GWS SPECIALISTS IN EMPIRICAL ECONOMIC RESEARCH

RENEWABLES IN THE MENA REGION – EXPERIENCES AND HOPES

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Acknowledgement

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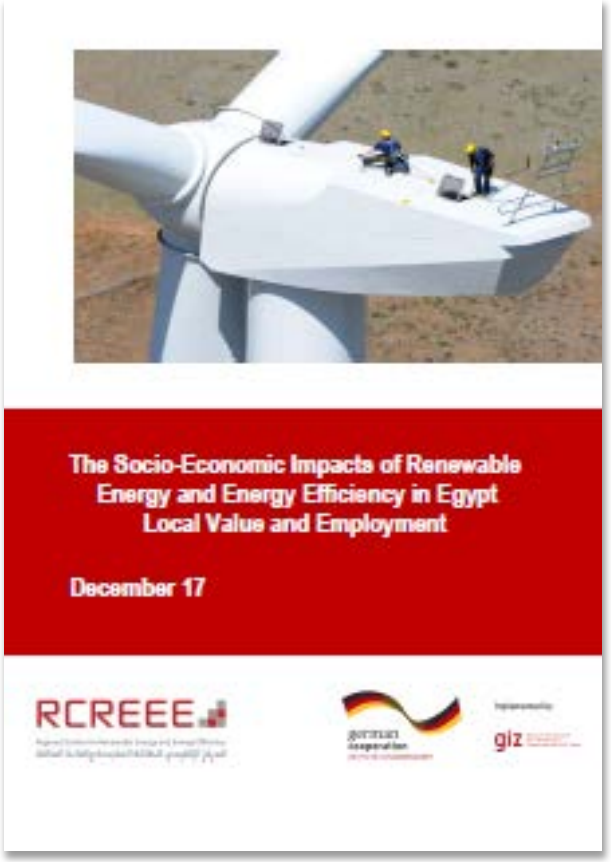

http://www.rcreee.org/sites/default/files/report-final_rcreee_website-_13-02.pdf

GWS: Where and who?

- Privately funded think tank/ research institute / consultancy
- Founded in 1996 – university spin-off
- Member of the INFORUM modelling group
- Currently ~ 24 researchers
- Private and public customers
  - International, national and regional Governments, Ministries
  - International, national and regional Administration
  - EC DG-TREN, RTD, Env, Climate, Energy
  - Energy companies, banks

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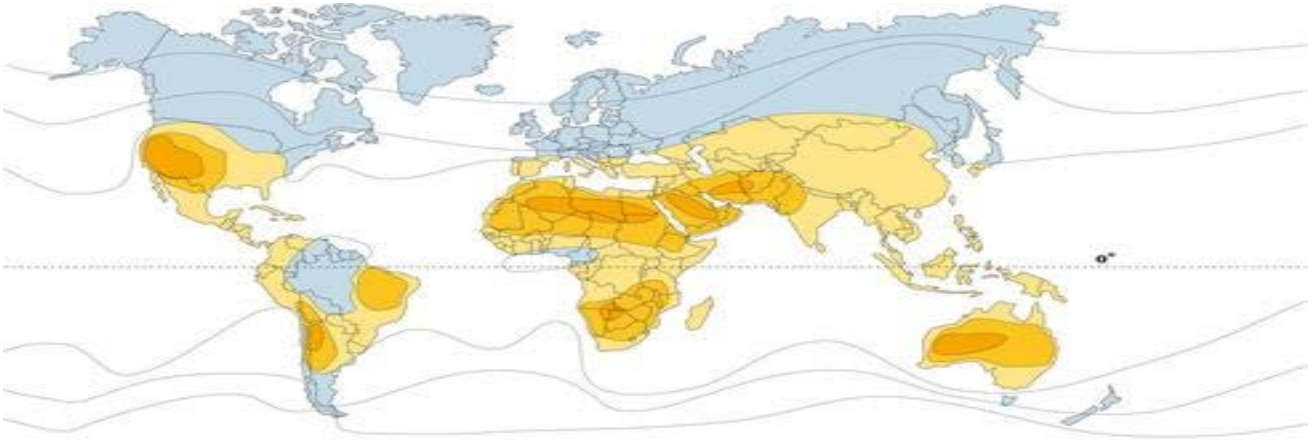
What we do:

- Support private and public decision makers with sound empirical, data based, economic tools
- Main areas of interest:
  - ⇨ Environmental questions, energy policy, focus on renewable energy, materials, focus on resource efficiency
  - ⇨ Economic modelling, individual country models, regional models, world
  - ⇨ Labor market issues

Renewable energy in MENA – why?



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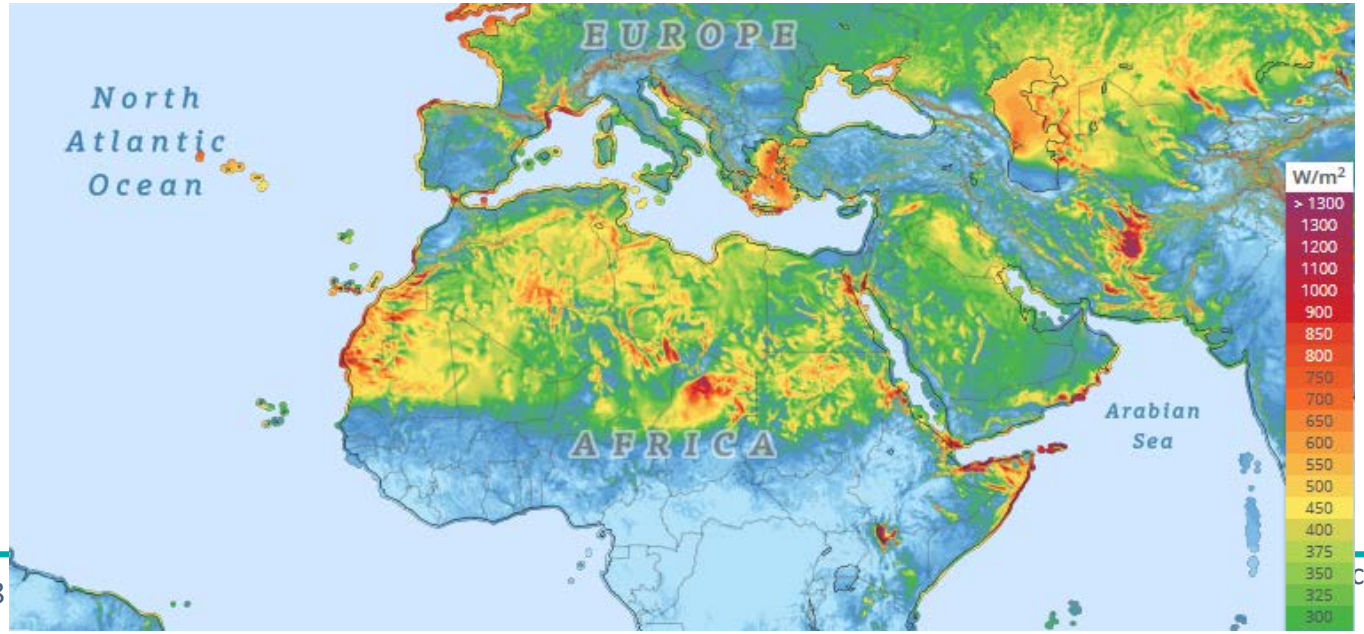
- MENA lies in the zone of high solar radiation; and decent wind speed



Renewable energy in MENA – why?

