BRINGING EUROPE AND THIRD COUNTRIES CLOSER TOGETHER THROUGH RENEWABLE ENERGIES

BETTER

WP3 – North Africa Case Study

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*WP Leader: **DLR***

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INTELLIGENT ENERGY EUROPE

FOR A SUSTAINABLE FUTURE

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3.1. Inventory of RES-E in NA

Conclusions and current status

- inventory data base with more than **1000 single power plant units** and **400 substations**
- Policies and targets identified
- Barriers identified

  - ➢ feedback needed from local stakeholders about the completeness of information and technical data
  - ➢ How can we better integrate local stakeholders so they feel more committed to support the project?

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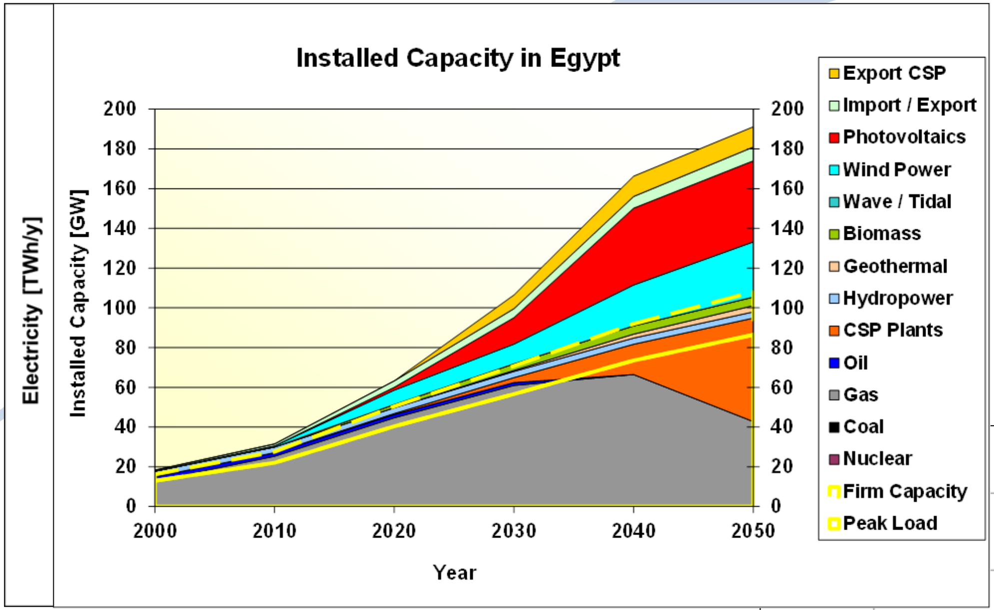
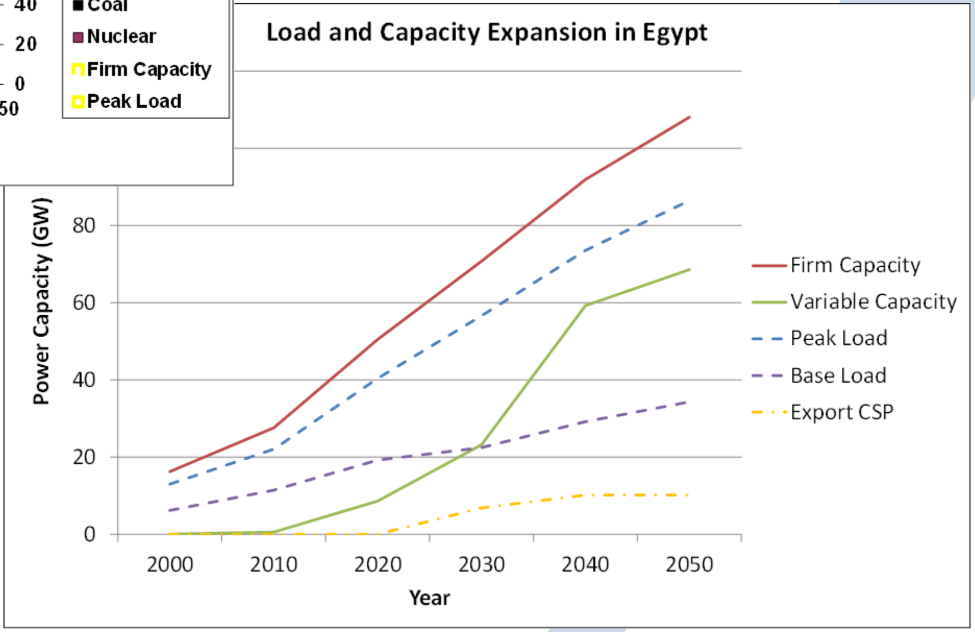
3.2. Prospects for RES-E in NA

