GERMAN EGYPTIAN YEAR OF SCIENCE AND TECHNOLOGY 2007

German Egyptian Year of Science & Technology
Closing Event
Cairo - November 12th,2007

Renewable Energy Expert Group

Activities and Prospects

Adel Khalil
Coordinator Egyptian Group

Hani El Nokraschy
Member of German Group

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Renewable Energy
Expert Group

The Expert Groups

Egyptian Expert Group

- **Prof. Dr. Adel Khalil**
  Cairo University
- **Prof. Darek Korzec**
  German University Cairo
- **Prof. Nihad El Chazly**
  National Research Center
- **Dr. Ehab Abdel Rahman**
  American University Cairo
- **Eng. Bothayna Rashed**
  New and Renewable Energy Authority
- **Dr. El Sayed Tag El-Din**
  Cairo Univeristy
- **Prof. Galal Osman**
  Mansoura University

German Expert Group

- **Prof. J. Schmid**
  ISET, Kassel University
- **Prof. H. Müller-Steinhagen**
  German AeroSpase Center DLR
- **Mr. A. Holtkotte**
  KfW, Office Cairo
- **Prof. J. Müller**
  Hohenheim University
- **Prof. B. Hoffschmidt**
  Solarinstitut Jülich (SIJ)
- **Dr. V. Wittwer**
  FhG-ISE, Freiburg
- **Dr. Hani El Nokraschy**
  Nokraschy Engeneering

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Our Goal

Is it Possible to shift Egypt's Electricity Generation to be

100% Renewables?

by When?

What about Water demand?

How far is local manufacturing involved?

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Work done

Survey on the Economic Potential of Renewables in Egypt, by IMC and DLR

- Concentrating Solar Power (CSP)→**73 656 TWh/year** (electricity generation with steam turbines)
- Wind Energy → **90 TWh/year**
- Biomass 60 Million tonns/year → **15.3 TWh/year**
- Hydro Power 15 TWh/year (nearly all operational)
- Photovoltaic (PV) 36 TWh/year (remote areas)

Elec. demand Egypt 2007 ~100 TWh/y → 630 TWh/year 2050

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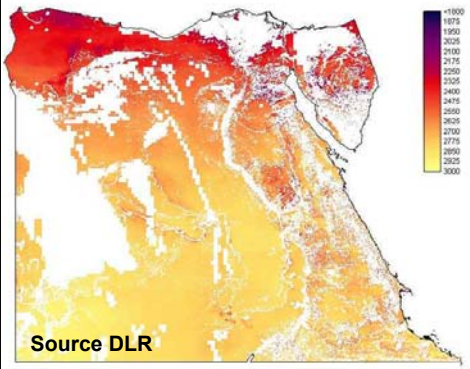
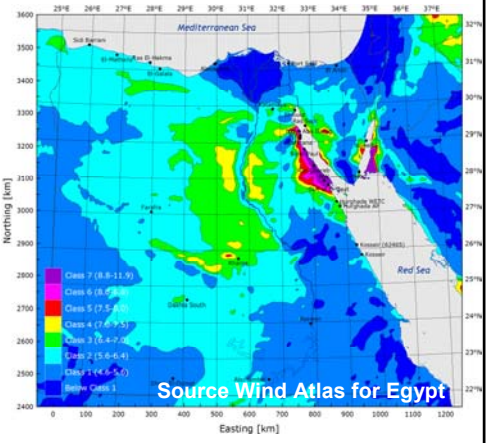
The most promissing Renewable Energy Sources



Direct Normal Irradiance up to 3200 kWh/m²/year



Wind speed up to 12 m/sec

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Potential of Local Manufacturing share (IMC)

Technology	Reactive Policy	Pro-active Policy
Concentrated solar power	30%	50%
Wind energy	40%	60%
Biomass	50%	95%
Photovoltaic systems	20%	30%
Solar water heaters	70%	95%

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AQUA-CSP

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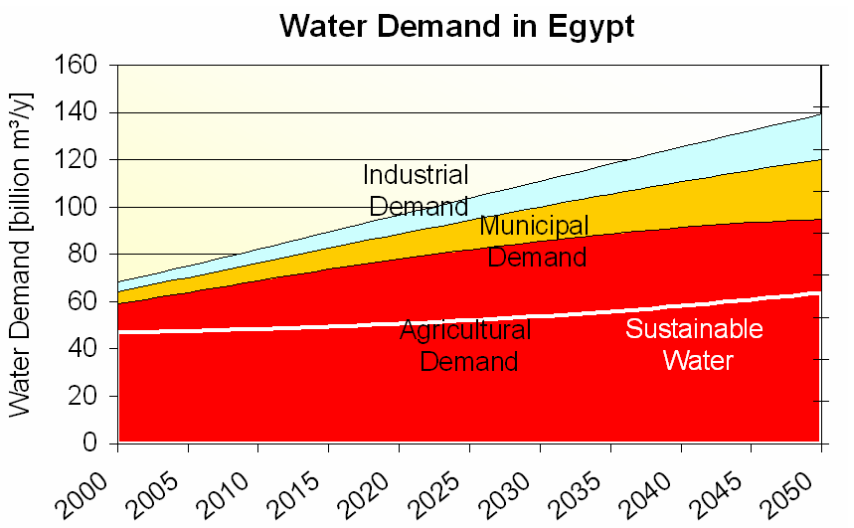