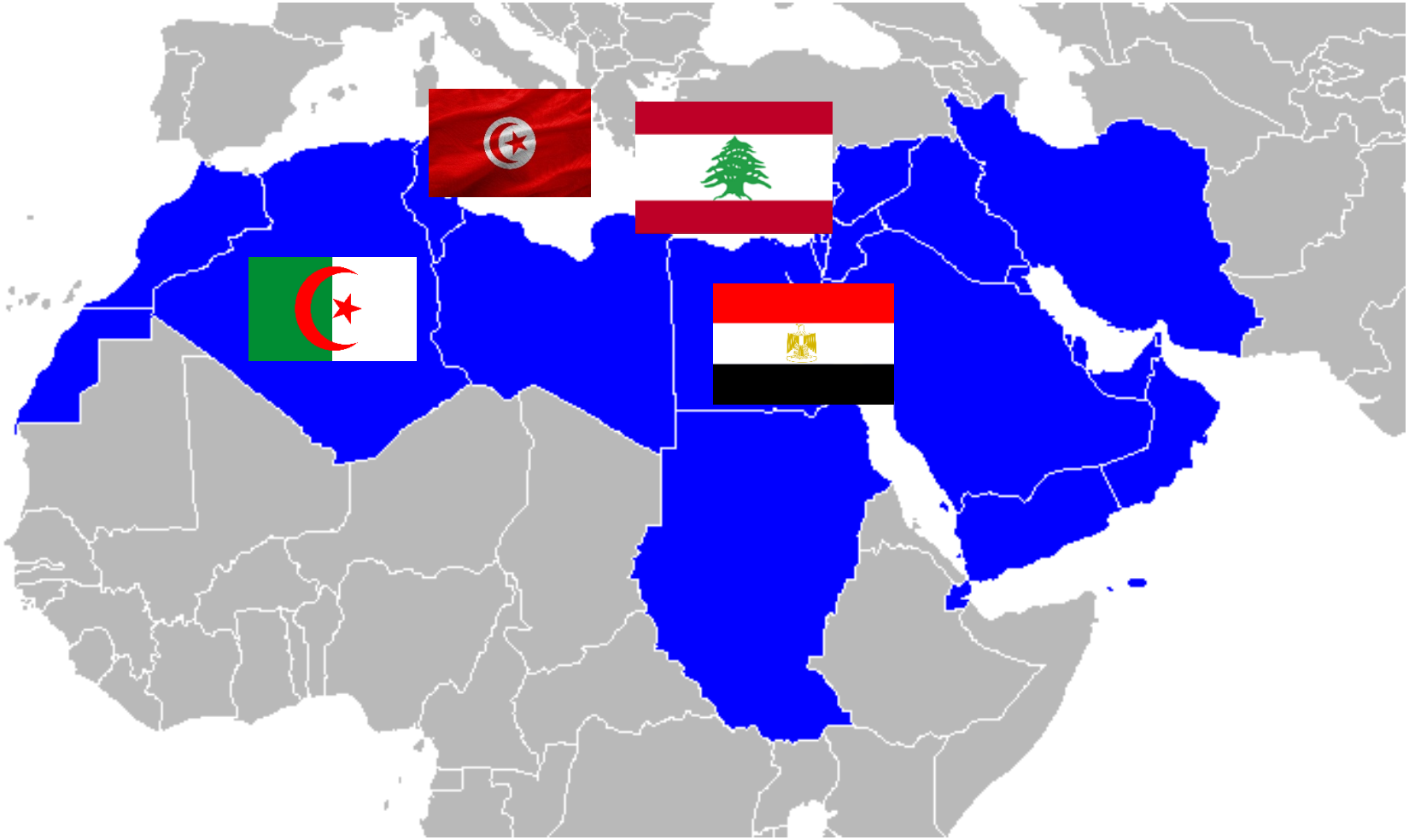
Energy issues

- Increasing populations
- Increasing energy demand
- No sufficient supply
- Structural problems on the energy markets:
  - ⇨ High subsidies
  - ⇨ Monopolistic structures
  - ⇨ Frequent power-out
  - ⇨ Insufficient efficiency in cost recovery

Other

- High unemployment
- High share of young people
- High share of young (educated) unemployed males
- Low confidence of foreign investors
- Money with strings attached

MENA Region and countries analysed in depth



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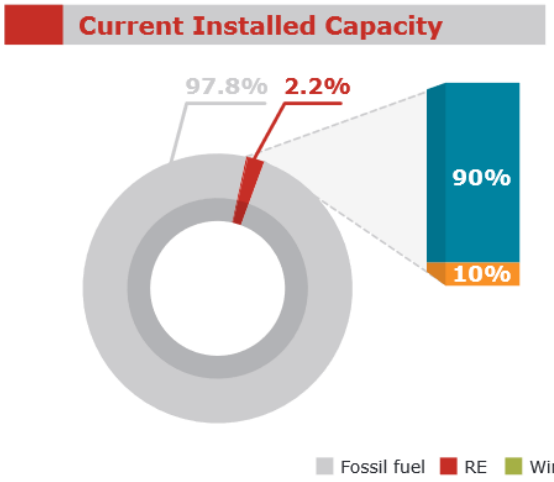
Country Profiles

Background – Algeria – Energy - Economy– Facts and Policy

- **Economy**
  - **GDP/Cap:** $15,200 (2017 est.)
  - Hydrocarbons 30% of GDP, 60% of budget revenues, and nearly 95% of export earnings.
  - 10th-largest reserves of natural gas in the world
  - 6th-largest gas exporter.
  - 16th in proven oil reserves.
  - **Resource curse!**



