Diesel to Solar Transformation

RCREEE Private Investments’ Promotion Program

Presented by
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About RCREEE

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

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.”

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.”
A Key Objective

To translate improving framework conditions in Member States into concrete renewable energy and energy efficiency actions by the private sector
Market assessment studies for most promising applications
Outreach events to companies in the relevant sectors to raise their awareness
Technical and financial assessment tools to identify feasible projects

Case studies about successful projects to demonstrate to policy makers market potential
Coaching to companies and banks implementing demonstration projects
Technical assistance and Business model design to develop bankable projects

Technical assistance for governments to create support programs
Technical and financial capacity building workshops for companies and banks
Technical support for banks to create appropriate and affordable financial products
• Market assessment supported by UNDP

• First of its kind for the Arab region

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- 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
### Country Specific Analysis (Sudan)

<table>
<thead>
<tr>
<th>Population</th>
<th>HDI ranking</th>
<th>GDP (USD)</th>
<th>Electrification rate</th>
<th>Diesel price (USD per Liter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>37,960,000 (World Bank, 2013)</td>
<td>166 out of 187 (United Nations Development Programme, 2013)</td>
<td>66.57 billion (World Bank, 2013)</td>
<td>34.5% (Arab Union of Electricity, 2013)</td>
<td>0.51 (World Bank, 2014)</td>
</tr>
</tbody>
</table>

~ 3200MW Installed Capacity

**Key socioeconomic and energy facts for Sudan**
## Country specific analysis: Djibouti

<table>
<thead>
<tr>
<th>Population</th>
<th>HDI ranking</th>
<th>GDP (USD)</th>
<th>Electrification rate</th>
<th>Diesel price (USD per Liter)</th>
</tr>
</thead>
</table>

~ 130 MW Installed Capacity

**Key socioeconomic and energy facts for Djibouti**
## Country Specific Analysis (Yemen)

<table>
<thead>
<tr>
<th>Population</th>
<th>HDI ranking</th>
<th>GDP (USD)</th>
<th>Electrification rate</th>
<th>Diesel price (USD per Liter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25,956,000 (Central Statistical Organization, 2014)</td>
<td>154 out of 187 (United Nations Development Programme, 2013)</td>
<td>35.95 billion (World Bank, 2013)</td>
<td>40% (United Nations Development Programme, 2014)</td>
<td>0.70$^{12}$ (Yemen Petroleum Company, 2015)</td>
</tr>
</tbody>
</table>

~ 1500MW Installed Capacity

**Key socioeconomic and energy facts for Yemen**
Country specific analysis: Egypt

<table>
<thead>
<tr>
<th>Population</th>
<th>HDI ranking</th>
<th>GDP (USD)</th>
<th>Electrification rate</th>
<th>Diesel price (USD per Liter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>90,000,000 (Central Agency for Public Mobilization and Statistics, Nov 2015)</td>
<td>110 out of 187 (United Nations Development Programme, 2013)</td>
<td>272 billion (World Bank, 2013)</td>
<td>99% (Arab Union of Electricity, 2013)</td>
<td>0.23 (World Bank, 2014)</td>
</tr>
</tbody>
</table>

~ 38000MW Installed Capacity

Key socioeconomic and energy facts for Egypt
### Country specific analysis: Egypt

Isolated diesel power plants in Egypt

<table>
<thead>
<tr>
<th>Company</th>
<th>Number of plants</th>
<th>Installed capacity (MW)</th>
<th>Gross energy generation (GWh/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canal DC</td>
<td>18</td>
<td>145</td>
<td>184.7</td>
</tr>
<tr>
<td>El-Behera DC</td>
<td>4</td>
<td>12.3</td>
<td>30.7</td>
</tr>
<tr>
<td>Middle Egypt DC</td>
<td>6</td>
<td>41.3</td>
<td>24.3</td>
</tr>
<tr>
<td>Upper Egypt DC</td>
<td>1</td>
<td>2.9</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>29</td>
<td>201.5</td>
<td>239.7</td>
</tr>
</tbody>
</table>
### Country specific analysis: Egypt

