

Combined Solar Power and Desalination Plants:
Techno-economic potential in Mediterranean Partner Countries

Renewable Energy Scenarios

Dr. Franz Trieb



Training Workshop
RABAT, 17 MAY 2010

Portfolio of Energy Sources for Electricity

- ✓ Coal, Lignite
 - ✓ Oil, Gas
 - ✓ Nuclear Fission, Fusion
 - ✓ Concentrating Solar Power (CSP)
 - ✓ Geothermal Power (Hot Dry Rock)
 - ✓ Biomass
 - ✓ Hydropower
 - ✓ Wind Power
 - ✓ Photovoltaic
 - ✓ Wave / Tidal
- ideally stored primary energy
- storable primary energy
- fluctuating primary energy



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Criteria for Sustainable Electricity Supply

- ✓ **Inexpensive**
 - low cost
 - no long term subsidies
- ✓ **Secure**
 - diversified and redundant supply
 - power on demand
 - inexhaustible resources
 - available technology
- ✓ **Compatible**
 - low pollution
 - climate protection
 - low risks for health and environment
 - fair access



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Renewable Energy Technologies



Hydropower



Concentrating
Solar Power



Biomass



Geothermal



Tides



Waves



Photovoltaic



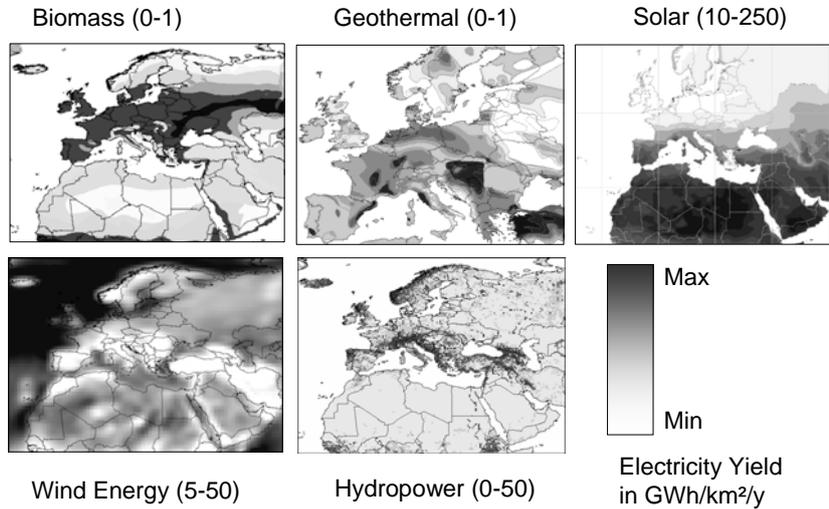
Wind Power



<http://www.erneuerbare-energien.de/inhalt/36983/35338/>

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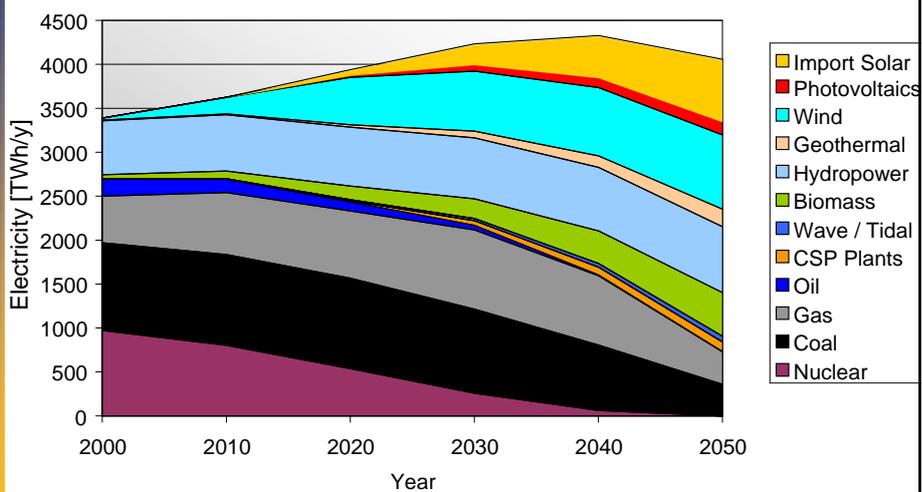
Renewable Electricity Potential in Europe, Middle East & North Africa



