Regional and International Cooperation, Knowledge Exchange: RCREEE insights from the field

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MENAREC6
Kuwait, 6 April, 2016

RCREEE
Regional Center for Renewable Energy and Energy Efficiency
المركز الإقليمي للطاقة المتجددة وكفاءة الطاقة

About RCREEE

- Independent regional inter-governmental organization
- 17 member states
- National focal points in every country
- In operation since 2008
- Headquartered in Cairo, Egypt

Our Vision

"The energy systems in the Arab region are characterized by a significant share of renewable resources and a highly-efficient use of energy."

Our Mission

"To enable a sustainable growth in Arab states' adoption of renewable energy and energy efficiency applications and initiatives through leading regional policy dialogues, learning, and research."

Technology Transfer

According to IPCC ,

"**Technology transfer** encompass the broad set of processes covering the **flows of know-how, experience and equipment** for specific technological application **amongst different stakeholders** such as governments, private sector entities, financial institutions, NGOs and research/education institutions.

The broad and inclusive term **"transfer"** includes **diffusion of technologies and technology co-operation across and within countries.**

It comprises the process of **learning** to understand, **utilize** and **replicate the technology**, including the **capacity to choose and adapt** to local conditions **and integrate** it with **indigenous** technologies"

3 Andersen. S. et al, "Methodological and Technological issues in Technology Transfer", Intergovernmental Panel on Climate Change, http:/www.grida.no/climate/ipcc/tectran/504.htm

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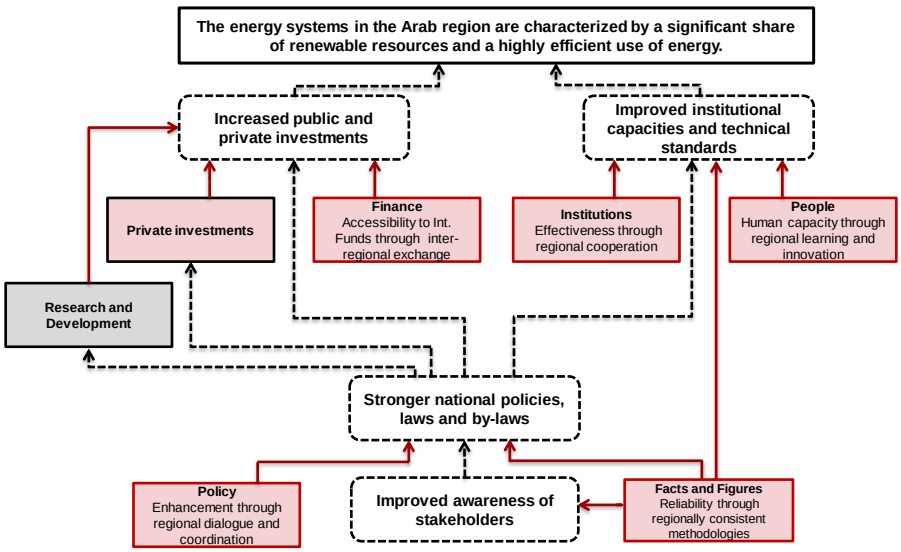
Results Framework



4

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5

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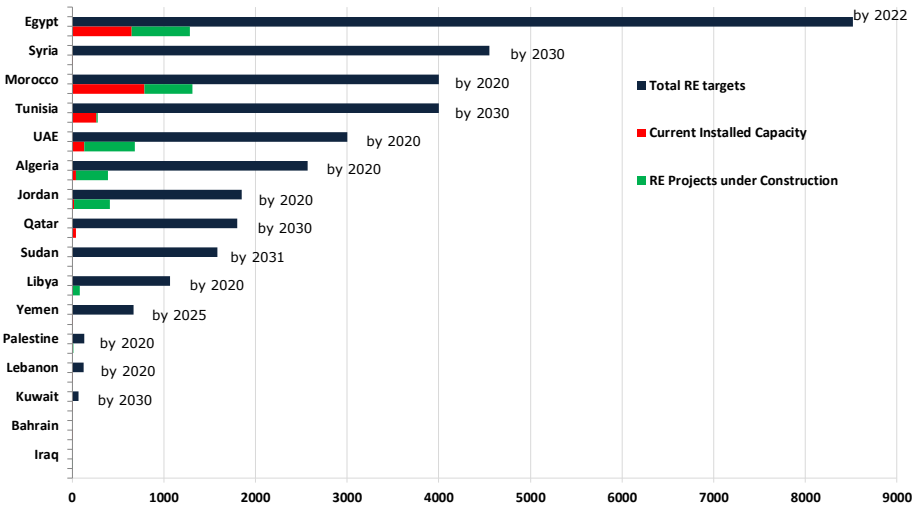
Distance to RE targets is really challenging !!



6

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New environmental pledges towards sustainable energy
Intended Nationally Determined Contributions (INDCs)

Countries publicly outline what post-2020 climate actions they intend to take under a new international agreement by the conclusion of the UNFCCC COP21 in Paris, Dec. 2015.

INDCs will largely determine whether the world achieves an ambitious 2015 agreement and is put on a path toward a low-carbon, climate-resilient future.

MENA countries officially submitted INDCs - RE targets

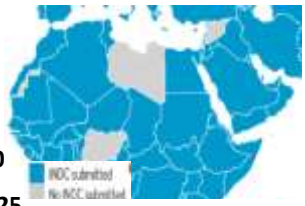
Algeria ➔ 27% of electricity generated from RE by 2030

Jordan ➔ 11% RE share in the total energy mix in 2025

Lebanon ➔ 15 -20%of the power and heat demand in 2030

Morocco ➔ over 50% of installed electricity capacity by 2025

Tunisia ➔ 14% of electricity production in 2020 and 30% in 2030



http://cait.wri.org/indc/#/map

7

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Markets

Several elements to consider

- IPP option
- PPA
- FiT
- Public bidding
- Auto-producer option
- Net-metering
- Grid access & dispatch priority
- Grid interconnections with neighboring countries
- Grid connection rules (grid code)
- RE Target
- Fossil Fuel / Energy Subsidies
- RE Agency
- Institutional Support
- Land allocation
- Tax incentives
- Grants, subsidies, loans
- Carbon/green credits
- Risk mitigation supports
- .....

8

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Sustainable Energy Transition Policies/Support Schemes adopted in MENA

	Number of countries	Name of countries
RE Law	**7**	Algeria, Egypt, Jordan, Morocco, Palestine, Syria and Tunisia
Statutory guarantee of priority grid access for RE	**2**	Algeria and Jordan
EPC contracting	**>15**	Algeria, Egypt, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Palestine, Saudi Arabia, Syria, UAE, Yemen, …
IPP competitive bidding for RE private large-scale projects	**>5**	Morocco, Egypt, Algeria, UAE, KSA, Libya (?)
Feed-in Tariff	**>3**	Algeria, Egypt, Palestine, Jordan (turned to direct orders), Syria (?)
Direct Proposal Submission	**2**	Jordan, Egypt
Net-metering	**>5**	Egypt, Jordan, Lebanon, Palestine, Syria (?), Tunisia, UAE (Dubai)