Bottom-up scenarios



Feasible pathways towards sustainable supply identified

Enough flexible RES-E available in NA



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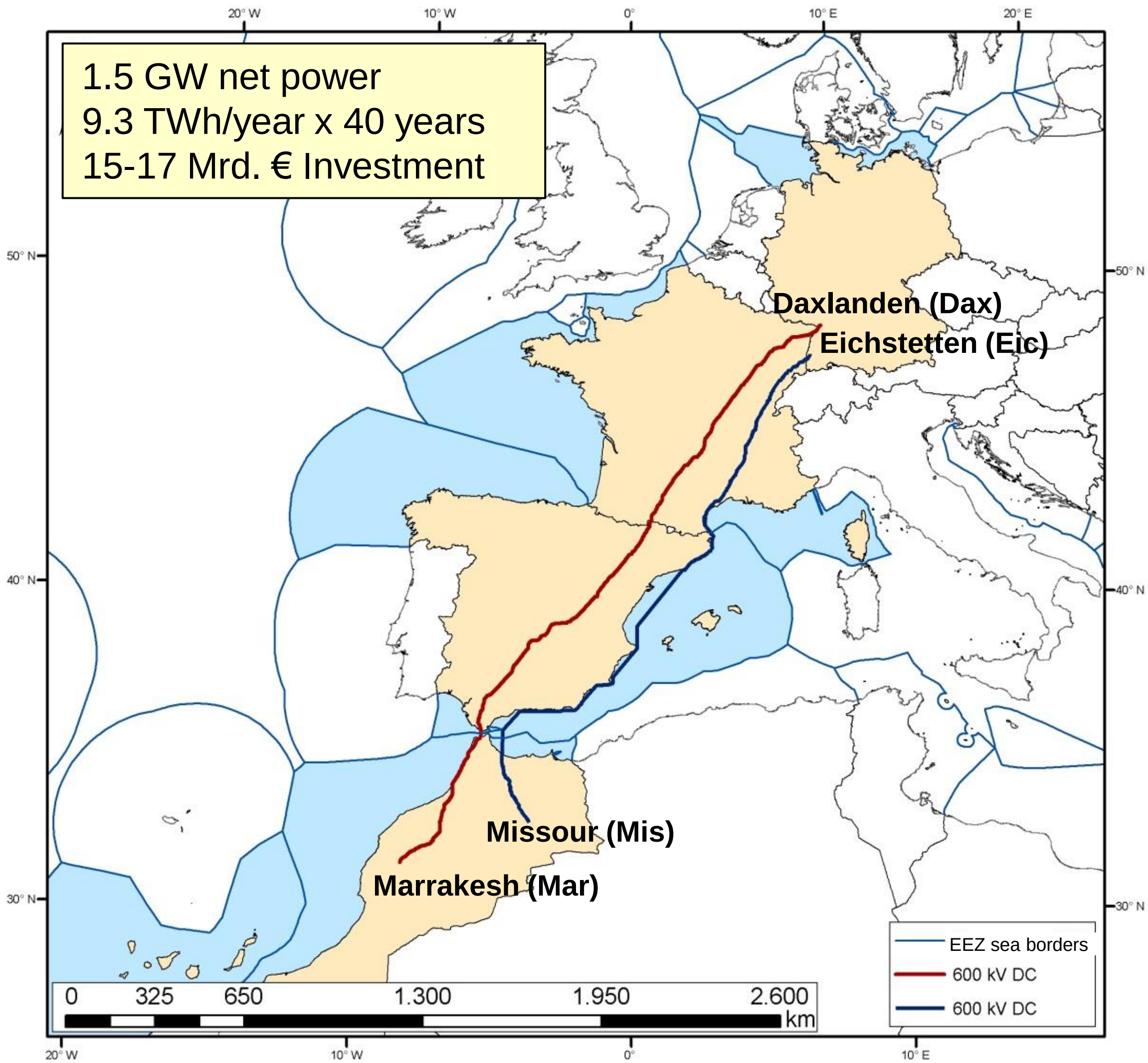
3.3. Prospects for RES-E exports

