Renewable Desalination: A Methodology for Cost Comparison

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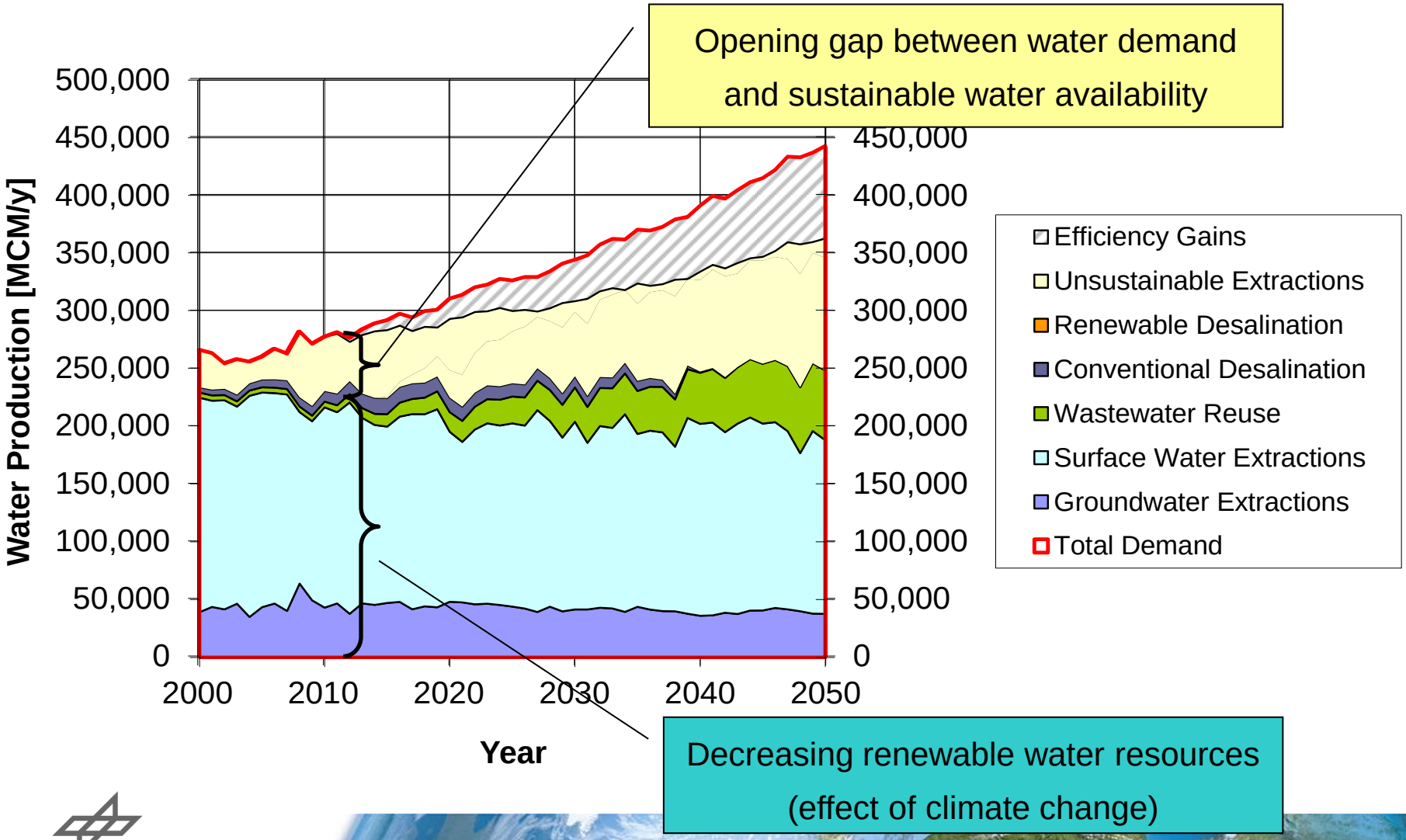