Source: RCREEE experts network

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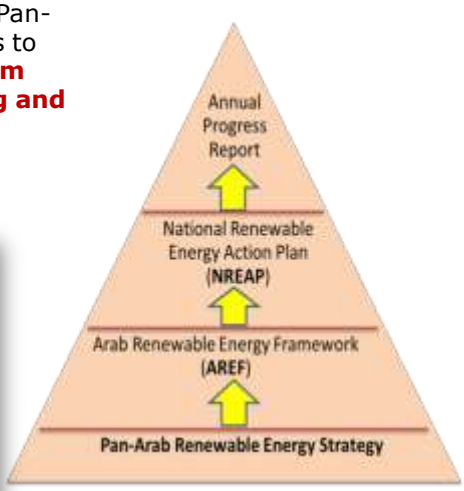
National RE action plan template (NREAP)

- Successful implementation of the Pan-Arab Strategy requires Arab states to engage in **short- to medium-term national RE planning, reporting and evaluation**



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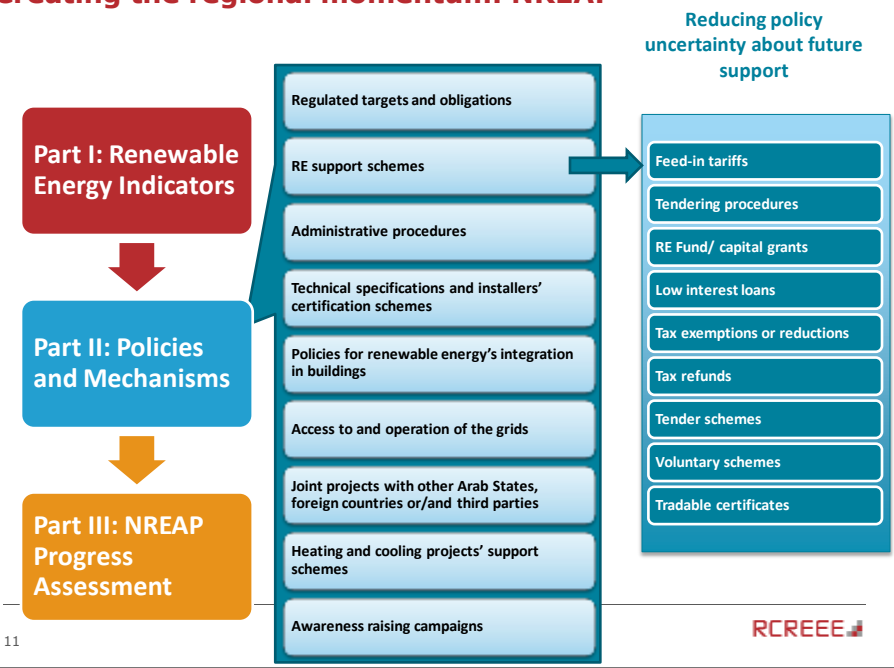
Creating the regional momentum: NREAP



11

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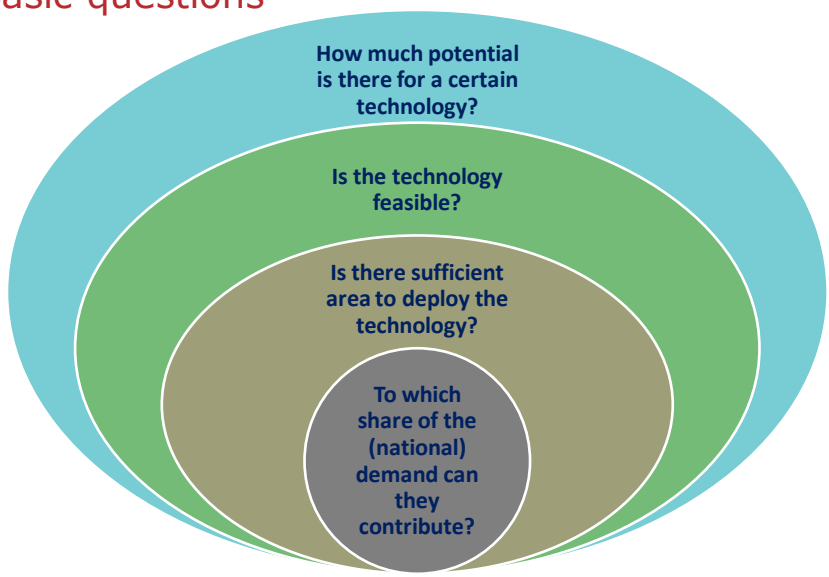
Basic questions



12

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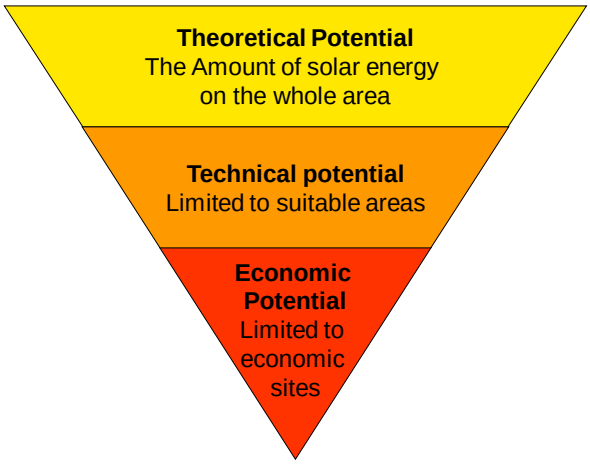
Assessing Potentials – CSP Sample



- DNI map of the region
- DNI map minus excluded areas
- Technical potential only for DNI e.g. above 2000 kWh/m²

Ref.: Carsten Hoyer-Klick (2011), "Introduction to Solar Resource Assessments", German Aerospace Center (DLR), Solar-Med –Atlas Workshop, Cairo, Egypt, November, 2011

13

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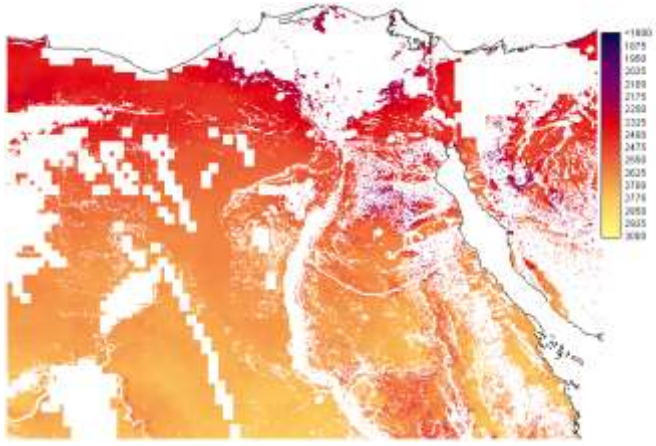
Solar Radiation at Usable Areas



Ref.: Carsten Hoyer-Klick (2011), "Introduction to Solar Resource Assessments", German Aerospace Center (DLR), Solar-Med –Atlas Workshop, Cairo, Egypt, November, 2011

14

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Ground measurements vs. satellite derived data

Ground measurements

Advantages

+ high accuracy *(depending on sensors)*
+ high time resolution

Disadvantages

- high costs for installation and O&M
- soiling of the sensors
- sometimes sensor failure
- no possibility to gain data of the past

Satellite data

Advantages

+ spatial resolution
+ long-term data *(more than 20 years)*
+ effectively no failures
+ no soiling
+ no ground site necessary
+ low costs

