Partenariat Energétique Tunisie - Allemagne
“Renewable Electricity Expansion in Tunisia“

Renewable Electricity Expansion in Tunisia

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Tunis, 29.04.2013

Solar Electricity Imports from North Africa to Europe

- Quantification of the demand for solar electricity imports providing flexible power and firm capacity for 30 European countries (TRANS-CSP 2006)
- Identification of 300 potential corridors connecting production sites in North Africa with centers of demand in Europe (REACCESS 2009)
- Selection of 30 potential corridors to provide 700 TWh/a to Europe (Trieb et al. Energy Policy 42 (2012))
- Selection and detailed description of a first HVDC corridor connecting a large-scale CSP plant in NA with a German center of demand in 2022 (BETTER 2012-2014)
RES-E Expansion in MENA

Strongly required firm and flexible power capacity to cope with growing demand

- PV and wind power are inexpensive “fuel savers” but do not provide firm power capacity
- Very limited availability of electricity storage and other flexible and firm RES-E like biomass or hydropower.
- CSP competitive in the peak and upper-mid merit segment to substitute firm capacity from fuel oil
- In the medium-term CSP competitive in mid-merit and base load segment to substitute firm capacity from gas and coal.
- CSP in long-term as back-bone of electricity supply complemented by wind power and PV.

Example Jordan 2012:

Source: REMix CEM, T. Fichter et al., DLR (2012)
Methodology for an optimized integration of RES-E technologies into existing power plant portfolios in MENA

- Emphasis on cost-optimized short-term integration of renewable energy systems for electricity generation (RES-E) and on security of supply
- Results for decision support for electricity authorities and power utilities in MENA

Source: REMix-CEM, T. Fichter et al., DLR (2012)

Policy Database for REMix-CEM

We will try to provide an overview for peer review before July 2013
Resource Database for REMix-CEM

- **Resource Maps**: DNI, GHI, $V_{\text{wind}}$
- **Exclusion Areas**

We will provide data for peer review before June 2013

- RES-(E) Hot Spots for Wind Power, PV and CSP
- Basic information on hydropower and biomass potentials

**Exclusion criteria**
- Slope of terrain
- Protected area
- Population density ($> 50$ km$^{-2}$)
- Land coverage
- Geomorphology
- Hydrography

System Database for REMix-CEM

- **Electricity Demand Tunisia [GWh/y]**
- **Peak Load Tunisia [MW]**

We will provide data for peer review in May 2013

- DNI in kWh/m²/yr
  - 0 - 2.000
  - 2.000 - 2.100
  - 2.100 - 2.200
  - 2.200 - 2.300
  - 2.300 - 2.400
  - 2.400 - 2.500
  - 2.500 - 2.600
  - 2.600 - 2.700

**Legend**
- **2010**: Light grey bar
- **2011**: Orange bar
- **2012**: Red bar
- **2016**: Dark red bar
- **2020**: Red bar

**Graph**: Hourly Load Curve Tunisia

- **2010**: 0, 5.000, 10.000, 15.000, 20.000, 25.000, 30.000
- **2011**: 0, 5.000, 10.000, 15.000, 20.000, 25.000, 30.000

**Graph**: Electricity Demand Tunisia [GWh/y]

- **2010**: 0, 5.000, 10.000, 15.000, 20.000, 25.000, 30.000
- **2011**: 0, 5.000, 10.000, 15.000, 20.000, 25.000, 30.000
- **2012**: 0, 5.000, 10.000, 15.000, 20.000, 25.000, 30.000
- **2015**: 0, 5.000, 10.000, 15.000, 20.000, 25.000, 30.000
- **2020**: 0, 5.000, 10.000, 15.000, 20.000, 25.000, 30.000

**Graph**: Peak Load Tunisia [MW]

- **2010**: 0, 5.000, 10.000, 15.000, 20.000, 25.000, 30.000
- **2011**: 0, 5.000, 10.000, 15.000, 20.000, 25.000, 30.000
- **2012**: 0, 5.000, 10.000, 15.000, 20.000, 25.000, 30.000
- **2016**: 0, 5.000, 10.000, 15.000, 20.000, 25.000, 30.000
- **2020**: 0, 5.000, 10.000, 15.000, 20.000, 25.000, 30.000

**Graph**: Hourly Load Curve Tunisia
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Power Plant Database for REMix-CEM

- Transformer Stations
- Power Lines:
  - 400 kV AC
  - 225 kV AC
  - 30 kV AC
- Transformer Stations

We will provide data for peer review before May 2013

Grid Database for REMix-CEM

- Power Lines:
  - 400 kV AC
  - 225 kV AC
  - 30 kV AC
- Transformer Stations
  - Geographic Information System
    - (*.kmz files)
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REMix-CEM – Decision Support

- On the basis of this information, REMix-CEM will provide a model for cost-optimized integration of RES-E in Tunisia and the other North African countries in the short, medium and long term.

**Source:** REMix-CEM, T. Fichter et al., DLR (2012)

We will provide data for peer review of the results before November 2013

Thank you for your attention!

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**BETTER – German Tunisian Energy Partnership**

- CIEMAT – Centro de Invest. Energ. Mediamb. Tecn (Spain)
- DLR – Deutsches Zentrum Für Luft- und Raumfahrt e.V (Germany)
- ECN – Energy Research Centre of the Netherlands (Netherlands)
- JOANNEUM – Forschungsgesellschaft Mibh (Austria)
- NTUA – National Technical University of Athens (Greece)
- OME – Observatoire Méditerranéen de l’Énergie (France-Int.)
- PIK – Potsdam Institute for Climate Impact Research (Germany)
- TUWIEN – Vienna University of Technology (Austria)
- UNDP – United Nations Development Programme (International)