
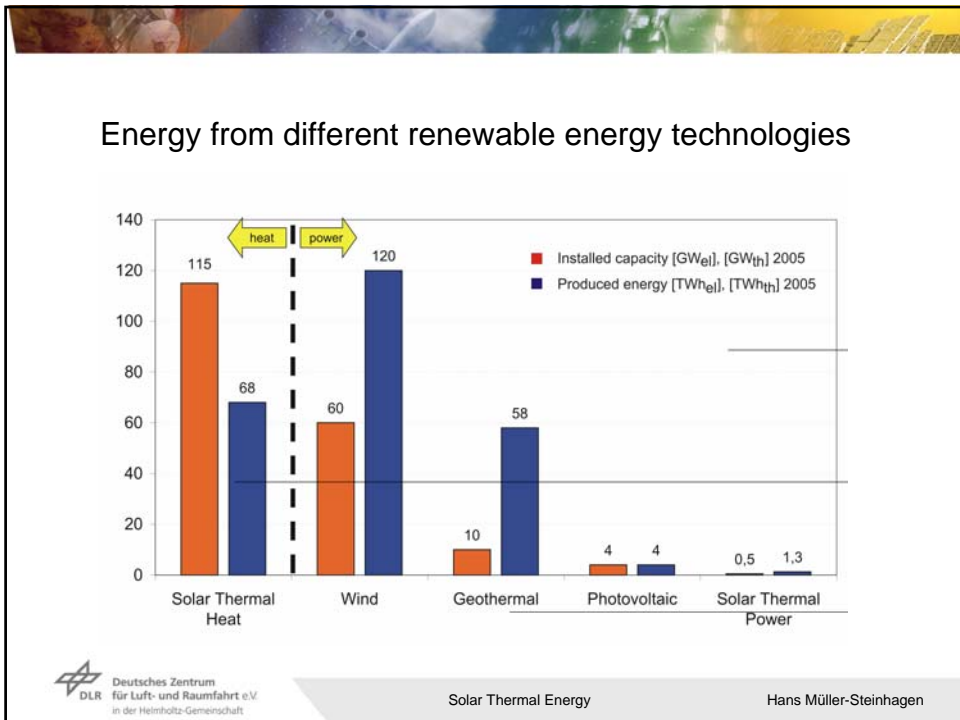


Solar Thermal Energy

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Applications of solar thermal energy

- cooling and air conditioning -10°C – 20°C
- heating of buildings 40°C – 70°C
- hot water 50°C – 80°C
- low temperature process heat 80°C – 250°C
- electricity generation 250°C – 1000°C
- high temperature process heat 250°C – 1500°C

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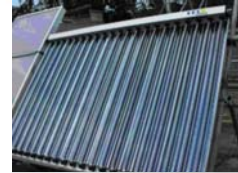
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Solar heat for buildings

Small systems:

hot water preparation
and / or space heating
for single family houses

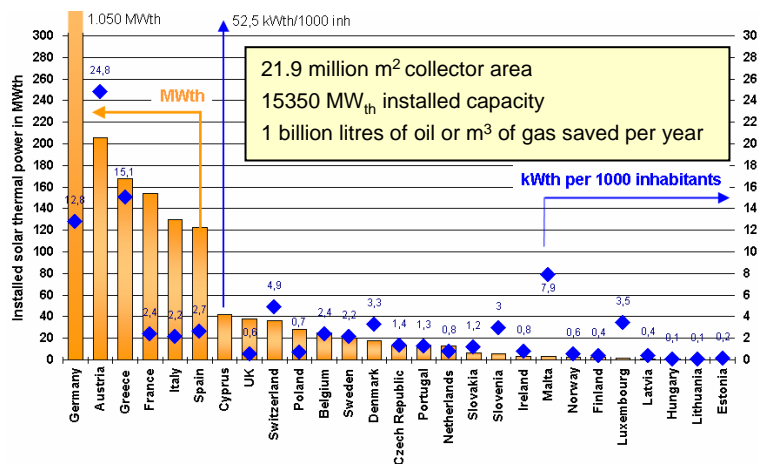


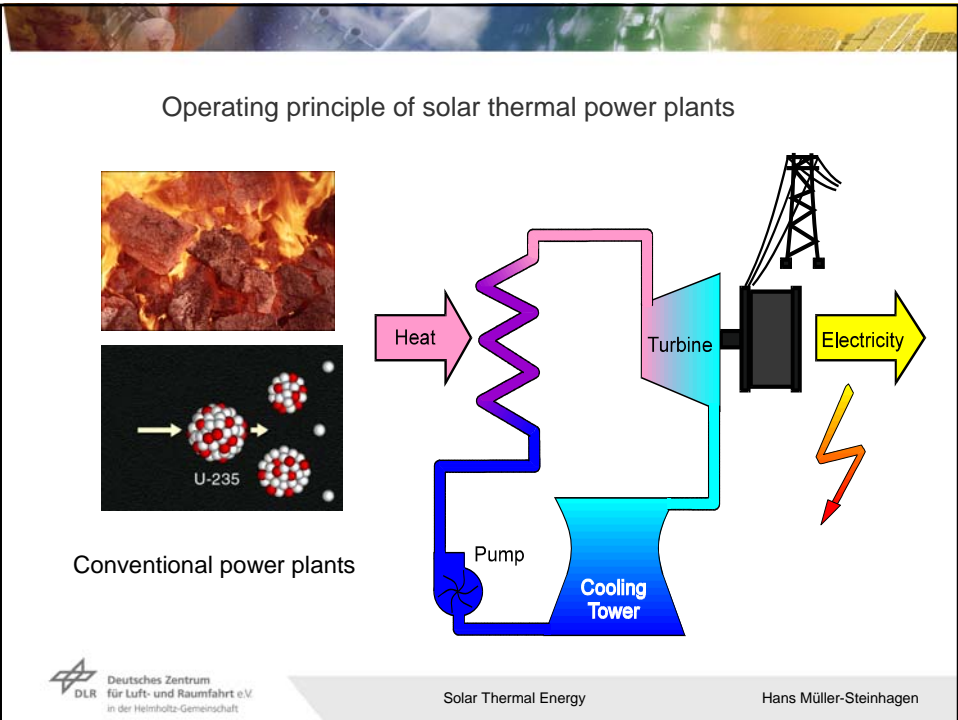
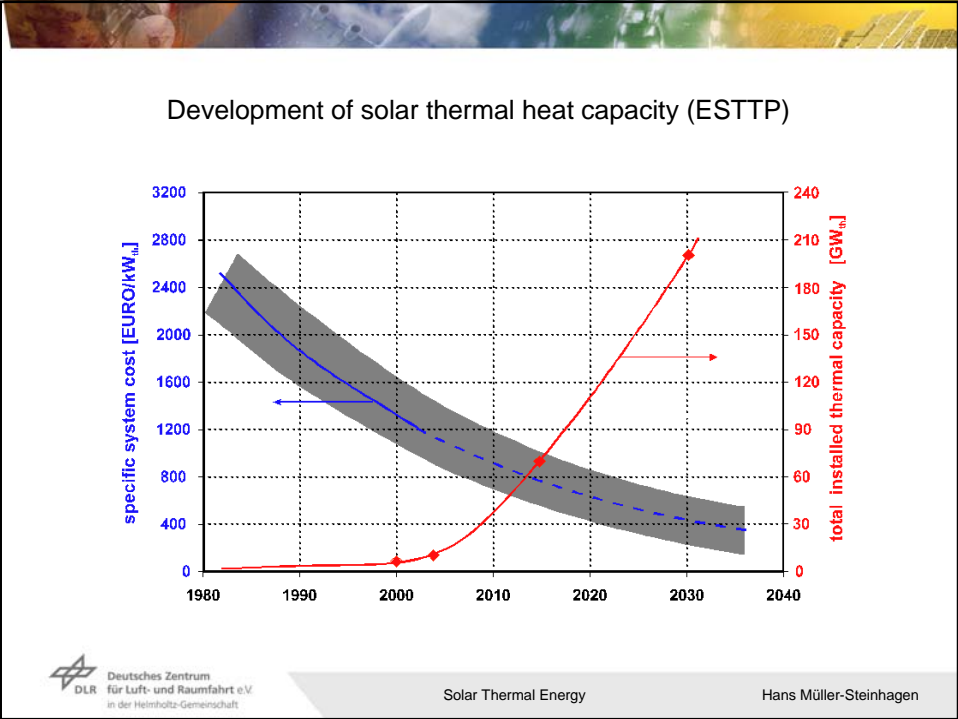
Large systems:

hot water preparation and / or
space heating for large buildings
and/or housing developments,
possibly in conjunction with
seasonal heat storage



Installed solar thermal power and m² collector area per 1000 inhabitants in the EU member states