MEDCSD

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Electricity Supply in Europe

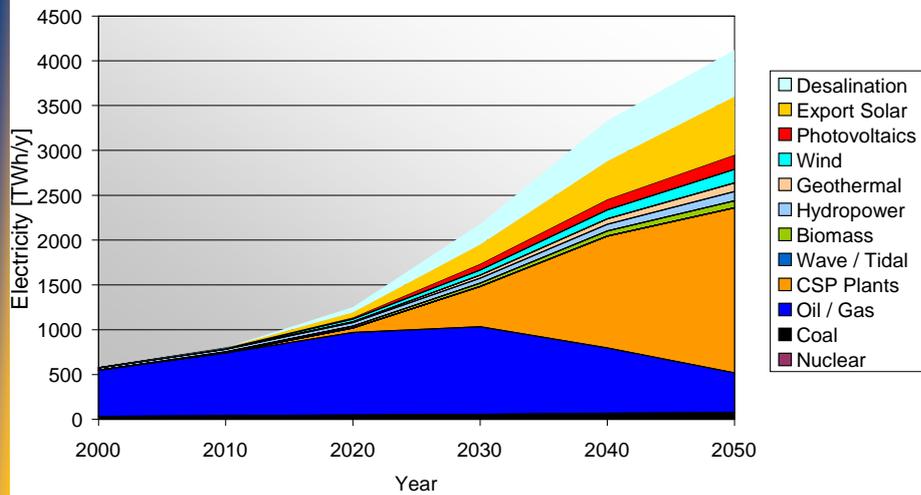


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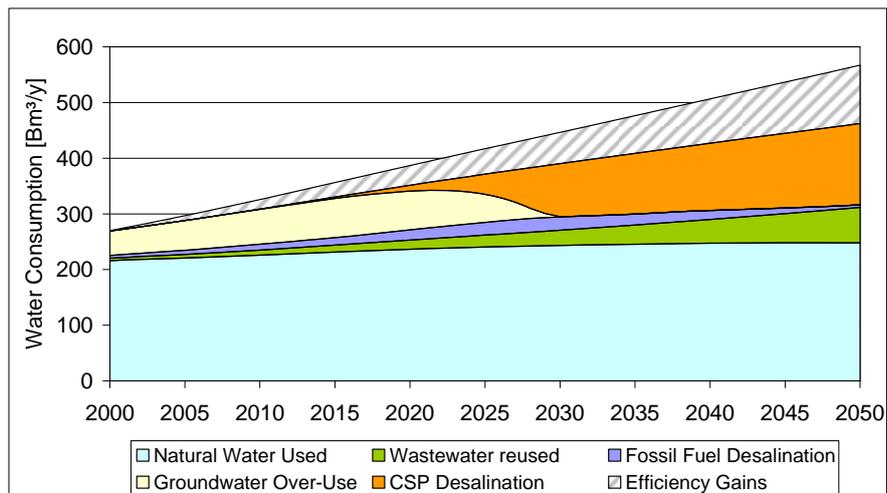
www.dlr.de/tt/trans-csp

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Electricity Supply in the Middle East & North Africa