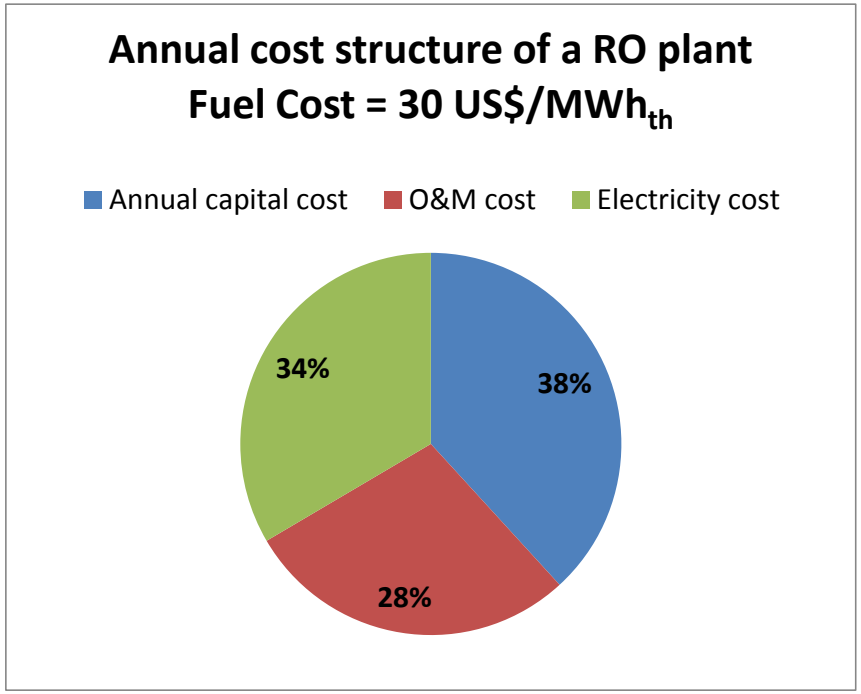
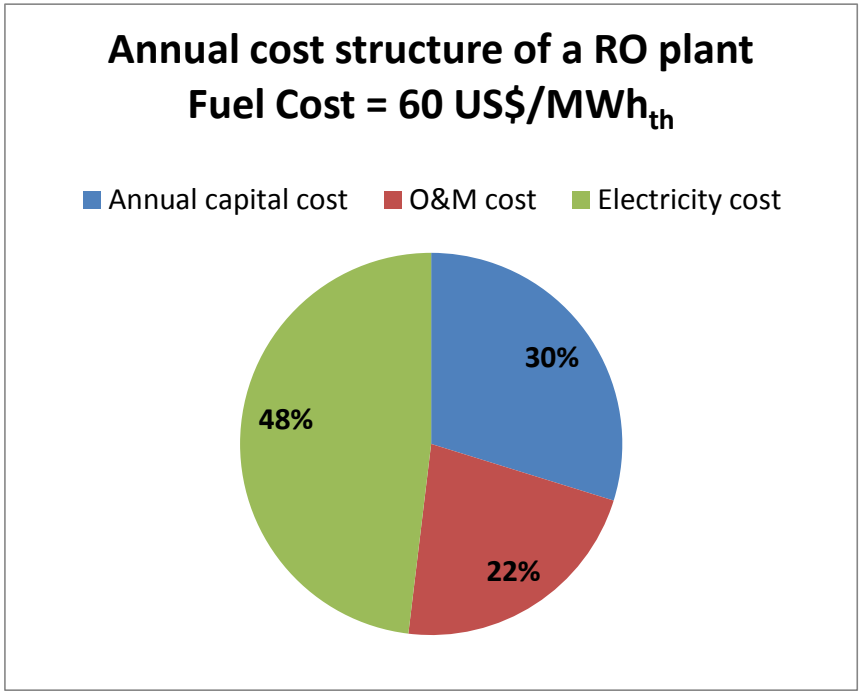
Water Supply Scenario for MENA