First draft of CSP-HVDC Link Morocco-Germany

High value, flexible power on demand



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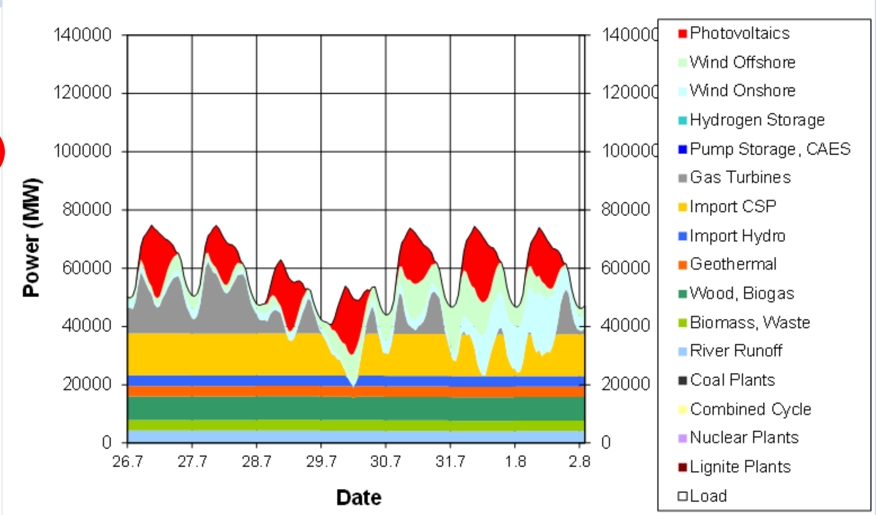
3.3. Prospects for RES-E exports

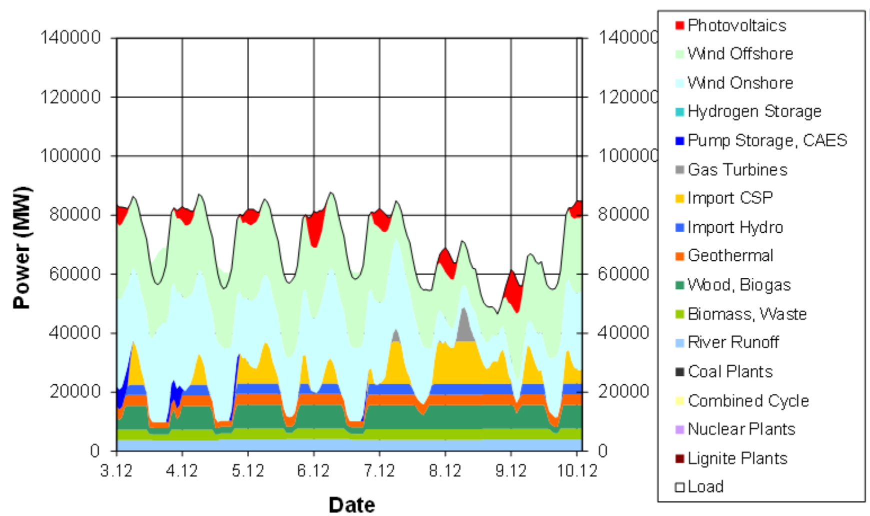
Role of RES-E imports in Europe

A 90% RES-E scenario for Germany with CSP imports:

225 GW + 8 GW NTC + 20 GW HVDC + 8 GW Storage

Energy source	Installed Capacity	Annual electricity yield	average utilization
	MW	TWh/a	h/a
Variable / renewable	117500	288.1	
Photovoltaics	45000	44.5	989
Wind Onshore	40000	89.4	2235
Wind Offshore	27000	116.0	4295
River Runoff	5500	38.2	6951
Flexible / renewable	35000	220.2	
Biomass, Waste	4000	30.0	7502
Wood, Biogas	7000	49.8	7112
Geothermal	4000	30.2	7547
Import Hydro	4000	25.8	6462
Import CSP	16000	84.3	5271
Fossile / Nuclear	65000	54.4	
Gas Turbines	65000	54.4	837
Coal Plants	0	0.0	0
Combined Cycle	0	0.0	0
Nuclear Plants	0	0.0	0
Lignite Plants	0	0.0	0
Storage and net transfer	16000	3.1	
Pump Storage, CAES	7500	1.9	255
Hydrogen Storage	0	0.0	0
H2-Storage Capacity (days)	0		
Net Transfer Capacity (NTC)	8500	1.1	135
Total power park	**225000**	**561**	**2494**