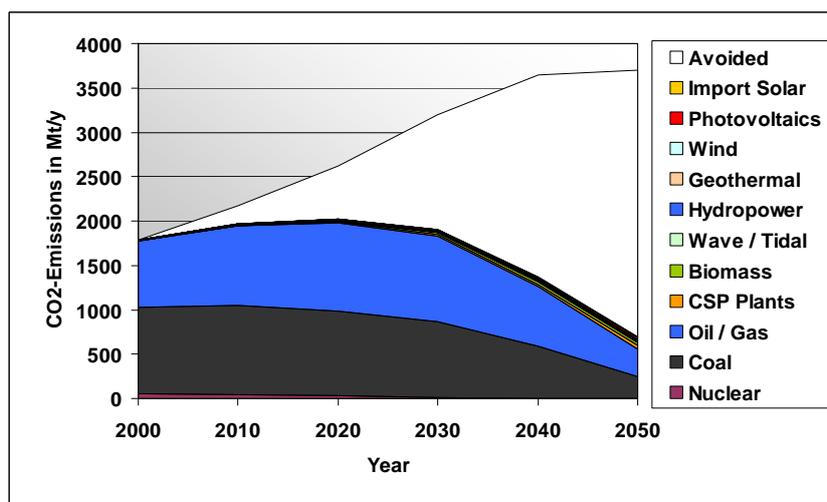
Water Supply in the Middle East & North Africa



Availability and Redundancy

- Power on Demand by a Mix of Fluctuating and Balancing Sources
- Increased Number of Non-Correlated Energy Sources
- Increased Number and Reduced Average Size of Power Plants
- Increased Number of Supply Regions
- Additional HVDC Grid Infrastructure for Long-Distance Transfer
- Domestic Sources Dominate the Electricity Mix
- Renewable Sources Dominate the Electricity Mix
- Strategy Based on Proven Technologies

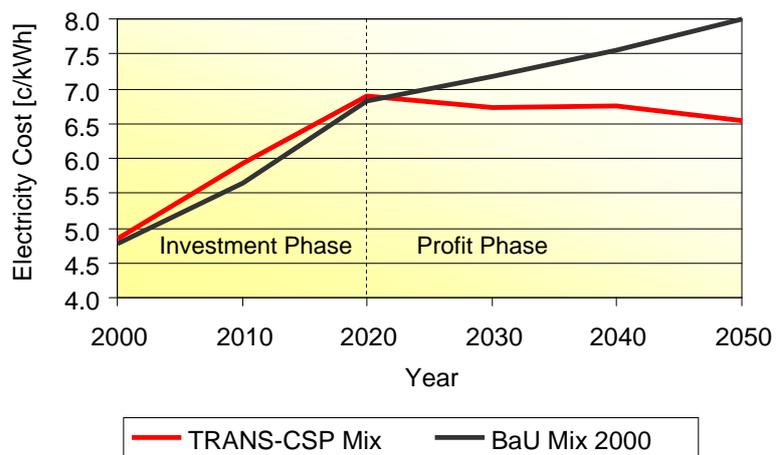
Carbon emissions of EUMENA power sector are reduced to 38 % until 2050 in spite of a quickly growing demand



Environmental Security

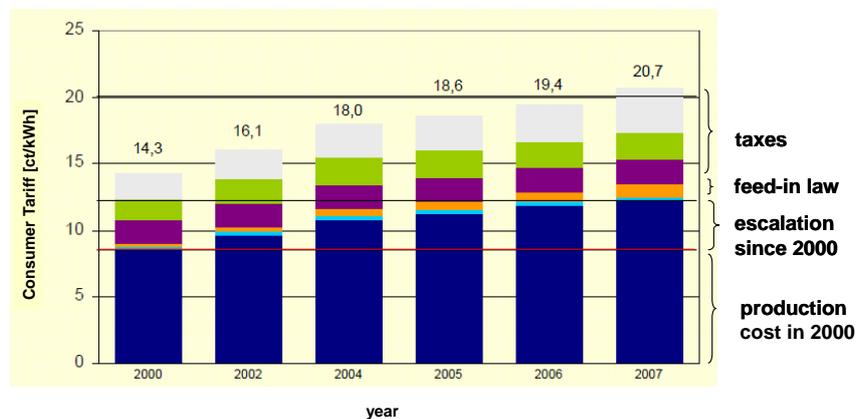
- Reduced Life Cycle Greenhouse Gas Emissions
- Reduced Risks from Nuclear Radiation and Proliferation
- Reduced Pollution by Combustion Products
- Optimal Land Use (1%) through Diversified Mix
- Technology based on Recyclable Materials

