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

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MENAREC6
Kuwait, 6 April, 2016

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" encompasses 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.”

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Results Framework

The energy systems in the Arab region are characterized by a significant share of renewable resources and a highly efficient use of energy.
A dream coming true

Distance to RE targets is really challenging!!

- Egypt
- Syria
- Morocco
- Tunisia
- UAE
- Algeria
- Jordan
- Qatar
- Sudan
- Libya
- Yemen
- Palestine
- Lebanon
- Kuwait
- Bahrain
- Iraq

- Total RE targets
- Current Installed Capacity
- RE Projects under Construction

by 2020
by 2030
by 2020
by 2030
by 2020
by 2031
by 2020
by 2025
by 2020
by 2020
by 2030
by 2030
by 2025
by 2030
by 2020
**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

**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
- .....
### Sustainable Energy Transition Policies/Support Schemes adopted in MENA

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

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**
Part I: Renewable Energy Indicators

Part II: Policies and Mechanisms

Part III: NREAP Progress Assessment

Creating the regional momentum: NREAP

Reducing policy uncertainty about future support

Regulated targets and obligations

RE support schemes

Administrative procedures

Technical specifications and installers’ certification schemes

Policies for renewable energy’s integration in buildings

Access to and operation of the grids

Joint projects with other Arab States, foreign countries or/and third parties

Heating and cooling projects’ support schemes

Awareness raising campaigns

Basic questions

How much potential is there for a certain technology?

Is the technology feasible?

Is there sufficient area to deploy the technology?

To which share of the (national) demand can they contribute?
Assessing Potentials – CSP Sample

- **Theoretical Potential**
  The Amount of solar energy on the whole area

- **Technical potential**
  Limited to suitable areas

- **Economic Potential**
  Limited to economic sites

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

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Solar Radiation at Usable Areas

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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


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**Comparison with ground measurements and accuracy**

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

DNI time serie for 1.11.2001, Almeria
Partially cloudy conditions, cumulus humilis

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.

Connection & Infrastructure Challenges

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

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

- Short-term forecast
- Congestion management
- Access priority
- Reserve and Balancing capacities
- Frequency and voltage control (Codes)
- Curtailment

Balancing Capacities

Site, grid and market dependent

At 20% capacity penetration, typically 7% of additional capacity is needed for balancing.

Assuming a perfect forecast, it is estimated that only 2% additional capacity would be needed at this penetration level.

Source: Marwa Mostafa, Egypt/ERA, 2013, LAS/RCREEE Workshop on RE grid Integration, Bahrain
**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**

<table>
<thead>
<tr>
<th>Year</th>
<th>Reserve no-wind</th>
<th>Reserve with wind</th>
<th>Incremental reserve</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>110</td>
<td>111</td>
<td>1%</td>
</tr>
<tr>
<td>2015</td>
<td>126</td>
<td>131</td>
<td>4%</td>
</tr>
<tr>
<td>2020</td>
<td>172</td>
<td>204</td>
<td>19%</td>
</tr>
</tbody>
</table>


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**Congestion Management**

- Implementation of power flow controlling devices in conventional or Flexible Alternative Current Transmission System (FACTS) technology,
- Construction of new lines and substations

**Access Priority, Curtailment**

- Storage (Hydro Pump-Storage, others)
- Cross-boarder Interconnection
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

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)

<table>
<thead>
<tr>
<th>Institutional setup</th>
<th>Dedicated RE agency</th>
<th>Alternative* energy agency</th>
<th>No RE agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of countries</td>
<td>6</td>
<td>4</td>
<td>12</td>
</tr>
</tbody>
</table>

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

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
Sustainable Energy Dedicated Institutions

Sustainable Energy Public Funds

EDF
FNME
NEREA
JREEF

Revolving Fund

RCREEE
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

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)
Markets: Attracting Investments

This is where the procedures for new RE project starts getting a little complicated!

Source: http://www.ehealthinformationsolutions.com

Objective

To translate improving framework conditions in Member States into concrete renewable energy and energy efficiency actions by the private sector
Emerging Investment Opportunities in the Arab Region: De-centralized 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
Examples of Supporting Policies for Decentralized Small-Scale Projects

Net-metering combined with grant and bank loan 15 MW of PV installed

National Energy Efficiency and Renewable Energy Action (NEEREA) offers low-interest loans as low as 0.6% with a repayment period of as long as 14 years for decentralized PV systems

Rural Electrification Project Install 1.1 million individual solar rooftops in rural areas between 2012-2031

Net-metering and high retail electricity prices PV installation for self-consumption already at grid parity, today more than 15 MW have been installed

Examples of Supporting Policies for Decentralized Small-Scale Projects

Market assessment studies for most promising applications
Case studies about successful projects to demonstrate to policy makers market potential
Technical assistance for governments to create support programs

Outreach events to companies in the relevant sectors to raise their awareness
Coaching to companies and banks implementing demonstration projects
Technical and financial capacity building workshops for companies and banks

Technical and financial assessment tools to identify feasible projects
Technical assistance and Business model design to develop bankable projects
Technical support for banks to create appropriate and affordable financial products

34
Markets assessment studies for most promising applications

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Technical support for banks to create appropriate and affordable financial products

- 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)

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

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)  

<table>
<thead>
<tr>
<th>Category (MW)</th>
<th>Djibouti</th>
<th>Egypt</th>
<th>Sudan</th>
<th>Yemen</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utility mini-grids</td>
<td>0.7</td>
<td>62</td>
<td>53</td>
<td>280</td>
<td>395.7</td>
</tr>
<tr>
<td>Private mini-grids</td>
<td>7</td>
<td>77</td>
<td>-</td>
<td>76</td>
<td>160</td>
</tr>
<tr>
<td>Single-activity applications</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Water pumping in agriculture</td>
<td>0.5</td>
<td>1,938</td>
<td>101</td>
<td>894</td>
<td>2,933.5</td>
</tr>
<tr>
<td>Total</td>
<td>8.2</td>
<td>2,077</td>
<td>154</td>
<td>1,255</td>
<td>3,494.2</td>
</tr>
</tbody>
</table>
The way forward
Situational analysis

1. Low awareness
   Companies and banks are unaware of market potential and the existence of profitable investment opportunities

2. Low capacity
   Local businesses, banks and government agencies do not have sufficient capacity to identify profitable projects and experiment with new business models

3. Perception of high risk
   Insufficient well-documented demonstration projects and success stories to overcome initial distrust

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

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

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

RCREEE's HCD Implementation Strategy

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
Credentialing of Arab Training Institutions

Capacity Development Strategy: Option 3

Regional certification and qualification

- Selection of training centres and universities
- MoU for implementation

Regional accreditation of certification Bodies

- Regional networks inclusion
- National networks inclusion

Regional entity

Support for acquiring regional technical requirements

Accreditation under RCREEE Referential and ToR

- Certification
- Professional register development

Personal Certification bodies
- Certification process
- Credential programs
- Certification requirements
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

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

LAS ALU UN (ESCWA, ECA, UNEP, UNIDO, …) IRENA UFM, Dii, … EC projects (MED-ENERC, PWMSP, …)
WB AIDMO DLR GIZ …

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

Bi/multilateral exchanges,

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

RE Regulations and Trading

Energy Statistics Network and e-learning

Arab SE Clusters Forum “planned”
Learn more ....

Selected Publications
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Solar Med Atlas interactive map

Map - Provided by Solar Med Atlas

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

Mahatma Gandhi
Thank You

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