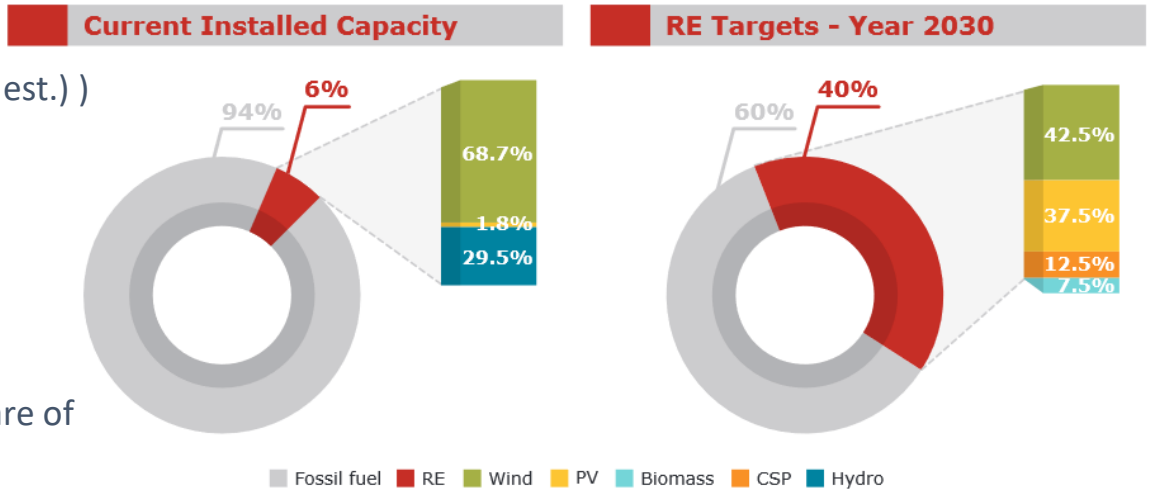
	Wind	PV	CSP	Hydro	Total RE	Total all Energy
MW	0	0	25	228	253	11390

	Wind	PV	CSP	Total	Target Date
MW	10	6	25	41	2013
MW	50	182	325	557	2015
MW	270	831	1500	2601	2020
MW	2000	2800	7200	12000	2030

- **Renewable energy**
  - Algeria aims to increase the share of renewables to 40% by 2030
  - The most important driver is CSP and PV technology
  - RE fund has been established by executive decree No. 11-423 (December 2011).
  - No policy of financial guarantee to private investors to ensure payment - power purchase agreement.
  - No customs duty or internal tax benefits for renewable energy projects.

Background – Tunisia – Energy - Economy– Facts and Policy

- **Economy**
  - **GDP/Cap:** $11,800 (2017 est.))
  - Diverse economy
  - Natural gas reserves.



- **Renewable energy**
  - Tunisia aims to increase the share of renewables to 40% by 2030
  - The most important driver is wind and PV technology

	Wind	PV	CSP	Hydro	Total RE	Total all Energy
MW	154	4	0	66	244	4043

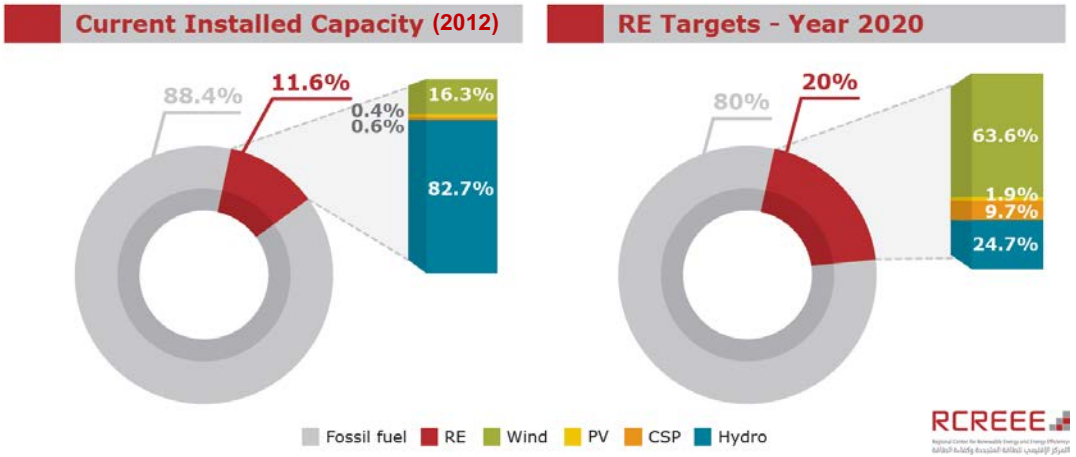
RE Targets (MW Installed Capacity)					
Wind	PV	CSP	Biomass	Total	Target Date
430	140		40	610	2016
1700	1500	500	300	4000	2030

- Tunisia does not have a policy of providing financial guarantees to private investors to ensure payment under power purchase agreements.
- According to tax legislations, all RE equipment and components that do not have locally-manufactured substitutes are fully-exempted from customs import duty and internal taxes.
- The National Fund for Energy Saving (FNME) provides financing for renewable energy and energy efficiency projects.
- Net metering
- Prosol for SWH, PV

Background – Egypt – Energy - Economy– Facts and Policy

► Renewable energy

- ⇨ Egypt aims to increase the share of renewables to 20% by 2020
- ⇨ The most important driver is wind technology
- ⇨ Large-scale private RE projects are encouraged + long term power purchase agreements are ensured

