The Deserts of MENA as Everlasting Power Houses for sustainable Electricity and Water

InWent, 29 Oct.-01 Nov. 2008

by

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www.nokraschy.net
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TRANS-CSP

MED-CSP

NEAL
New Energy Algeria

NOKRASCHY ENGINEERING
Mechanical Vibrations and Infrasound under Control
Solar Power for Sustainable and Everlasting Energy

NREA

HWWA
HAMBURG

DLR

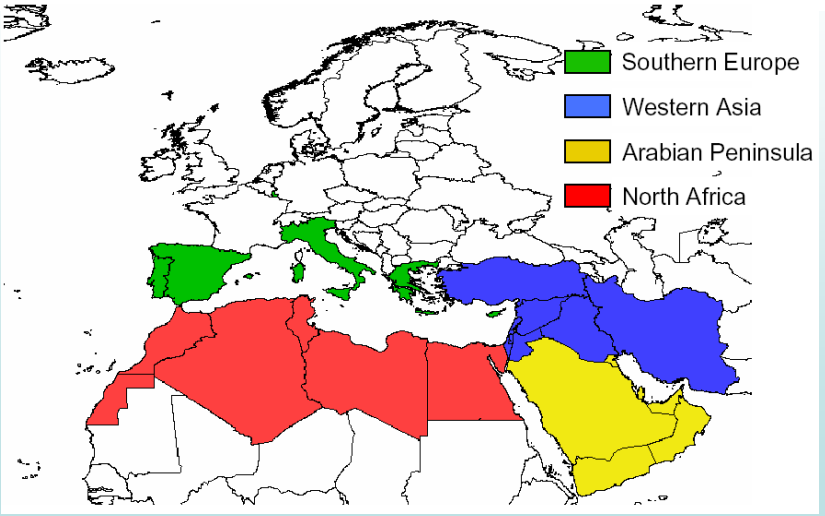
The Federal Ministry
for the Environment,
Nature Conservation
and Nuclear Safety

IFEED

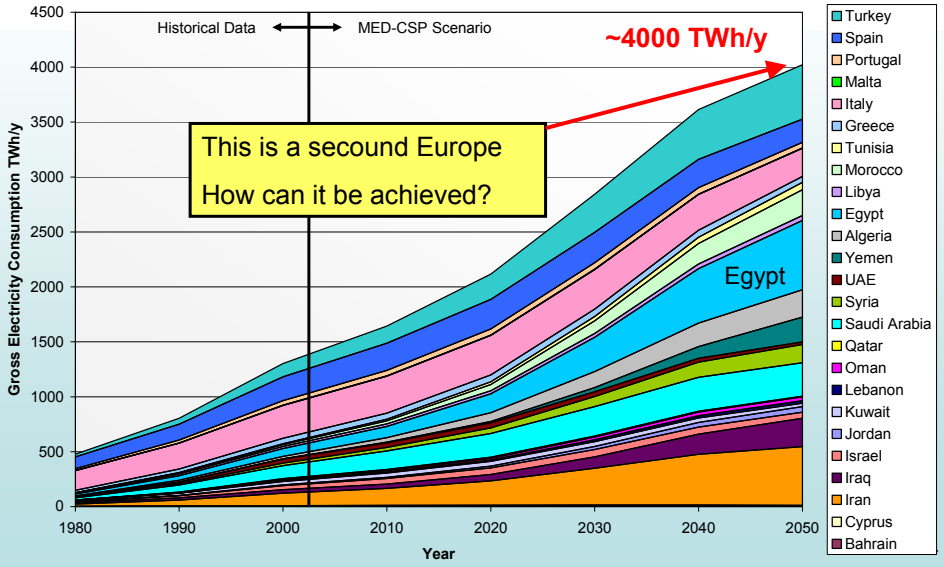
Renewable Energies around the Mediterranean

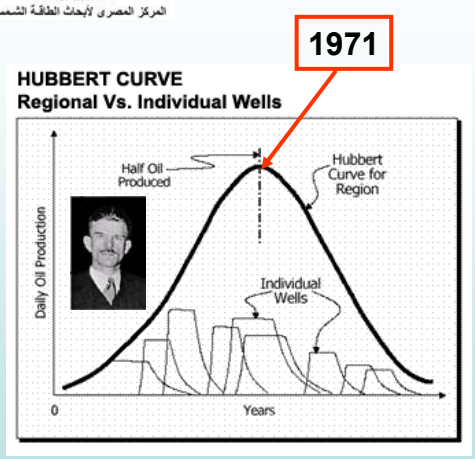
A study commissioned by the Federal Ministry of Environment
and conducted by the German Aerospace Center DLR

Countries analysed within the MED-CSP and TRANS-CSP Studies



Growing Electricity Demand in Southern EU-MENA





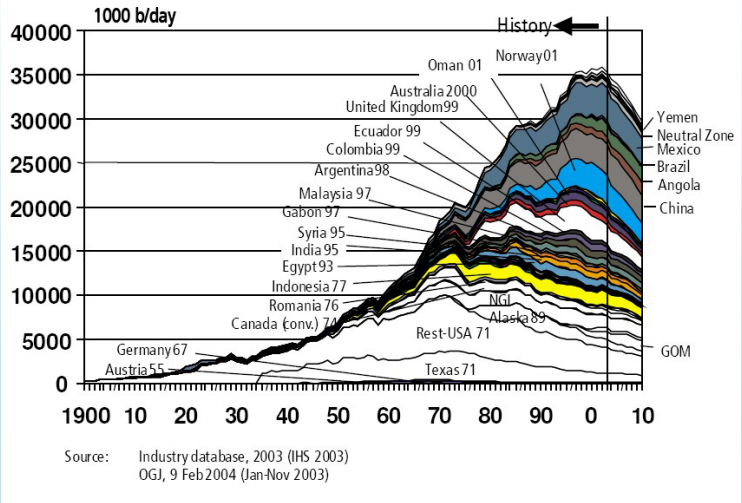
1947 Hubbert assessed the oil production from the southern states of USA. In the time an oil field depletes, several other oil fields are discovered.

