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# Jordan's future power supply – development of scenarios in a collaborative approach

MENA SELECT research project

Conference:  
„100% Climate Neutrality – Solutions for Crossing Borders“  
Sønderborg  
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## Agenda



- The MENA SELECT research project
- Our participatory approach
- Collaborative development of scenarios in Jordan
- Experiences from our workshops
- Summary, conclusion and outlook



Research project:

**M**iddle **E**ast **N**orth **A**frica **S**ustainable **E**lectricity **T**rajectories

Funded by the German Federal Ministry for Economic  
Cooperation and Development (BMZ)

Period: 2015-2018



EUF



Our aim in the research project:

- Development of consistent scenarios for the future power supply of Morocco, Jordan and Tunisia by local stakeholders
- Utilization and distribution of EUF's simulation model *renpassGIS* and a simplified spreadsheet model, respectively

Overall project objectives:

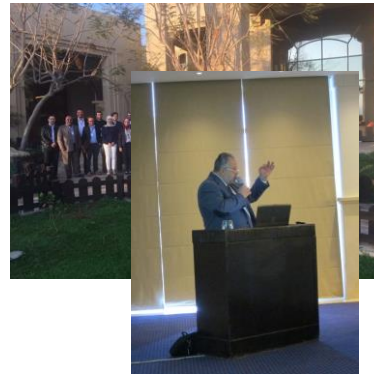
- Support the discussion in the project countries about their future power systems
- Enable the local civil society to take part in this discussion



## Our participatory approach I



- Workshops in the project countries
- Invite local stakeholders: heterogenous group of approx. 25 representatives of various societal groups
- Challenge: attract potential participants to attend the workshops
- Invitation through a local partner
- Input talk from a high representative
- Moderation of the discussions supported by a local partner



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## Collaborative development of scenarios I



- At the beginning of the workshop: ask the workshop participants for their aims and expectations for Jordan's future power system (2050) → "storyline"
- Spreadsheet model:
  - start with mid-term goals, i.e. capacities
  - compare with 2050 load curve
  - adjust capacities until the load is covered in every hour of the year 2050



JORDAN		MAIN INPUT AND OUTPUT PARAMETERS		MENA SELECT	
<b>Custom specifications</b>		<b>Control results</b>		<b>Control results</b>	
Electricity demand	96,86 TWh/a	<b>Power supply</b>		<b>NO SUPPLY SHORTAGES DURING THE YEAR.</b>	
Electricity production	between 6.916 and 12.0 TWh/a	Supply efficiency		2,88 TWh/a	
Wind energy	20,000 MW	Costs (€/MWh)		2,13 M€/a	
Solar PV	10,000 MW	Electricity production		18,95	
Geothermal	1,000 MW	Storage		0,00	
Small and medium hydro power	1,000 MW	Grid expansion		0,00	
Hydro Reservoir	1,000 MW	<b>Costs per kWh</b>		<b>13,97</b>	
Biomass	2,000 MW	Costs (incl. CO <sub>2</sub> emission certificates (long))		18,00	
Concentrated Solar Power (CSP)	1,000 MW	Costs (incl. CO <sub>2</sub> emission certificates (medium))		18,10	
Nuclear	1,000 MW	Costs (incl. CO <sub>2</sub> emission certificates (short))		18,20	
Coal	1,000 MW	Energy capacities		0,000	
Oil	1,000 MW	Maximum power capacity		0,000	
Natural Gas	1,000 MW	Maximum load capacity		0,000	
Total	77,000 MW	Storage electricity		0,000	
<b>Storage</b>		Produced electricity		0,000	
Maximum storage (dispatched hydro)	1,000 MWh				
Maximum capacity (hydro)	1,000 MW				
Maximum capacity (thermal)	1,000 MW				
Maximum storage (battery)	20,000 MWh				
Power capacity (battery)	10,000 MW				
Storage loss (production at full load)	0,00%				

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## Collaborative development of scenarios II



- Key figures on Jordan:
  - 9.7 Mio. inhabitants
  - Refuge
  - 90,000 km<sup>2</sup> of size
  - Water scarcity
  - Power system:
    - Today mainly based on natural gas
    - Few domestic fossil resources
    - Nuclear power discussed
    - RE in the upswing
    - Excellent solar resource
    - Annual demand 2050: 106 TWh



