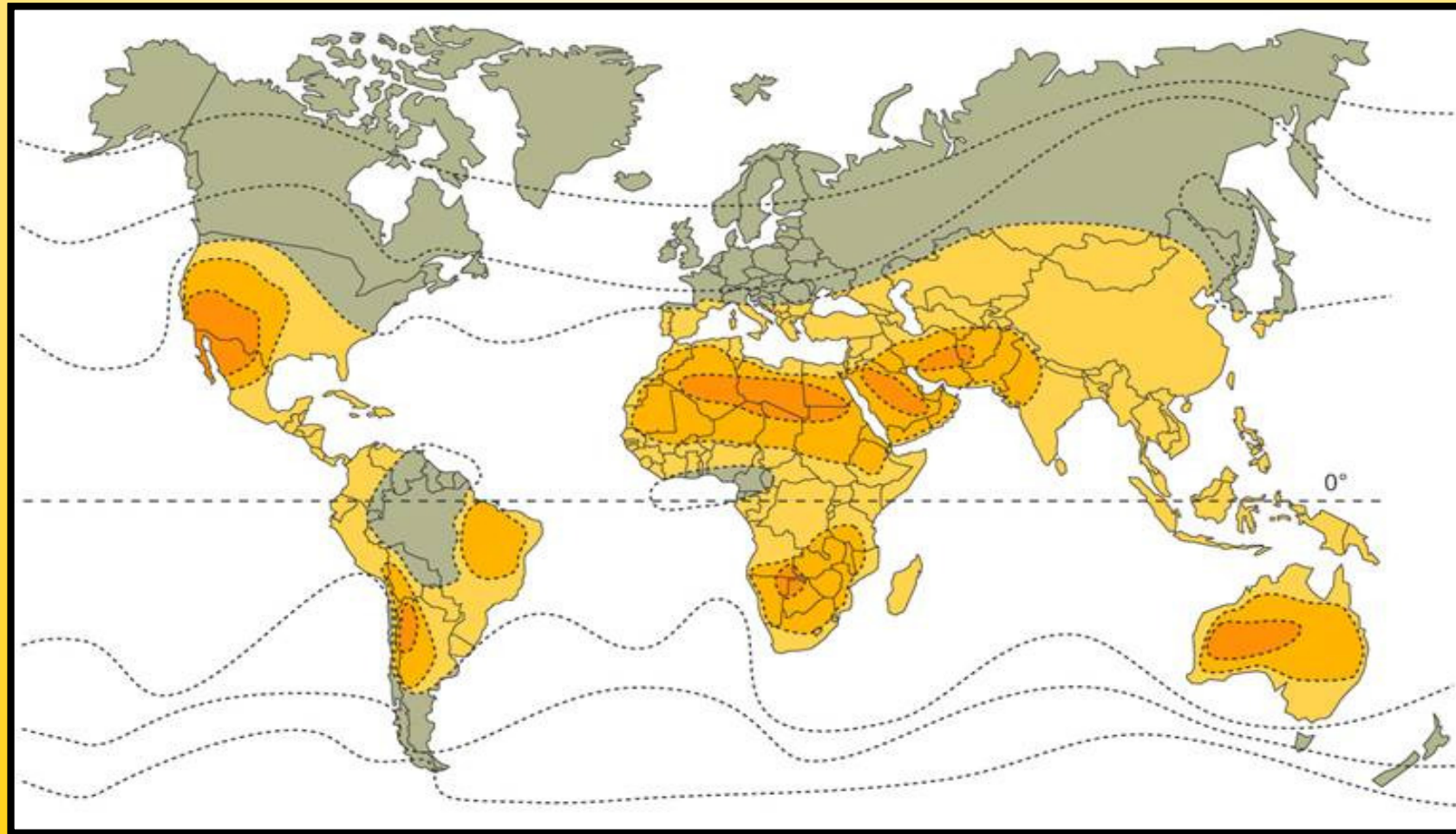
Principles of Solar Irradiation


- Beam or Direct Irradiation are the Sunrays directly hitting the Target
- Diffuse Irradiation hits the Target Area in different angles after Reflection of Obstacles
- Global Irradiation is the Sum of Direct and Diffuse Irradiation





1. Introduction to Solar Thermal Energy Global Solar Resources





1. Introduction to Solar Thermal Energy

Solar Potential of Indonesia

Example: Paiton (Java)

Source	Global Horizontal Irradiation (GHI)	Direct Normal Irradiation (DNI)	Diffuse Irradiation
Meteonorm	1.744 kWh/m ² /a	1.212 kWh/m ² /a	907 kWh/m ² /a
NASA Surface meteorology	2.350 kWh/m ² /a	2.790 kWh/m ² /a	470 kWh/m ² /a

Problem:

- Meteonorm only lists a single measurement station for entire Indonesia
- NASA satellite source has a resolution of 10.000 km²

⇒ High inaccuracy of and uncertainty about the solar potential

⇒ Solar measuring campaign mandatory for development of CSP projects



1. Introduction to Solar Thermal Energy

	Photovoltaics	Solar Thermal	Concentrating Solar Thermal
Energy Source	Global Irradiation	Global Irradiation	Beam Irradiation
Product	Electricity	Low Temperature Thermal Energy	High Temperature Thermal Energy
Application	Power Production	Hot Water Heating Absorption Cooling	Power Production Industrial Process Steam Seawater Desalination Absorption Cooling



