

# New Solar Thermal Power Plants can cover Egypt's Demand for Energy and Water

Presentation at the National Research center

Cairo, 25 March 2008

by

**Dr.-Ing. Hani El Nokraschy**

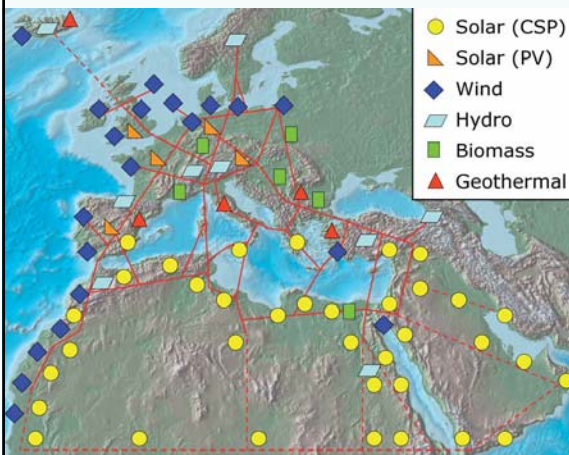
[www.nokraschy.net](http://www.nokraschy.net)

[www.solarec-egypt.com](http://www.solarec-egypt.com)

## The Future evolved to Present ...

as from 14.03. 2008 the "MEDITERRANEAN UNION"

proposed by Mr. Sarkozy and Ms. Merkel is REALITY



منتدى روما العلمي

التعاون حول البحر المتوسط للطاقت المتجددة

**TREC**  
Clean Power from Deserts  
Trans-Mediterranean  
Renewable Energy Cooperation  
An Initiative of The Club of Rome

Berlin, 19.04.2007

## Ministerial Conference on Renewable Energy FORGING ENERGY PARTNERSHIP



Heidemarie  
Wieczorek-Zeul

German Minister of Economic Cooperation:

We want to **forge** an **energy partnership** with Africa for sustainable energy management.

## A Ground breaking Idea

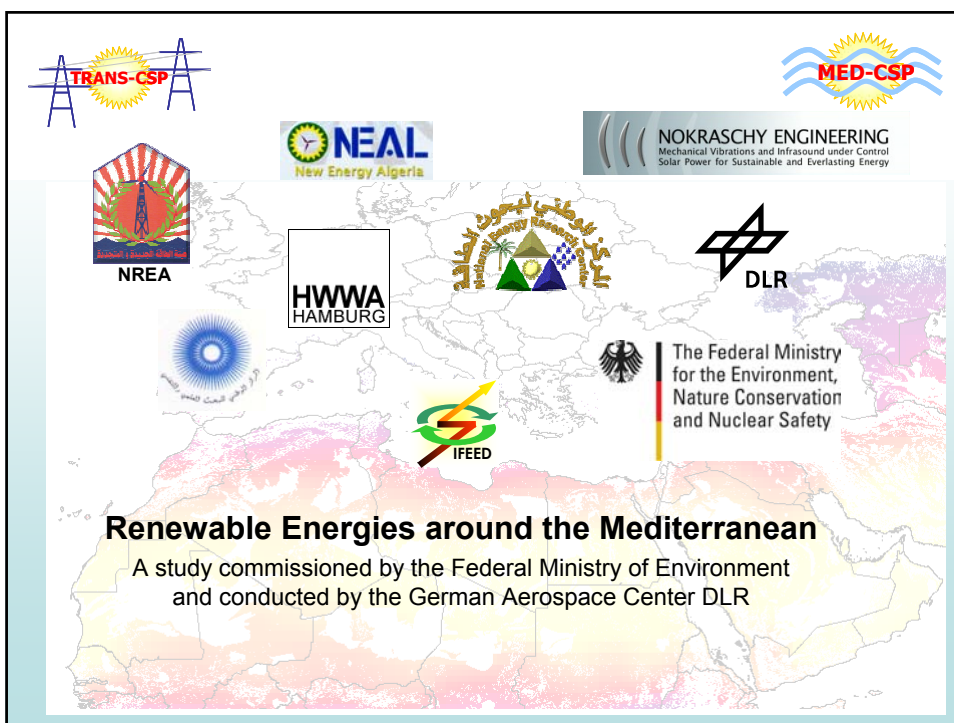
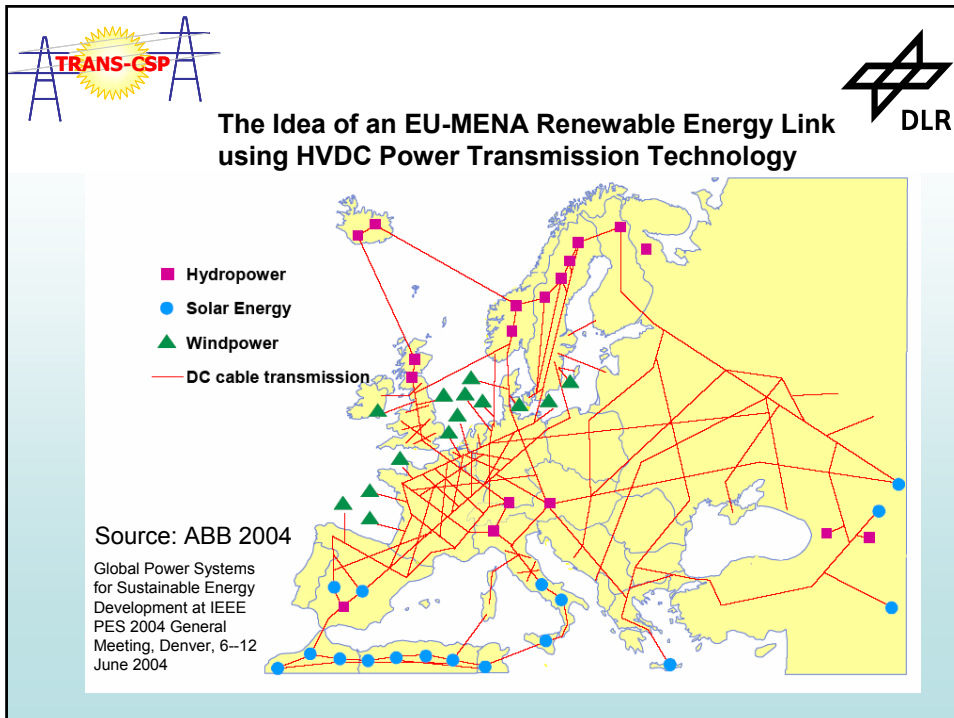
German Federal Minister of Environment:

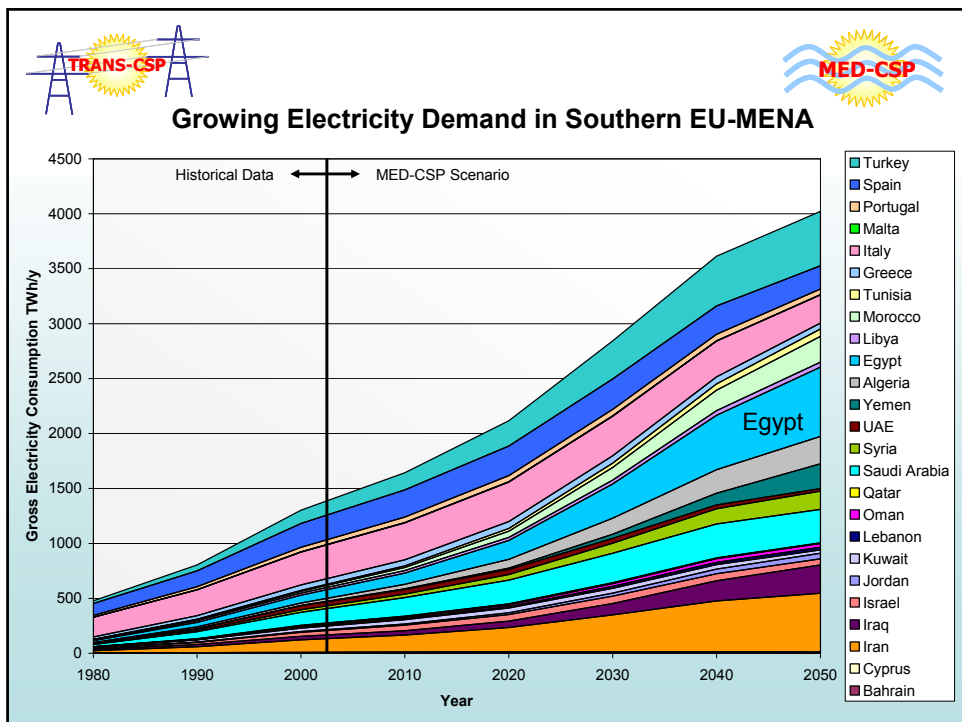
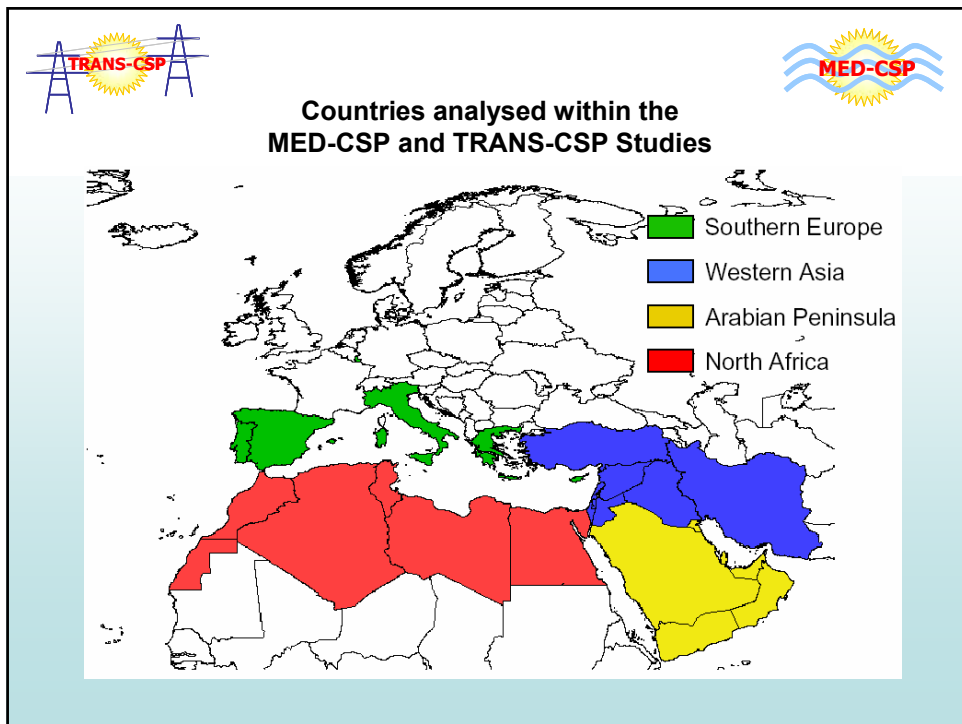