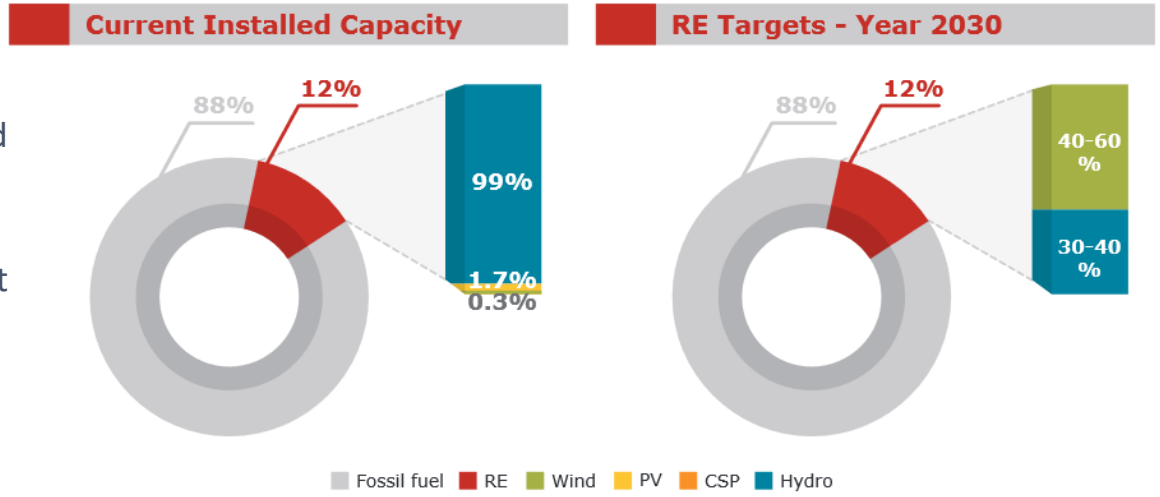


► Economy

- ⇨ GDP/cap $12,700
- ⇨ Own oil, own gas

Background – Lebanon – Energy - Economy– Facts and Policy

- **Economy**
  - ⇨ **GDP/Cap:** $19,400 (2017 est.)
  - ⇨ No natural resources exploited so far
  - ⇨ BUT: Tamar – and the adjacent gas fields…..
- **Renewable energy**
  - ⇨ Lebanon aims to increase the share of renewables to 12% by 2030
  - ⇨ The most important driver is wind technology



	Wind	PV	CSP	Hydro	Total RE	Total all Energy
MW	~0.5	1	0	*282	283.1	2313

* Total operating capacity is around 150 MW.

	Wind	Hydro	Waste to Energy	Total	Target Date
MW	60-100	40	15-25	115-165	2015

- Currently, there is no RE fund established by law for financing RE projects. However, the Central Bank of Lebanon offers low interest loans (0.6%) for RE projects for a period of 14 years (with 4 years of grace period, and 10 years for repayment). There is also a grant from the European Union offering to cover up to 15% of project costs not exceeding USD 150,000 per project. The 15% grant applies to RE projects in nonsubsidized sectors and 5% for projects in subsidized sectors.
- Lebanon does not have yet a policy of providing financial guarantee to private investors to ensure payment under power purchase agreement.
- No customs duties or internal tax benefits provided to RE projects. Lebanon is in the process of compiling a list of RE equipment for future customs duty exemption.

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Measuring employment from renewable energy – why and how?

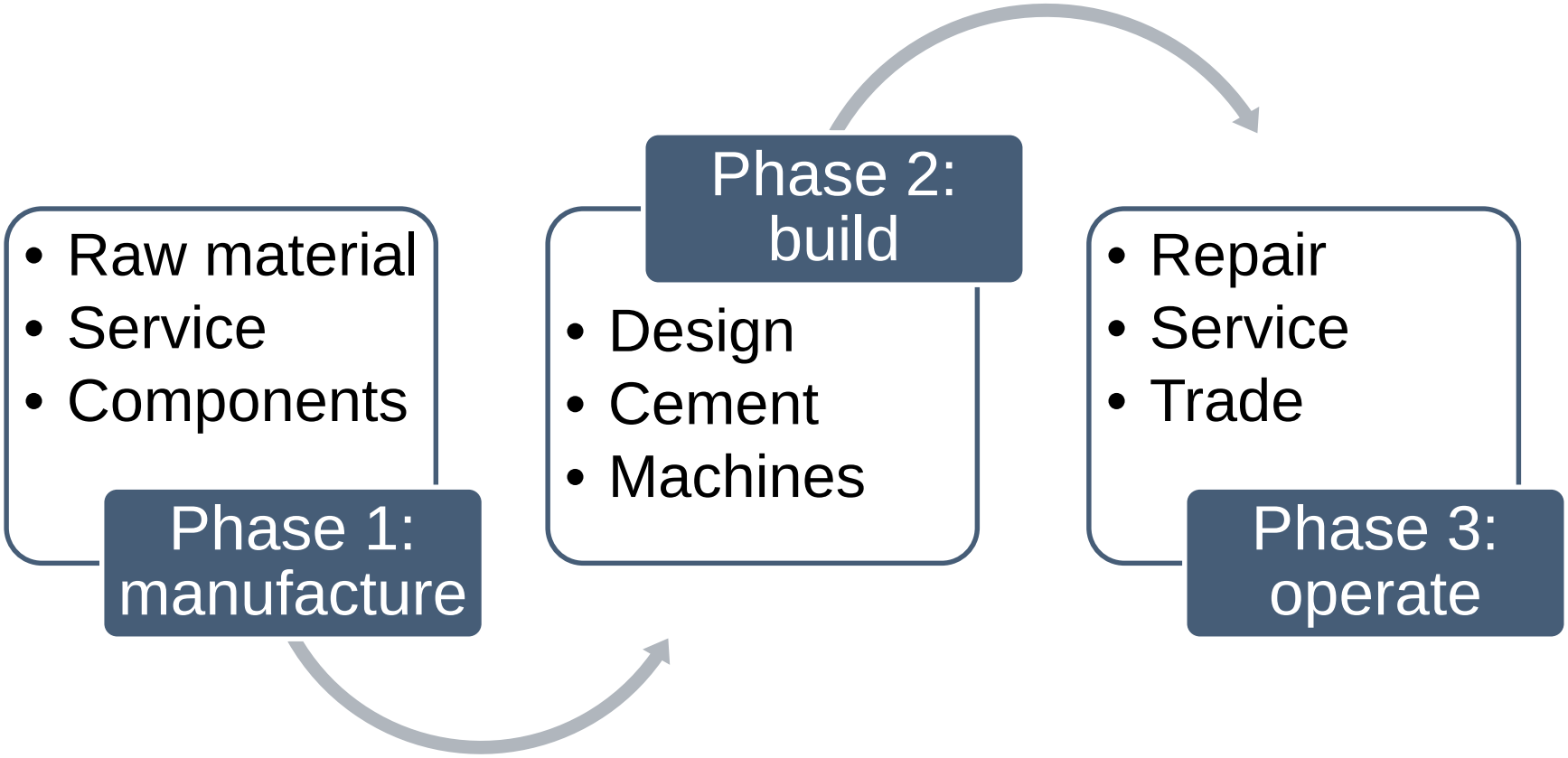
Measuring employment from RE and EE – who asks and why?