Electricity Cost (Example Spain)



€₂₀₀₀ Fuel Cost: IEA / WEO 2005, after 2020 CCS

German Feed-In Law: Impact on Consumers

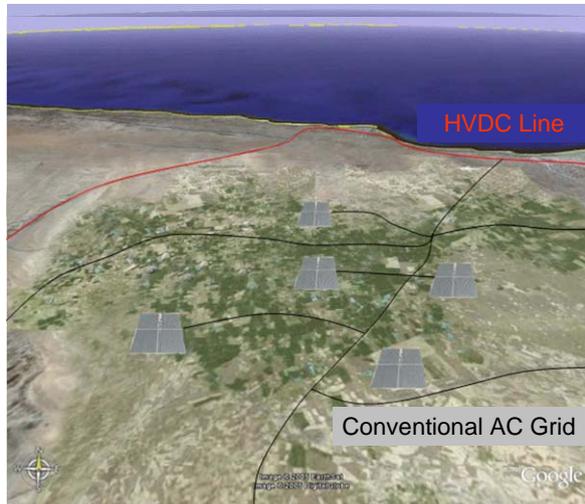


Feed-In Law 2007: 1.0 ct added but 0.5 ct escalation avoided

Economic Security

- Economic Risk Hedged by Increased Portfolio
- Intrinsic Trend to Lower Cost and Lower Price Volatility
- Energy Cost Stabilization through Investment in New Sources
- Avoids Cost Escalation from Environmental Constraints
- Avoids Cost Escalation from Scarcity
- Reduction of Energy Subsidies

Solar Power & Desalination Plants



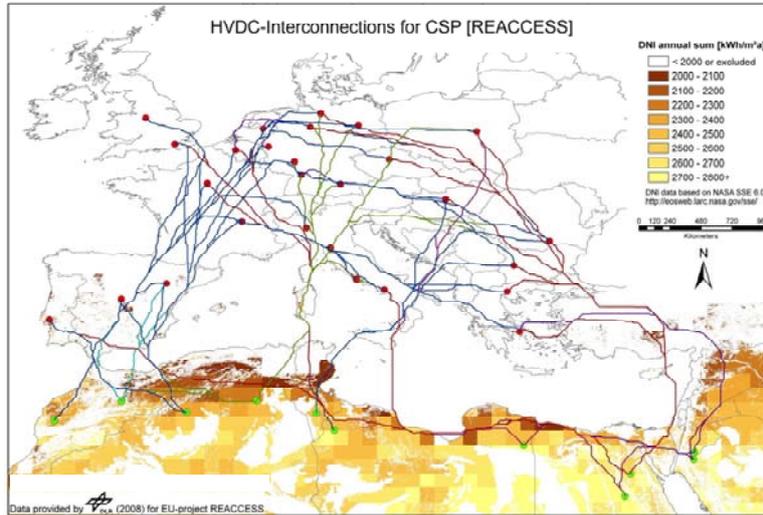
Energy,
Water,
Food,
Labor and
Income

for further
300 Million
People
in MENA ?

Political Security

- Conflict Prevention by Reducing Pressure on Fuels
- Conflict Prevention Solving Energy and Water Scarcity
- Conflict Prevention Increasing Energy Diversity
- Reduction of Energy Import Dependency
- Addition of Energy Corridors for Sustainable Supply
- Initiating EU-MENA (Energy) Partnership

