



## DESERTEC – Clean Power from Deserts

A concept for energy security and climate protection  
for a world with 10 billion people

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## In 2050, the world's population will need 3 planets to cover it's demand for resources



2

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## How can 10 billion people live peacefully together on just one planet?



3

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## Desert Potential: 3000 PWh/y      Energy is abundant

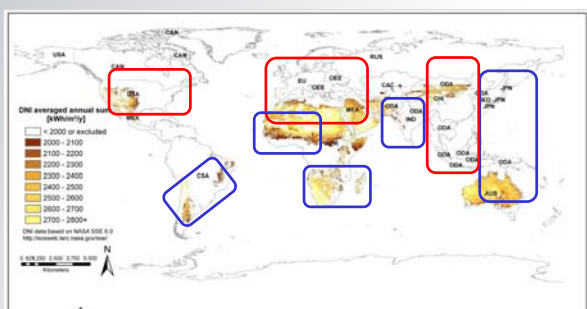


Annual economic potential, in PWh (= 1000 TWh)  
Global demand (2008): 18 PWh/y      Source: Trieb et.al., DLR, 2009

4

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## Potential DESERTEC regions

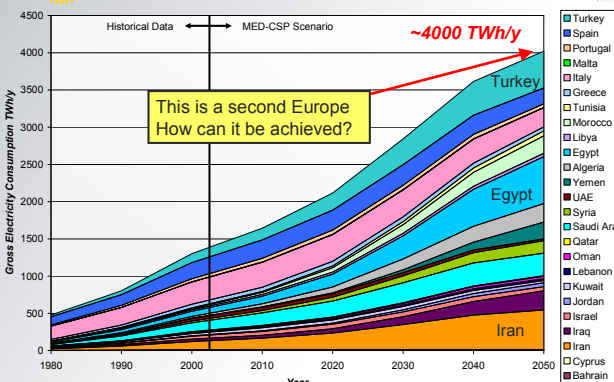


Source: Gerhard Knies

5

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## MED-CSP      EU-MENA ... a rapidly growing region



Historical Data      MED-CSP Scenario

This is a second Europe  
How can it be achieved?

~4000 TWh/y

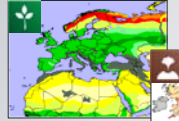
6

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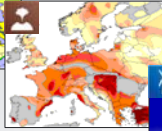
## The DESERTEC Concept for EU-MENA

DLR Studies: renewable energy potential in the EU and in MENA

Biomass: 1,350 TWh/y

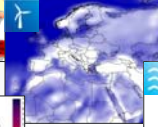


Geothermal: 1,100 TWh/y

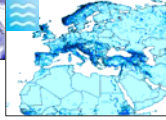


Electricity demand in EU-MENA in the year 2050: 7,500 TWh/y

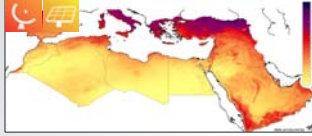
Windpower: 1,950 TWh/y



Hydropower: 1,350 TWh/y



Solar power: 630,000 TWh/y



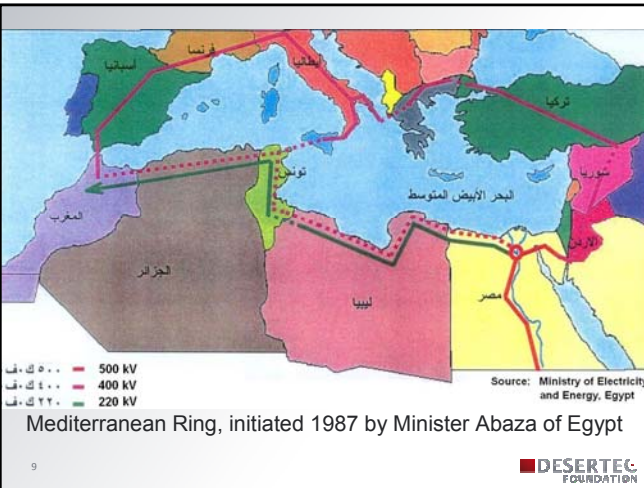
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## Vision for 2050

3 Samples out of 20 EU-MENA HVDC interconnections each line transmitting 5 Giga Watt

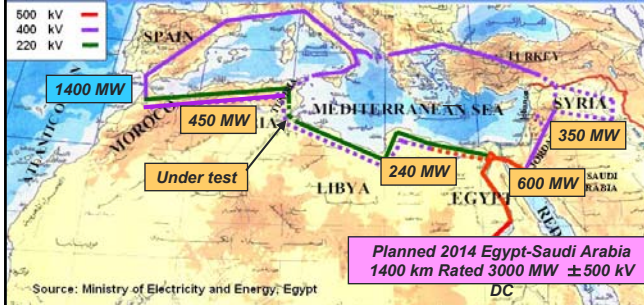


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## Situation 2010 with 220/400 kV AC Lines



