Combined Solar Power and Desalination Plants: Update on the MED-CSD Project

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Global Water Scarcity

Source: IWMI 2006
Global Potential for Concentrating Solar Power

Global Technical Potential: 3,000,000 TWh/y
Global Electricity Consumption: 18,000 TWh/y

Source: REACCESS 2009

CSP potentials in TWh/y available in the REACCESS world regions for different DNI Classes

Source: REACCESS 2009
Global Concentrating Solar Power Projects

428 MW operating, 500 MW under construction
~8,000 MW under development

New Concentrating Solar Power Projects

PS10, PS20 Sevilla, Spain
(10 MW + 20 MW, 2007 & 2009)

www.solucar.es
New Concentrating Solar Power Projects

Nevada Solar One
Las Vegas, USA (64 MW, 2007)

ANDASOL 1, Guadix, Spain
(50 MW, 7 h Storage, 2009)
Linear Fresnel Demos

Plataforma Solar
Almeria, Spain
(MAN/SPG)

Calasparra,
Spain
(Novatec)

AQUA-CSP Scenario for Middle East & North Africa

- Natural Water Used
- Wastewater reused
- Fossil Fuel Desalination
- Groundwater Over-Use
- CSP Desalination
- Efficiency Gains

www.dlr.de/tt/aqua-csp
Conventional Desalination Plant

- Tunel Intake
- Screening, Filtration
- Desalination Plant
- Anti-Scaling
- Anti-Foaming
- Anti-Corrosion
- Desinfection
- Power Plant
- Heat / Power
- Direct Discharge

Advanced CSP-Desalination Plant

- Concentrating Solar Collector & Storage
- Power Plant
- Heat / Power
- Nano-Filtration
- Desalination Plant
- Horizontal Drain Intake or Micro- & Ultrafiltration
- Horizontal Drain Discharge

Source: MED-CSD 2008
Configurations of CSP Desalination Plants

CSP / RO

Power Only

Solar Field → Storage → Power Plant → RO

• Solar heat
• Fuel

Combined Heat & Power

Solar Field → Storage → Power Plant → MED

• Solar heat
• Fuel

CSP / MED

MED: Multi-Effect-Distillation
RO: Reverse Osmosis Membrane Desalination

Source: MED-CSD 2008

General Operating Conditions

→ Combined Production of Electricity and Water
→ Daytime Peaking Power to Grid
→ Continuous Operation of Desalination Plant

→ Peak Load Power
→ Base Load Water

Source: MED-CSD 2009
Load Curve (MW)

- **Base Load**: Coal Steam Turbines / Gas Combined Cycles
  - 2-4 ct/kWh

- **Intermediate Load**: Coal / Heavy Oil Steam Turbines
  - 6-10 ct/kWh

- **Peak Load**: CSP
  - 15-25 ct/kWh

**Average Electricity Cost**: 6 ct/kWh

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**CSP/RO**

- Integrated Operation
- Parabolic Trough Collector
- Superheated Steam Turbine
- Synthetic Heat Transfer Fluid
- Molten Salt or Concrete Energy Storage
  - Capacity: 15 MW / 10,000 m³/d
- Investment: 100 M€

**CSP/MED**

- Integrated Design
- Linear Fresnel Collector
- Saturated Steam Turbine
- Direct Steam Generation
- Concrete or Phase Change Energy Storage
  - Capacity: 15 MW / 10,000 m³/d
- Investment: 100 M€

**Source**: MED-CSD 2009
Site Selection for CSP Desalination Plants

Source: MED-CSD 2009

Thank You!