Accumulation of all discoveries yielded a peak in 1971

This was not believed till it happened really.

Since then the theory of peak-oil was applied on other regions and proved true

Till 2003 peaked regions of the world …
…when will the rest peak?



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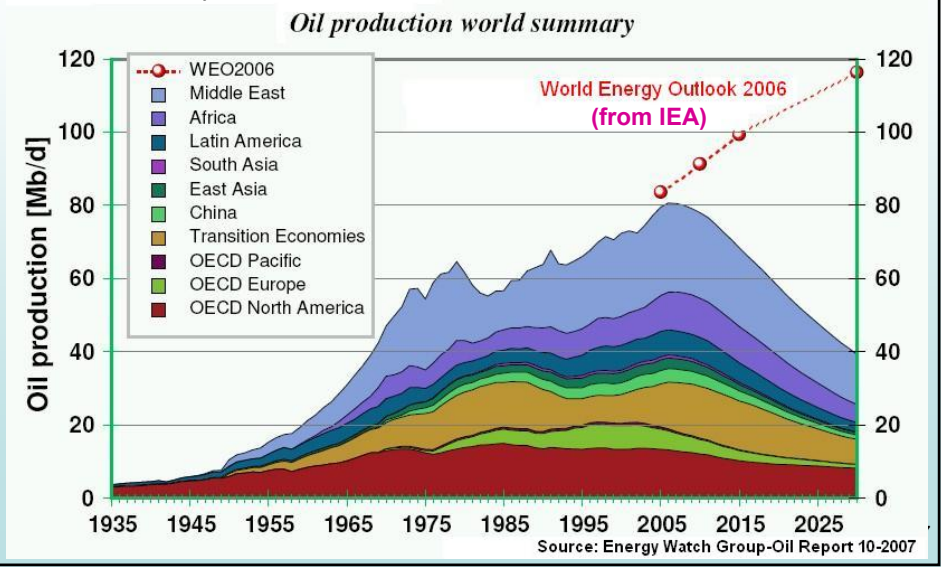
The International Energy Agency corrected ist forecast for peak-oil from „Never“ to 2015 then 2010. It HAPPENED 2007



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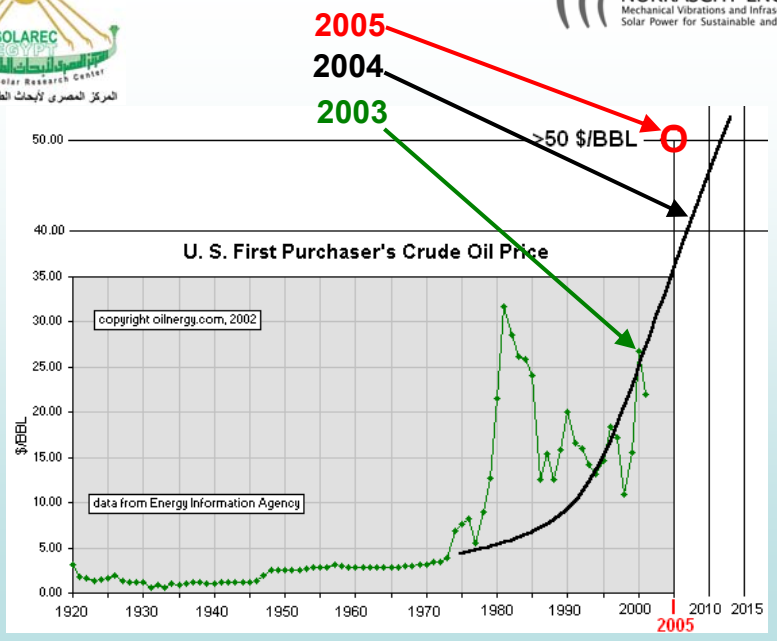

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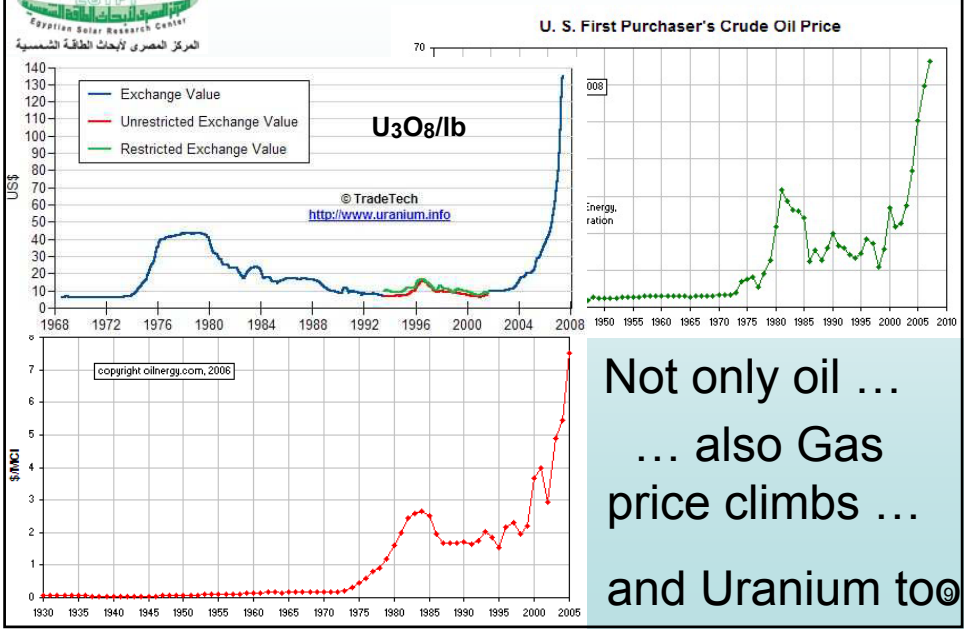