<table>
<thead>
<tr>
<th>Nameplate capacity (HP)</th>
<th>Estimated operational capacity (kW)</th>
<th>Yearly energy consumption¹ (kWh)</th>
<th>Diesel consumption per kWh (gm)</th>
<th>Number of pumps</th>
<th>Total diesel consumption (000s tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Portable:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 5</td>
<td>2.625</td>
<td>15,750</td>
<td>400</td>
<td>45,599</td>
<td>294</td>
</tr>
<tr>
<td>6 – 9</td>
<td>5.625</td>
<td>33,750</td>
<td>350</td>
<td>89,951</td>
<td>1,086</td>
</tr>
<tr>
<td>10 – 12</td>
<td>8.25</td>
<td>49,500</td>
<td>300</td>
<td>36,178</td>
<td>549</td>
</tr>
<tr>
<td>&gt; 12</td>
<td>10.5</td>
<td>63,000</td>
<td>250</td>
<td>15,467</td>
<td>249</td>
</tr>
<tr>
<td><strong>Fixed:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 15</td>
<td>7.5</td>
<td>45,000</td>
<td>250</td>
<td>27,549</td>
<td>317</td>
</tr>
<tr>
<td>16 – 25</td>
<td>14.25</td>
<td>85,500</td>
<td>235</td>
<td>24,716</td>
<td>508</td>
</tr>
<tr>
<td>26 – 45</td>
<td>26.25</td>
<td>157,500</td>
<td>220</td>
<td>8,597</td>
<td>304</td>
</tr>
<tr>
<td>&gt; 45</td>
<td>37.5</td>
<td>225,000</td>
<td>200</td>
<td>10,182</td>
<td>468</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>258,239</strong></td>
<td><strong>3,775</strong></td>
</tr>
</tbody>
</table>
D2S Market Assessment – Key Findings

~ 6 Million tonnes/year of diesel consumption in the four target applications

<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

- **3.5 GWp** potential PV peak capacity

<table>
<thead>
<tr>
<th>Category (MWp)</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><strong>Total</strong></td>
<td>8.2</td>
<td>2,077</td>
<td>154</td>
<td>1255</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
### Stakeholder Involvement

1. **End Users**  
   Farms, hospitals, army bases, hotel owners, etc.

2. **Solution providers**  
   Local diesel providers, local solar energy providers, etc.

3. **Government and public agencies**  
   Ministry of energy, ministry of development, sustainable energy agencies, etc.

4. **Development organizations**  
   UN organization, international NGOs, foundations, etc.

5. **Financial institution and investors**  
   National banks, commercial banks, national funds, etc.
Proposed Actions

- Detailed market assessment and awareness building
- Capacity building and technical tools
- Pilot projects
Examples of Supporting Policies for Decentralized Small-Scale Projects

Net-metering combined with grant and bank loan

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

Net-metering and high retail electricity prices
PV installation for self-consumption

Rural Electrification Project
Install 1.1 million individual solar rooftops in rural areas between 2012 - 2031
Business Models for Private Mini-grids

Business Models for PV in Egypt

by

Matthias Nampales

submitted to the
Faculty of Electrical Engineering and Computer Science
University of Kassel, Germany
and the Faculty of Engineering
Cairo University, Giza, Egypt

In partial fulfillment of the requirements for M.Sc. degree in
Renewable Energy and Energy Efficiency for the MENA Regions
RCREEE

15th of May 2015

Examiner: Prof. Dr. sc. techn. Dirk Oehlhausen
Examiner: Prof. Dr. Amr Abd Elshafi
Supervisor: Amr Bargouth
Supervisor: Dr. Benjamin Schulz
RCREEE – Lahami Bay PV Site Visit

Report on PV Plant Installation Check of Lahami Bay Pilot Power Plant on March the 19th, 2015

Site Visit & Report by Matthias Namgallos, Visiting Researcher at RCREEE

23rd of March 2015
Example: Stand-alone Single Well Solution

http://raseed-rcreee.com

Regional Project Re-activate: Promoting Employment Through Renewable Energy and Energy Efficiency in the MENA Region

Infomaterials

<table>
<thead>
<tr>
<th>Title</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>GIZ RaSeed Green Energy in Agriculture Brochure</td>
<td>View</td>
</tr>
<tr>
<td>Manual for Irrigation Practices in Egypt</td>
<td>View</td>
</tr>
<tr>
<td>Practical Guidelines for Solar Pump Systems in Egypt</td>
<td>View</td>
</tr>
<tr>
<td>Solar Pump Systems in Egypt</td>
<td>View</td>
</tr>
<tr>
<td>Presentation Desert Modules</td>
<td>View</td>
</tr>
</tbody>
</table>

Pilot Projects

Four pilot projects supported by the RaSeed initiative to promote the feasibility and efficiency of solar energy in hot weather conditions, high saltinity, and other desert conditions. They are implemented at four different locations across Egypt. This allows for a realistic overview of opportunities and challenges for the future of solar energy in desert areas.

- Desert Farms on Cairina outskirts
- First step in Farms Energy Transformation: 123.5kWp for one of the irrigation pumps
- PICO Company Choice in negotiation phase
Selected Publications
Final Remark: Attracting Investments

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

Source: http://www.ehealthinformationsolutions.com
“The best way to predict your future ... is to create it.”

Peter Drucker
Thank You

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