BRINGING EUROPE AND THIRD COUNTRIES CLOSER TOGETHER THROUGH RENEWABLE ENERGIES

WP3 – North Africa Case Study
Prospects for RES-E

Jürgen Kern, Franz Trieb

BETTER Regional Workshop,
28th October 2013, Rabat, Morocco

WP Leader: ***DLR***

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BETTER- Bringing Europe and Third Countries closer together through Renewable Energies

The core objective is to assess, through case studies, stakeholders involvement and integrated analysis to what extent cooperation with third countries (Art. 9 of the RES Directive) can help Europe achieve its RES targets in 2020 and beyond, trigger the deployment of RES electricity projects in third countries and create synergies and win-win circumstances for all involved parties

EXPECTED OUCOMES

- **Evaluation** of the impacts associated to Article 9 implementation
- **Action Plan** to foster RES production through cooperation mechanisms
- **Policy recommendations** with regards to the implementation of Article 9
- **Practical guidelines** for project developers
- Solid **stakeholder network** between EU and 3rd countries
- Knowledge generation and dissemination material

Partners: CIEMAT, DLR, ECN, JR, TU-WIEN, OME, NTUA, UNDP, PIK

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BETTER WP3: North Africa Case Study for Morocco, Algeria, Tunisia, Libya, Egypt

3.1. Inventory of RES-E in NA countries (PIK)

- 3.1.1. Energy system characterization and RES(-E) deployment
- 3.1.2. Energy policy framework
- 3.1.3. Present Barriers for RES-E market introduction and expansion
- 3.1.4. Regional grid capacity and grade of interconnection

3.2. Prospects for renewable energy expansion for the NA countries – bottom-up assessment (OME)

- 3.2.1. Renewable energy potentials and related costs
- 3.2.2. Demand development scenarios
- 3.2.3. RES(-E) Policy targets in the short (2020) to long-term (2050) from national/regional viewpoint in NA countries
- 3.2.4. Estimated framework development
- 3.2.5. Technologically and economically feasible pathways for RES(-E) deployment
- 3.2.6. Environmental and Socio-economic impact assessment

3.3. Prospects for renewable energy exports from NA to EU (DLR)

- 3.3.1. Grid technology characterisation
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- 3.3.6.: Environmental and Socio-economic impact assessment related to exports

3.4. Role and Design of the Cooperation Mechanisms (DLR)

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- 3.4.3: Compatibility with other instruments
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- 3.4.5: Assessment of the possible role of the cooperation mechanism from a host-country perspective

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3.6. Preparation of a case study report that summarizes results of WP3 (DLR)

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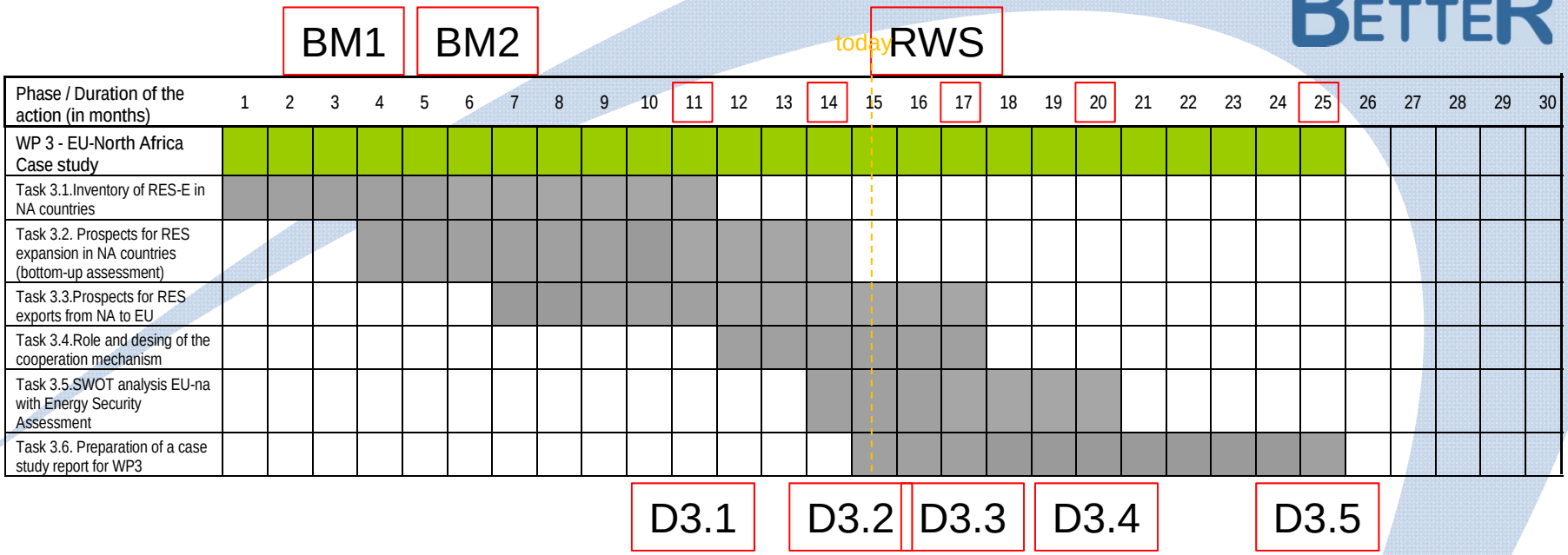
WP3 Timeline and Deliverables



D 3.1: Report on power system inventory E, T, M (L, A)
D 3.2: Report on future RES(-E) prospects in NA
D 3.3: Report on future RES(-E) prospects for export from NA to EU
D 3.4: Report about security aspects of RES(-E) imports from NA to EU
D 3.5: Final report on EU-NA Case Study
BM1: Bilateral Meeting Morocco
BM2: Bilateral Meeting Tunisia/Algeria
RWS: Regional Workshop