Not only oil …

… also Gas price climbs …

and Uranium too

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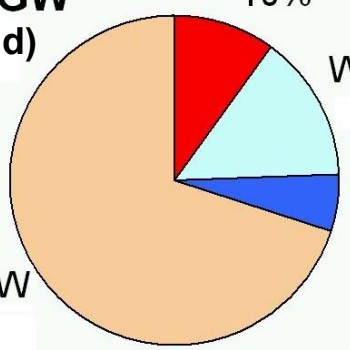
Nuclear electricity is NOT a solution, because it will cover – at best expectations – only a small fraction of the demand (example from Egypt)

Electricity of Egypt
Year 2022
Total 50 GW
(Demand)



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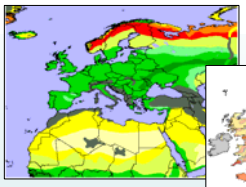
Renewable Energy Resource Mapping

Biomass



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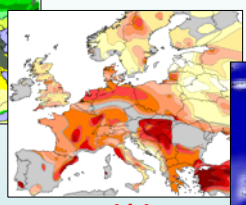
Economic Potential TWh/y
(Demand 2050 ≈ 4000 TWh/y)

Geothermal Energy



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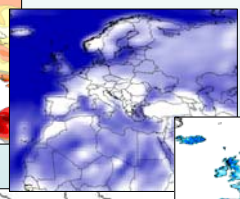
Wind Energy



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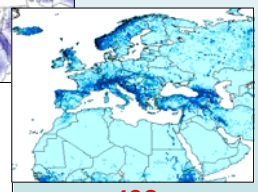
Hydropower



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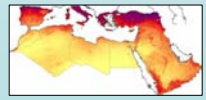
PV



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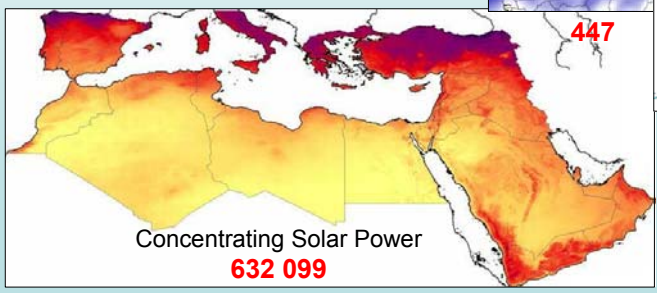

Concentrating Solar Power
632 099

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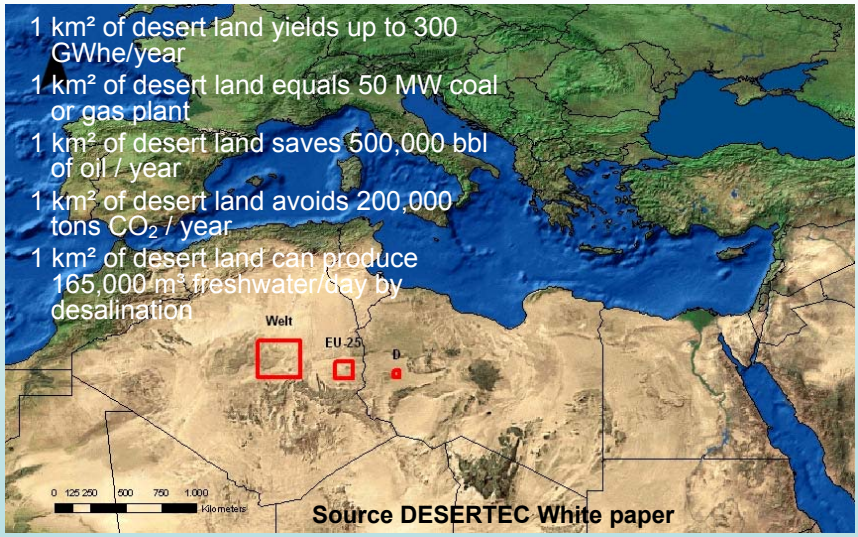
How much land do they need?

a very small area of the Sahara can cover the world's demand



Source DESERTEC White paper

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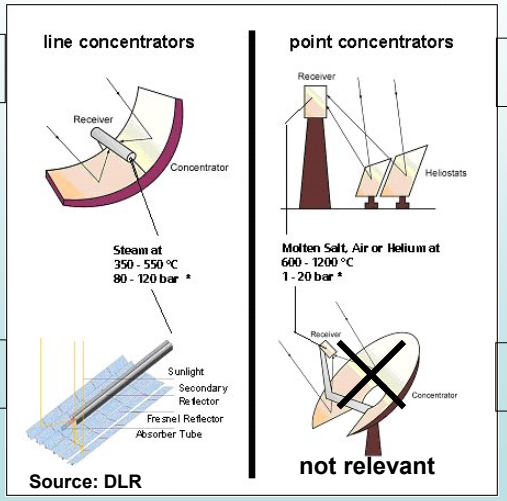
Concentrating Solar Power

relevant for Power Stations are 5 MW to 1000 MW

Parabolic Trough
5-600 MW

Linear Fresnel
5-600 MW



Solar Tower
5-100 MW

Parabolic Dish
0,5-50 kW

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CONCENTRATING SOLAR POWER TECHNOLOGIES