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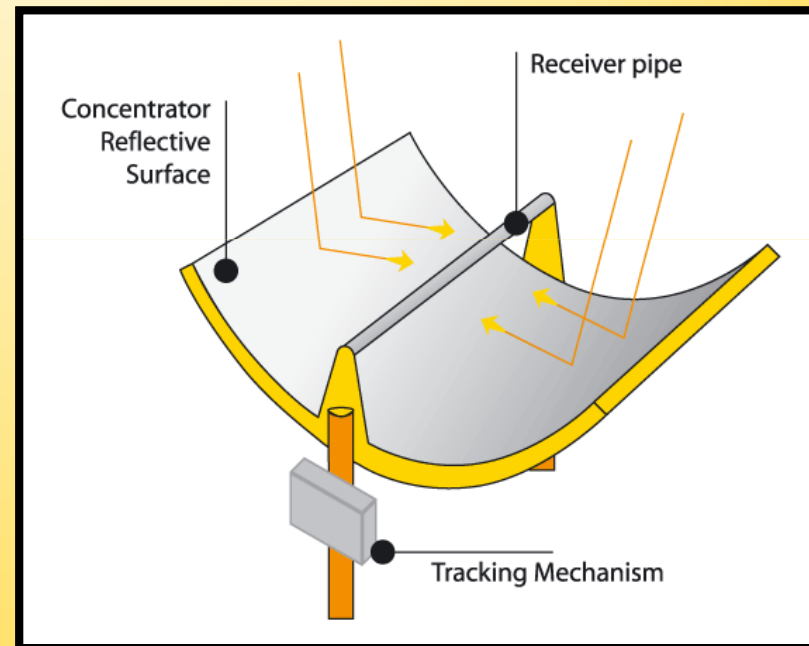


2. Technologies

Parabolic Trough Collectors

The irradiation incoming on the parabolic mirror surface is concentrated on a receiver tube.

- Tracking: 1-axis
- Temperature: max. $\approx 400\text{ }^{\circ}\text{C}$
- Capacity: $>500\text{ kW}_{\text{th}}$ for small PT
 $>150\text{ MW}_{\text{th}}$ for large PT
- Product: hot thermal oil,
hot water, steam



2. Technologies

Solarlite Industrial Scale Parabolic Trough Collectors



Temperature : up to 330 °C

Application: power production
hot water
saturated steam
absorption cooling

Size : > 500 kWth



Woltrow, Germany

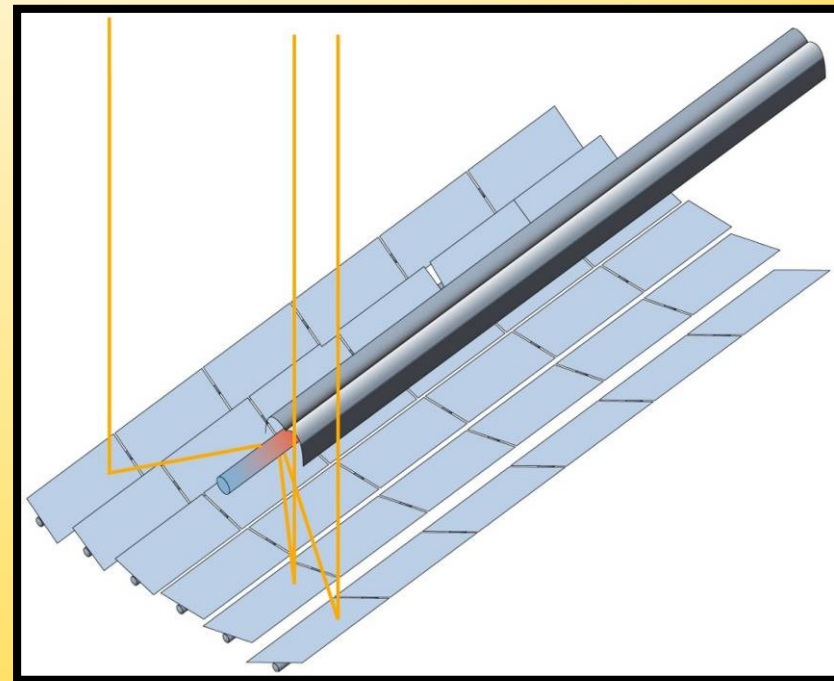


2. Technologies

Linear Fresnel Collectors

The flat mirrors of the Linear Fresnel Collector are positioned in a horizontal level. Analogue to the parabolic trough, the solar irradiation is concentrated on an absorber tube.

Tracking:	1-axis
Temperature:	max. $\approx 450\text{ }^{\circ}\text{C}$
Capacity:	$> 50\text{ kWth}$
Product:	steam, hot water hot thermal oil



2. Technologies

PSE commercial scale Fresnel collectors



Temperature : up to 250 °C

Application : hot water
saturated steam
absorption cooling

Size : > 50 kWth



Bergamo, Italy

2. Technologies

SPG Power Plant Scale Fresnel Collectors



Temperature : up to 450 °C

Application: power production
hot water
saturated steam
super heated steam

Size : > 1 MWth



Almeria, Spain