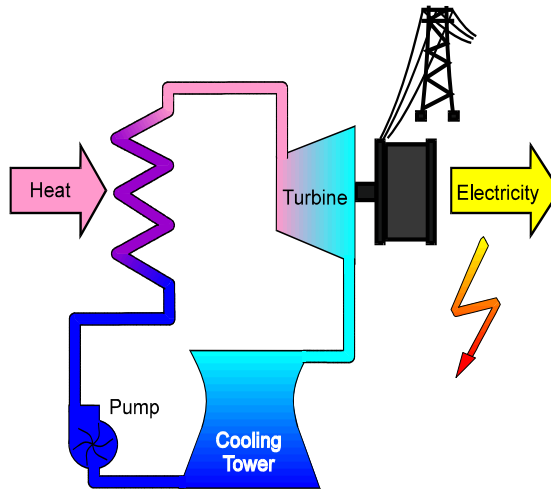




Operating principle of solar thermal power plants



Solar thermal power plants



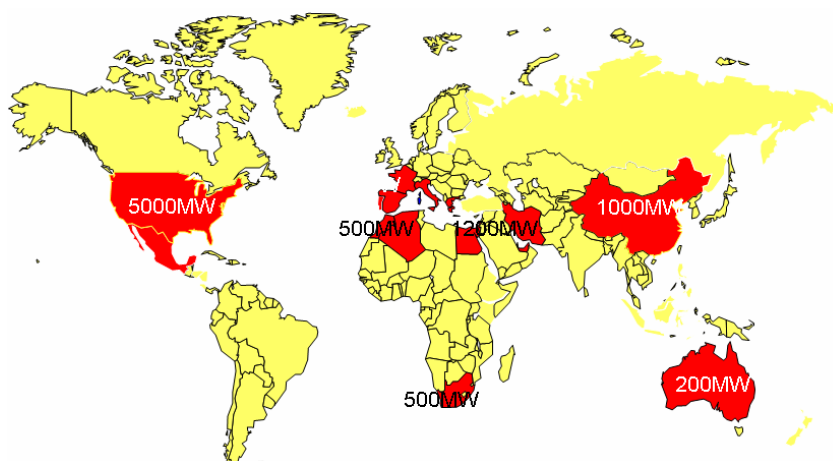
Picture of 50 MW Andasol 1 power plant near Guadix / Spain

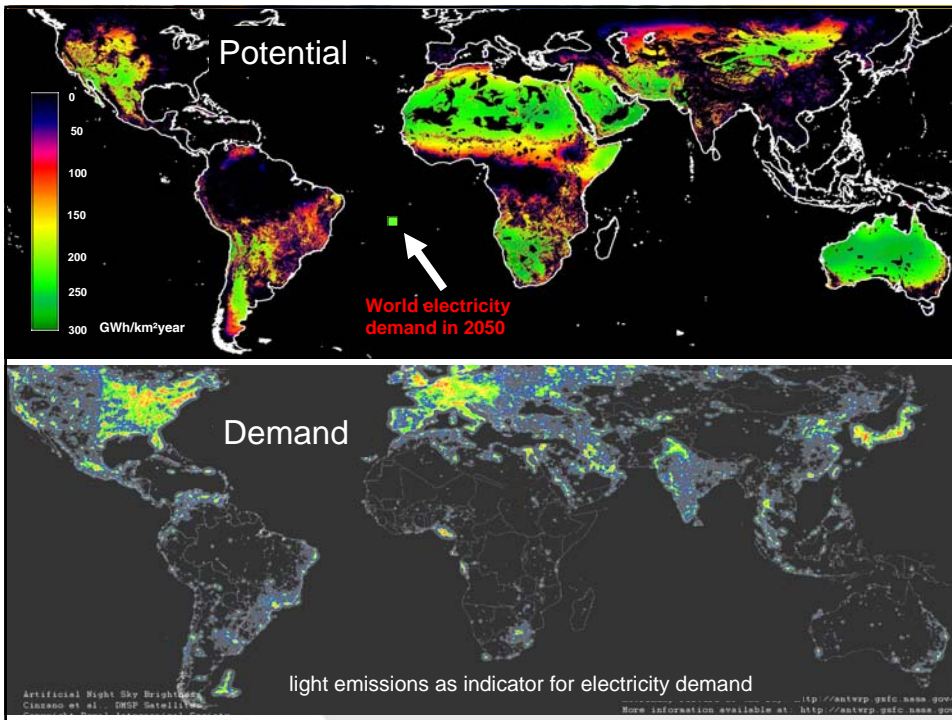
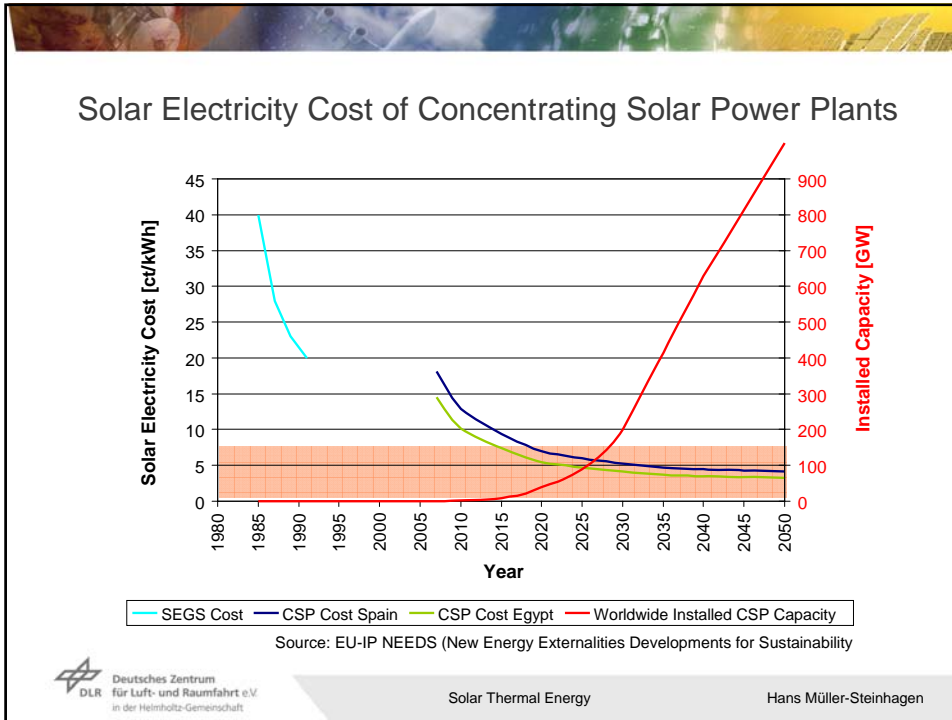