Source: MENA Regional Water Outlook

Energy Cost for Conventional Desalination (Example: RO)



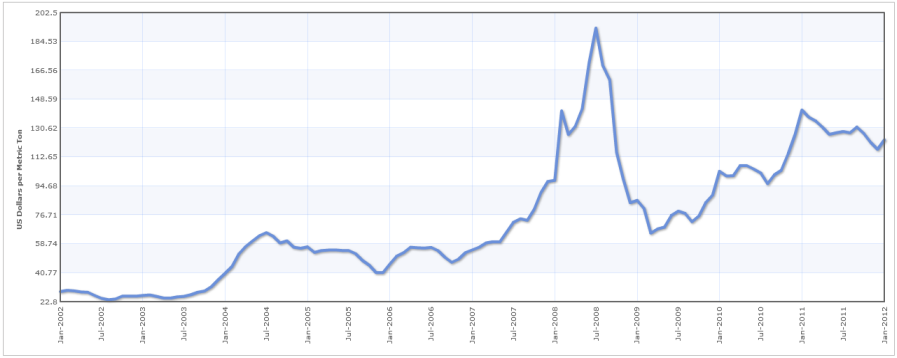


LWC: 1.23 US$/m³

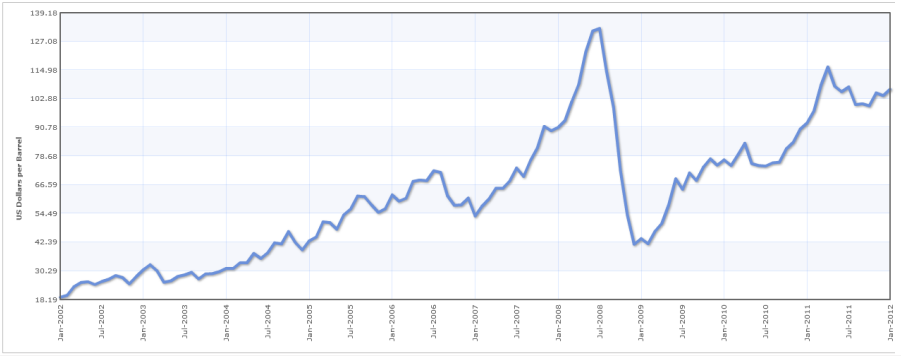
LWC: 1.58 US$/m³

Fossil fuels cost 2002 - 2012

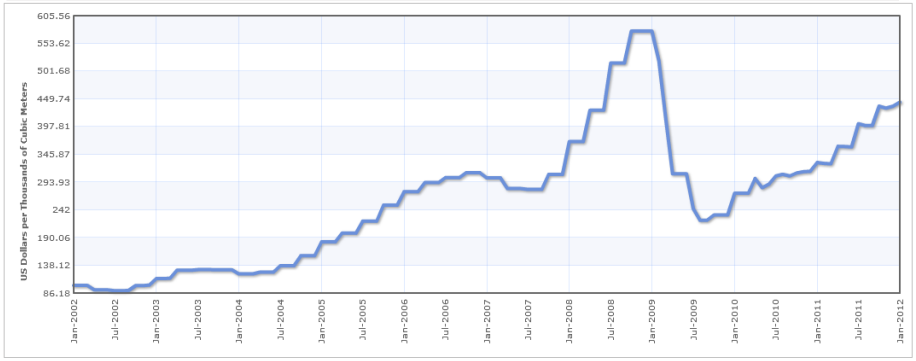