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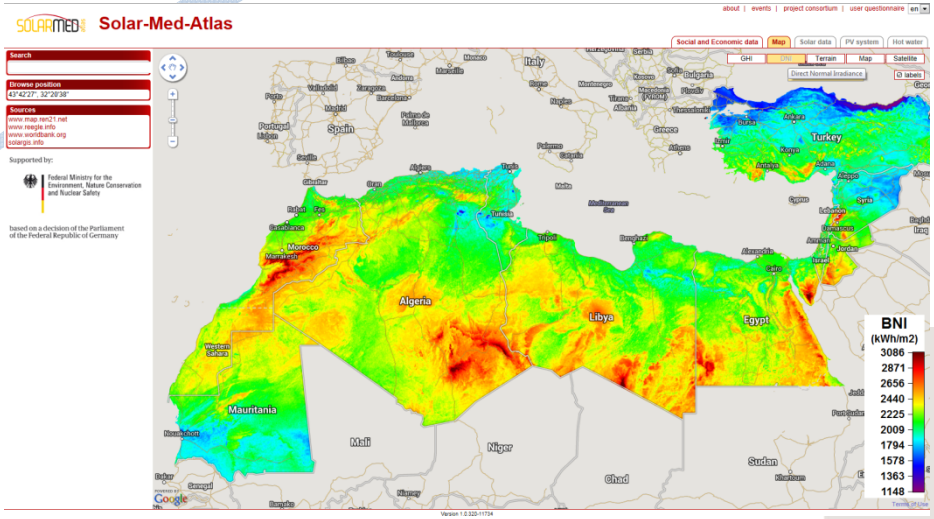
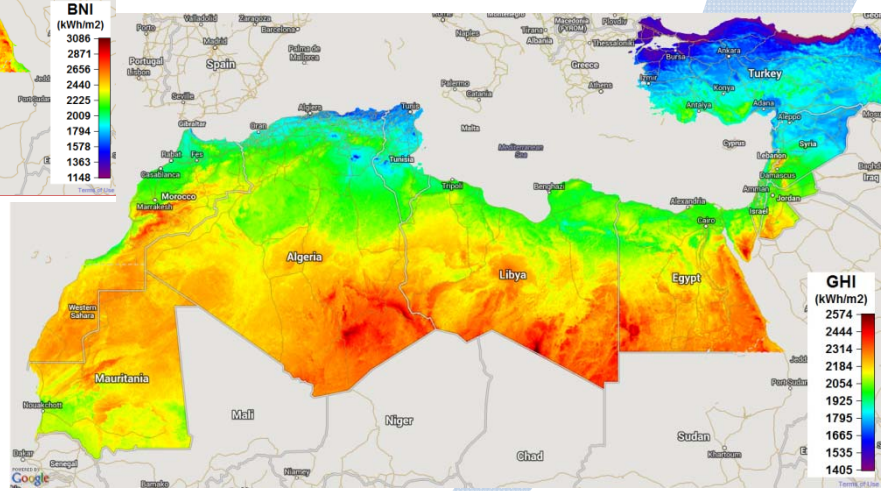
3.2. Prospects for RES-E in NA

3.2.1: RE potential and related costs

1. RES-E cost database under discussion
2. RES-E potentials in NA analyzed (visualization in process)





www.solar-med-atlas.org

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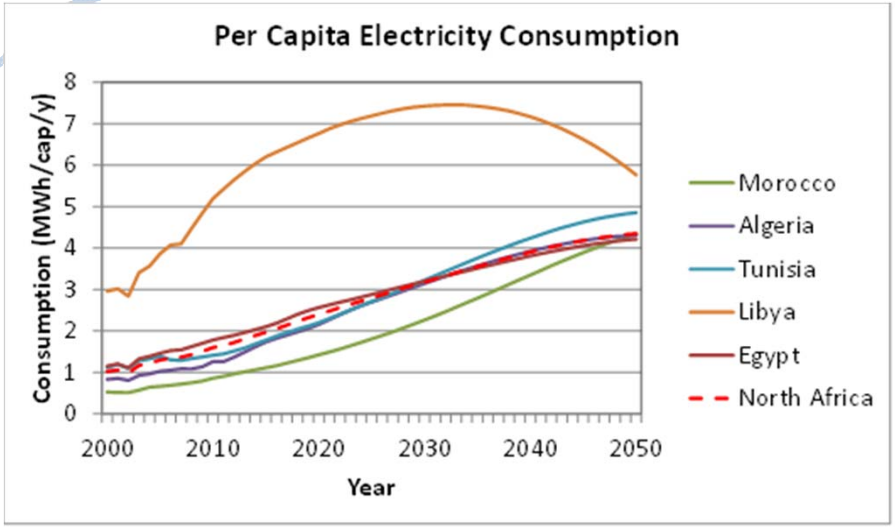
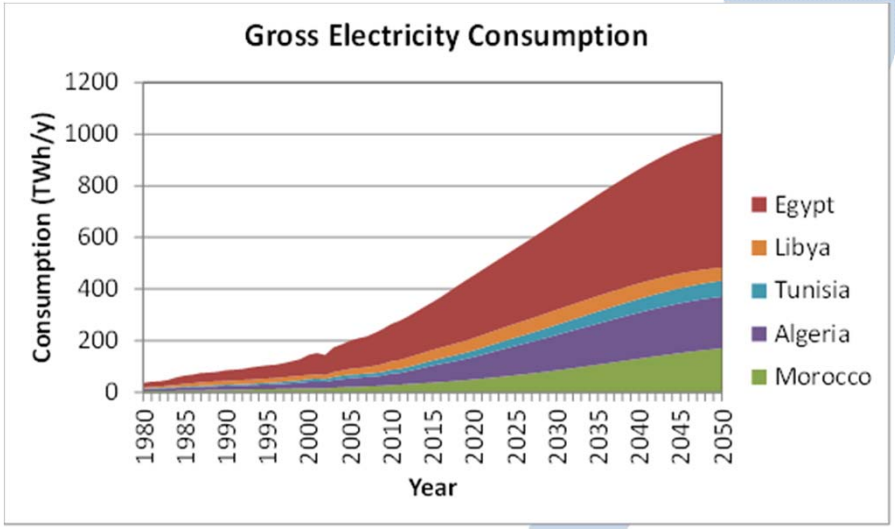
3.2. Prospects for RES-E in NA

3.2.2: Demand development scenarios

1. Demand model for each country from 2000 to 2050
2. Empirical demand growth function based on population, GDP and efficiency gains





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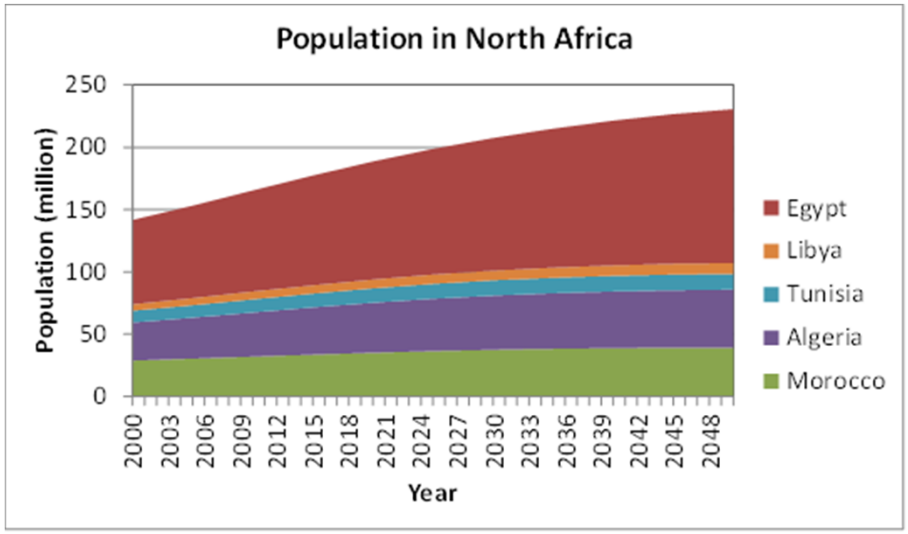
3.2. Prospects for RES-E in NA