Solar Electricity Corridors from MENA to Europe



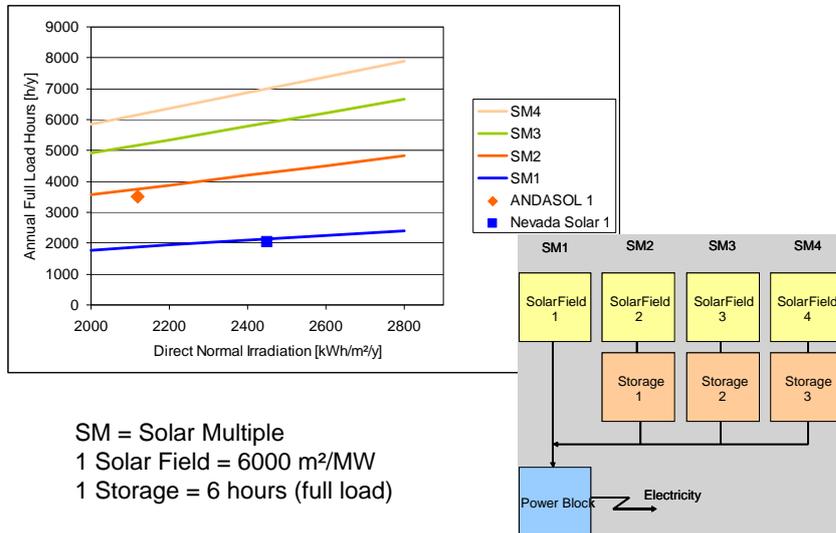
High Voltage Direct Current Transmission in China



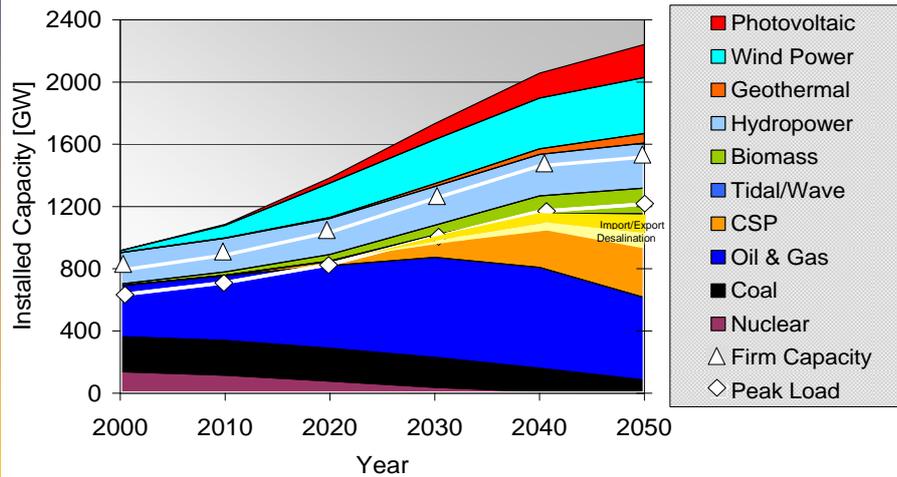
Voltage: ± 800.000 Volt
 Power: 6400 Megawatt
 Length: 2070 km
 Source: Hydropower
 Losses: 7%



Effect of Thermal Energy Storage on the Availability of CSP



Installed Capacity vs. Peak Load in EUMENA



Challenges

- Requires New Structures and New Thinking (Change of Paradigm)
- Requires Long-Term Financing Scheme for Large Infrastructure
- Based on International Cooperation and Interdependencies
- Higher Complexity than Using Ideally Stored Fossil Energy Sources
- More Stakeholders Involved due to Decentralized Generation
- Cultural and Political Differences in EUMENA
- Lobby Groups Acting Against Each Other
- Speed of Environmental Change and Conflict Potentials

WHY POWER FROM THE DESERT ?

Potential:
3.000.000 TWh/a 18.000 TWh/a Global Demand

Land Use:
150-300 m²/GWh 400 m²/GWh Coal
 800 m²/GWh „Clean“ Coal

Availability:
7.500 h/a 7.500 h/a Nuclear Plant

WHY NOT ?

Thank you



franz.trieb@dlr.de

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