Algeria: Energy Ministry; Tunisia: ANME (Energy Agency);

Egypt: RCREEE and NREA (Ministry of New Energy); Lebanon: UNDP

- Control what has been achieved and what will be achievable
- Translate installations into local/ domestic jobs
- Account for economic opportunities under the respective local conditions

Theory: Renewable energy and energy efficiency value chains – direct and indirect effects



Input Output Analysis

Economic tool for the analysis of direct and indirect effects

- ⇨ Goes back to Wassily Leontief (Nobel prize 1973)
- ⇨ Illustrates the effects of additional demands in one industry on all industries in the economy
- ⇨ Input-Output Tables are available for more than 100 countries in the world
- ⇨ Consistent analytical framework which helps to connect RE deployment analysis to economic analysis already done for other sectors or the whole economy

Leontief model and equations

- Total production X (vector) of an economic sector equals the sum of final demand D and intermediate demand by other sectors AX, with A (matrix) in percent:

$$X = A*X + D$$

- Reformulation gives the famous Leontief equation:

$$X = (I-A)^{(-1)}* D$$

- To calculate answers to a demand change:

$$\Delta X = (I-A)^{(-1)}*\Delta D$$

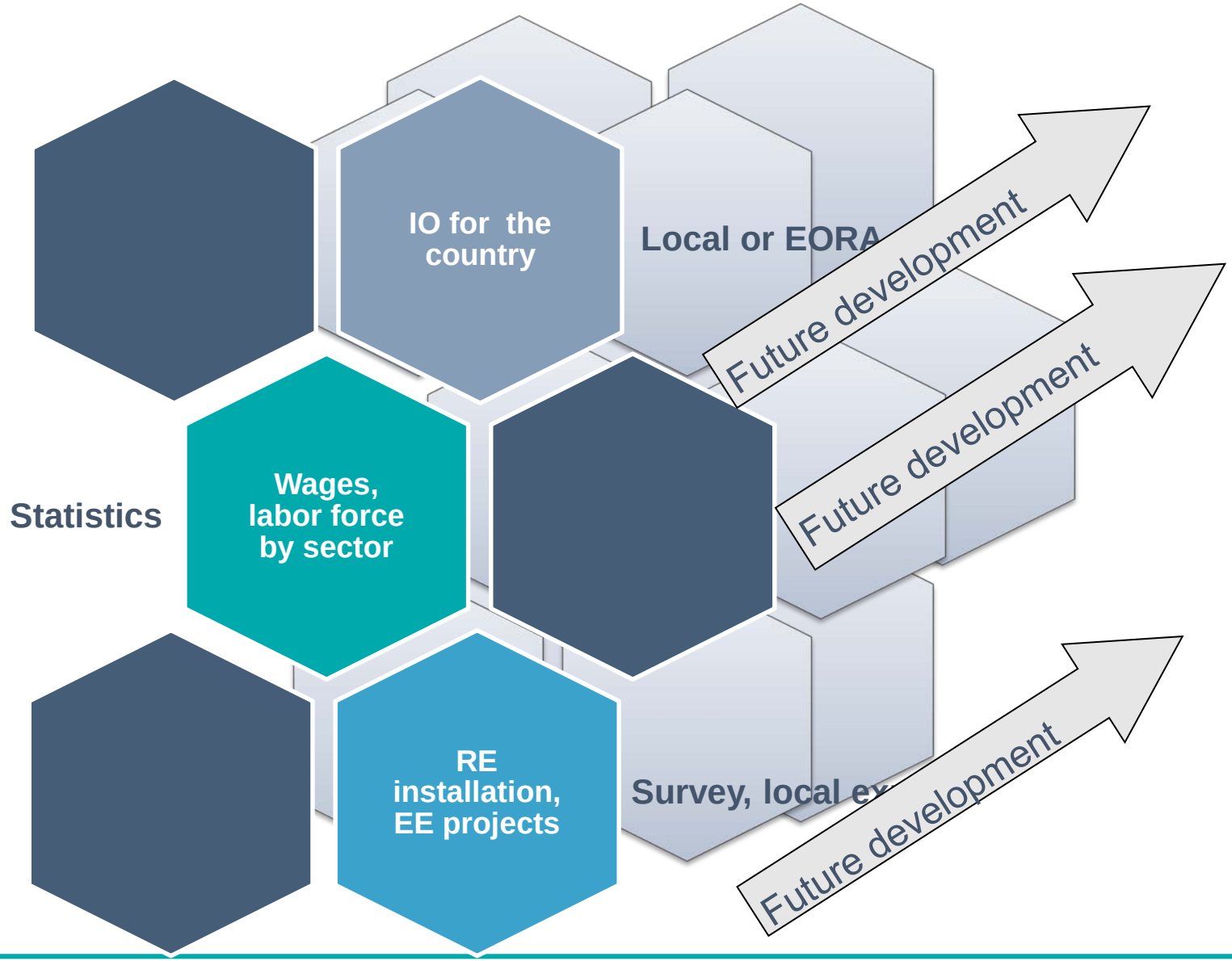
- To calculate employment answers to a demand change

$$\Delta E = e*[(I-A)^{(-1)}*\Delta D]$$

Advantages for the estimation of jobs from EE&RE

- RE&EE deployment is interpreted as demand change.
- Input structure of RE and EE is known from earlier projects
- IO model yields indirect impacts of the increase in RE and EE.
- Shows how increasing integration and increasing the economic and productive capacity spurs employment
- Shows which sectors will be winning most.
- Can be easily driven to the future
- Recommended by ILO, IRENA, IEA-RETD

No fun without data!



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Similarities and differences

Economic structures

- Successful democratic reforms after Arab spring
- Economy not back on track
- Early mover with renewable energy strategy
- Good at developing strategies and instruments, lacking implementation
- Encourages private enterprises, medium red tape

- Turbulent time after Arab Spring, elected Government, Military coup
- Economy – also tourism – not fully back
- Large infrastructure investments to tackle unemployment (new capital, etc.)
- Low incentives for private enterprises
- Many new enterprises founded by military, also solar PV production
- Regional, agriculture, solar pumping, rural jobs

- Turbulent also without Arab spring
- High educated population
- Service and science (IT) oriented economic structure
- Few production capacities
- Severe impact from Syrian crisis
- Small elite
- High bureaucracy hurdles

- Stalemate after “black years”
- Stalled political institutions
- Resource curse
- Tendency to closed economy
- Developed oil/gas/hydrocarbon industry
- Self-sufficient

Labor market

Labor force:

- 11.82 million (2017 est.)
  - ⇨ agriculture: 10.8%
  - ⇨ industry: 30.9%
  - ⇨ services: 58.4% (2011 est.)

Unemployment:

- 11.7% (2017 est.)
- 10.5% (2016 est.)

Labor force:

- 4.054 million (2017 est.)
  - ⇨ agriculture: 14.8%
  - ⇨ industry: 33.2%
  - ⇨ services: 51.7% (2014 est.)

Unemployment:

- 15.9% (2017 est.)
- 15.5% (2016 est.)