Solar thermal power tower plants PS10 and PS20 near Seville / Spain

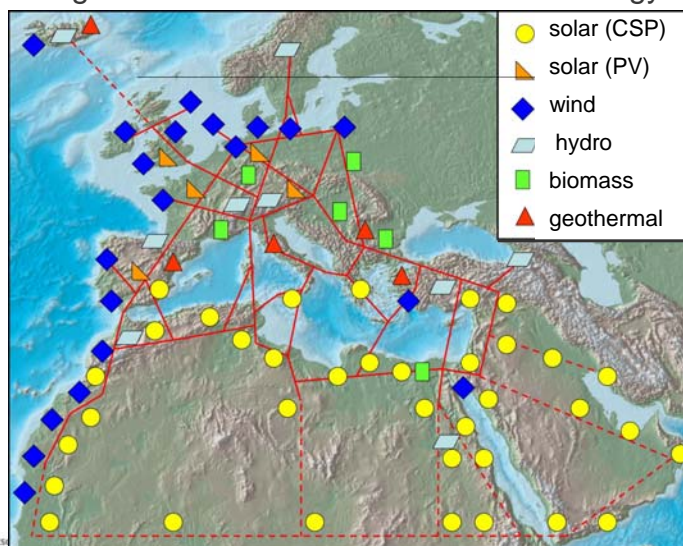


Project development for solar thermal power plants





Concept of a EU-MENA Renewable Energy Link Using HVDC Power Transmission Technology



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Scenario for total EU-MENA HVDC interconnection 2020 – 2050 *

Year		2020	2030	2040	2050
Capacity GW		2 x 5	8 x 5	14 x 5	20 x 5
Transfer TWh/y		60	230	470	700
Capacity Factor		0.60	0.67	0.75	0.80
Land Area km x km	CSP	15 x 15	30 x 30	40 x 40	50 x 50
	HVDC	3100 x 0.1	3600 x 0.4	3600 x 0.7	3600 x 1.0
Investment Billion €	CSP	42	134	245	350
	HVDC	5	16	31	45