Linear Fresnel

Parabolic Trough

Central Receiver

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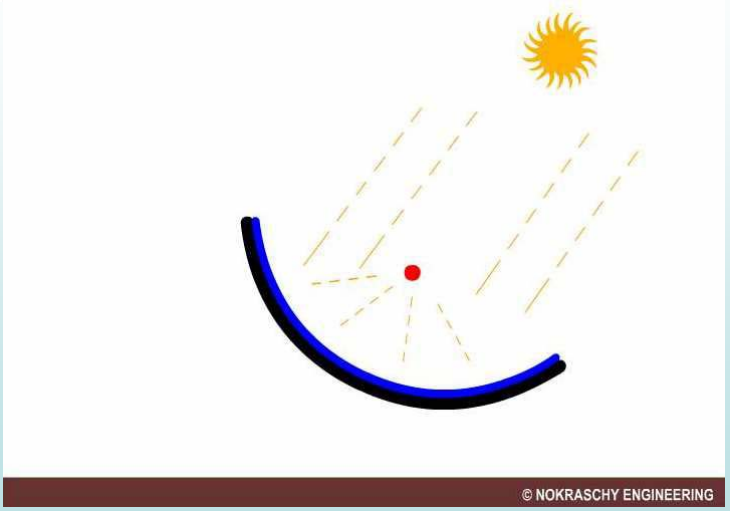
Parabolic trough Technology



Proven Technology of the past century

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CSP-Plant in California since 1985

Rows of parabolic troughs swivelling to track the sun

Line focus and flexible joints

Cleaning the mirrors

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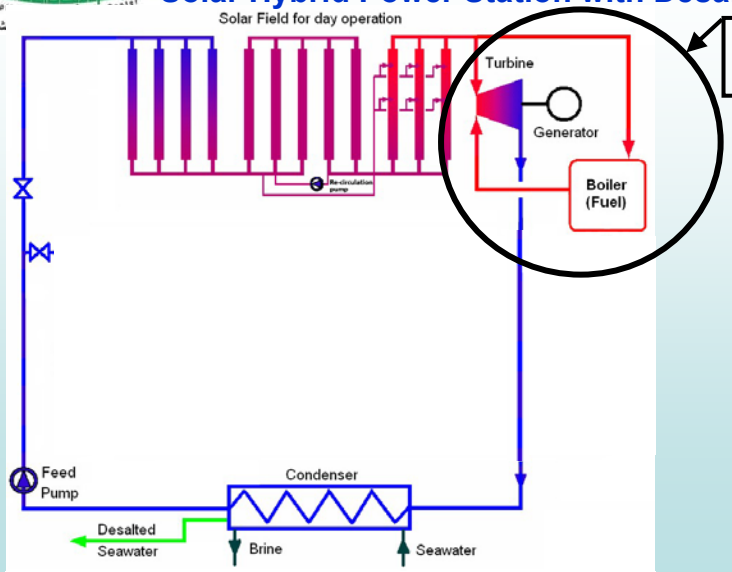
Solar Hybrid Power Station with Desalination



Desalination (MED) with Waste Heat

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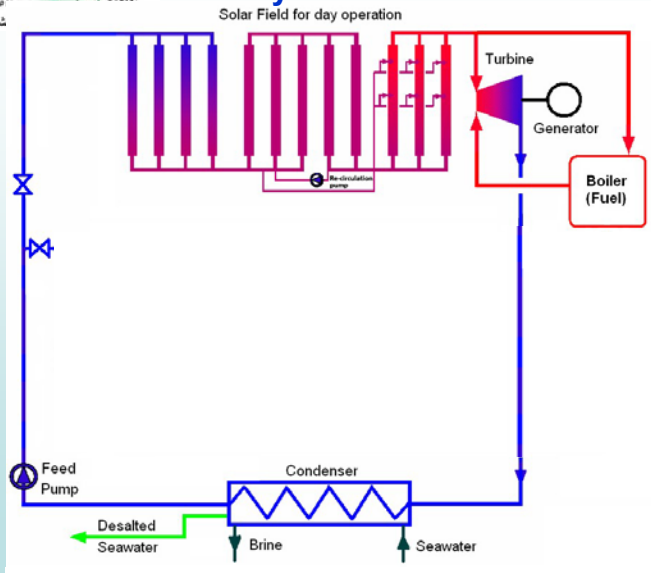
Solar Hybrid Power Station with Desalination



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

Desalination (MED) with Waste Heat

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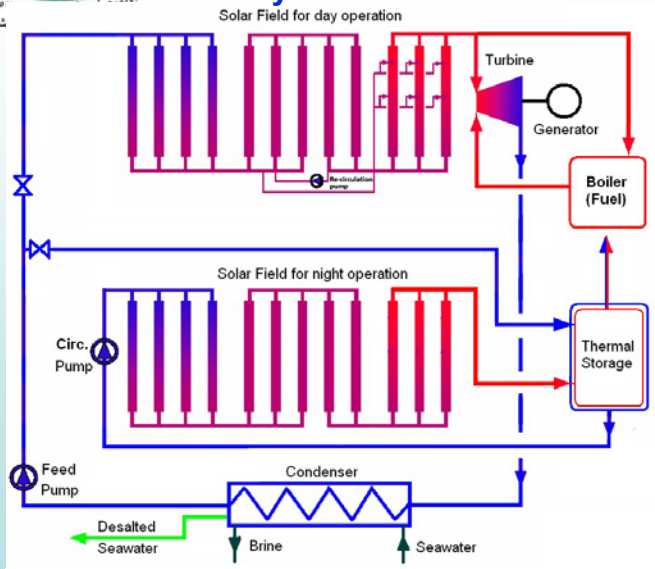
Solar Hybrid Power Station with Desalination