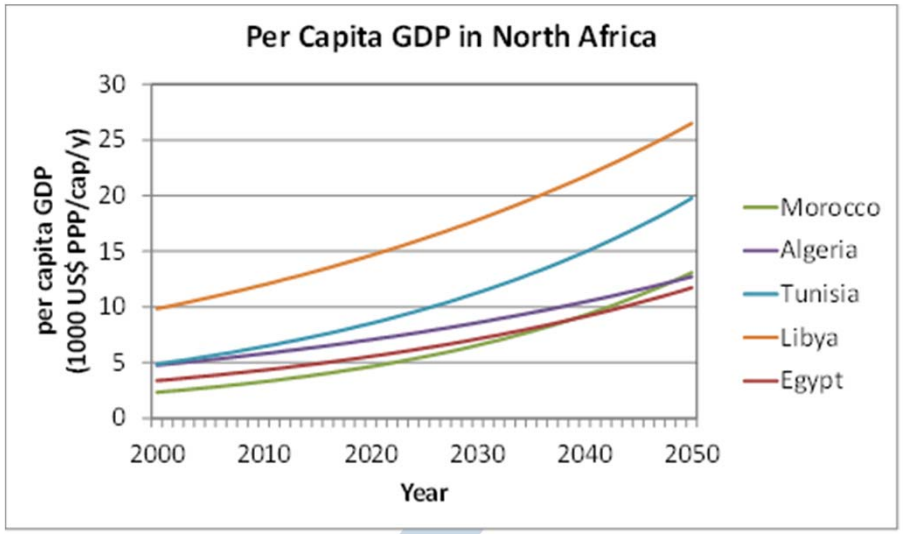
3.2.2: Demand development scenarios

Assumptions for GDP and Population:

- United Nations Population Prospects Medium Growth Scenario 2012
- International Monetary Fund 2012

Country	Per capita GDP Growth Rate MED-CSP Study 2005 %/y	GDP/cap 2003 MED-CSP Study 2005 US$/cap/y	Per capita GDP Growth Rate Model Update 2010 %/y	GDP/cap 2010 Model Update 2010 US$/cap/y
Morocco	4.6	2500	3.5	3290
Algeria	4.0	4950	2.0	5800
Tunesia	3.6	4900	2.8	6440
Libya	3.8	10000	2.0	12000
Egypt	4.6	3300	2.5	4330





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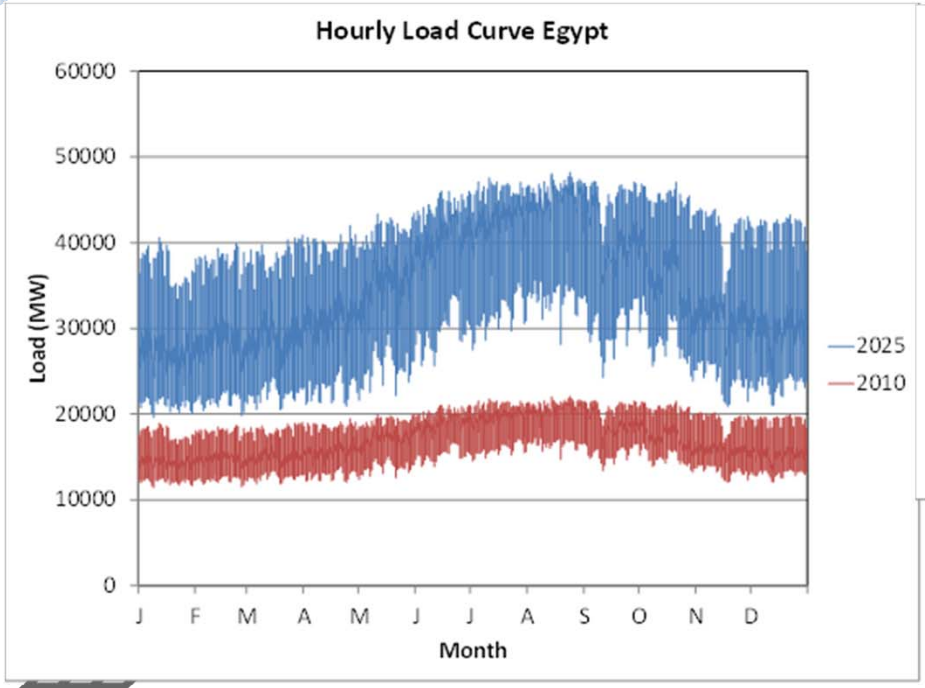
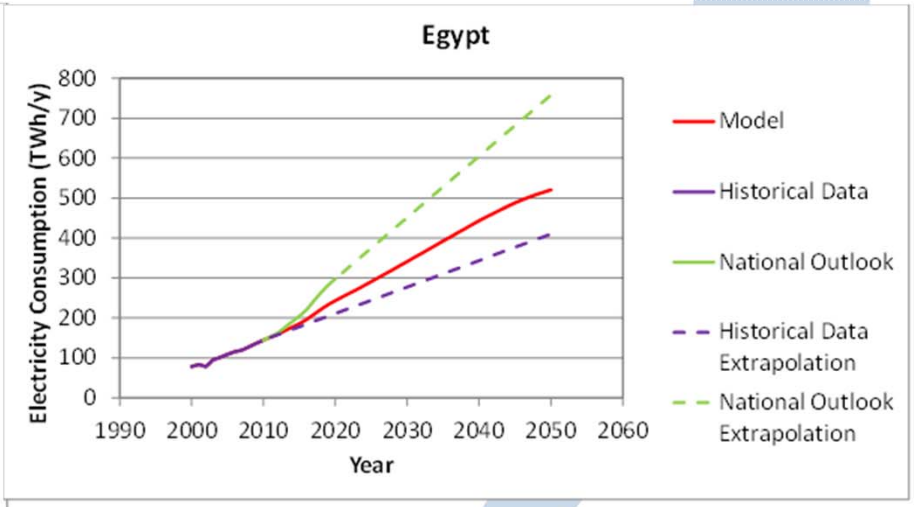
3.2. Prospects for RES-E in NA