- Coal (Australia)
  x 4.2



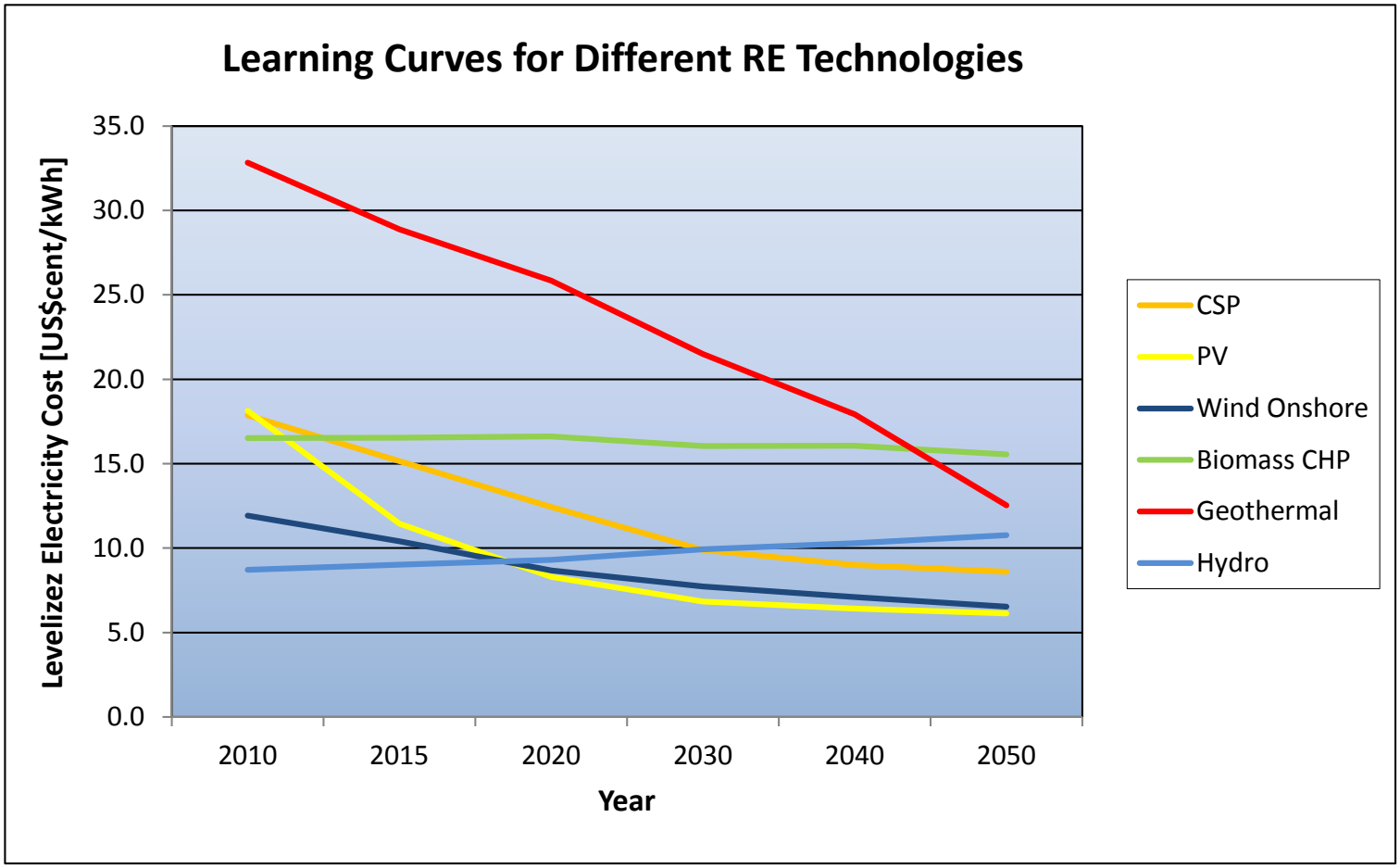
- Crude Oil (Brent)
  x 5.6



- Natural Gas (Russia)
  x 4.4

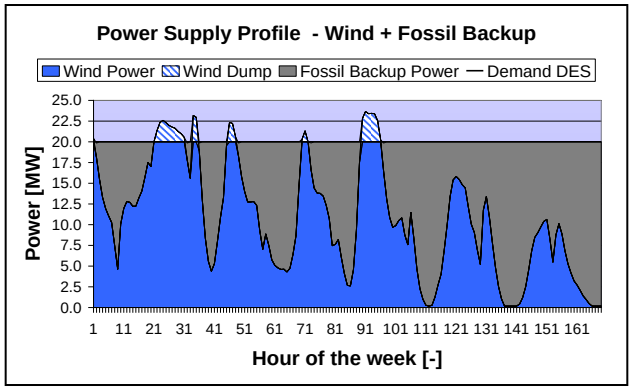


Energy Cost Development of RE-Technologies

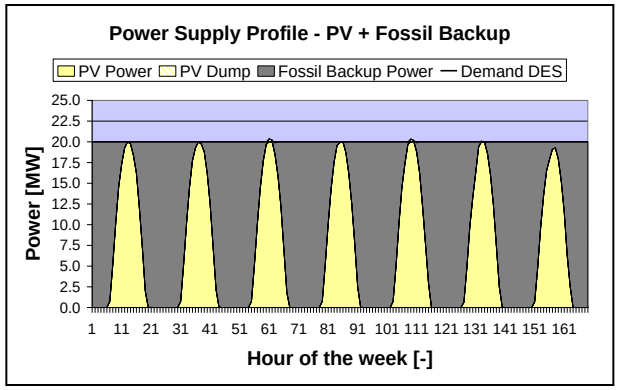


Note: qualitative trends only!