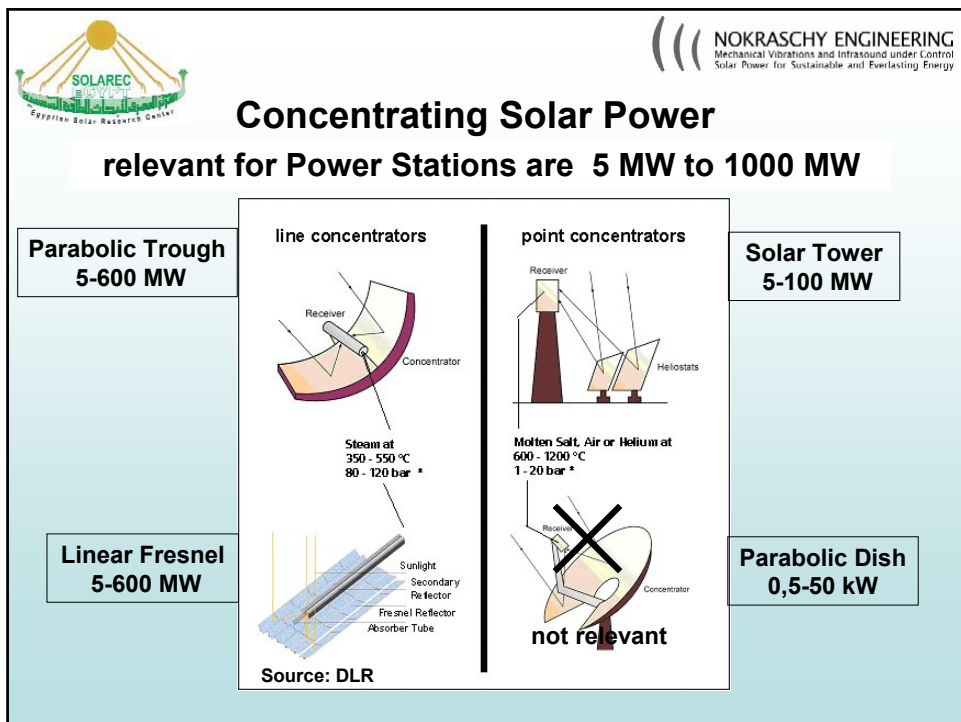
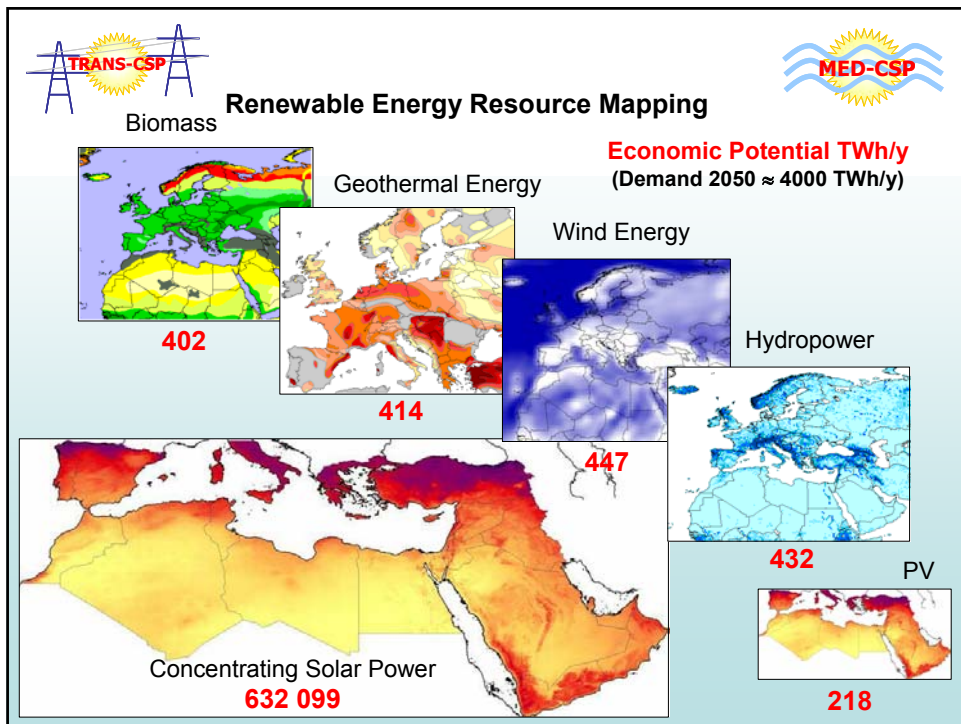
Sigmar Gabriel