Disadvantages

- lower time resolution
- low accuracy at high time resolution

15 Ref.: Carsten Hoyer-Klick (2011), "Introduction to Solar Resource Assessments", German Aerospace Center (DLR), Solar-Med –Atlas Workshop, Cairo, Egypt, November, 2011

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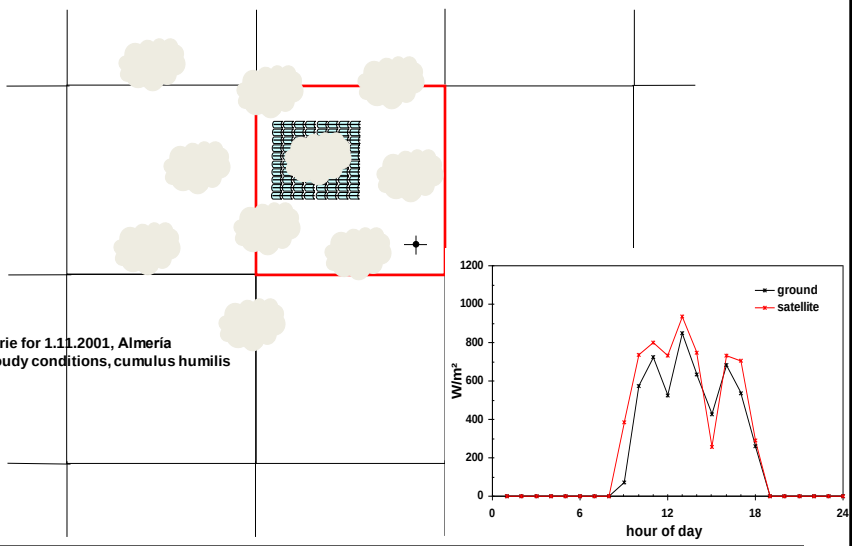
Comparison with ground measurements and accuracy

general difficulties: *point versus area* and *time integrated versus area integrated*



16 Ref.: Carsten Hoyer-Klick (2011), "Introduction to Solar Resource Assessments", German Aerospace Center (DLR), Solar-Med –Atlas Workshop, Cairo, Egypt, November, 2011

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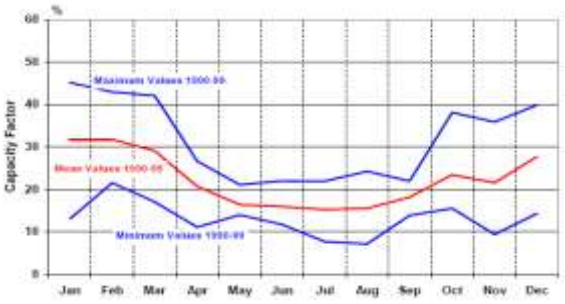
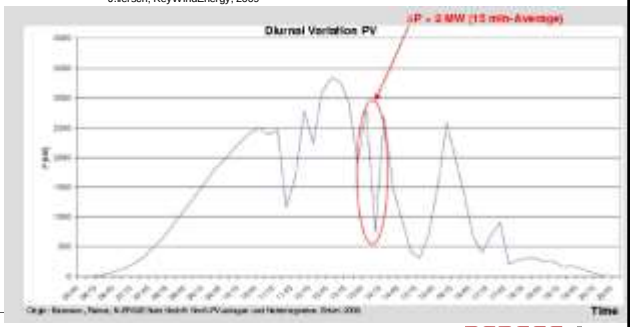


J.Iersch; KeyWindEnergy, 2009

Example for Seasonal **Variation of Wind** Energy

Example for Variation of PV output due to clouds

PV systems can experience variations in output of +/- 50% in a 30 to 90 seconds , and +/- 70% in a five to ten minute time frame



17

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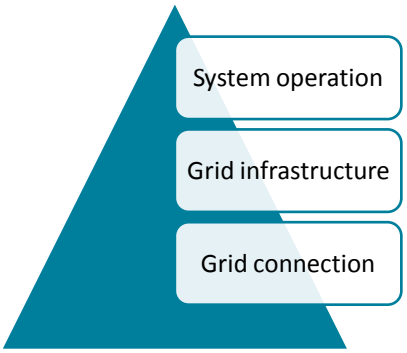
Connection & Infrastructure Challenges

- System constraints
- Lack of grid access
- Limited grid capacity and coverage
- Lack of technical standards



18

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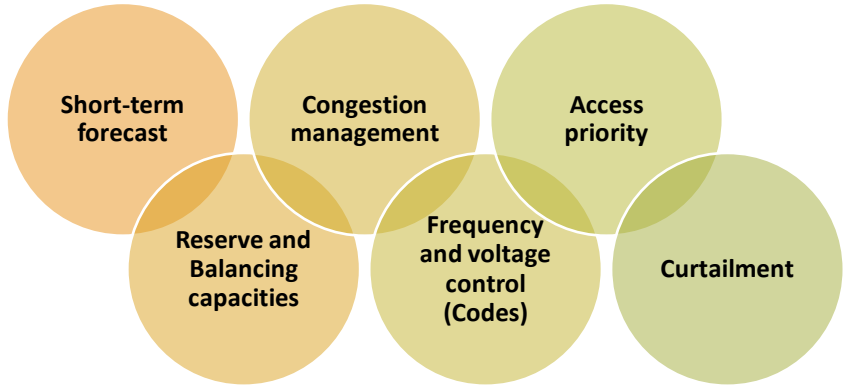
System operation

High levels of penetration of RE power have significant impact on the planning and operation of the grid.



19

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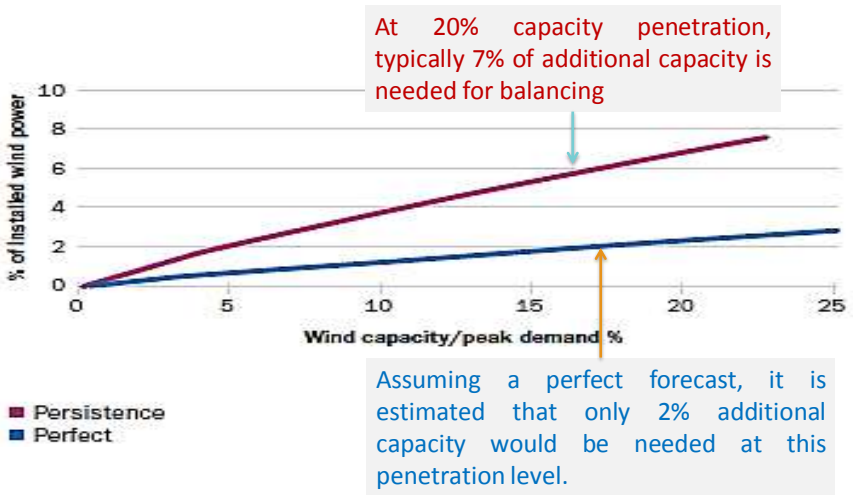
Balancing Capacities

Site, grid and market dependent



Source: Marwa Mostafa, EgyptERA, 2013, LAS/RCREEE Workshop on RE grid Integration, Bahrain

20

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Highlights from RCREEE Countries

Jordan Case

Technical Impact

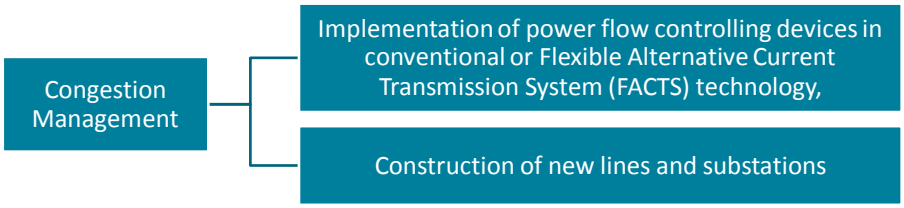
- ✓ For horizon year 2020 the unexpected generation drop of wind Farms can be tolerated only in interconnected mode.
- ✓ The trip of wind farms in isolated mode of operation can be mitigated increasing the primary control reserve up to 10% of total generation otherwise blackout.