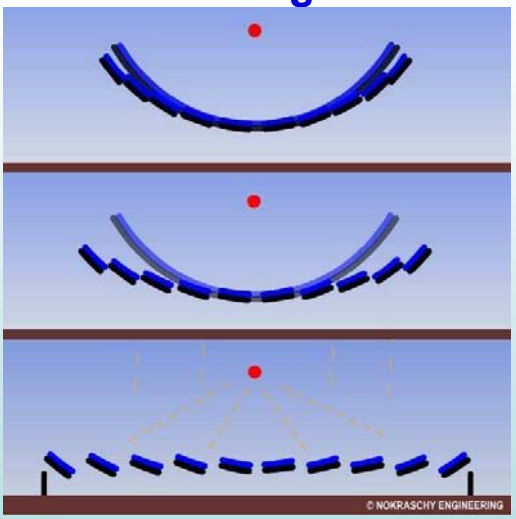
Desalination (MED) with Waste Heat

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

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

Spanish CSP Power Plant to be connected to grid in Nov. 2008

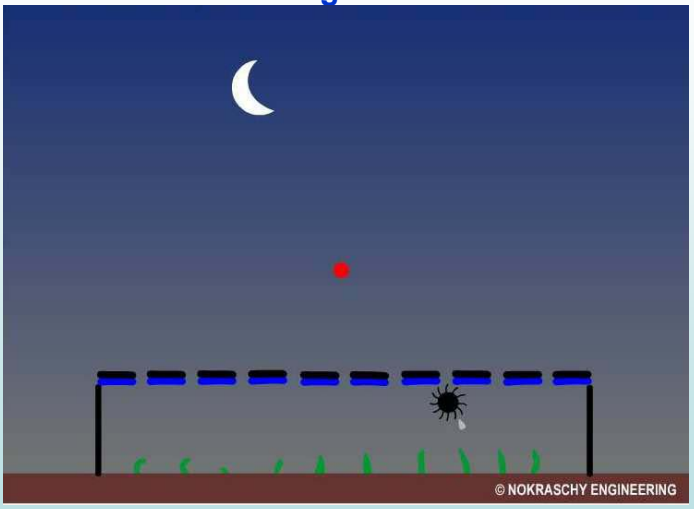
Advanced Design: Flat Mirrors



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

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CSP in action

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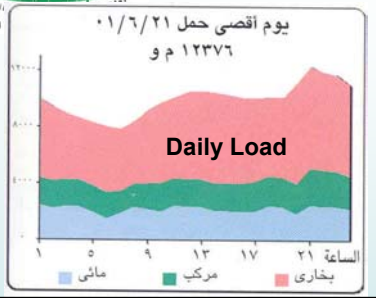
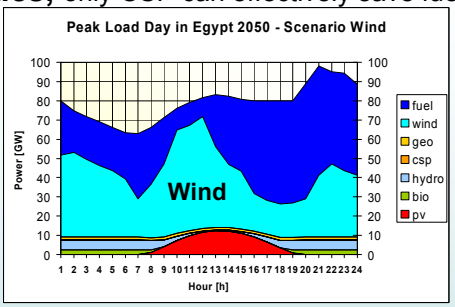
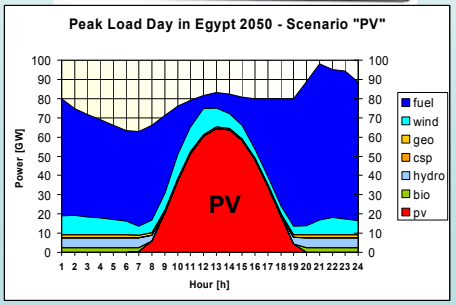
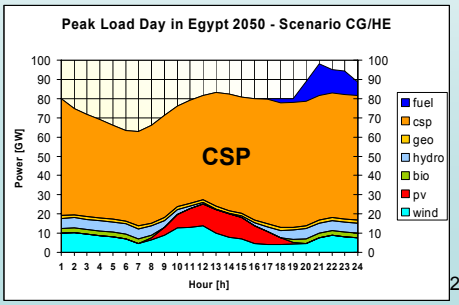
Load Characteristics, only CSP can effectively save fuel









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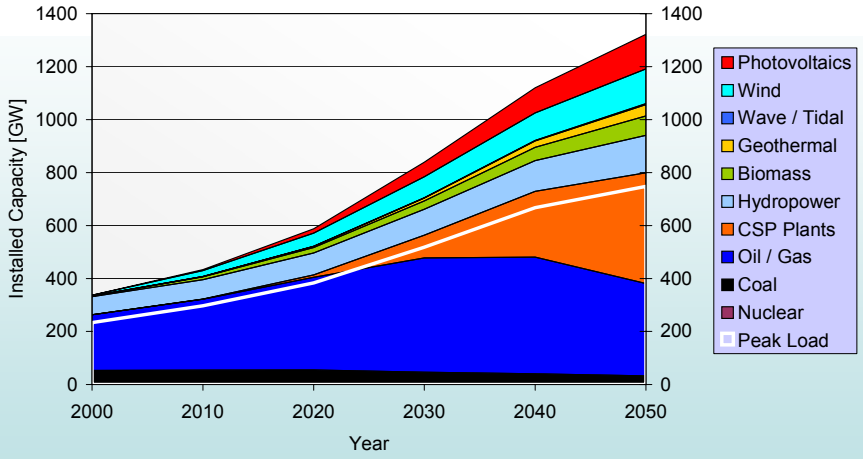
Installed Capacity of Southern EU-MENA



At any time, peak power demand is covered with an extra 25 % reserve capacity, All renewables are participating

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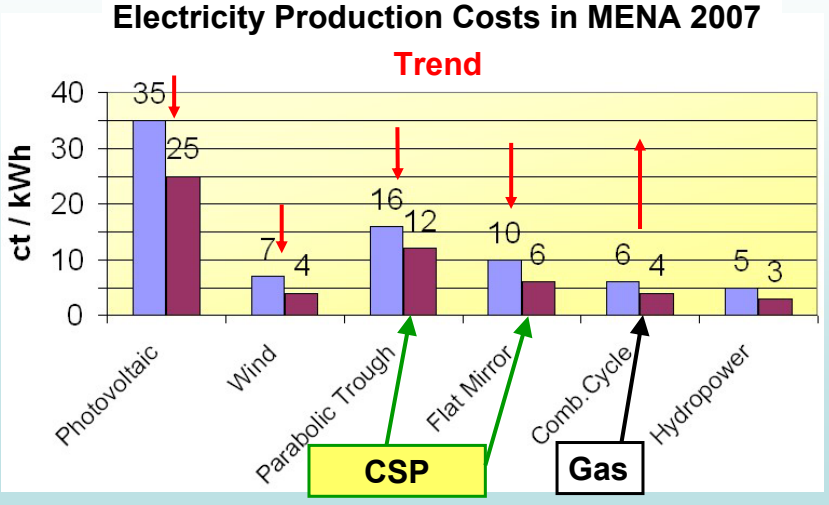
Electricity Production Costs in MENA 2007