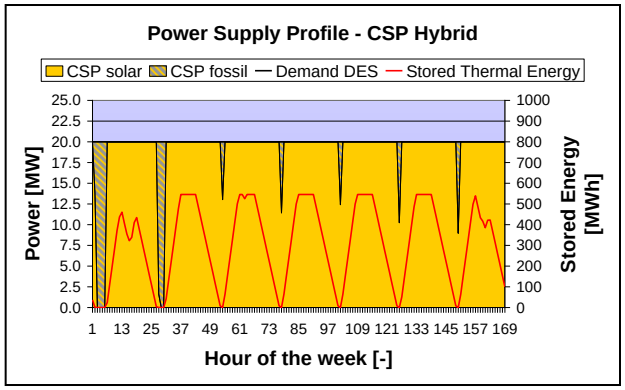
Typical Electricity Generation Profiles of RE



Wind



PV



CSP

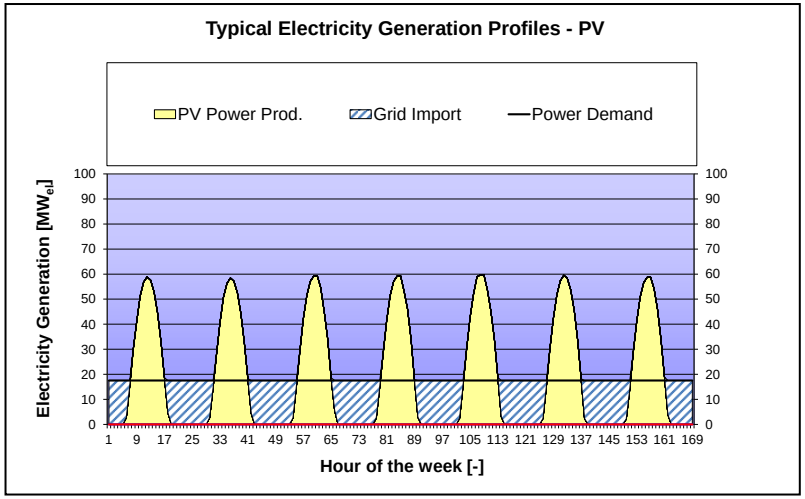
Large desalination plants require continuous operation

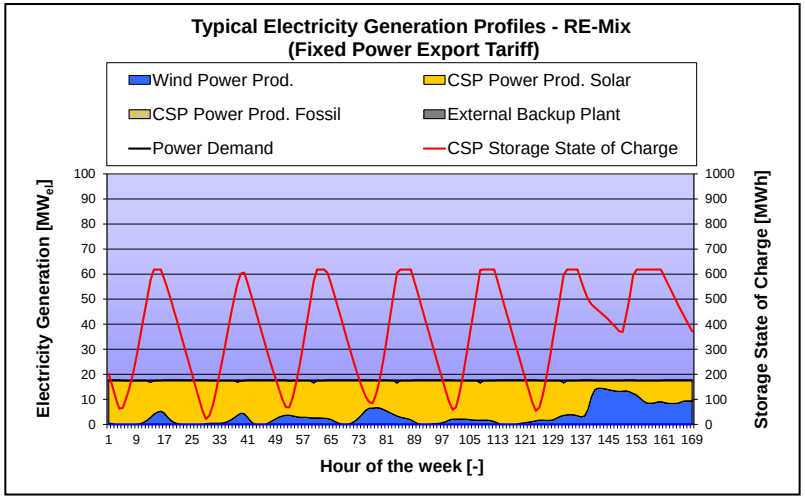
→ Conflict with the intermittent nature of renewable energies

→ CSP offers the option of thermal energy storage

→ Hybrid operation is possible in the same power block
(no backup power plant required)

Comparison Methodologies





Annual Energy Balance of Load and Supply

- Options have unequal quality
- Cost externalization
  - Fossil backup
  - Grid management cost

