

A Sustainable Electricity Scenario for Europe, Middle East and North Africa

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Deutsches Zentrum für Luft- und Raumfahrt e.V. in der Helmholtz-Gemeinschaft

Criteria for Sustainable Electricity Supply:

- ✓ **Inexpensive**
low electricity cost
no long term subsidies
- ✓ **Secure**
diversified and redundant supply
power on demand
based on inexhaustible resources
available or at least visible technology
capacities expandable in time
- ✓ **Compatible**
low pollution
climate protection
low risks for health and environment
fair access

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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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Renewable Electricity Potential in Europe, Middle East & North Africa

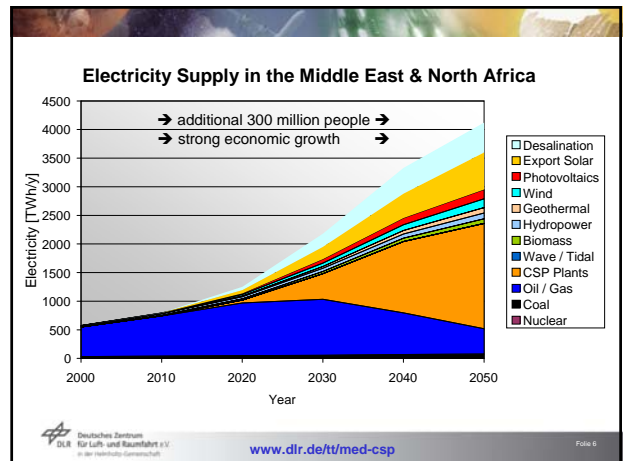
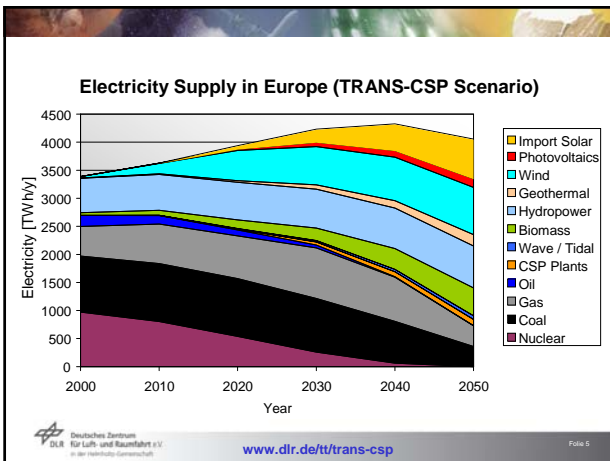
Biomass (0-1) Geothermal (0-1) Solar (10-250)

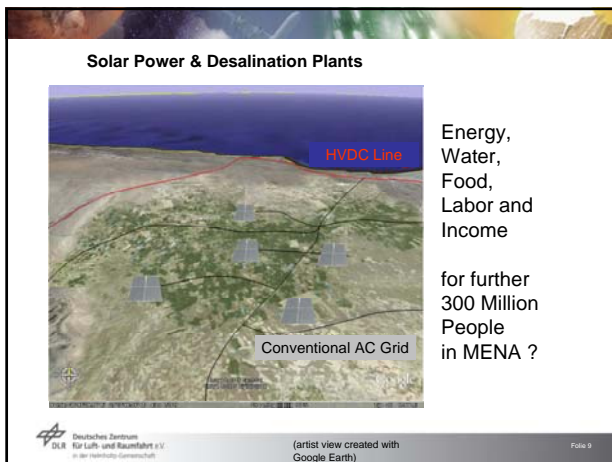
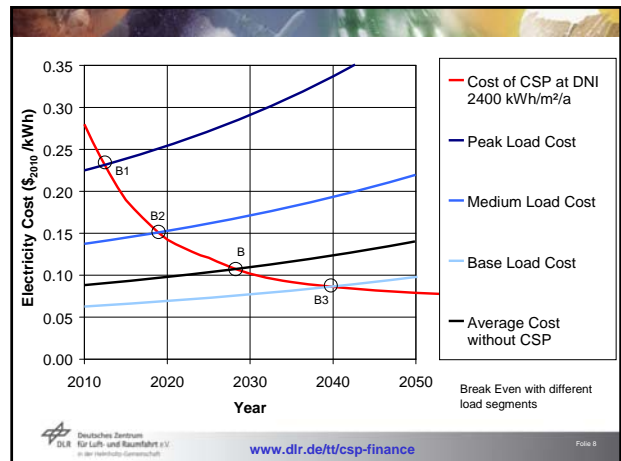
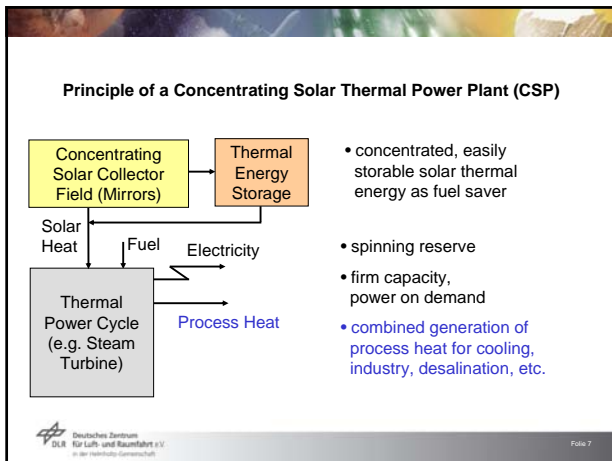
Wind Energy (5-50) Hydropower (0-50)

Electricity Yield in GWh/km²/y

Max
Min

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- ### Opportunities
- Power on Demand by a Mix of Fluctuating and Balancing Sources
 - Increased Number of Sources and Supply Regions
 - Strategy is Based on Proven Technologies
 - Reduced Pollution and Climate Change
 - Optimal Land Use (1%) through Diversified Mix
 - Intrinsic Trend to Lower Cost and Lower Price Volatility
 - Conflict Prevention Solving Energy and Water Scarcity
 - Initiating EU-MENA (Energy) Partnership
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Foto 10

- ### Challenges
- Requires New Structures and New Thinking (Changes of Paradigm)
 - Requires Long-Term Financing Schemes due to Long-Term Investments
 - 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 EU-ME-NA
 - Lobby Groups Acting Against Each Other
 - Speed of Environmental Change and Conflict Potentials
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Foto 11



High Voltage Direct Current Transmission



Voltage: ± 800.000 Volt
Power: 6400 Megawatt
Length: 2070 km
Source: Hydropower
Losses: 7-8%
Construction: 2 years



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<http://www.abb.com>
<http://www.siemens.com>

Foto 13



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Foto 14