3.2.2: Demand development scenarios

3. Annual hourly load curves identified for 2010 and scaled until 2025 (AUE 2013)

4. Demand scenarios created and compared to historical data and national outlook





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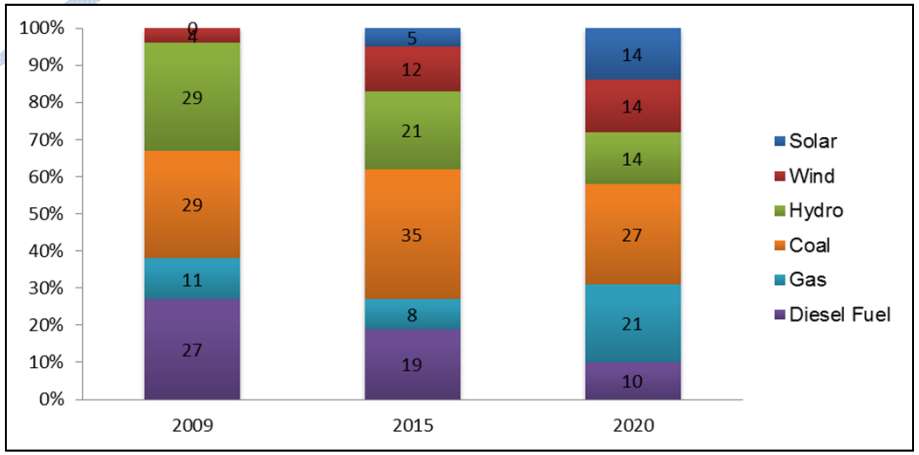
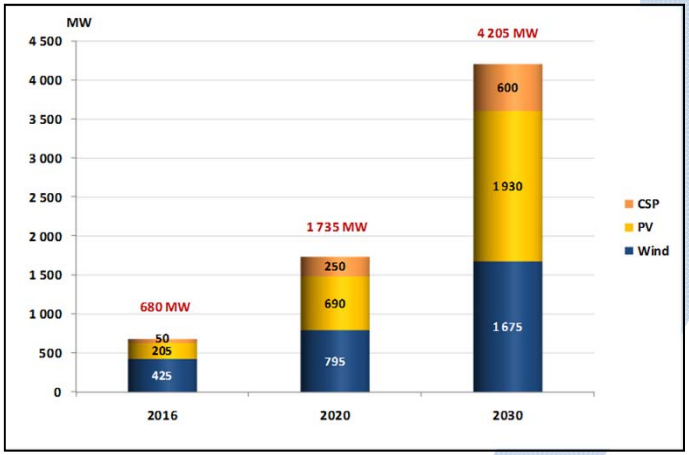
3.2. Prospects for RES-E in NA

3.2.3: Policy targets

1. Targets for 2020 and in some countries for 2030
2. Bottom up-scenarios adapted to medium term targets with long-term outlook until 2050 as far as available



Share and targets of installed electricity capacities in Morocco



Targets of installed electricity capacities in Tunisia

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3.2. Prospects for RES-E in NA

3.2.4: Estimated framework development

1. **Affordability**
   - Low cost
   - Low subsidies
   - Low structural effort
2. **Security**
   - Diversification of supply
   - Power on demand and redundancy
   - Sustainable energy resources
   - Available technology
3. **Environmental compatibility**
   - Low pollution, climate protection
   - Low risks for health and nature
   - Low land use and structural impacts
4. **Social compatibility**
   - Fair access to energy
   - Balance of dependencies and interdependencies
   - Strategic flexibility during transition

➔ One consistent pathway towards sustainable supply under specific limitations

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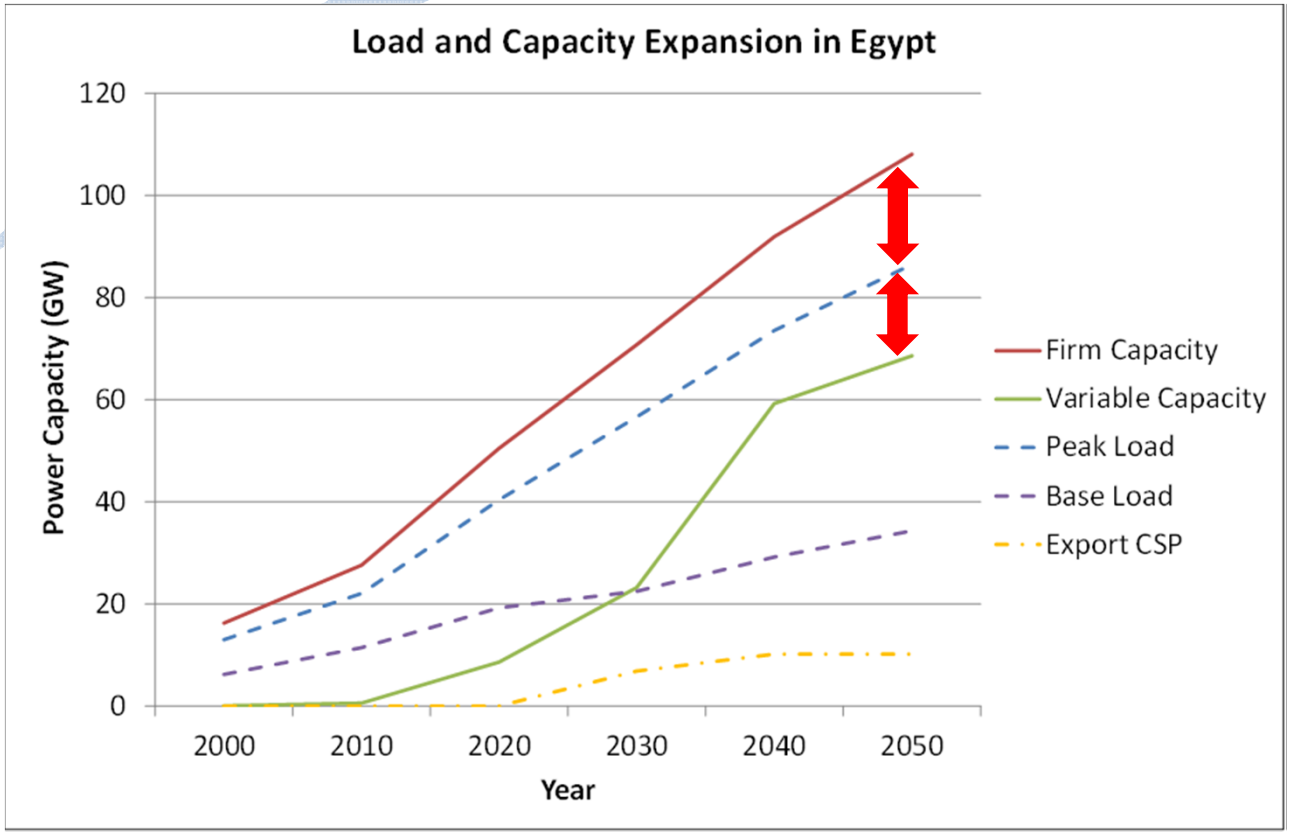
3.2. Prospects for RES-E in NA
3.2.4: Estimated framework development