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Events in 2007

- **27 March 2007**
  Renewable Energy day at the Arab German Chamber of Commerce
- **5 May 2007**
  Cairo University Sustainable Energy Session.
- **21-23 May**
  Visit of German Group to Egyptian Universities
- **22 May 2007**
  Prof. Schmid speaks to „Environment 2007“
- **12-20 June 2007**
  Project days Renewables Energy at the German School
- **16-17 October 2007**
  Symposium „Wind Energy and Integration“ in Kassel
- **11-12 November 2007**
  Symposium „Solar Thermal Plants and Desalination“ in Cairo

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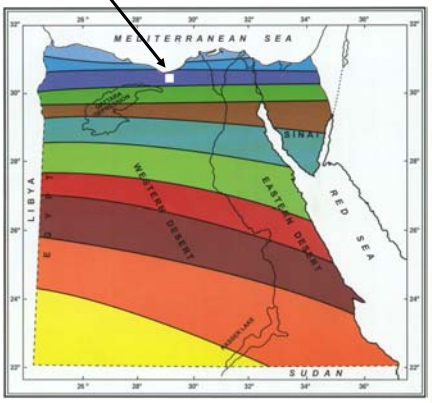
Short term planning and Electricity export possibilities

This Area 32x32 km = 1000 km² gives 50% of Germany's electricity



Source NREA / DLR

Source MoEE

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Wind Energy and Integration Symposium at ISET-Kassel

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Co-operation resulting from Symposium

Proposal no. 1: Wind Turbines

- Selecting the most suitable wind turbine on the market for the Egyptian weather conditions
- Most suitable Electricity Generation Method for the particular Wind conditions in Egypt.
- Specifications for local manufacturing of wind turbine components. The production of these turbines should cover the local and regional demand for wind turbines.

Partners: CUFE and ISET

Duration : 12 months

Required Funding: EURO 200,000

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Proposal no. 2: Integration of large scale Wind Power in the Egyptian Electricity Grid

- Enable the Egyptian TSO to optimally operate the electrical grid, at high wind penetration ratios.
- Aid in future grid planning and extensions to transport electrical power.
- Support for legal aspects and in the design of an efficient commercial operation.
- Contribute to the capacity building in Egypt by educational and training activities and to disseminate knowledge gained.

Partners: (ISET, CUFE, TSO, NREA, Regulatory Body)

Duration : 3 years

Required Funding: EURO 800,000

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Symposium: Solar Thermal Plants and Desalination

- DLR presented an impressive map showing the outstanding position of Egypt for CSP electricity generation.
- DLR studies showed that it is extremely economic to desalinate Seawater in combination with electricity production by means of CSP.
- Promising new trends in CSP technologies, some of which enable mass production.
- Hydrogen and Oxygen production with CSP by means of the innovative HYDROSOL Technology