Labor force:

- 2.166 million
- note: excludes as many as 1 million foreign workers and refugees (2016 est.)
- Last Labor market survey from 2005
- Currently carried out as an ILO project

Labor force:

- 29.95 million (2017 est.)
  - ⇨ agriculture: 25.8%
  - ⇨ industry: 25.1%
  - ⇨ services: 49.1% (2015 est.)

Unemployment

- 11.9% (2017 est.)
- 12.7% (2016 est.)

Employment factors (FTE/MW)

	Install	Produce	O&M
Wind	0.98	4.7	0.3
PV	1.2	-	0.12
SWH	11	4	0.01
Hydro	3.5	1.5	1.28

	Install	Produce	O&M
Wind	4.4	3.5	0.3
PV	2	5	0.12
SWH	3.7	3.8	-
Hydro	-	-	-

For comparison:

► Global (EREC/Greenpeace)

	Install	Produce	O&M
Wind	2.5	6.1	0.2
PV	11	6.9	0.3
SWH	7.4		
Hydro	6	1.5	0.3

	Install	Produce	O&M
Wind	3.6	-	0.28
PV	11		0.1
SWH		-	-
Hydro	7.5		1.38

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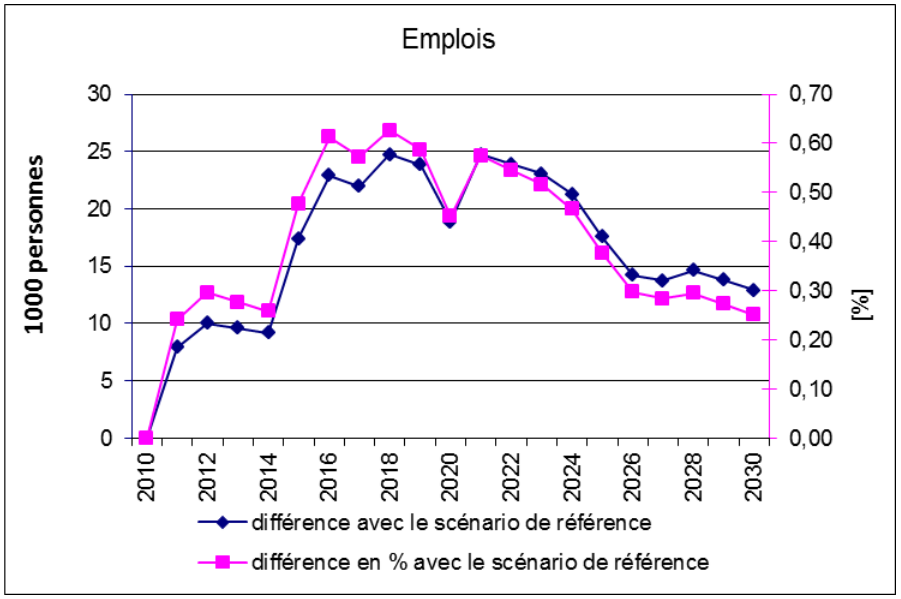
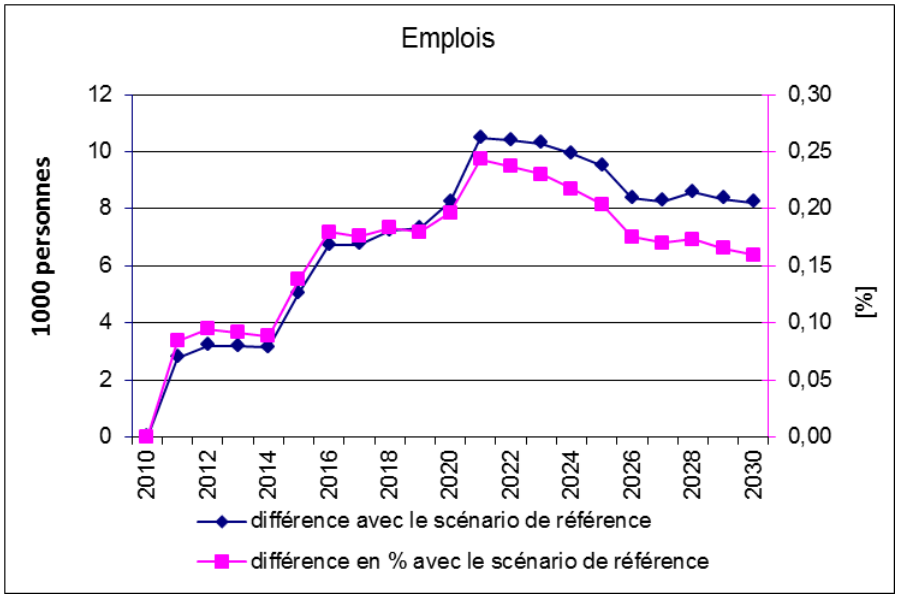
Results