Studies on potential by the **German Aerospace Center** find that **solar thermal power plants** in southern Europe and northern Africa could play an important role in securing a sustainable European energy supply.....

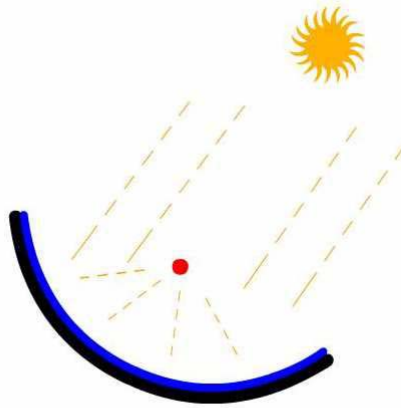
**The idea is ground-breaking:** it means that in 20 to 30 years we can procure part of our energy from solar power plants in North Africa. ....one day, the European "**super grid**" will be able to transfer electricity produced in **solar thermal power plants** to central Europe – without any power cuts!







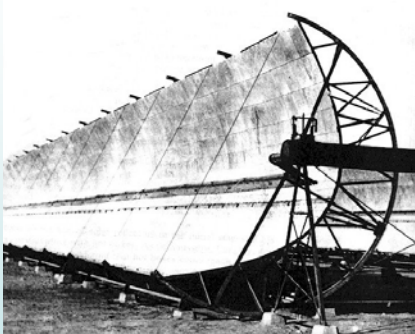
## Parabolic trough Technology



© NOKRASCHY ENGINEERING

**Proven Technology of the past century**

## Following a German Patent from 1906



**Frank Shuman**  
built in Maady 1912  
the first CSP facility

He wrote: "One thing I am sure of; the human race should either utilize solar energy directly or go back to pre-civilization".