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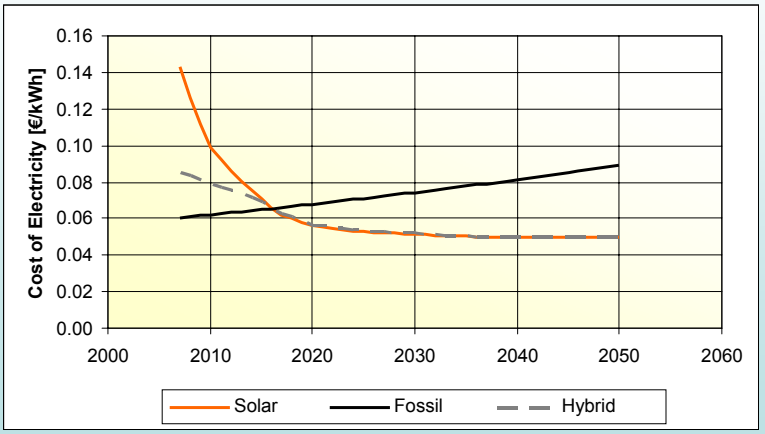
Unsubsidised cost of electricity of CSP versus natural gas CC



Discount rate 5%, economic life 25 years, fuel cost 25 €/MWh, fuel cost escalation 1 %/y, irradiance 2400 kWh/m²/y, real €2007, €/$=1

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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!

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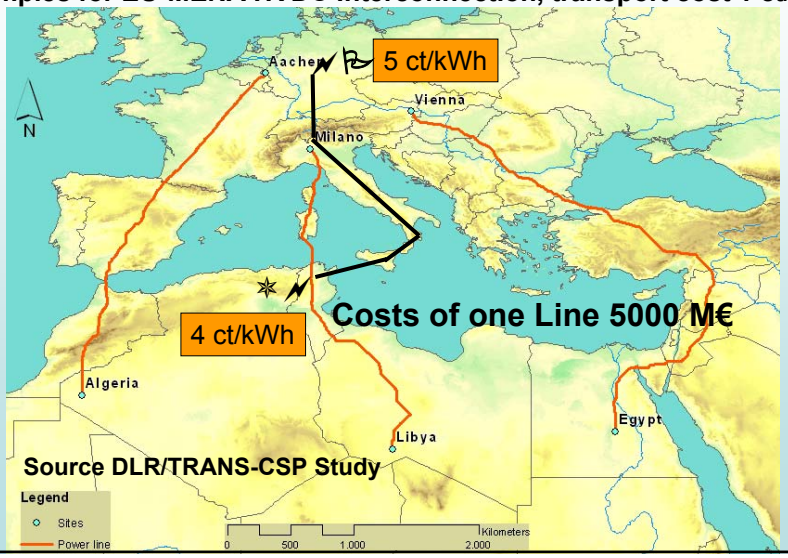
Till 2050

The CSP in North Africa will cost 4 ct/kWh

3 Samples for EU-MENA HVDC Interconnection, transport cost 1 ct/kWh



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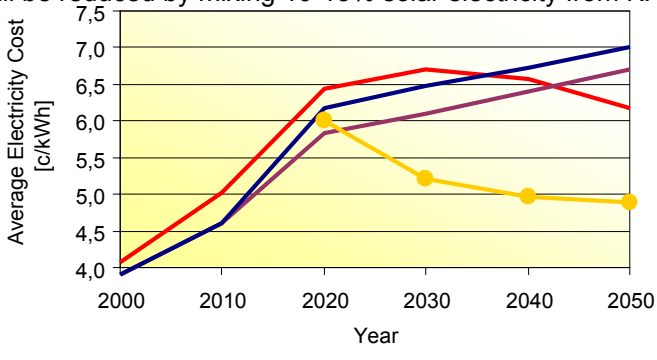
Europe‘s Advantage …

RUE
Rational Use of Energy

RES
Renewable Energy Systems

CCS
Carbon Capture & Sequestration

Cost of convent. elect. mix in 2050 ~7ct/kWh in Germany, will be reduced by mixing 10-15% solar electricity from NA



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

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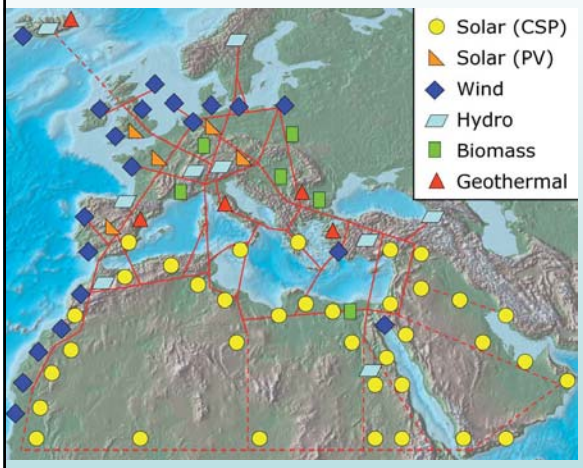
President Mobarak and President Sarkozy launched the "Union for the Mediterranean" 13.07.2008



THE CLUB OF ROME

منتدى روما العلمي

التعاون حول البحرالمتوسط للطاقات المتجددة

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

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The Requirements in MENA are different than those of Europe…