Incremental Requirements for Operational Reserve

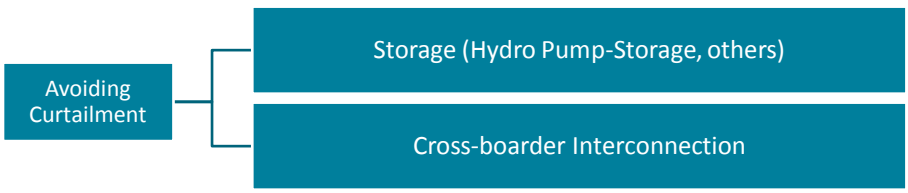
Year	Reserve no-wind	Reserve with wind	Incremental reserve
2013	110	111	1%
2015	126	131	4%
2020	172	204	**19%**

Source: Eng. Omar Al-Momani, Jordanian Ministry of Energy and Mineral Resources, 2013. LAS/RCREEE Workshop on RE Grid Integration, Bahrain

Congestion Management



Access Priority, Curtailment



Arab Guideline for Renewables Grid Connection Requirements

Scope : Wind and solar energies for generating electricity.

Expected Contents:

- Major technical challenges and proposed solutions
- Regulatory translation of the technical requirements
  - Regulations
  - Contracts
- Codes:
  - Generic codes for large scale wind farms being connected on high voltage grids
  - Generic codes for small scale PV connected to low voltage
- Compliance with grid codes
- Basic and complementary studies for connecting RE plants and Forecast of RE
- Survey for the current status of grids and RE and the expected plans, and associated analysis with examples of necessary documents in different Arab countries

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Structure: Institutional Capacity

National institutional frameworks for RE deployment varies widely based mostly on

- **Political commitment** to RE
- Power sector **structure**
- Mandate and **relative influence** of different actors (ministry of energy, regulators, RE agency, utilities)

Main focus of existing RE related institutions:

- Barriers removal/ risk mitigation (investors certainty)
- Competitiveness of markets
- Technological advances
- Socio-economic / environmental problems related to energy

Institutional setup	Dedicated RE agency	Alternative* energy agency	No RE agency
Number of countries	6	4	**12**

* RE with EE in 3 cases; and RE with nuclear in 1 case

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Sustainable Energy Dedicated Institutions

25

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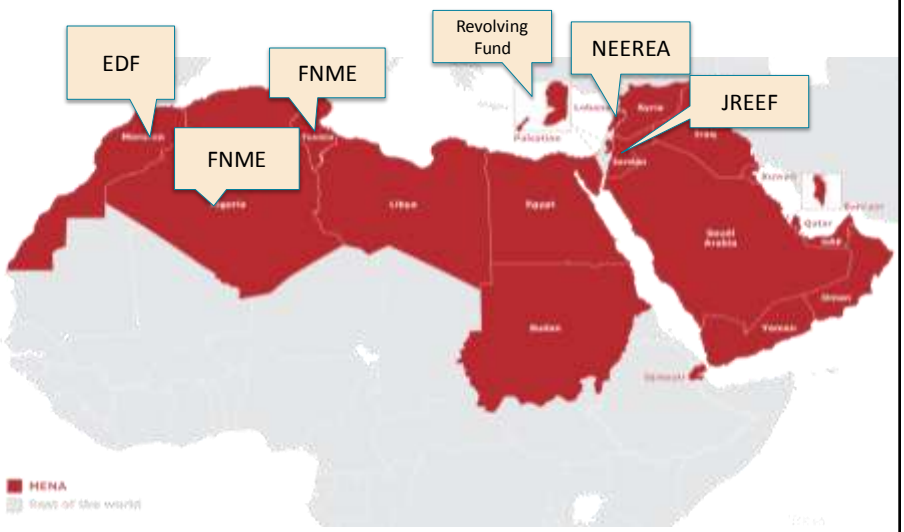
Sustainable Energy Public Funds



26

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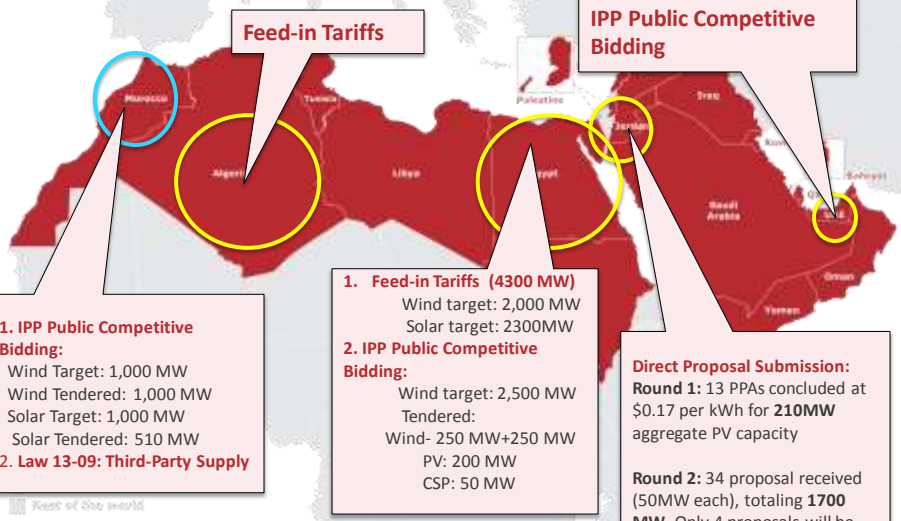
Supporting Policies for Sustainable Energy Transition
Large-scale Projects



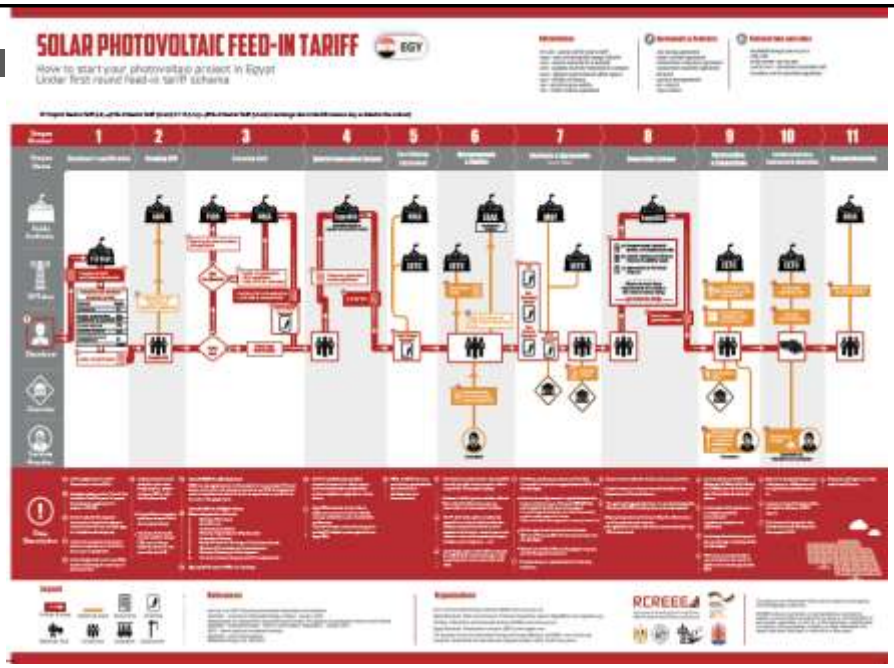
1. IPP Public Competitive Bidding:
Wind Target: 1,000 MW
Wind Tendered: 1,000 MW
Solar Target: 1,000 MW
Solar Tendered: 510 MW
2. **Law 13-09: Third-Party Supply**