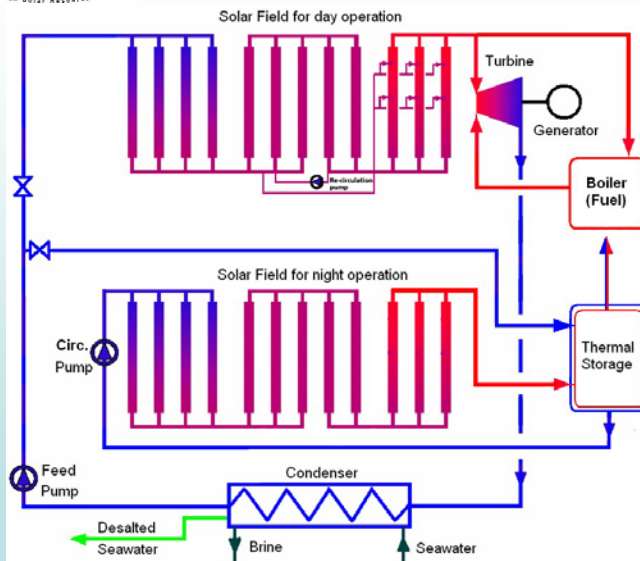


## CSP-Plant in California



Eurotherm, PSA, Spain. Test facility for the development of a solar parabolic trough collector for process heat, power generation and desalination in a range up to the hundreds Megawatts.

## Solar Hybrid Power Station with Desalination

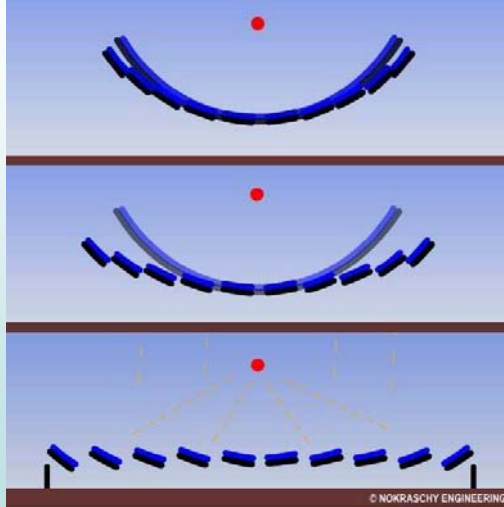


**Desalination (MED) with Waste Heat**

Step 1:  
Solar field  
in Hybrid  
operation for  
day and night  
service.

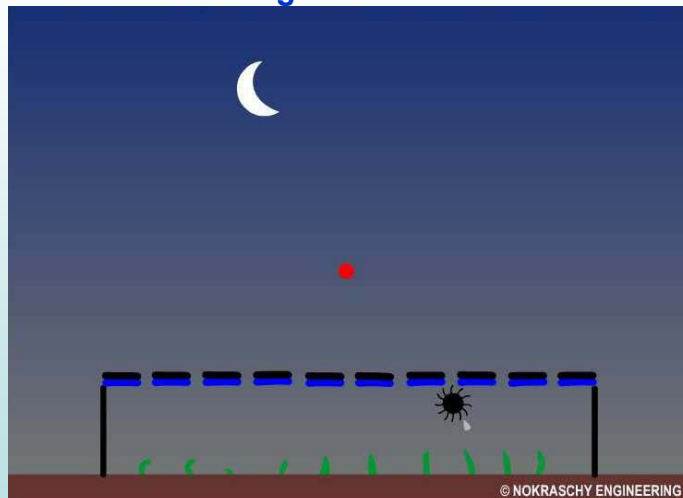
Step 2:  
Solar field  
with Heat  
Storage for Night  
operation + fossil  
boiler as reserve.

## Advanced Design: Flat Mirrors



**Best collection of the Sunrays. Simple, cost effective and usage of area underneath mirrors is possible**

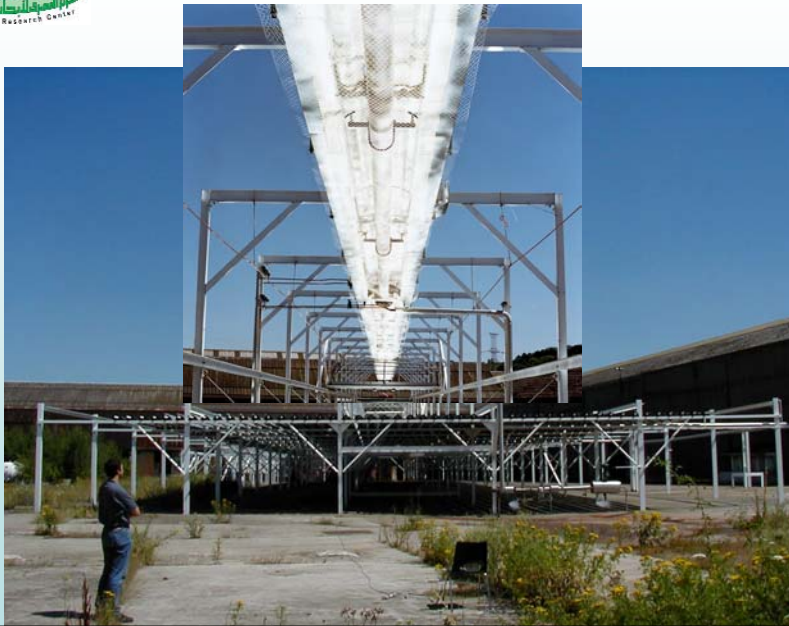
## Automated Cleaning ... ... less cleaning water & it is not wasted