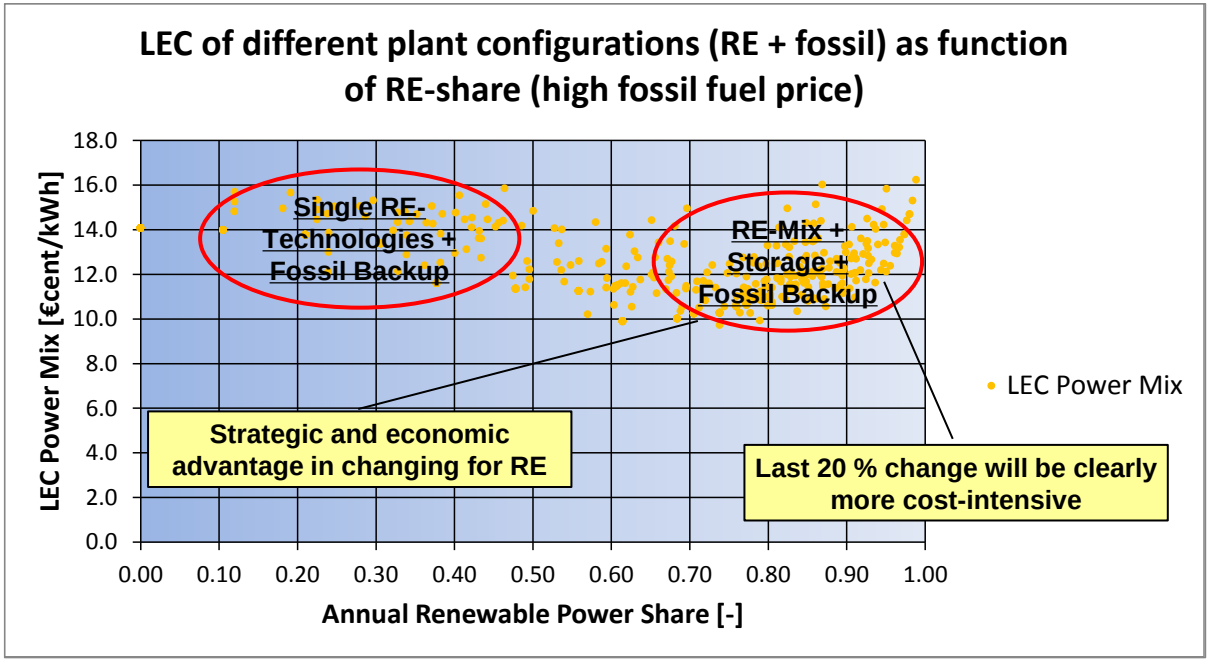
→ Cheap, fluctuating RE

Direct Energy Balance of Load and Supply

- Options have equal quality
- No cost externalization

→ RE-Mix including backup and storage

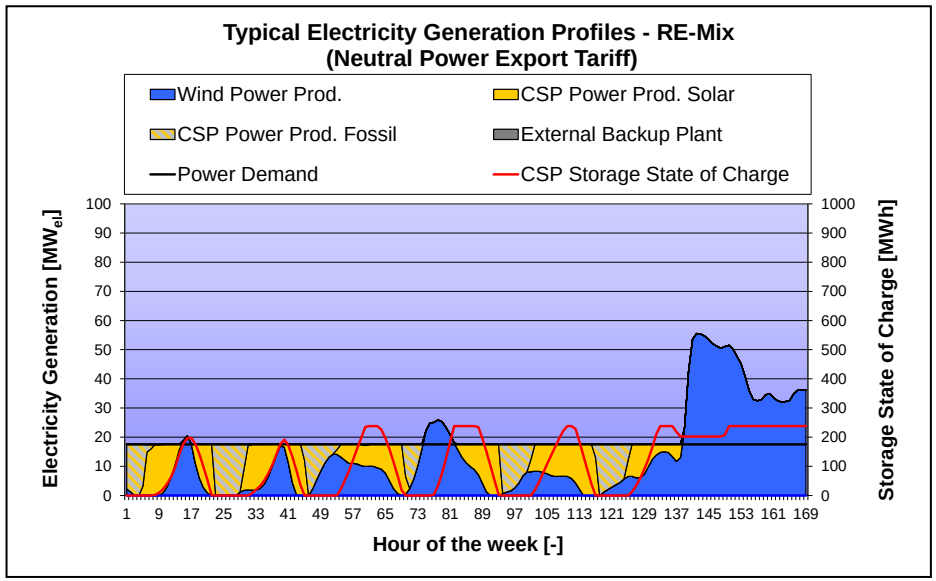
Energy Cost as Function of RE-Share and Fuel Cost