Results soon at: www.menarec.org

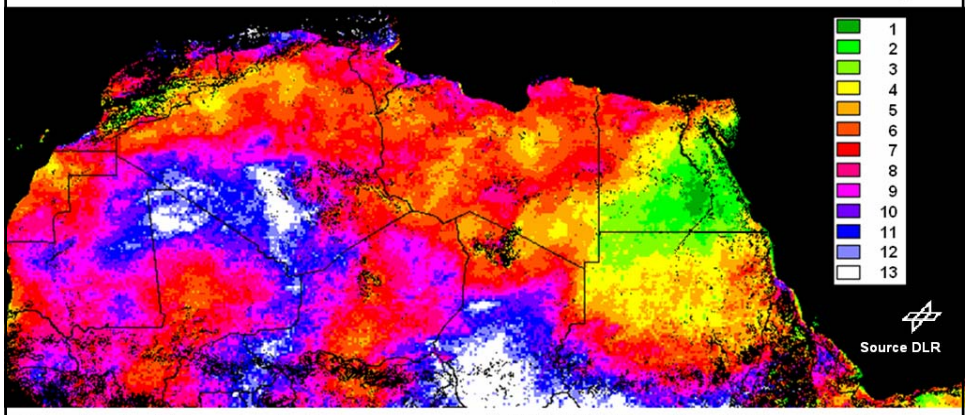
TRANS-CSP

MED-CSP

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 km² yearly

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AQUA-CSP

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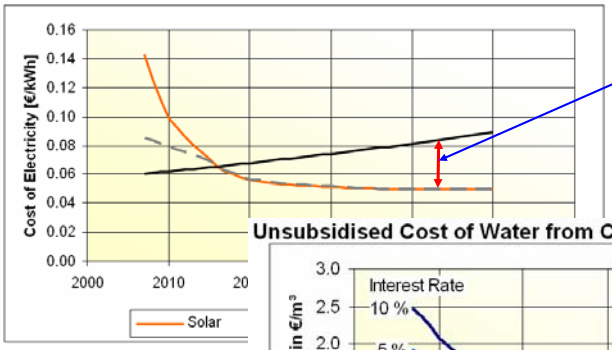
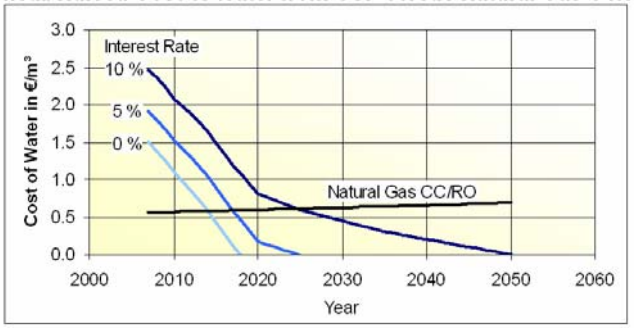
Unsubsidised cost of electricity of CSP versus natural gas CC



This diffirence 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

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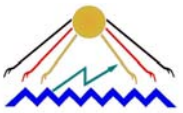
Co-operation resulting from Symposium



- Combining Capabilities of weather prediction in Egypt with those of DLR and extending to modeling output of solar thermal power stations, especially assessing the effect of sand storms on the performance of the solar field.
- Co-operation for local production of CSP components.
- Support to establish feed-in Tariffs for the Egyptian RE Feed-in-Law, that are suitable for the Egyptian market.
- Exchange of Master degree students.

Partners: (DLR, CUFE, GUC, AUC, NREA, Regulating Body)

Duration & Required Funding: to be suggested

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Proposed Initiatives 2008

- Joint research proposals for FP7 and other funding agencies in themes related to Renewable energy.
- Researchers exchange on institutional level through bilateral agreements for periods of 2 to 6 months.
- Staff mobility to visit German institutions using FP7 funding.
- Joint supervision with German Universities on Ph.D. degrees in the Renewable Energy Field.
- Establishing a Centre of excellence in Renewable energy.
- Joint postgraduate and research programs with German Universities.

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Prof. S. Shaheen offers a present to Prof. H. Müller-Steinhagen

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Conclusions

- Yes it is possible to shift to Renewables
  - By 2050 to be 50-60% of Electricity Generation
  - By 2100 to be 100%
- It is possible to provide desalinated Seawater at reasonable costs using CSP
- Renewable Energy Feed-in-Law is needed. Study for applicable and justified Tariffs suggested by DLR.
- Local Production is possible, it is even a MUST

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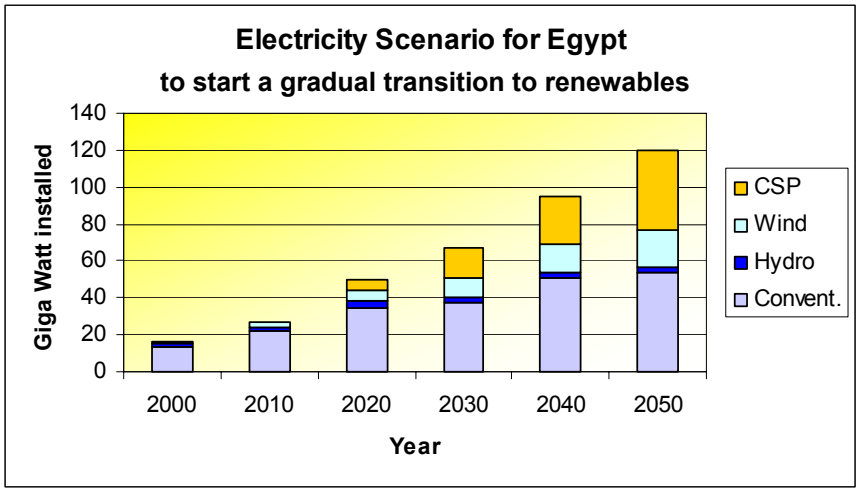

To down load the DLR-Studies: **www.menarec.org**