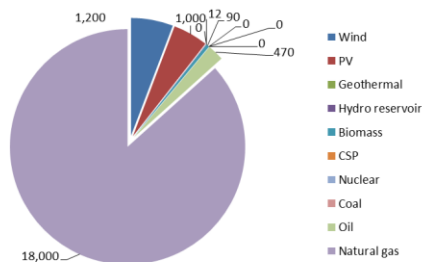
Source: University of Texas



## Two exemplary scenarios

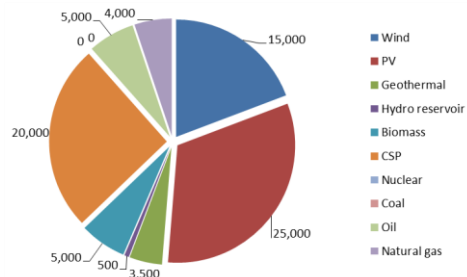


### Scenario B



Installed capacity	20,772 MW
Electricity production	110 TWh
Electricity demand	106 TWh
Share of RES (energy)	4.5 %
CO <sub>2</sub> emissions	26.7 Mt
System costs	<b>9.52 Ct./kWh</b>

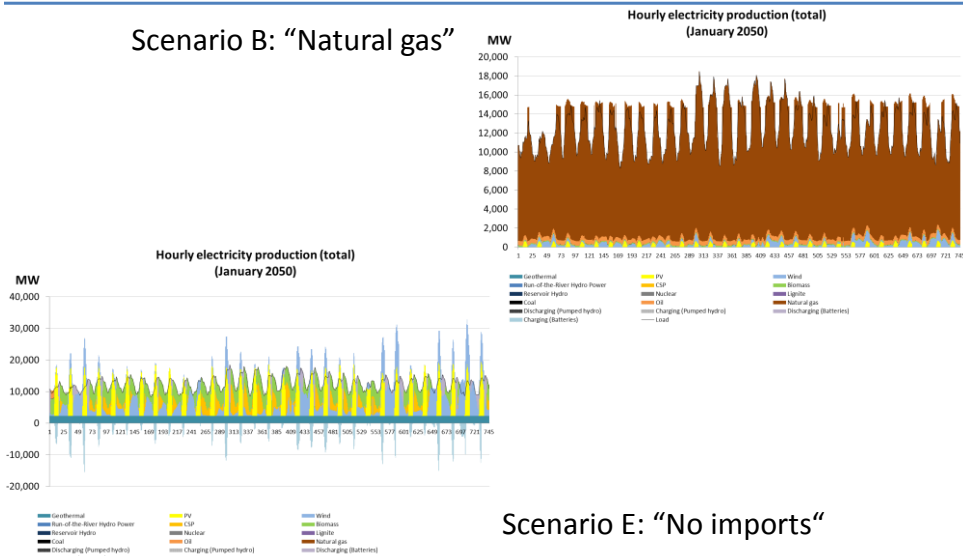
### Scenario F



Installed capacity	78,000 MW
Electricity production	117 TWh
Electricity demand	106 TWh
Share of RES (energy)	101.8 %
CO <sub>2</sub> emissions	0.26 Mt
System costs	<b>28.19 Ct./kWh</b>



### Scenario B: “Natural gas”



### Scenario E: “No imports”



- Conducting the workshops on-site is key
- Invitation process and workshop organization with local partners is key
- Great discussions below workshop participants (different views, explanations, ...)
- The scenarios developed sometimes corresponded to various “storylines” stated at the beginning of the workshop
- Lesson learnt: storyline “low cost” is a given



- Results from discussions and scenarios:
  - Wide range of scenarios conceivable
  - 100% RES in Jordan alone is technically possible but presumably a great challenge to implement
  - Problem awareness is available with local stakeholders
- Capacity building conducted on-site
- Collaborative scenario development can support the national discussion about long-term and intermediate targets (RES shares, demand level, energy independence etc.) towards climate neutrality



## Thank you for your attention!

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