1. **Feed-in Tariffs (4300 MW)**
Wind target: 2,000 MW
Solar target: 2300MW
2. **IPP Public Competitive Bidding:**
Wind target: 2,500 MW
Tendered:
Wind- 250 MW+250 MW
PV: 200 MW
CSP: 50 MW

Direct Proposal Submission:
Round 1: 13 PPAs concluded at $0.17 per kWh for **210MW** aggregate PV capacity

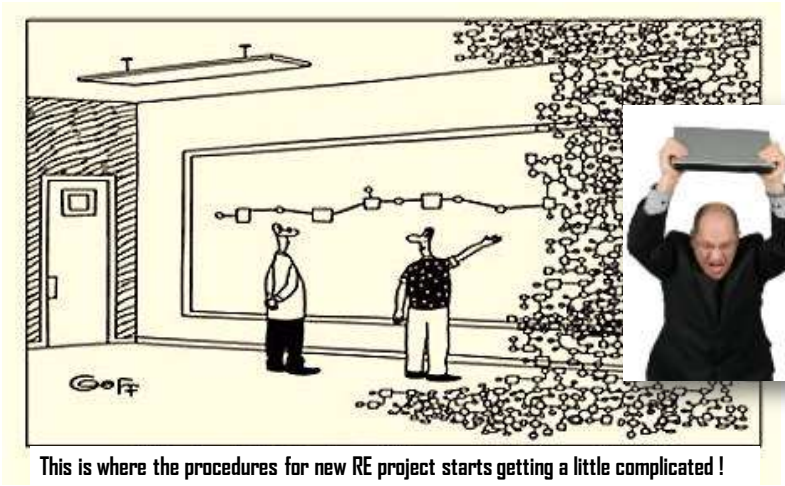
Round 2: 34 proposal received (50MW each), totaling **1700 MW**. Only 4 proposals will be selected (**200 MW**)

27



28

Markets: Attracting Investments



Source: http://www.ehealthinformationsolutions.com

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Objective

To translate **improving framework conditions** in Member States into concrete renewable energy and energy efficiency **actions by the private sector**

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Emerging Investment Opportunities in the Arab Region: De-centeralized SE Solutions

- Utility-Scale power plants
- On-grid Residential and Houses of Worship PV Solar Rooftop
- RE Self-Consumption in Productive Sectors (On-grid and off-grid)
- Off-grid Rural and Peri-Urban Electrification
- Solar PV Pumping

31

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32

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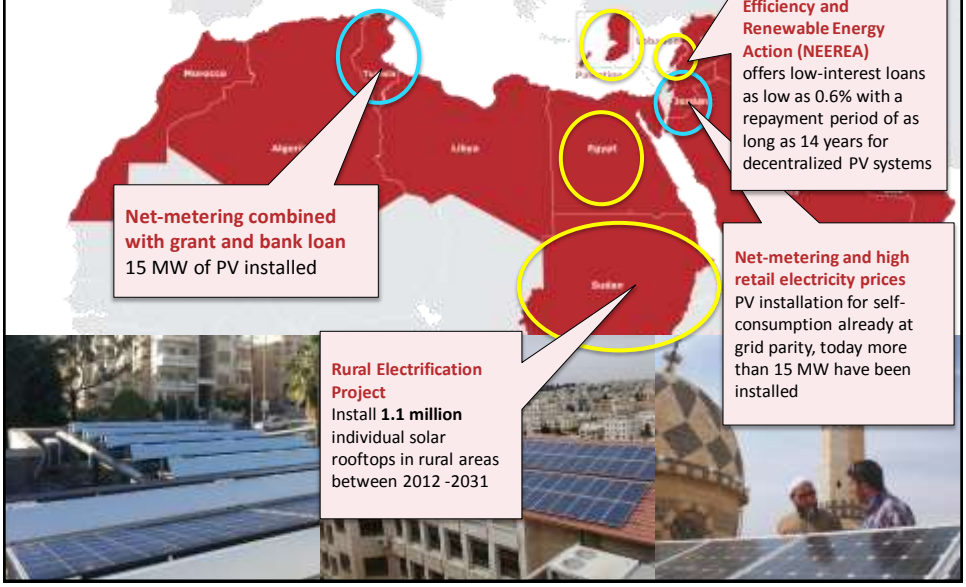
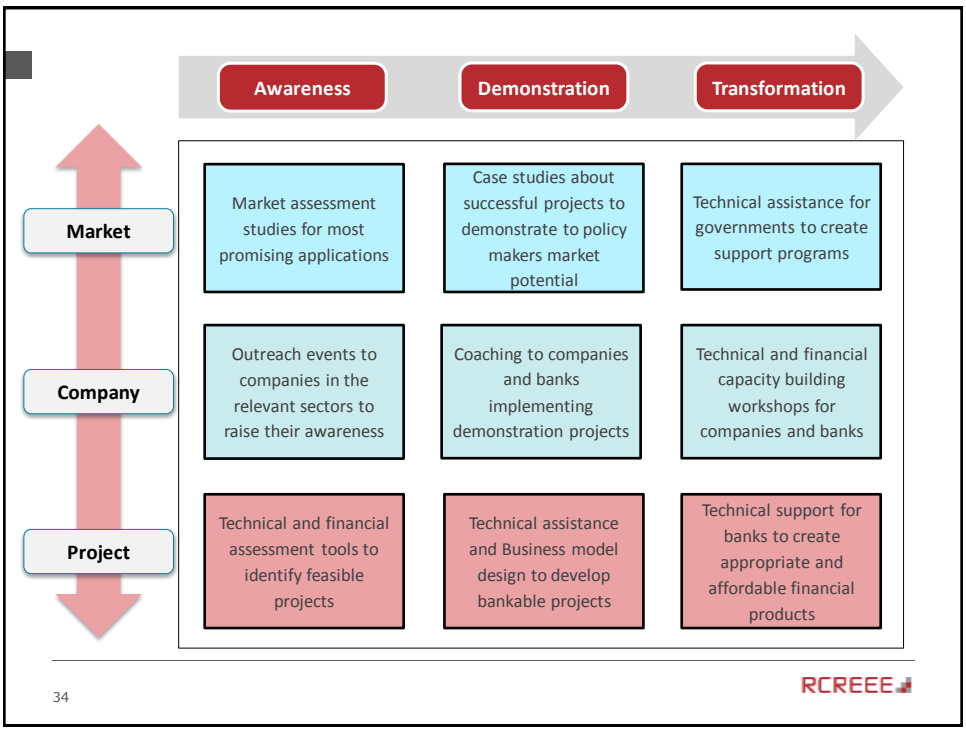
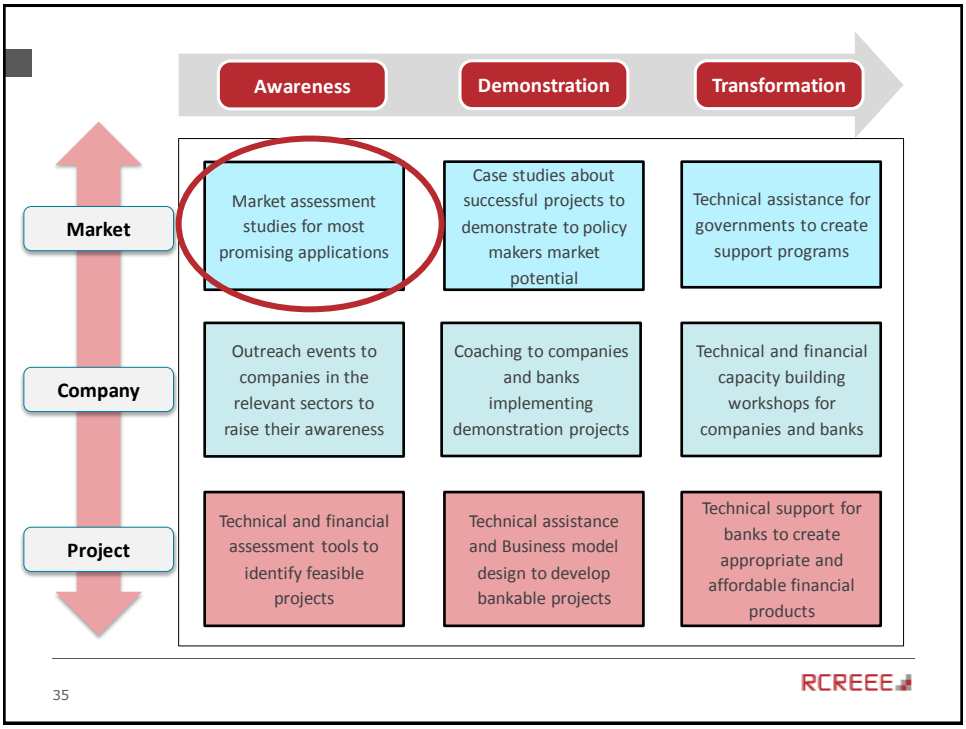
Examples of Supporting Policies for Decentralized Small-Scale Projects