Peak load management: in Saudi Arabia noon peak and in Egypt evening peak

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## The DESERTEC Concept for EU-MENA

The best sites offer the greatest benefit for climate protection

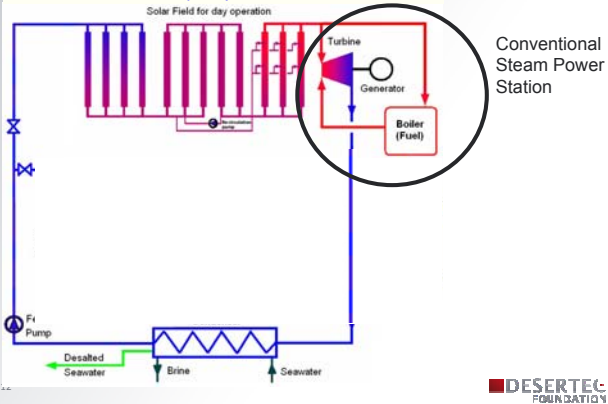
- For the same investment, the best sites can produce more clean electricity and therefore replace more conventional power
- Solar energy especially in the south, wind power in coastal areas, hydropower in the mountains, biomass in fertile central Europe, geothermal as available



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## Solar Hybrid Power Station with Desalination

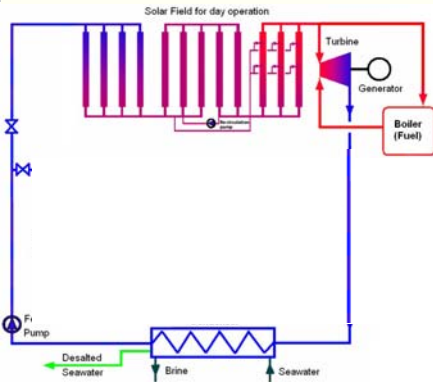
Desalination (MED) with Waste Heat



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## Solar Hybrid Power Station with Desalination

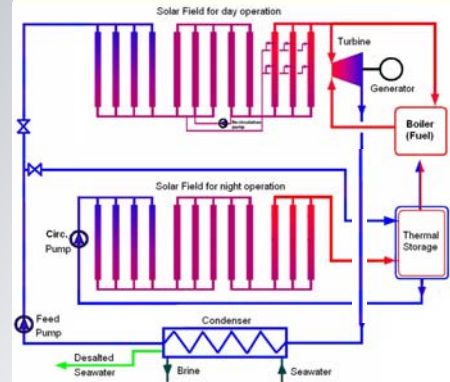
### Desalination (MED) with Waste Heat



Step 1:  
Solar field in Hybrid operation for day and night service.  
Solar share ~30%

## Solar Hybrid Power Station with Desalination

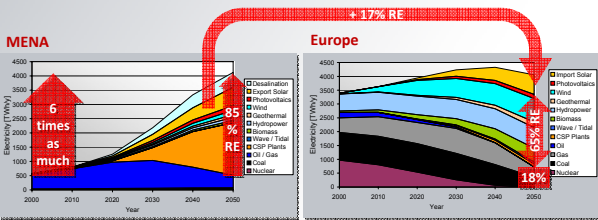
### Desalination (MED) with Waste Heat



Step 2:  
Solar field with Heat Storage for Night operation + boiler as back up.  
Solar share ~99% & ~1% bio-fuel for days with sand storms or clouds

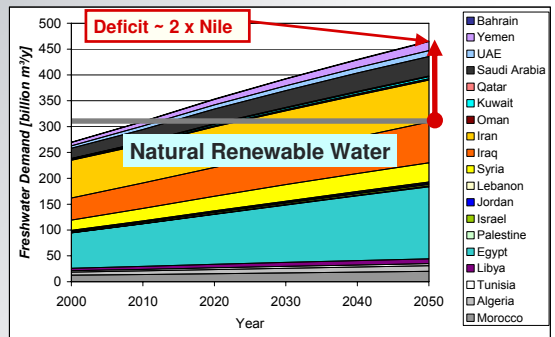
## Electricity production scenario for EU and MENA