- Not only Electricity is needed …

  … 6-8% increase yearly

- Water is also needed …

  … more than two Niles by 2050

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AQUA-CSP

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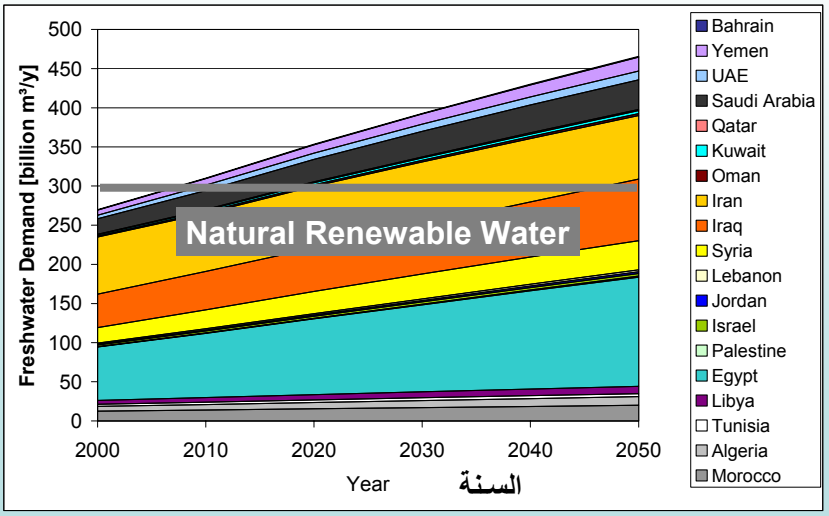
Water Demand in the Arab Countries

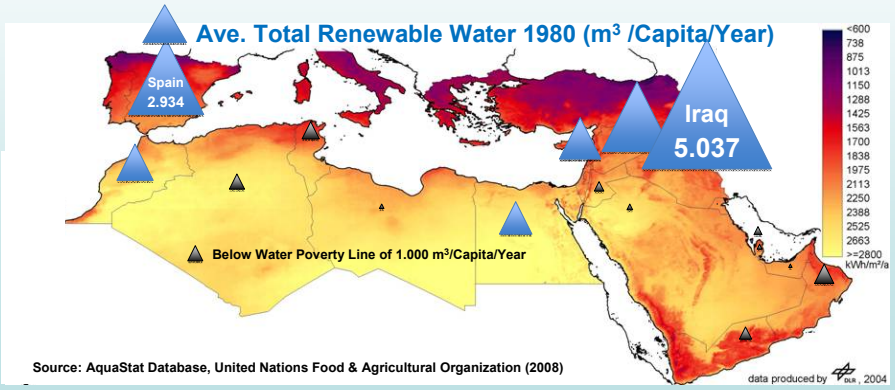


MENA Cleantech
Samer Zureikat

MENA cleantech

Why Should the MENA Adopt Concentrating Solar Power?

Because It Must.



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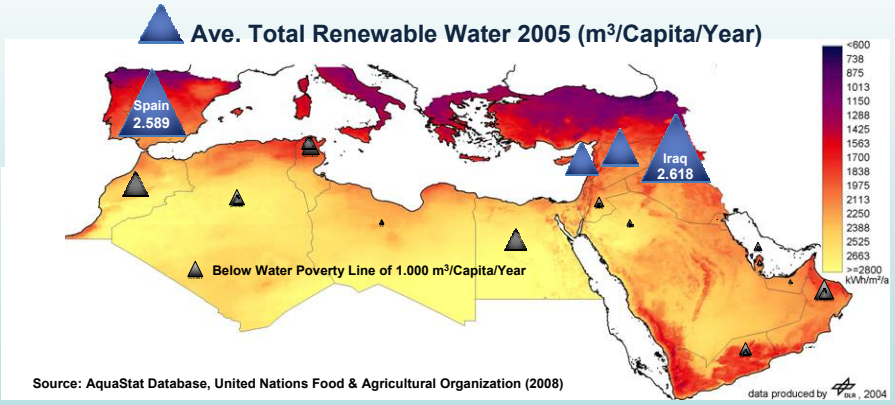

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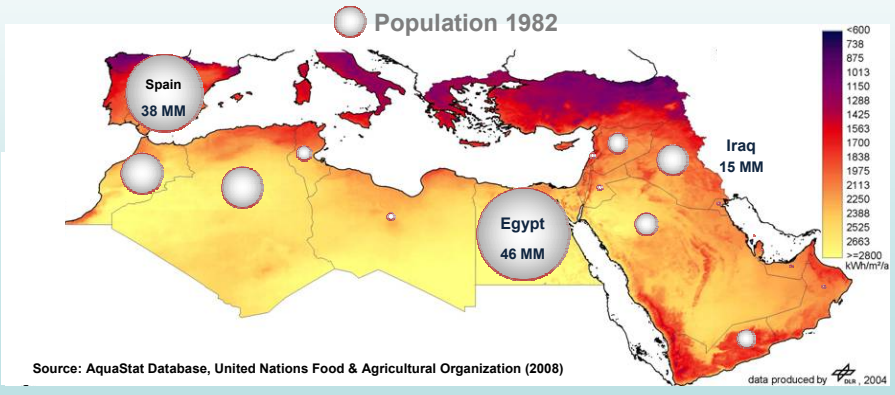

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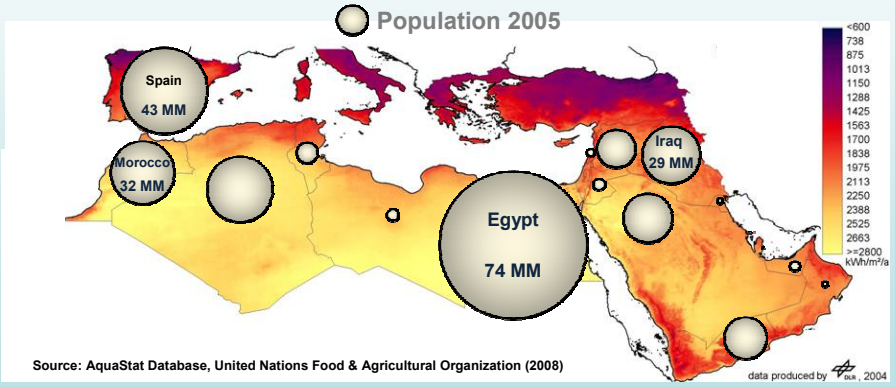

