Solar thermal power plants are technologically well-understood and have the potential for large-scale electricity generation

But at what cost?
What-ever technology is used, a 100 MW solar plant with thermal storage requires:

- 4 km² of land
- 25 000 tons of steel
- 12 000 tons of glass
- 30 000 tons of storage medium
- 20 000 m³ of concrete

This requires transport by 4000 20t trucks or 2000 railway waggons

A 100 MW solar power plant in Spain with 9 h storage means today an investment of 400 million Euro, 1000 jobs during construction and 100 jobs during the 25 years of operation.
Typical cost breakdown of a SEGS plant

80 MW SEGS cost breakdown

- POWER BLOCK
  - (Civil Works & Erection) 4%
  - (Equipment) 15%
  - (C&E) 3%

- BALANCE OF PLANT
  - (Equip.) 10%
  - (C&E) 6%
  - SERVICES 7%
  - SITE WORKS 3%

- HTF SYSTEM
  - (Equip.) 8%

- SOLAR FIELD
  - (C&E) 7%
  - SOLAR FIELD (Equip.) 37%
Solar Electricity Cost of Concentrating Solar Power Plants

Conventional electricity generation:

4-6 Euro cents/kWh middle load
6-8 Euro cents/kWh peak load
8-12 Euro cents/kWh niche markets with high fuel costs
Solar Electricity Cost of Concentrating Solar Power Plants

Source: EU-IP NEEDS (New Energy Externalities Developments for Sustainability)
Potential for Electricity Cost Reduction:

- Reduced component and system costs due to improved design and manufacturing techniques
- Improved power plant efficiency
- Increased number of full-load operating hours due to the installation of thermal storage
- Larger power blocks (economy of scale)
- Reduced operation and maintenance costs due to longer operating life, extended automation, reduced maintenance requirements, larger systems and units, reduced parasitic requirements
present construction activities
Commercial Plant Development

- Algeria: 140-150 MW ISCC plant with 25 MW solar capacity (trough)
- Abu Dhabi: 250 MW Fresnel and parabolic trough
- Egypt: 150 MW ISCC plant with 20 MW solar capacity (trough)
- India: ISCC plant with 53 MW solar capacity (trough)
- Iran: 450 MW ISCC plant with 10 MW solar capacity (trough)
- Italy: 40 MW solar addition to existing combined cycle plant (trough)
- Kuwait: 100 MW parabolic trough
- Mexico: 290 MW ISCC with 40 MW solar capacity (trough)
- Morocco: 220 MW ISCC plant with 30 MW solar capacity
- Spain: over 500 MW solar capacity using steam cycle (12 x 50 MW trough)
- Spain: 4 x 10-50 MW solar tower plants with solar-only steam cycle
- USA: 64 MW solar capacity steam-cycle plant in Nevada
- USA: 500 MW solar capacity dish park in California
Commercial Plant Development

- 5000MW
- 1000MW
- 1200MW
- 200MW

Map showing distribution of commercial solar thermal power plants around the world.
Identification of Suitable Sites Using Meteosat Data
Identification of Suitable Sites Using Meteosat Data

North Africa – solar thermal electricity generation costs
Solar Thermal Power Plants

Hans Müller-Steinhagen

Potential

1 km of desert land yields up to 200 - 300 GWh/year

1 km of desert land equals 50 MW coal or gas plant

1 km of desert land saves 500,000 bbl of oil/year

1 km of desert land avoids 200,000 tons CO$_2$/year

1 km of desert land can produce 165,000 m$^3$/day by desalination

World electricity demand in 2050

Demand

light emissions as indicator for electricity demand
Concept of a EU-MENA Renewable Energy Link Using HVDC Power Transmission Technology
Interconnecting MENA and Europe: The TRANS-CSP Study
Summary

- Solar thermal power plant technologies are important candidates for providing a significant share of the clean and renewable energy needed in the future.

- Solar thermal power plants are already today of 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 of about 1000 MW are being built world-wide, with a further 10 GW being in the 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.
Thank you for your attention