A simple rule to minimize structural effort and keep costs low:



Firm power larger than peak load

Fluctuating power not much larger than peak load

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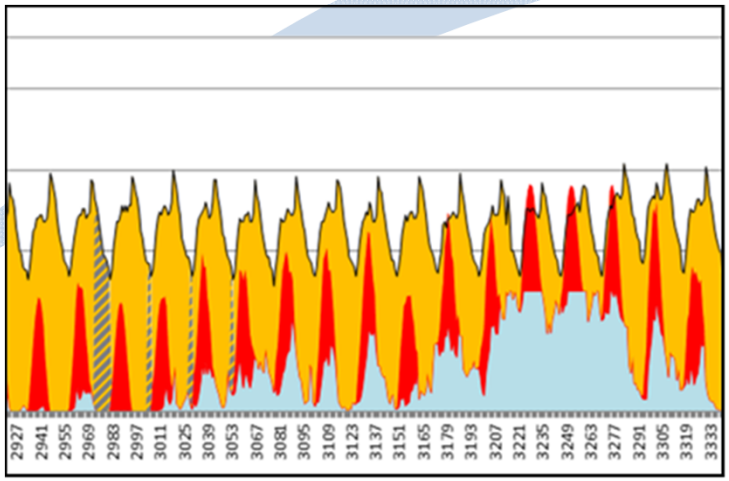
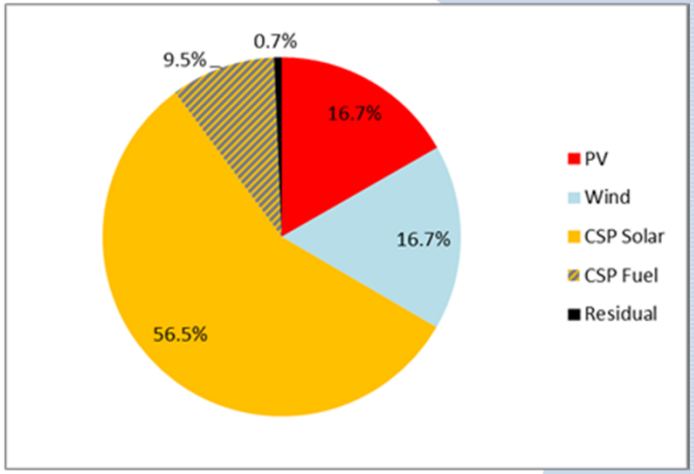
3.2. Prospects for RES-E in NA

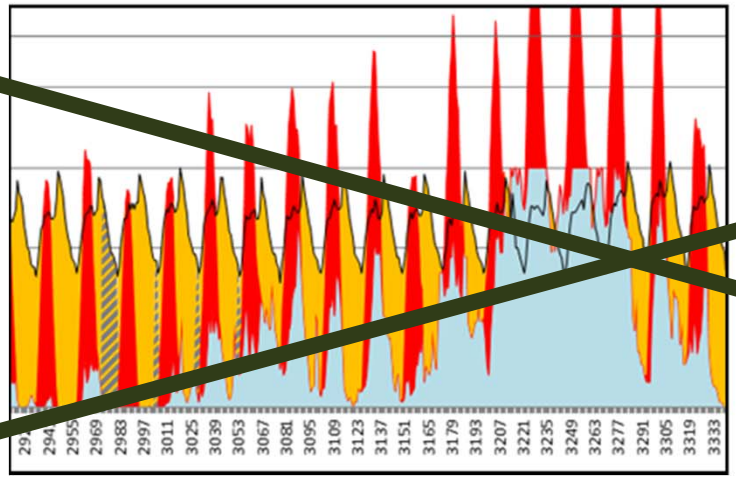
3.2.5: Bottom-up scenarios (feasible pathways)