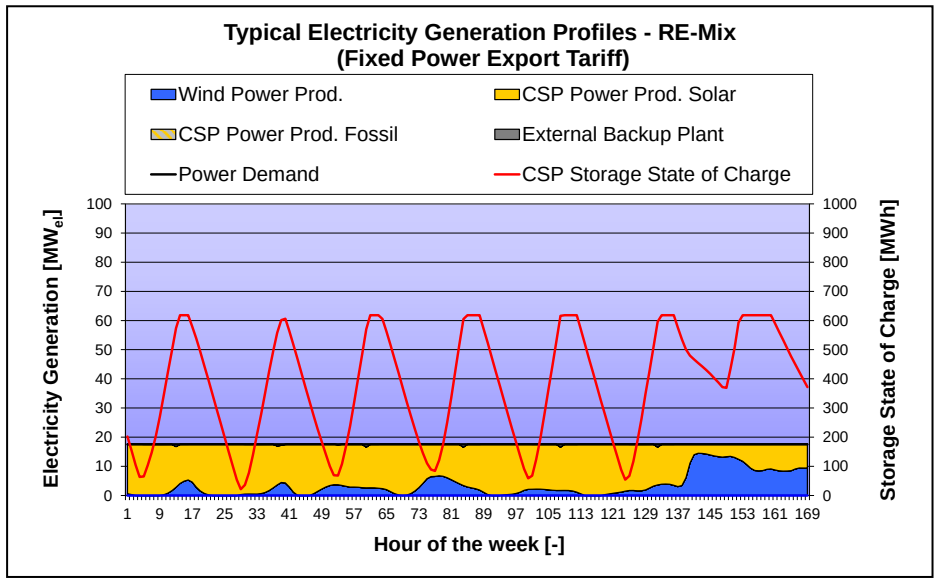


- Direct RO electricity supply (RE and fossil)
- Pre-defined number of configurations (no optimization)
- **2 fossil fuel prices**:
  - Low: 30 US$/MWh$_{th}$
  - High: 60 US$/MWh$_{th}$

Effect of different Feed-in Tariff Values for Power Export

- RO supply / 80 % EE-Share / Fossil fuel price: 60 US$/MWh$_{th}$





Neutral Tariff

Low Tariff

→ High sensitivity of optimal plant configuration on economic boundary conditions!

Conclusions (1/2)

- Among other measures, new desalination plants will be required in MENA in order to cover the increasing water demand

- For this purpose, new power plants need to be installed in order to supply firm capacity to the desalination plants

- Fossil fuel prices are prone to high volatility and a clear upward trend

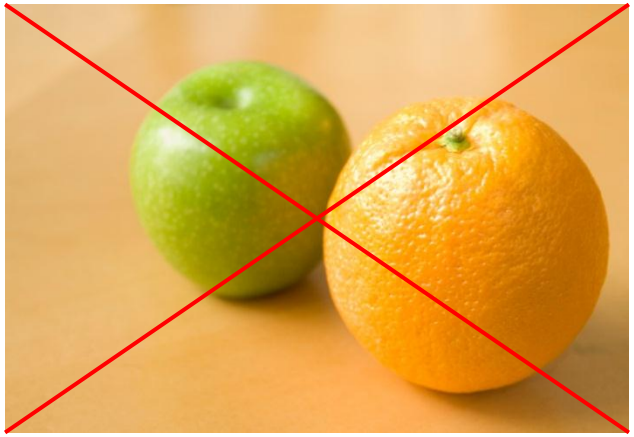
- On the contrary, Renewable Energies (RE) represent a key element for an environmentally friendly, cost stable and low-risk energy supply

- When comparing different supply options, the right question to ask is:
    - Which is the most effective technology **mix** to secure the supply?

  Rather than
    - Which is the cheapest technology?

Conclusions (2/2)

- A fair comparison between options should consider configurations which guarantee equal quality of supply (consideration of externalities):



they do not compare!

- The optimal energy supply for desalination plants will probably consist of a combination of low cost variable power (PV, Wind) and slightly more expensive balancing power (CSP with thermal energy storage)

Source: wikipedia

Thank you
for your attention!

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