**In the shadow plants need less irrigation water**



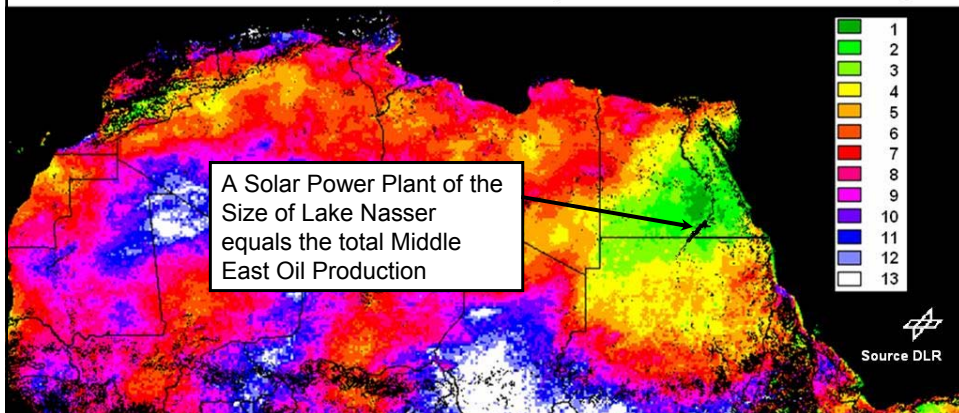
## CSP in action



## Economic Site Ranking

Calculation of the economic site ranking  
from the electricity yield and the project costs

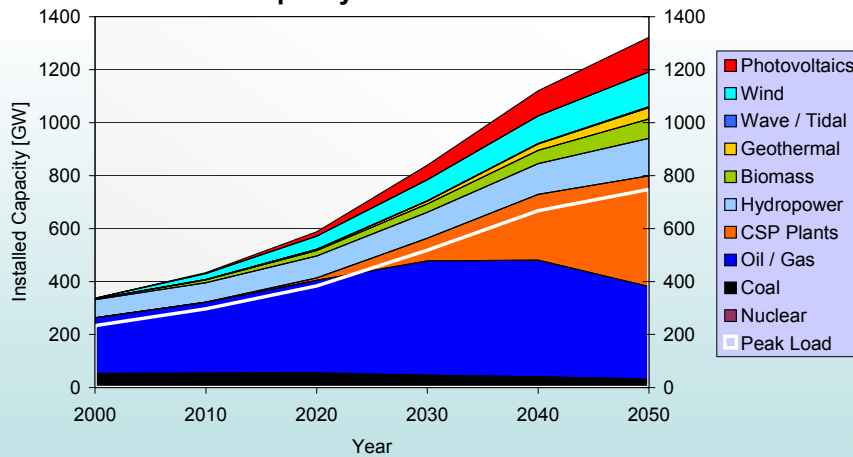
### North Africa – Solarthermal Electricity Generation Cost Ranking



The North African Solar Energy equals 1 000 000 Barrels of Oil per km<sup>2</sup> yearly



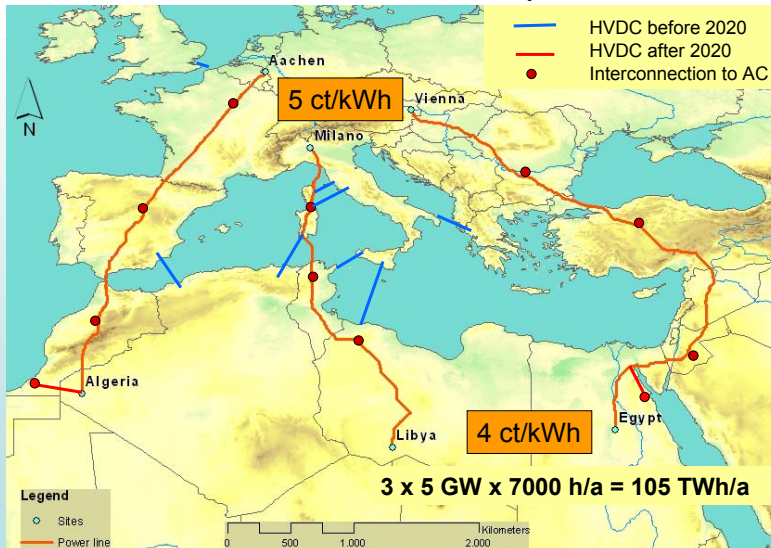
### Installed Capacity of Southern EU-MENA