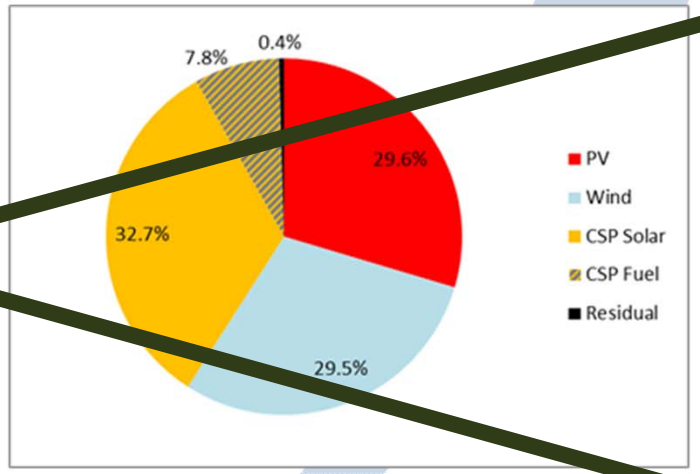
Typical bottom up scenario result





~~**Doubling PV and wind power**~~





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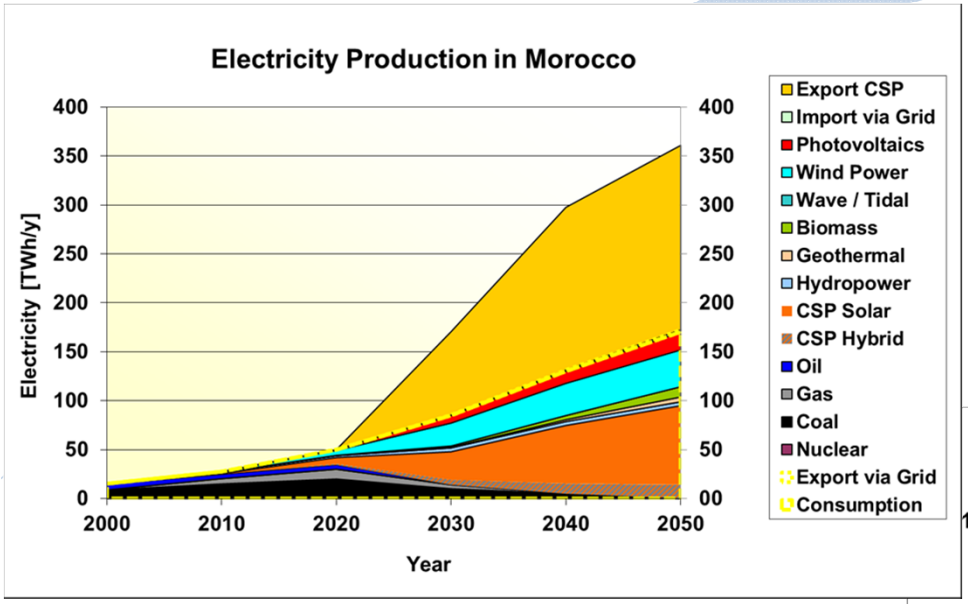
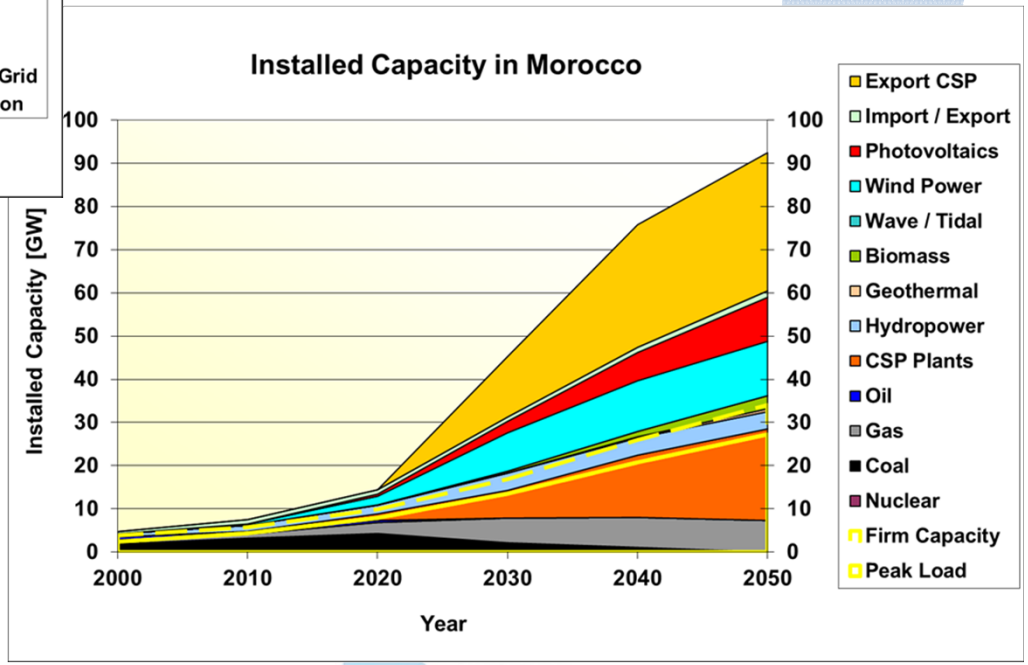


Case Study
Morocco



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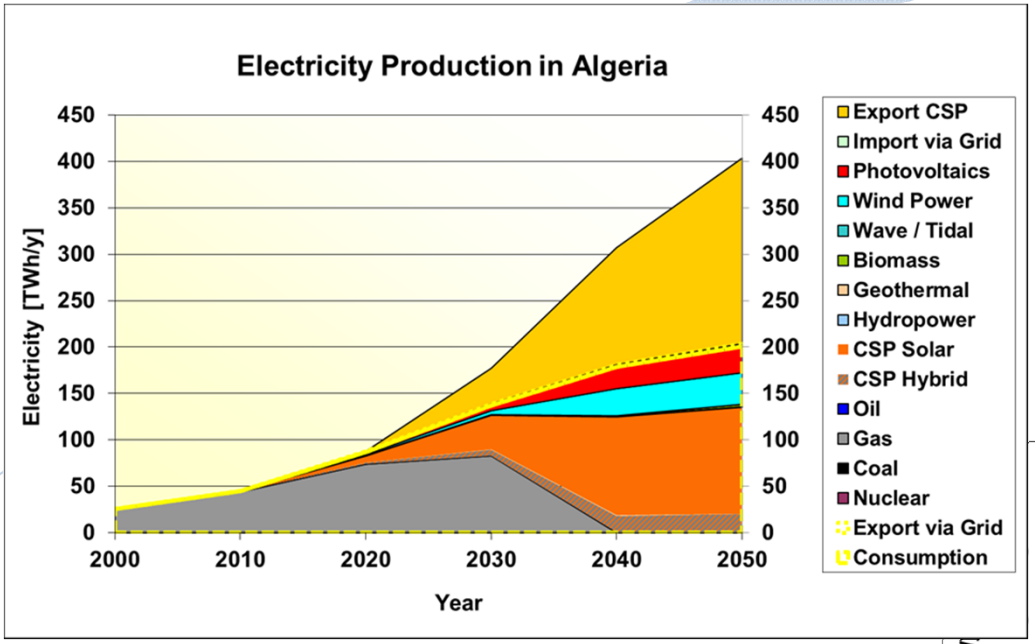
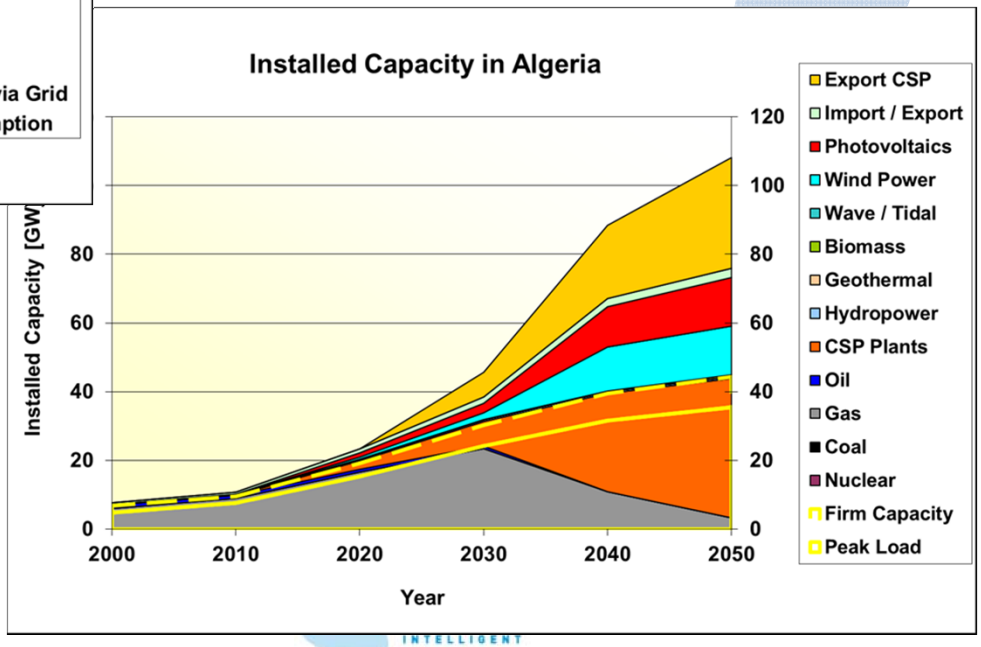