- Four countries: Egypt, Djibouti, Sudan and Yemen
- Mixed primary and secondary sources
- Identifies the most promising applications

Target applications

- ✓ Utility mini-grids
- ✓ Private mini-grids
- ✓ Single-activity applications
- ✓ Water pumping

Table 1 - Diesel consumption figures for the four countries (000s tonnes)

Category (000s tonnes)	Djibouti	Egypt	Sudan	Yemen	Total
Utility mini-grids	5	78	40	223	346
Private mini-grids	20	60	-	78	158
Single-activity applications	-	-	-	16	18
Water pumping in agriculture	0.7	3775	52	1,648	5,475.7
Total	25.7	3,915	92	1,965	**5,997.7**

37

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D2S Market Assessment – Key Findings

- The corresponding potential PV peak capacity is shown in the following table:

Table 2 - Potential PV peak capacity for the four countries (MW_p)

Category (MW_p)	Djibouti	Egypt	Sudan	Yemen	Total
Utility mini-grids	0.7	62	53	280	395.7
Private mini-grids	7	77	-	76	160
Single-activity applications	-	-	-	5	5
Water pumping in agriculture	0.5	1,938	101	894	2,933.5
Total	8.2	2,077	154	1255	**3,494.2**

38

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The way forward
Situational analysis

39

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Address immediate gaps in regional skills in technical, policy, and regulatory aspects (short term tailor-made programs)

Human capacity development within RCREEE projects' activities and raising the level of knowledge management within the relevant institutions

Ensuring effective interactions of RCREEE MS with regional and international initiatives and projects

Strengthening cooperation among Arab Countries (South-South) and fostering harmonization of national systems

Establishing Specialized Arabic communication, learning, and best-practices sharing platforms/networks that improve ability to perform functions, solve problems, and set and achieve objectives.