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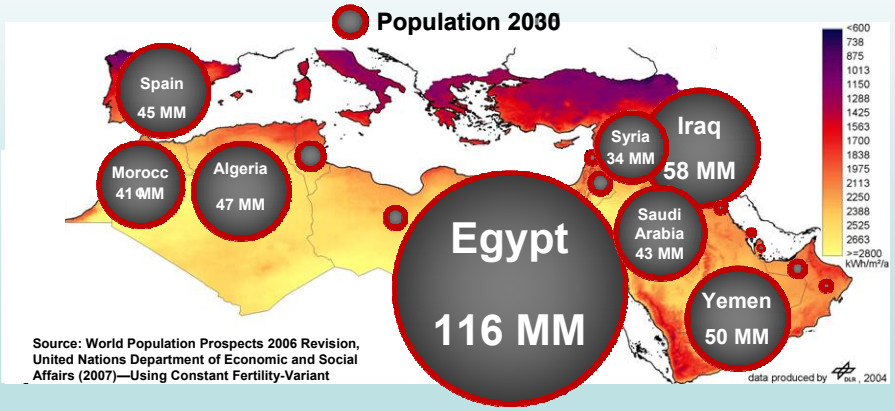

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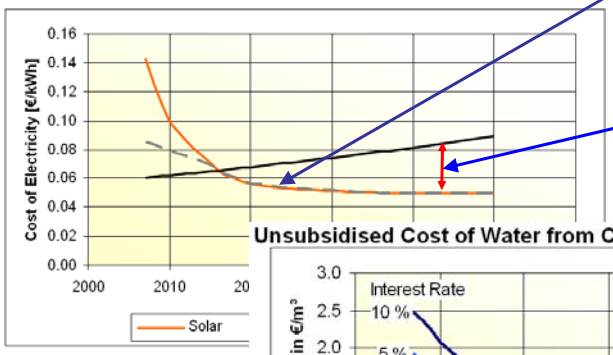
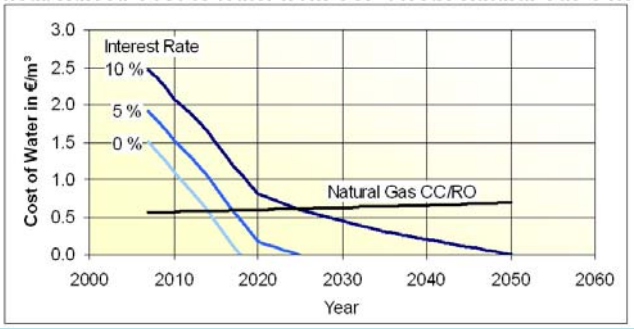
Unsubsidised cost of electricity of CSP versus natural gas CC



Smart people use CSP now to have cheaper electricity in the future

This difference is used to support water desalination

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



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

9

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Solar Power for Sustainable and Everlasting Energy

How can we create

EU-MENA

Renewable Energy Partnership

for Security of Energy and Water

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Just an Example:

- A European company establishes together with a company from MENA a Low Cost Solar Power Station in a MENA country.
- Solar-Hybrid concept is preferred to ensure supply on demand.
- The solar electricity share of at least 20% will be transmitted to Europe (Transmission costs 1 ct/kWh with HVDC lines) while the conventional share will be consumed in the MENA country.
- Beside electricity, desalted water will be produced from the waste heat of the power station, thus boosting the economies.
- Electricity may be used to produce clean Hydrogen

A Political and Financial
Framework shall give security to the participants

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General Ideas for the Framework

- Renewable energy shall be produced where it is most economical. For example in MENA countries
  - Wind 10 m/s (gulf of Suez and Atlas mountains)
  - Sun 3000 kWh/m²/y (nearly all over the Sahara)
- Agreements between country groups or bilateral agreements are suitable to reach the goal.
- Mutual benefit is aimed in this co-operation.
- At the start phase strong support from the European country to the MENA country will accelerate the development.
- Clean electricity and Hydrogen from MENA shall cover about 15% of Europe´s demand.

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What can the MENA-country do?

- Shift subsidies from oil/gas to electricity directly to the user, privileging RE.
- Offer free land and infrastructure.
- Buy the conventional electricity share (for example at 2.5 ct/kWh depend. on fuel price)
- Buy the desalted water produced from waste heat (for example at 50 ct/m³)
- Guarantee by law capital security.
- Free from taxes for the first 10 years.

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What can the European country do?

- Set a quota for clean electricity, which is increased each year by 1% points over the actual value for each electricity producer. This is compatible with the target of 20% in 2020.
- Extend support to clean electricity and clean Hydrogen for supplies from outside the country.
- Set support for clean electricity import over the price of local electricity production, assumed now 4 ct/kWh:
  - for example 8 ct/kWh for solar electricity ➔ 12 ct/kWh
  - for example 4 ct/kWh for wind electricity ➔ 8 ct/kWh
- The support is valid only for the clean share of a hybrid system.
- The support is guaranteed for 10 years.
- After 10 years it is reduced by 10% points each year.

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What are the „Win-Win-objectives“?

- **Europe wins:**
  - Clean and cheaper electricity and Hydrogen.
  - Employment due to investment instead of burning oil
  - Diversification of energy sources.
- **MENA wins:**
  - Water + Water + Water
  - Sells electricity and Hydrogen for a reasonable price.
  - Social and economic development.
- **Environment wins:**
  - Less CO_2 emission.
  - This system encourages developing low cost equipment and extending solar share to 100% using heat storage.

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MENA has the possibility of marketing a new product … clean electricity