**At any time, peak power demand is covered with an extra of 25 % reserve capacity**



### 3 Samples for EU-MENA HVDC Interconnection Production cost in 2050 4ct/kWh, Transportation 1 ct/kWh

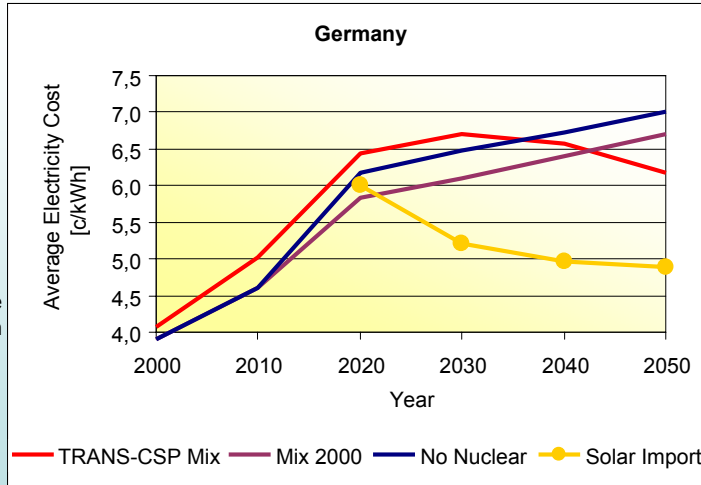


## Cost of Electricity... 2050 about 7 ct/kWh in Germany

**RUE**  
Rational Use of  
Energy

**RES**  
Renewable  
Energy  
Systems

**CCS**  
Carbon Capture  
& Sequestration



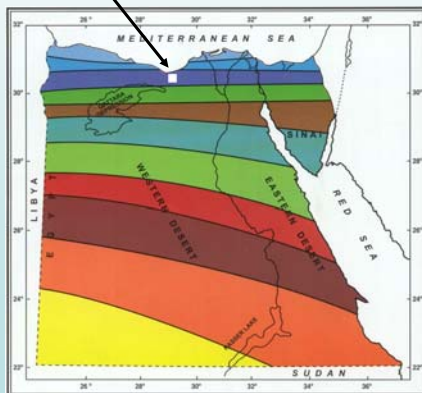
**TRANS-CSP Mix:** Energy Mix as described here incl. RUE, RES and CCS