Case Study
Algeria



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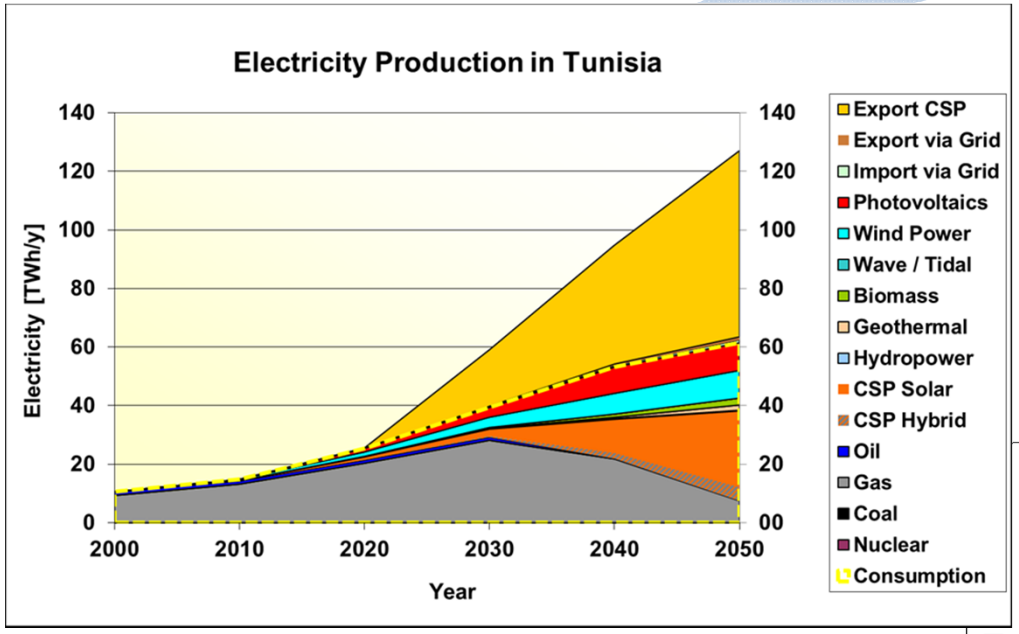
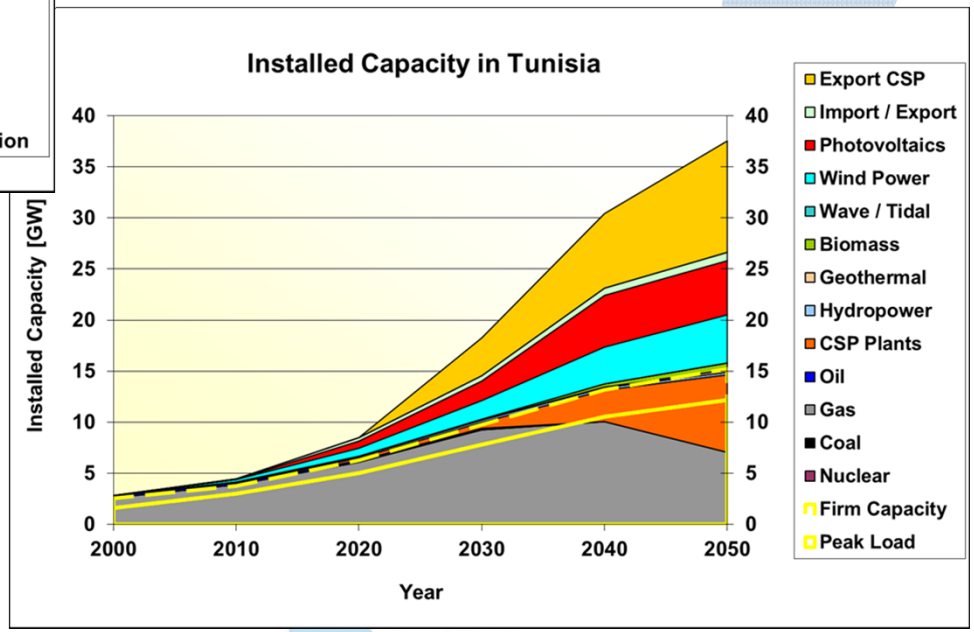


Case Study
Tunisia



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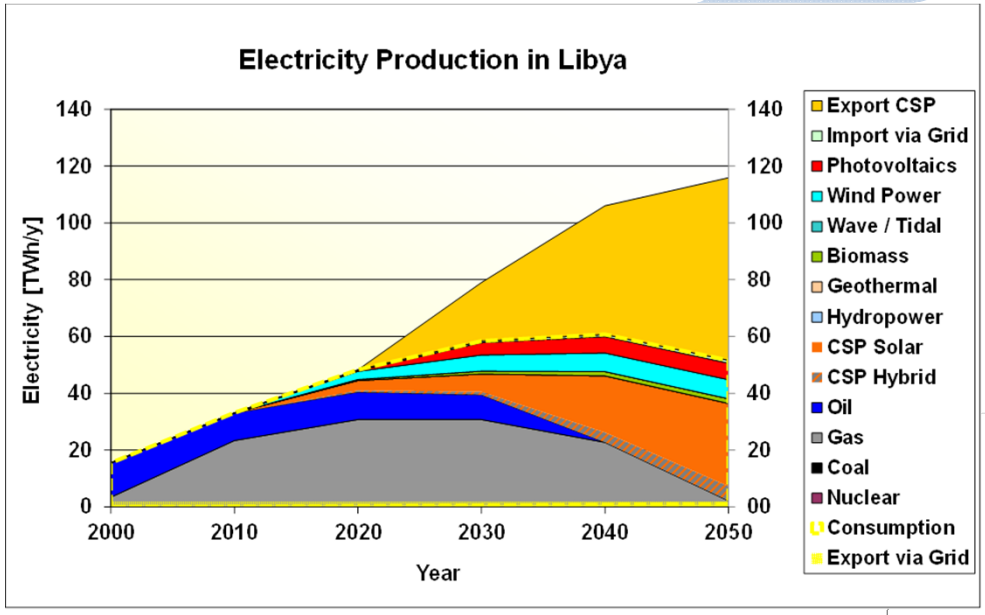
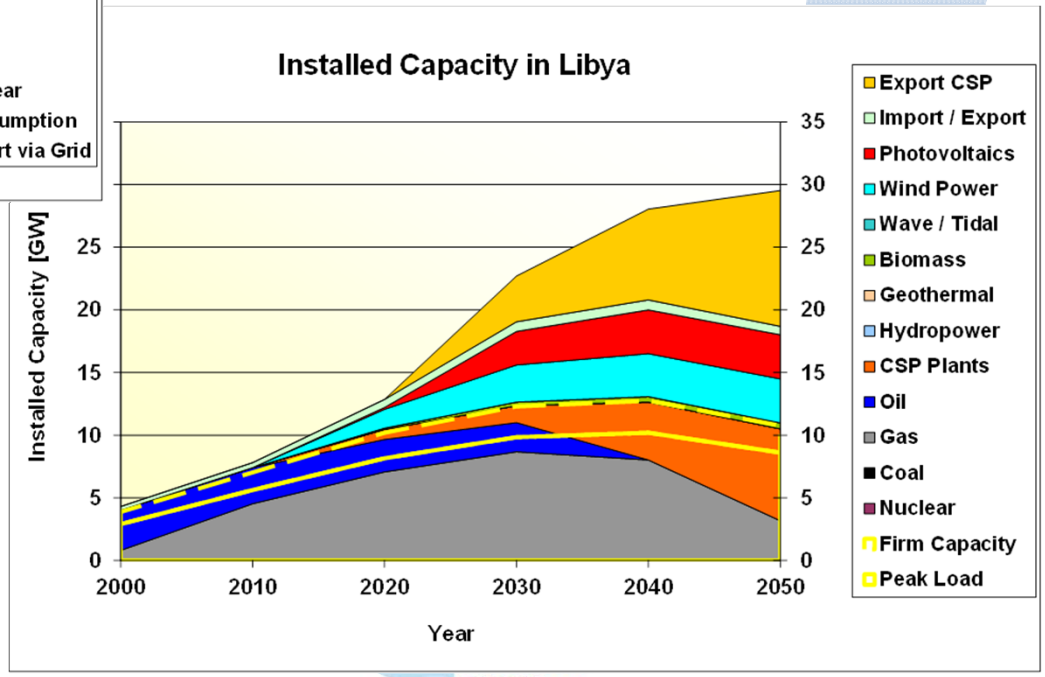