DLR Studies: Clean power from deserts for local demand and export

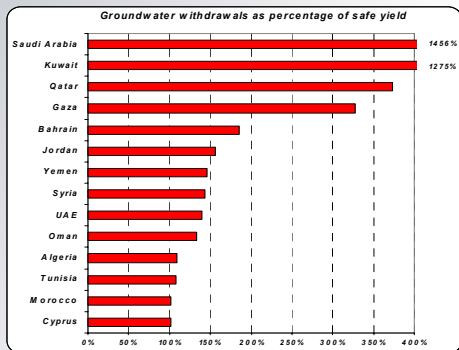


- MENA: Power from deserts mainly for local electricity demand and desalination
- Europe: Expansion of domestic renewable energies
- Dispatchable desert power complements the European electricity mix, enabling a higher proportion of PV & Wind, thus quickening the shift to a renewable energy supply

## Freshwater Demand Prospects by Country



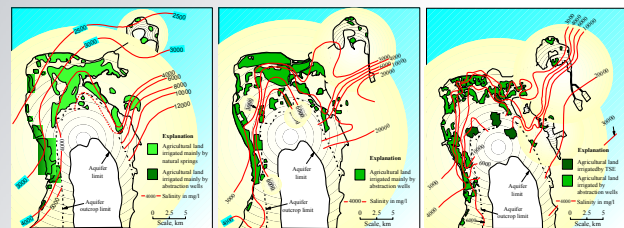
Source: DLR, Trib



Groundwater withdrawals exceeds safe yield  
Saghir 2000

## Desertification of Soils due to Groundwater Over-exploitation and Salinization (e.g. Bahrain)

Source Dr. Waleed Zebari, Arabian Gulf University



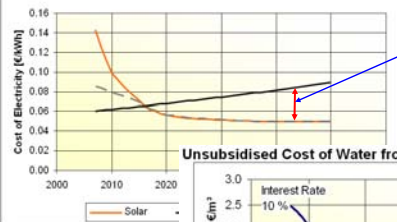
1960's

1980's

1990's

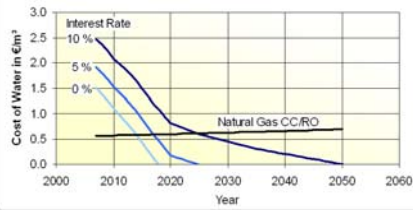


# Unsubsidised cost of electricity of CSP versus natural gas CC



This difference is used to support water desalination

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



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Reducing cost of water from CSP/MED plants

19

Tunis, 30 Oct. 2010



20

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UNIKASSEL  
VERSITÄT



[www.menarec.org/remena.html](http://www.menarec.org/remena.html)

DAAD

Deutscher Akademischer Austausch Dienst  
German Academic Exchange Service

Cairo University



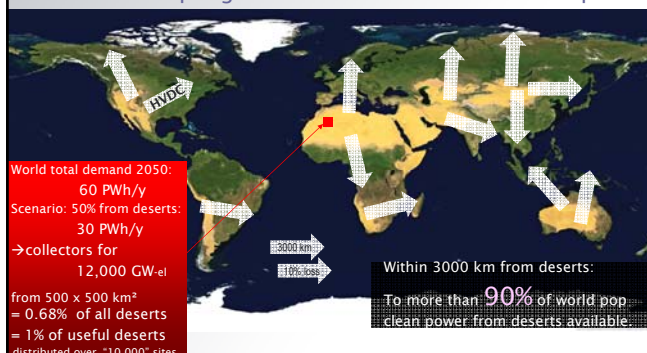
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21

## DESERTEC-WORLD

12,000 solar GigaWatt from Deserts

via HVDC super grid to a World with 10 billion People



Source: Gerhard Knies

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22

## The DESERTEC concept for 10 billion people

- Responsibility when managing the remaining resources  
➢ **Education for wise Resource Management**
- All peoples of the earth shall have a realistic chance for development.  
➢ **Energy for Development**
- Collect energy from the deserts, as it is abundant and not used  
➢ **The Sun gives in 6 hours the Energy used in one year**
- Transport the collected energy from the deserts over long distances to the users  
➢ **Via HVDC, an available technology**
- Produce potable water by desalination to satisfy food demand  
➢ **Clean Electricity and use of Waste Heat for Desalination**

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23

## What can we do to foster Development of MENA?

- Long term power purchase agreement to supply clean Energy from MENA to EU
- MENA shall shift subsidies from Oil/Gas for electricity production to subsidising delivered electricity, giving priority to locally produced components.
- Ground an EU-MENA company that builds HVDC lines between EU and MENA.
- Ground an EU Company that that buys clean electricity from MENA and sells it to the EU grid.
- Agree that the delivery of electricity is coupled with a reasonable amount of desalted seawater:  
e.g. 20-40 m<sup>3</sup> for each MWh delivered electricity.

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24