Results – Tunisia: jobs under different scenarios





Scenario ER+ +

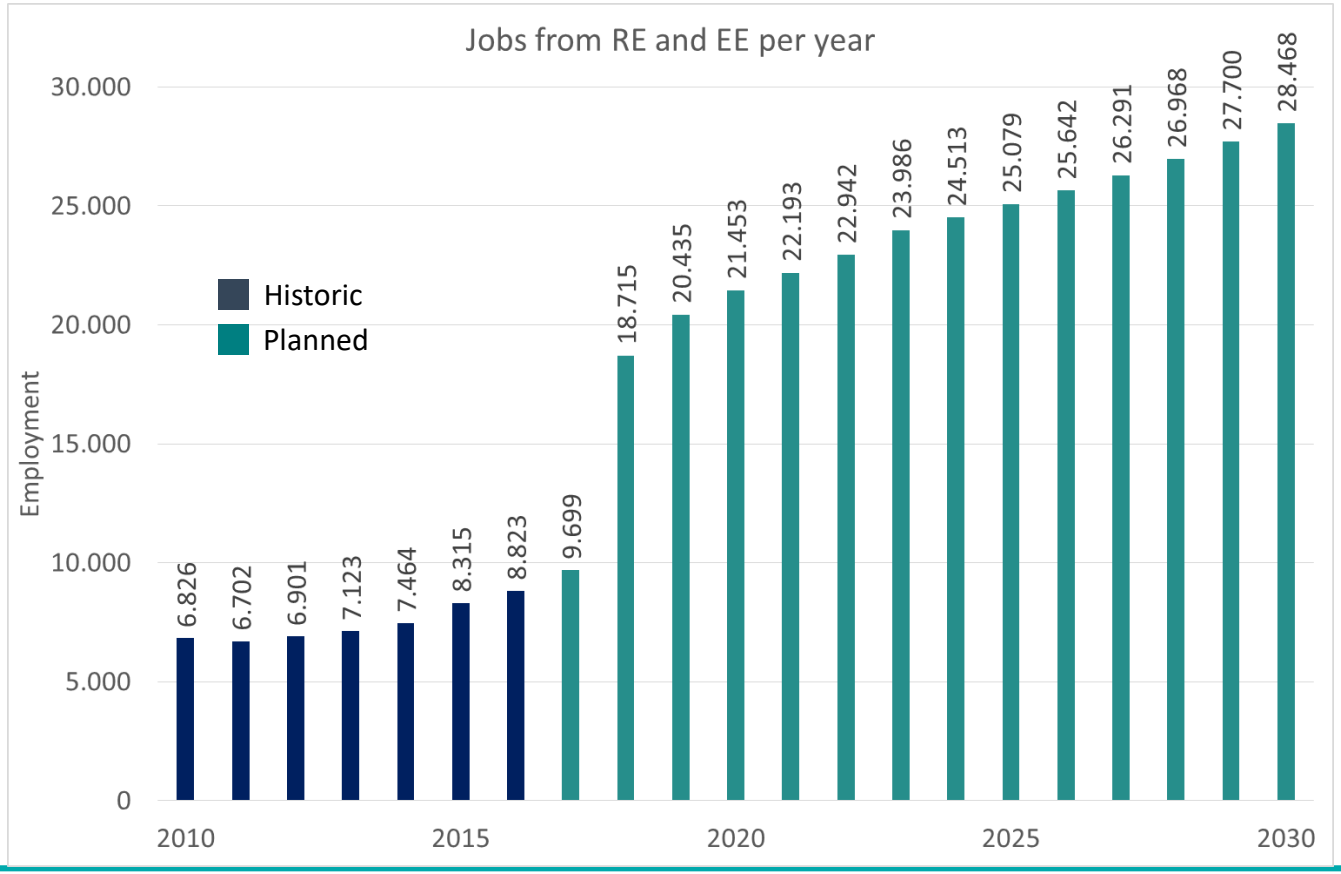
- 10% of systems (wind, PV, CSP) imported
- 24,700 jobs in 2018

Scenario ER+

- 85% of systems (wind, PV, CSP) imported
- 10,500 jobs in 2021

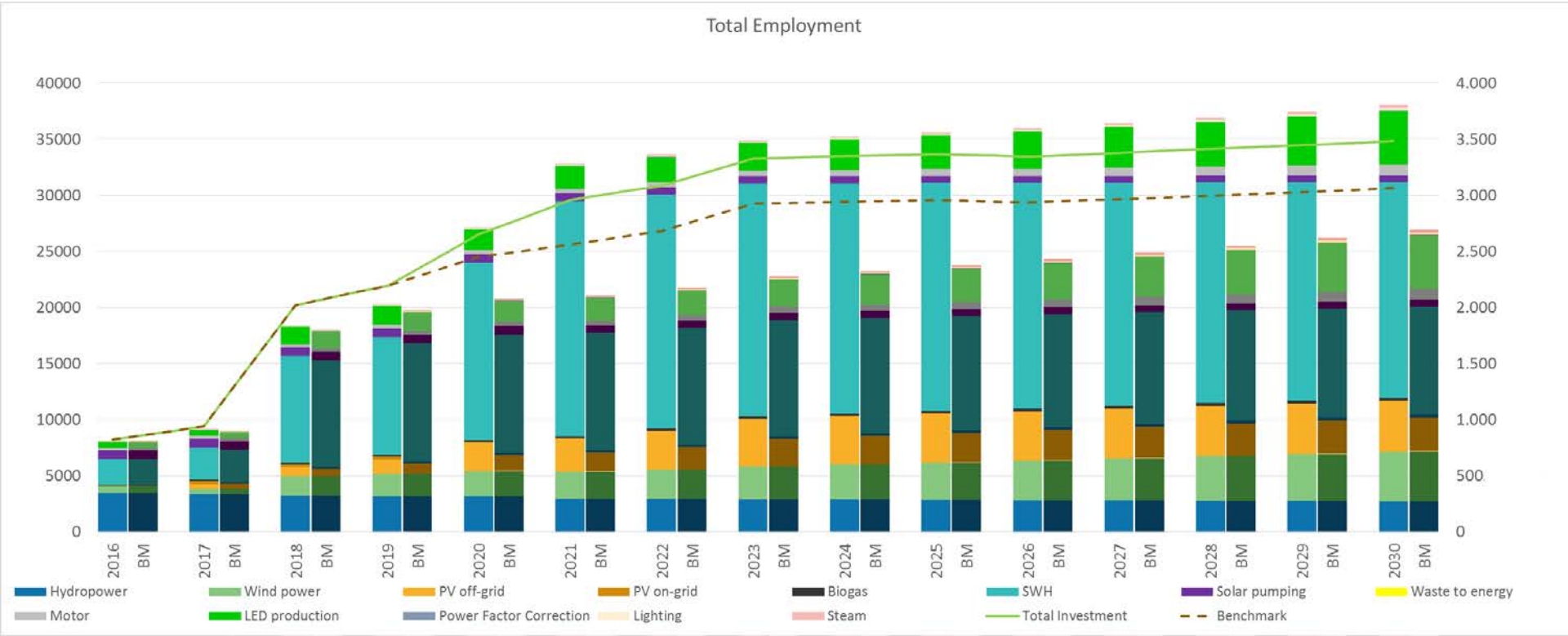
Results Egypt – Total Employment

The main drivers are the expansion of wind energy and solar energy (SWH and PV). Wind energy will be reaching a conservative target of 5000 MW by 2022, PV of 3000 MW, SWH sees 5 million square meters installed. The number of energy efficiency projects is assumed to increase by 10 percent/a.