RCREEE's HCD Implementation Strategy

40

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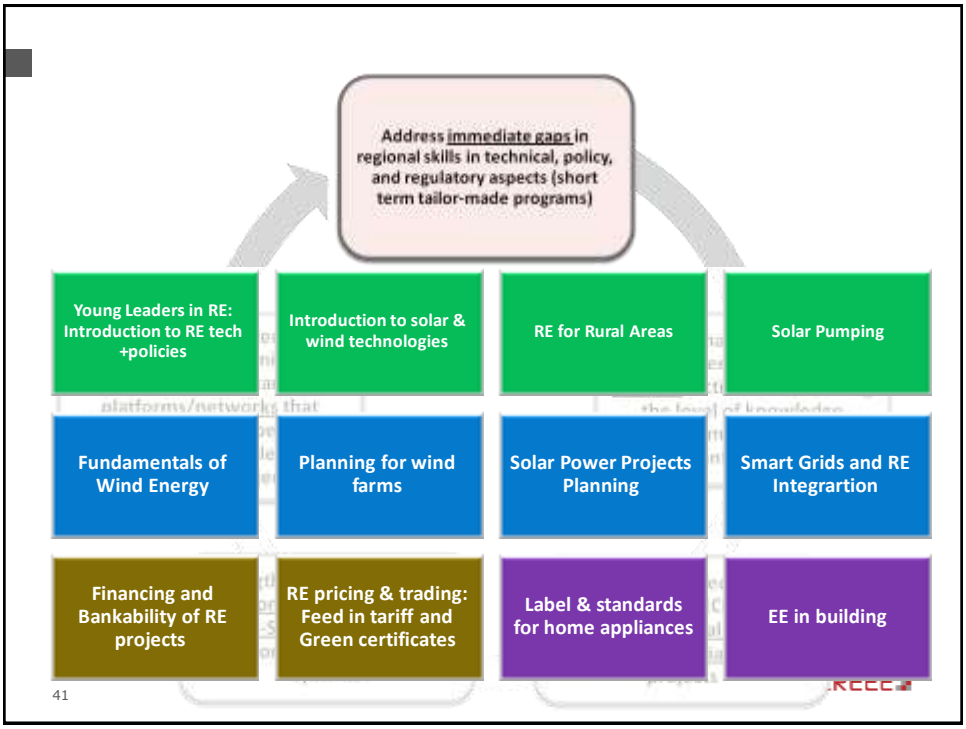
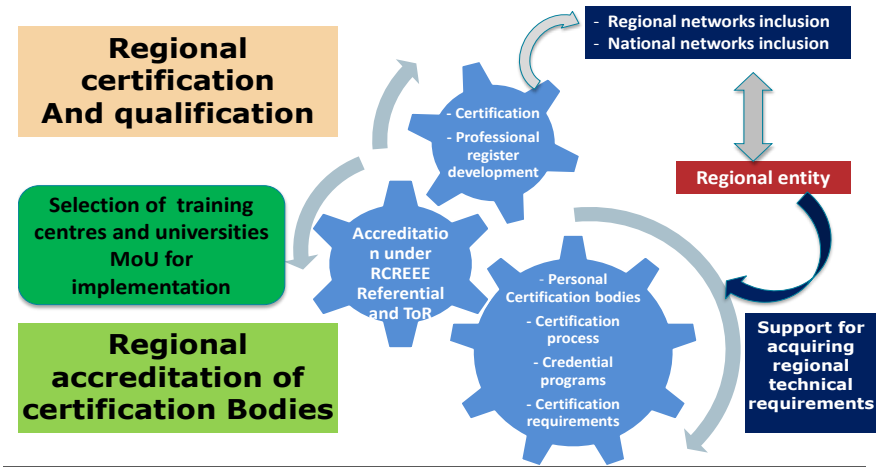
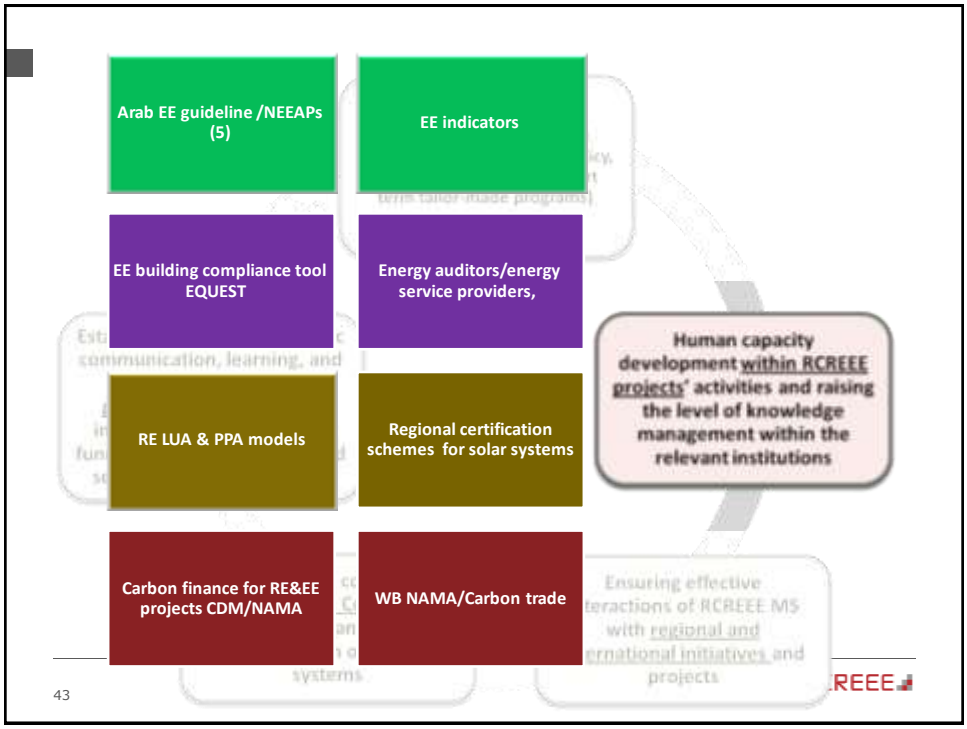
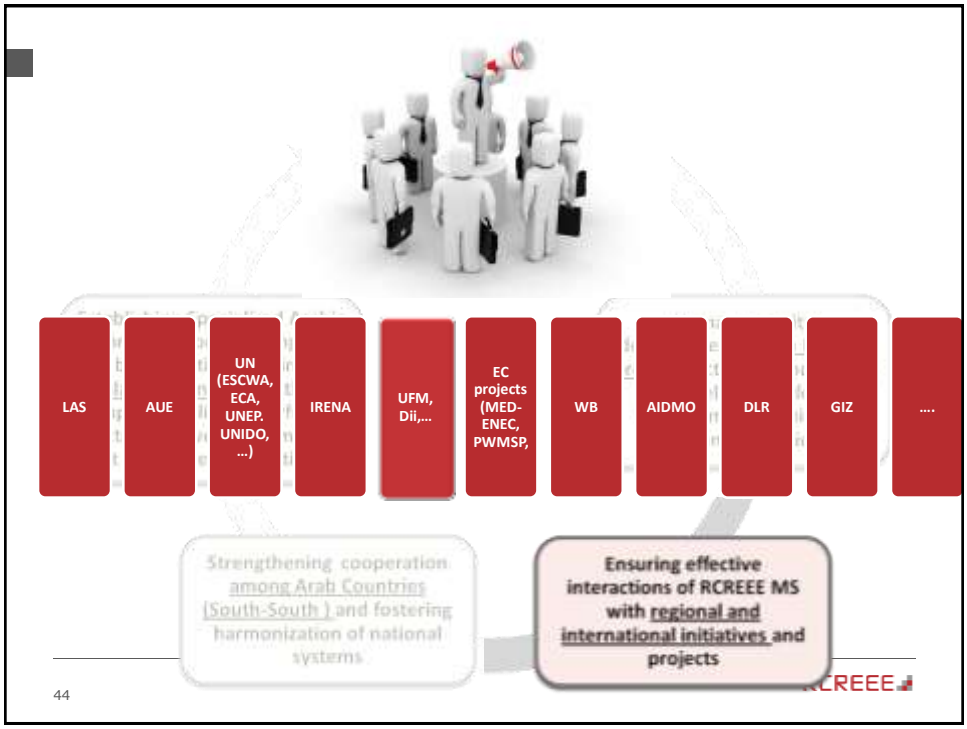


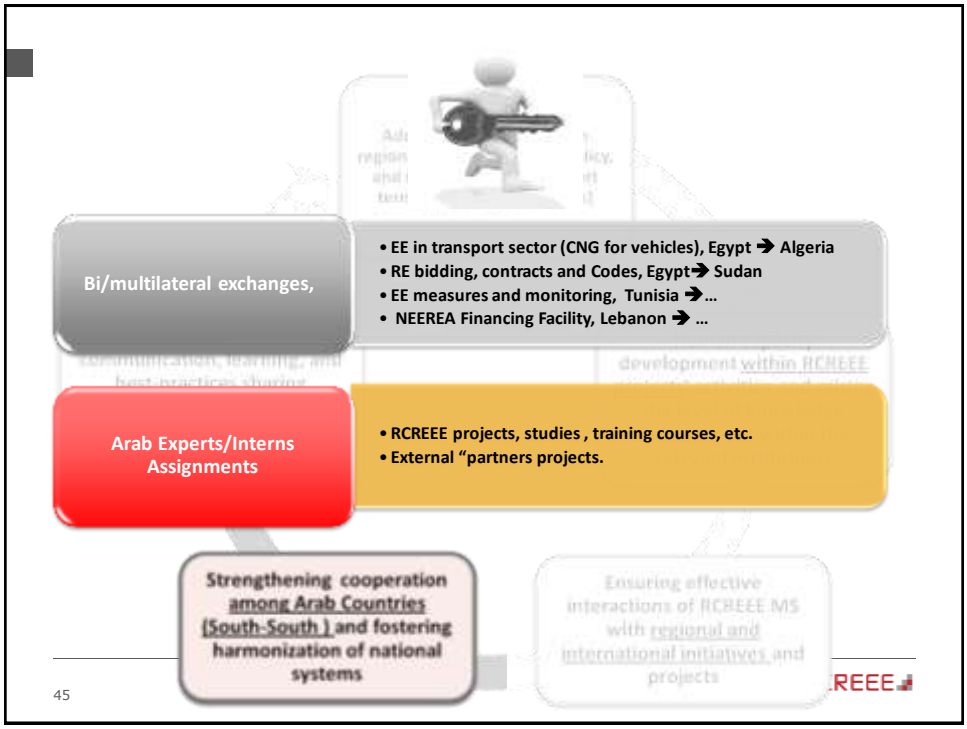
Credentialing of Arab Training Institutions