**Mix 2000:** Maintaining exactly the Power Mix like in the Year 2000 with CCS

**No Nuclear:** Mix like in the Year 2000, but substituting Nuclear by Coal & CCS

## Short term planning and Electricity export possibilities

This Area 32x32 km = 1000 km<sup>2</sup>  
gives 50% of Germany's electricity



Source NREA

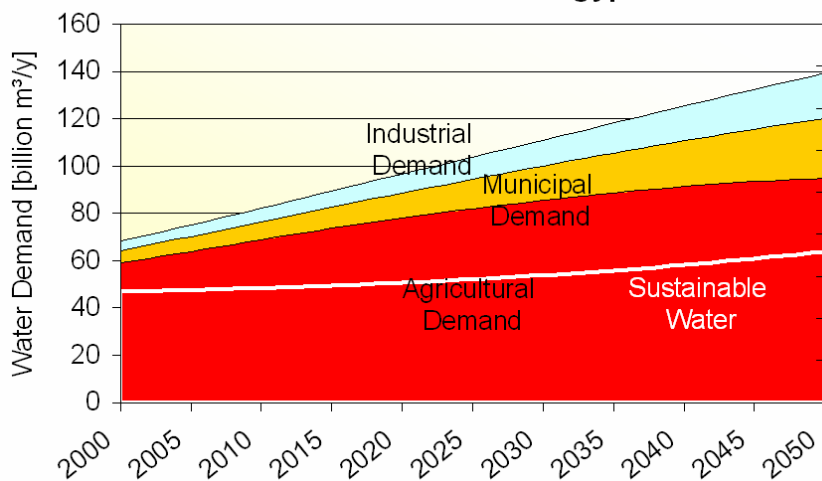


Source MoEE

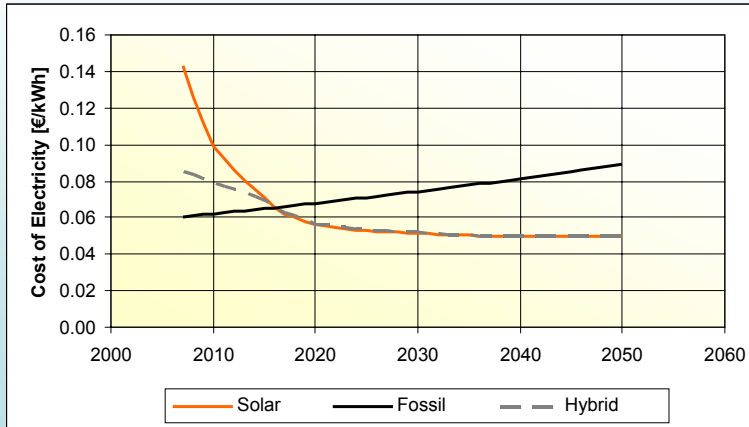
## The Requirements in Egypt are different than those of Europe...

- Not only Electricity is needed ...  
... 6-8% increase yearly
- Water is also needed ...  
... One more Nile by 2050

### Water Demand in Egypt

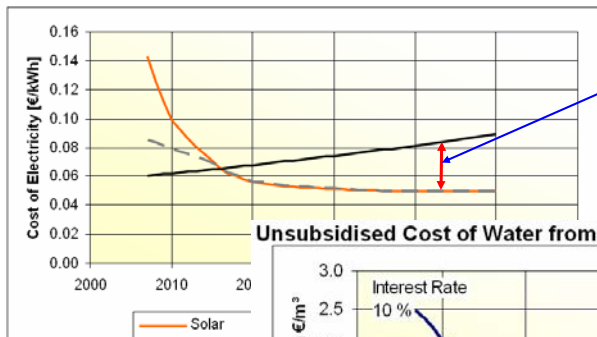


## Unsubsidised cost of electricity of CSP versus natural gas CC



Discount rate 5%, economic life 25 years, fuel cost 25 €/MWh, fuel cost escalation 1 %/y, irradiance 2400 kWh/m<sup>2</sup>/y, real €2007, €/€=1

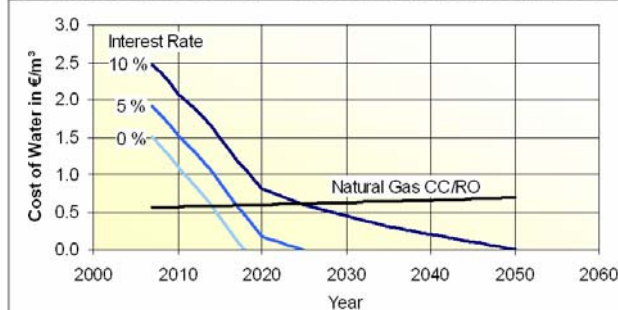
## Unsubsidised cost of electricity of CSP versus natural gas CC



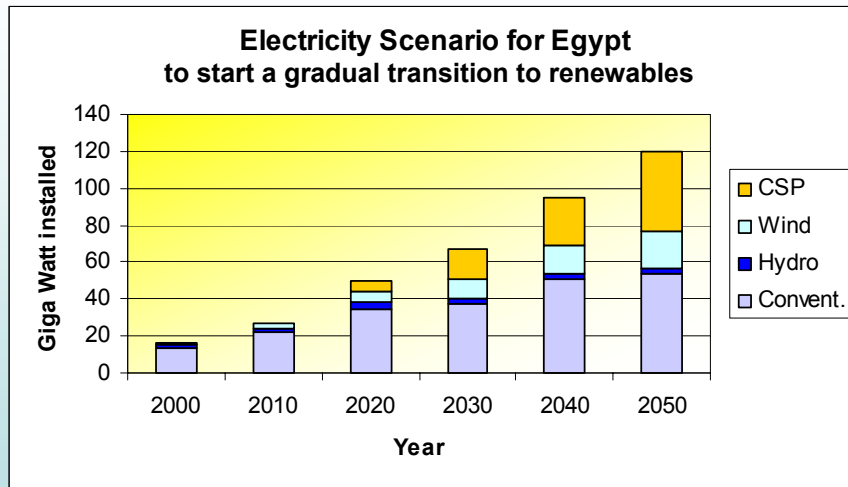
This difference is used to support water desalination

**Cost of water from CSP/MED plants. Please note that before 2020 water could be produced as bye-product without cost**

## Unsubsidised Cost of Water from CSP versus Natural Gas CC/RO



# Thank You



To down load the DLR-Studies: [www.menarec.org](http://www.menarec.org)