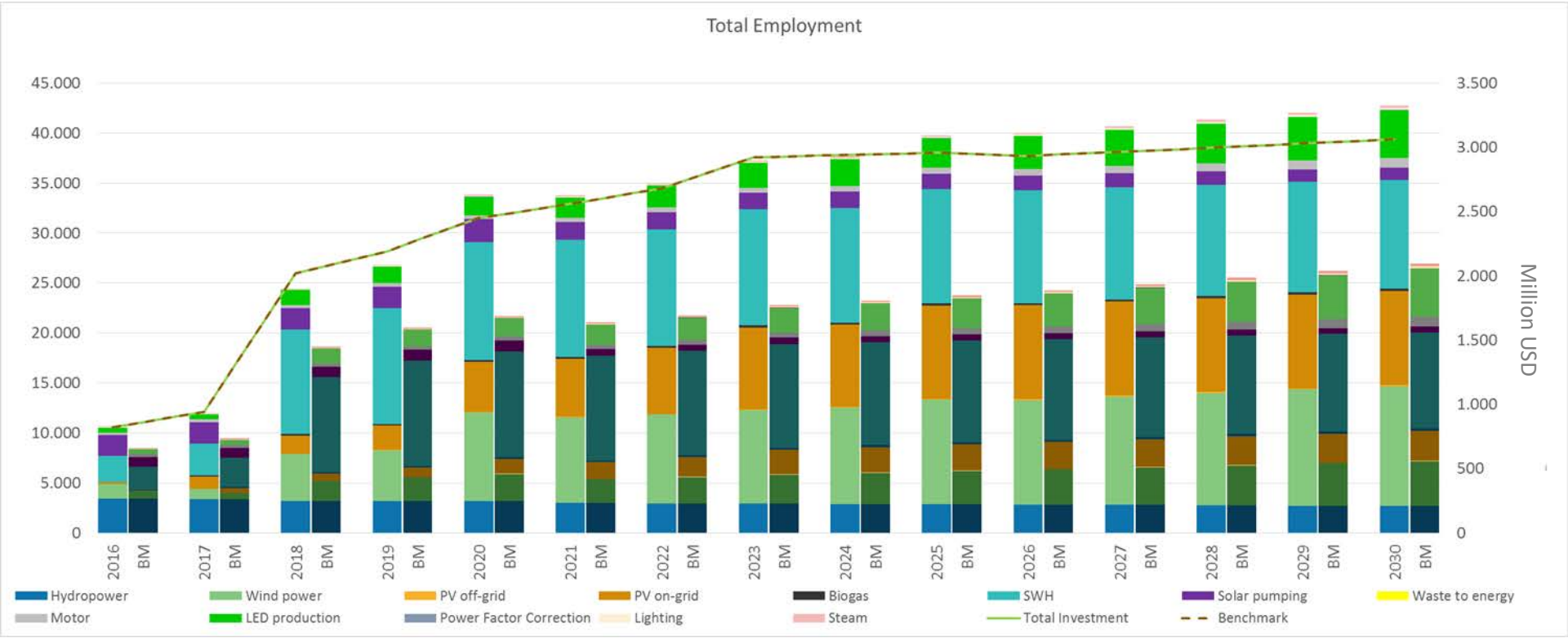
Results Egypt – Scenario Analysis: More Small Technologies

- Roof-top PV and solar water heaters are more labor intensive
- Decentralized installations spreads job opportunities to different regions
- More additional jobs than additional costs



Results Egypt – Scenario Analysis: More Local Content

- More local value from RE and EE while maintaining the same investment path
- Support for industrial clusters, SMEs, shift from assembling to producing



Results Lebanon: employment from PV 2018-2021

	2018	2019	2020	2021
SCENARIO A: Optimistic				
DIRECT EMPLOYMENT	**556**	**2.606**	**6.115**	**6.267**
Installation	550	2.574	6.025	6.118
Operation & Maintenance	6	32	90	149
INDIRECT EMPLOYMENT	**641**	**5,114**	**12,202**	**12,627**
Installation	609	4,987	11,707	11,763
Operation & Maintenance	*32*	*127*	*496*	*864*
TOTAL EMPLOYMENT	**1,197**	**7,720**	**18,317**	**18,894**
SCENARIO B: Conservative				
DIRECT EMPLOYMENT	**423**	**606**	**2759**	**4,619**
Installation	418	596	2725	4,545
Operation & Maintenance	5	10	34	73
INDIRECT EMPLOYMENT	**493**	**971**	**5,313**	**9,073**
Installation	463	926	5,077	8,485
Operation & Maintenance	30	45	236	588
TOTAL EMPLOYMENT	**917**	**1,577**	**8,072**	**13,692**
DIFFERENCE				
TOTAL EMPLOYMENT DIFFERENCE	**280**	**6,143**	**10,246**	**5,202**

Results

- Renewable energy deployment will lead to additional employment in all countries analysed
- RE and energy efficiency can alleviate some problems from the respective power markets.
- However, often structural problems in the markets remain.
- Examples are:
  - ⇨ Back-up provision still considers RE as threat and not as chance (Lebanon)
  - ⇨ Industry sees RE only as consumers (Lebanon, Egypt)
  - ⇨ Grid development does not include RE (Egypt, Tunisia)

Conclusions

- Data based decision support is often underdeveloped in emerging economies and developing countries
- Tool with clear messages can support local institutions such as RCREEE, Ministries, UNDP-agencies
- Data collection is only possible with local expert support
- Data collection is essential: the countries differ immensely
- Data collection is essential: only local data create credibility
- Data analysis and diagrams trigger discussions

Future research: regionalize!

Thank you for your attention.

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Data collection – template for RE

Concerned organization/source						
Technology*						
Year	Installed Capacity	Investments		Egyptian Direct Jobs		
		Local Share	Foreign share	Total No.	Permeant	Part-time
2010						
2011						
2012						
2013						
2014						
2015						
2016						
2017						
*** a separate table should be developed for each of the technologies that your organization is working with from the following technologies**						
Wind, PV, CSP, SWH, Biomass, and Biogas						

Data collection – templates – Example PV

NREA						
PV Power plants						
Year	Installed Capacity	Investments		Egyptian Direct Jobs		
		Local Share	Foreign share $	Total No.	Permanent	Part-time
2015	10 MWp in Siwa		22.750 mio.	18	3*	15**
2015	5 MWp in El Farafra		13.135 mio.	17	2*	15**
2015	0.5 MWp in Darb El Arbeen		1.313,5 mio.	17	2*	15**
2015	0.5 MWp in Abo Monkhar		1.313,5 mio.	17	2*	15**
2016	6 MWp in Marsa Alam		12.747,512 mio.	17	2*	15**
2016	5 MWp in Shalateen		10.622,926 mio.	17	2*	15**
2016	2 MWp in Abo ramad		4.249,170 mio.	17	2*	15**
2016	1 MWp in Halayeb		2.214,586 mio.	17	2*	15**
2016	2.1 MWp off grid in Aswan, Qena, Souhag, Matrouh and Louxer		16.870 mio.	22	2*	20**

Literature

1. Lenzen M, Kanemoto K; Moran D, and Geschke A (2012) Mapping the structure of the world economy. *Environmental Science & Technology* 46(15) pp 8374–8381. DOI: 10.1021/es300171x. Supplementary Information
2. Lenzen, M., Moran, D., Kanemoto, K., Geschke, A. (2013) Building Eora: A Global Multi-regional Input-Output Database at High Country and Sector Resolution. *Economic Systems Research*, 25:1, 20-49, DOI:10.1080/09535314.2013.769938