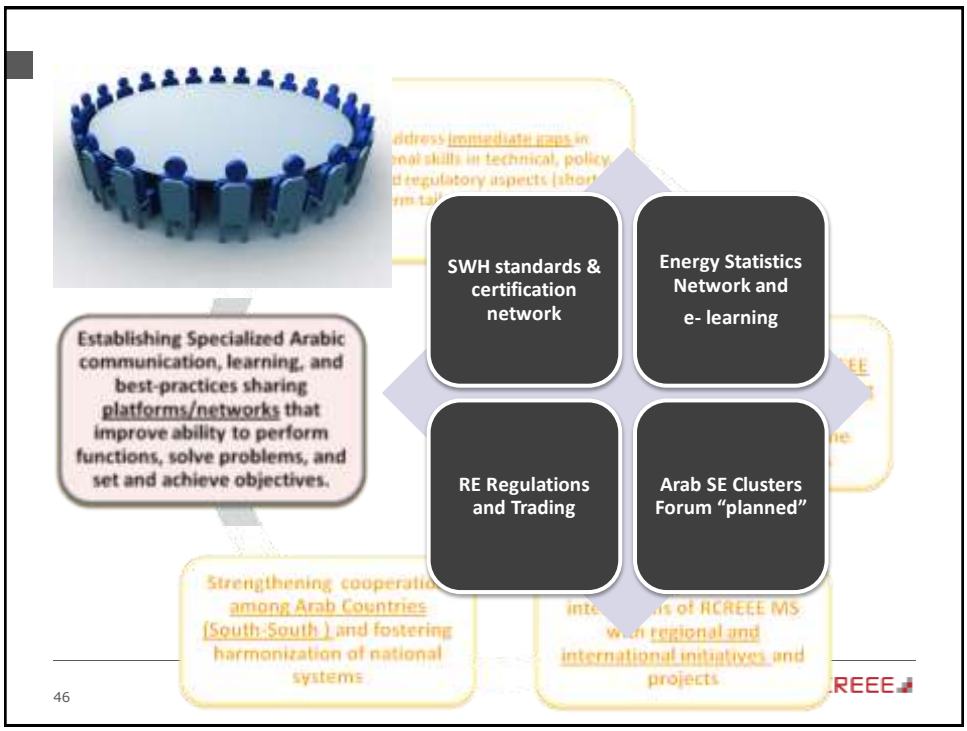
Capacity Development Strategy: Option 3




Arab EE guideline /NEEAPs (5)
EE indicators
EE building compliance tool EQUEST
Energy auditors/energy service providers,
RE LUA & PPA models
Regional certification schemes for solar systems
Carbon finance for RE&EE projects CDM/NAMA
WB NAMA/Carbon trade
Human capacity development within RCREEE projects' activities and raising the level of knowledge management within the relevant institutions
43


LAS
AUE
UN (ESCWA, ECA, UNEP. UNIDO, ...)
IRENA
UFM, Dii,...
EC projects (MED-ENEC, PWMSP,
WB
AIDMO
DLR
GIZ
....
Strengthening cooperation among Arab Countries (South-South) and fostering harmonization of national systems
Ensuring effective interactions of RCREEE MS with regional and international initiatives and projects
44


Bi/multilateral exchanges,
• EE in transport sector (CNG for vehicles), Egypt ➔ Algeria
• RE bidding, contracts and Codes, Egypt➔ Sudan
• EE measures and monitoring, Tunisia ➔…
• NEEREA Financing Facility, Lebanon ➔ …
Arab Experts/Interns Assignments
• RCREEE projects, studies , training courses, etc.
• External "partners projects.
Strengthening cooperation among Arab Countries (South-South) and fostering harmonization of national systems
45


Establishing Specialized Arabic communication, learning, and best-practices sharing platforms/networks that improve ability to perform functions, solve problems, and set and achieve objectives.
SWH standards & certification network
Energy Statistics Network and e- learning
RE Regulations and Trading
Arab SE Clusters Forum "planned"
46

Learn more ….

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Selected Publications

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Selected Publications

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TaqaWay www.TaqaWay.net

MORE THAN
30,000
STATISTICS

100's OF
DOCUMENTS
& PROJECTS

Verified and Regularly
UPDATED

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Gathering and sharing knowledge

TaqaWay طريق الطاقة
بوابة معرفة الطاقة المستدامة
Arab Sustainable Energy Portal

Consult
Statistics, Legal Texts Documents, RE projects and Stakeholders

Analyze data
Chart creator, Custom reports

Knowledge Portal: www.taqaway.net

51

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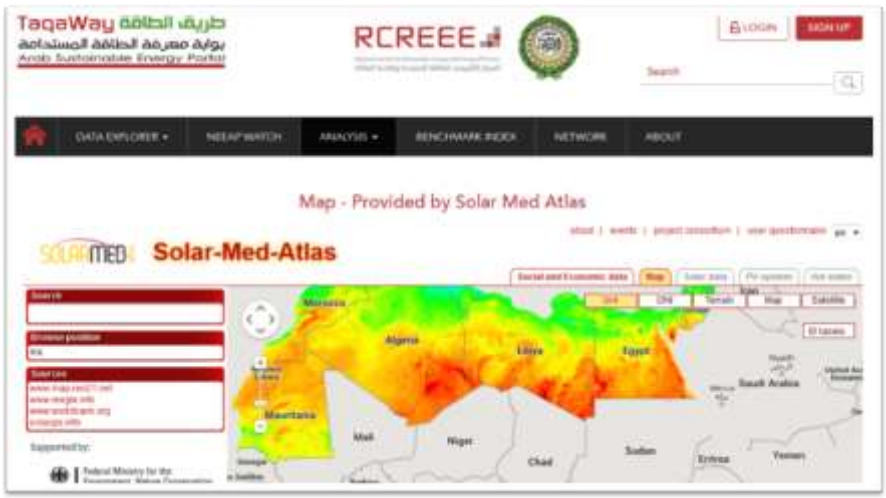
خرائط الطاقة الشمسية والتطبيقات الشمسية الموزعة التفاعلية
Solar Med Atlas interactive map



52

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"الأطلس الشمسي المتوسطي" (www.solar-med-atlas.org)

German Aerospace Center, Institute of Technical Thermodynamics, Department of Systems-Analysis and Technology Assessment (Coordinator) German Remote Sensing Data Center

Armines / Mines-ParisTech, Centre Énergétique et Procédés

Transvalor

European Commission, Joint Research Center Ispra, Institute for Energy, Renewable Energy Unit

GeoModel Solar

United Nations Environmental Programme, Division of Technology, Industry and Economics

OME, Observatoire Méditerranéen de l'Energie

RCREEE Regional Center for Renewable Energy and Energy Efficiency

53

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Gathering and sharing knowledge

TaqaWay طريق الطاقة

Arab Sustainable Energy Network شبكة خبراء الطاقة المستدامة

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54

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"Speed is irrelevant if you are going in the wrong direction."

Mahatma Gandhi

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Thank You

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