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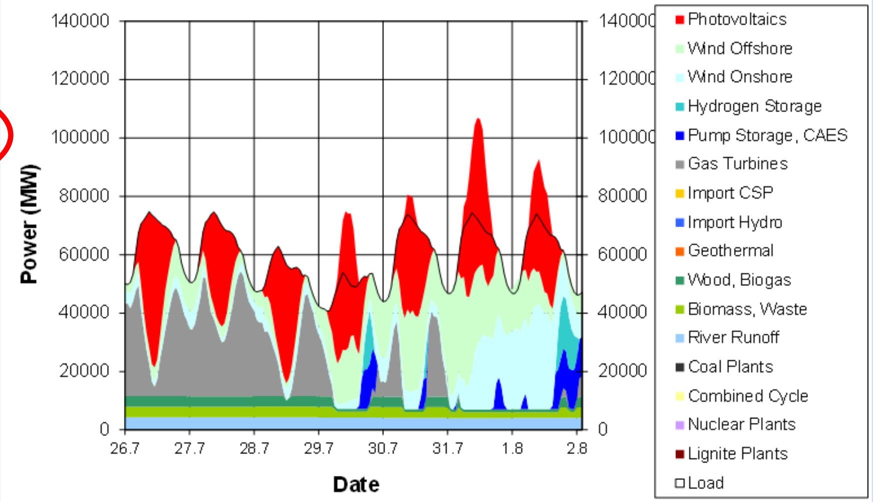
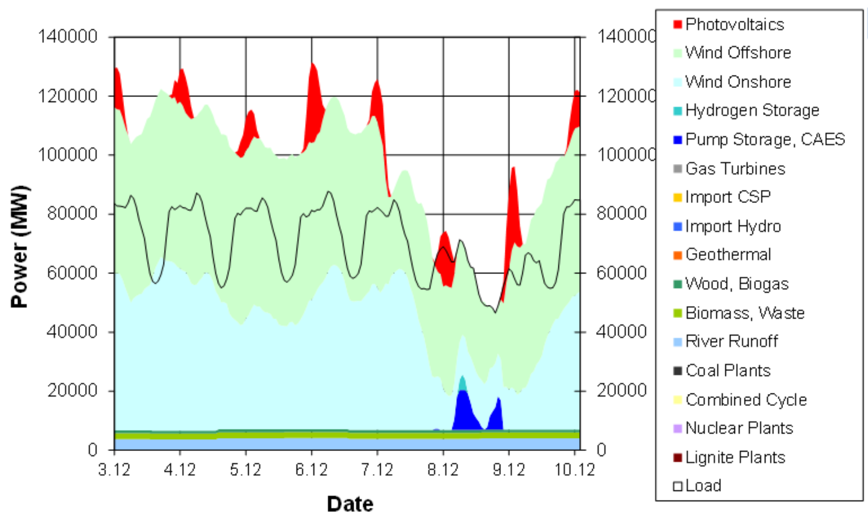
3.3. Prospects for RES-E exports

Role of RES-E imports in Europe

A 90% RES-E scenario for Germany without CSP imports:
375 GW + 40 GW NTC + 40 GW Storage

Energy source	Installed Capacity	Annual electricity yield	average utilization
	MW	TWh/a	h/a
Variable / renewable	235500	551.3	
Photovoltaics	100000	98.9	989
Wind Onshore	70000	156.4	2235
Wind Offshore	60000	257.7	4295
River Runoff	5500	38.2	6951
Flexible / renewable	8000	37.9	
Biomass, Waste	4000	22.1	5515
Wood, Biogas	4000	15.9	3964
Geothermal		0.0	0
Import Hydro		0.0	0
Import CSP		0.0	0
Fossile / Nuclear	90000	56.4	
Gas Turbines	90000	56.4	627
Coal Plants	0	0.0	0
Combined Cycle	0	0.0	0
Nuclear Plants	0	0.0	0
Lignite Plants	0	0.0	0
Storage and net transfer	80000	48.7	
Pump Storage, CAES	20000	15.7	785
Hydrogen Storage	20000	13.8	688
H2-Storage Capacity (days)	1		
Net Transfer Capacity (NTC)	40000	19.3	482
Total power park	**373500**	**579**	**1551**





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3.3. Prospects for RES-E exports

RES-E imports can unburden transformation in EU

CSP imports from NA to Germany via HVDC links would lead to:

1. 150 GW less power plants for the German “Energiewende”
2. 5 times less grid capacity (no significant expansion after 2020)
3. 5 times less power storage (no significant expansion after 2020)
4. 90% RES-E can be achieved much faster and with much less effort
5. Allows every European country to follow a similar strategy without creating external costs by RES-E surplus and gaps to be balanced by neighbors

Is there an alternative?

Surplus (??) from Moroccan CSP, wind power and PV (??) exported to Europe through the AC grid of Andalucia (??)

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3.3. Prospects for RES-E exports (DLR)

Conclusions and current status

- HVDC links identified as appropriate technology for RES-E transfers
- Flexible CSP plants identified as appropriate source to deliver RES-E on demand
- Technical and economic model for a CSP-HVDC link between Morocco and Germany developed
- Flexible RES-E imports can unburden the European “Energiewende”
- Opportunities for public participation identified
- Achievable earliest 2025 if started immediately

How can we disseminate our results more efficiently?

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Barriers for RES-E in NA

1. **Barriers for local RES-E deployment**
   - Markets distorted by subsidies
   - Lack of financing, restrictions of local investment and content
   - Inappropriate regulatory framework
   - Limited grid capacity to integrate fluctuation RES-E
   - Lack of awareness
2. **Barriers for RES-E exports to Europe**
   - No purchase agreements from EU side
   - Absence of North-South energy partnership
   - Lack of interconnections
   - Undefined tariffs
   - Lack of awareness

What could trigger a change of mind?

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franz.trieb@dlr.de

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