* All countries analysed in TRANS-CSP

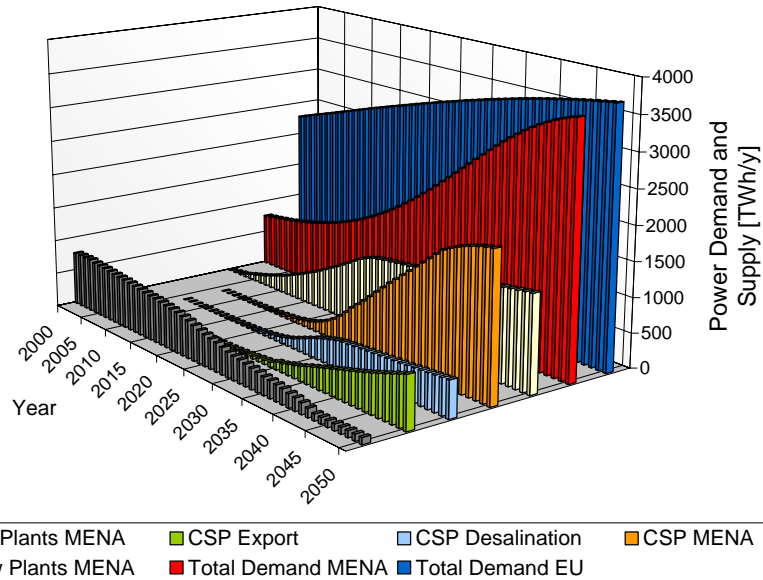


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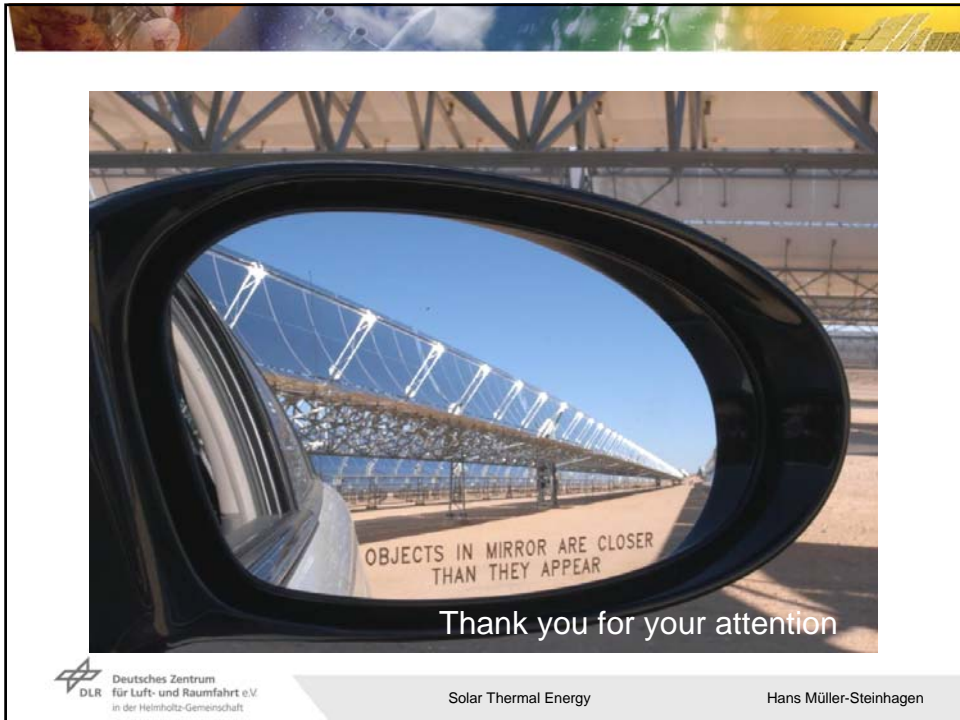
Hans Müller-Steinhagen

Interconnecting MENA and Europe: The TRANS-CSP Study



Summary

- The thermal utilization of solar radiation will make an enormous contribution to a sustainable heat and power provision.
- Solar thermal power plants already are a well-proven and demonstrated technology; since 1985 nine parabolic trough-type solar thermal power plants in California have fed more than 10 billion kWh of solar-based electricity into the Southern Californian grid.
- At present, solar thermal power plants with a total capacity exceeding 500 MW are under construction world-wide, with a further 10 GW being in advanced project development stage.
- In combination with thermal energy storage, solar thermal power plants can provide dispatchable electricity.
- Solar thermal power plants are already among the most cost-effective renewable power technologies.
- With further technological improvements and mass production of components, they will become competitive with fossil-fuel plants within the next decade.
- Solar thermal power plants can combine electricity generation and seawater desalination.
- With the installation of a EU-MENA HVDC grid it will be possible to provide a share of the Northern European electricity demand.



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