Case Study
Libya



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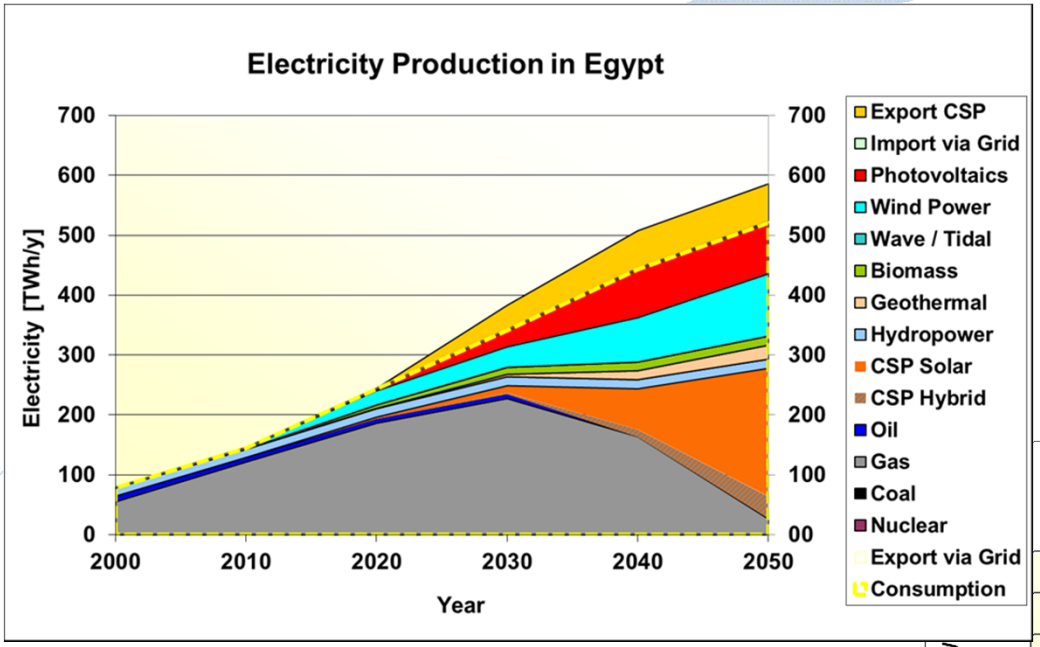
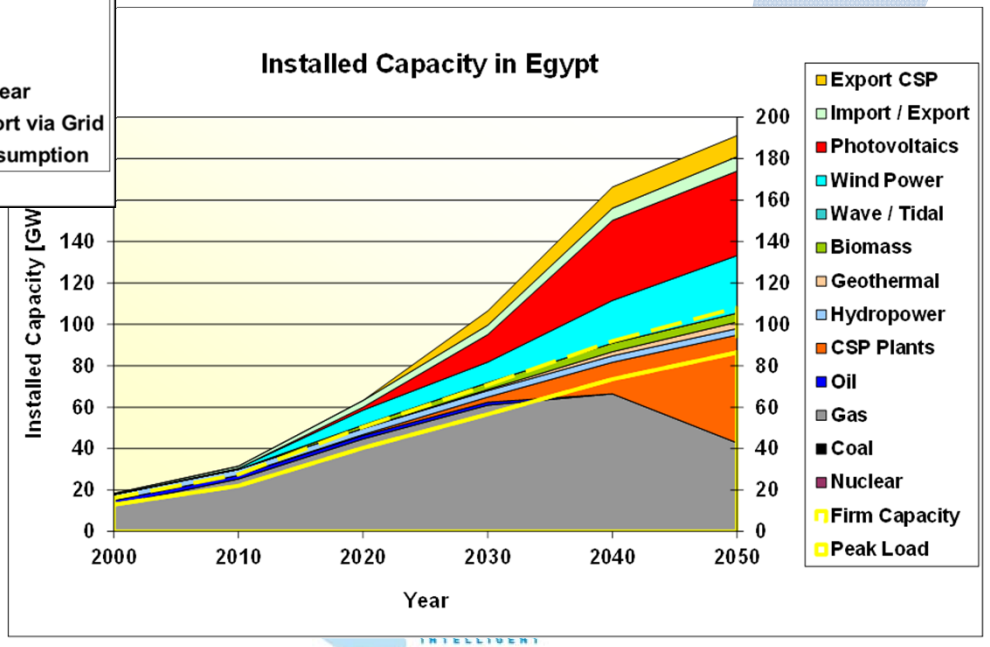


Case Study
Egypt



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3.2. Prospects for RES-E in NA
Conclusions and current status

- RES-E potentials have been analyzed and found to be larger than in former studies
- Electricity demand scenarios have been elaborated until 2025 and 2050
- Short term RES-E policy targets have been identified
- Framework conditions for sustainable supply have been defined
- Bottom-up scenarios (feasible pathways) towards sustainability have been described (low effort approach)

➢ **feedback needed from stakeholders about consistency with regional targets and policy**

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Jürgen Kern juergen.kern@dlr.de +49 711 6862 8119

Dr. Franz Trieb franz.trieb@dlr.de +49 711 6862 423

Deutsches Zentrum für Luft- und Raumfahrt e.V. (DLR)

www.DLR.de/tt/

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