Full Scale Program for Renewable Energy in Egypt
Contents

- Evolution of Egypt Needs of Electricity and its supply mix
- Renewable Energy Policy and Targets
- Renewable Energy Program Components
- Conclusions
Expected Evolution of Peak Load

Electricity demand till 2035

The projections derived from TIMES-Egypt Model and the 3 scenarios are related to the different economic growth estimations.

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>average growth (%)</th>
<th>2013</th>
<th>2018</th>
<th>2020</th>
<th>2030</th>
<th>2035</th>
</tr>
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<tbody>
<tr>
<td>Low</td>
<td>5.2</td>
<td>27</td>
<td>35</td>
<td>42</td>
<td>59</td>
<td>71</td>
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<tr>
<td>Medium</td>
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<td>35</td>
<td>43</td>
<td>62</td>
<td>76</td>
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<tr>
<td>High</td>
<td>7.1</td>
<td>27</td>
<td>36</td>
<td>46</td>
<td>68</td>
<td>86</td>
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Technical Assistance to Reform the Energy Sector “TARES”, EU supported Project; preliminary findings
Impact of Fuel Prices on Electricity Generation Cost

<table>
<thead>
<tr>
<th>Fuel Cost US$/MMBTU</th>
<th>Cost of kWh (pt/kWh) ($c/kWh)*</th>
<th>Cost of Fuel per kWh (pt/kWh) ($c/kWh)*</th>
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</thead>
<tbody>
<tr>
<td>3</td>
<td>35.2</td>
<td>4.92</td>
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<td>6</td>
<td>49.8</td>
<td>6.96</td>
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<td>9</td>
<td>65.2</td>
<td>9.11</td>
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<td>12</td>
<td>82.5</td>
<td>11.53</td>
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<tr>
<td>15</td>
<td>99.9</td>
<td>13.97</td>
</tr>
</tbody>
</table>

Fuel is currently supplied to the power sector at different Prices:
- Local gas supply: 3 US$/MMBTU (Currently represent around 70%)
- Local Heavy Fuel: 8.7 US$/MMBTU (Currently represents around 30%)
- Imported gas: N.A. (expected range between 12-17 US$/MMBTU) (will be around 10% as the current deficit)

1 US$ = 7.15 L.E
Advantages of Re

• Cost competitive for electricity generated from both heavy fuel and imported gas
• Indigence resource
• Price predictability (long term cost effective)
• Environmentally friendly
• Several externalities
### Expected Contribution of RE in the Supply Mix based on Different Scenarios

#### Installed capacities till 2035

<table>
<thead>
<tr>
<th>Capacity Installed requirements in GDP medium scenario/ different RES penetration levels</th>
<th>GW</th>
<th>2013</th>
<th>2018</th>
<th>2020</th>
<th>2030</th>
<th>2035</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scenarios</strong></td>
<td><strong>GW</strong></td>
<td><strong>2013</strong></td>
<td><strong>2018</strong></td>
<td><strong>2020</strong></td>
<td><strong>2030</strong></td>
<td><strong>2035</strong></td>
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<tr>
<td>Basic</td>
<td>total</td>
<td>31</td>
<td>59</td>
<td>65</td>
<td>92</td>
<td>107</td>
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<td></td>
<td>non hydro RES</td>
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<tr>
<td>High Penetration</td>
<td>total</td>
<td>31</td>
<td>62</td>
<td>73</td>
<td>112</td>
<td>140</td>
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<tr>
<td></td>
<td>non hydro RES</td>
<td>0</td>
<td>13</td>
<td>25</td>
<td>58</td>
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<tr>
<td>Free</td>
<td>total</td>
<td>31</td>
<td>59</td>
<td>68</td>
<td>105</td>
<td>130</td>
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<tr>
<td></td>
<td>non hydro RES</td>
<td>0</td>
<td>8</td>
<td>17</td>
<td>44</td>
<td>62</td>
</tr>
</tbody>
</table>

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Technical Assistance to Reform the Energy Sector “TARES”, EU supported Project; preliminary findings
Sources of Electricity Supply
the Least Cost Scenario

Technical Assistance to Reform the Energy Sector “TARES”, EU supported Project; preliminary findings
Renewable Energy Policy Making

Definition of targets → Choice of policies / instruments → Concrete design of instruments → Implementation → Administration, monitoring and adjustment
Program Target

Within the framework of the announced target of 20/20. GoE has announced an interim target for the first regulatory period (2015-2017) is to contract 4300 MW of both solar and wind energy, its breakdown is as follows:

- **300 MW** for small solar systems
- **2000 MW** of Medium and large size of solar plants
- **2000 MW** of Medium and large size of Wind plants
Renewable Energy Projects Development Schemes

Framework for Renewable Energy Development Mechanisms

- Merchant Renewable Plants
- Power Purchase Agreement
  - Feed in Tariff
  - Competitive Bidding
    - Transmission
    - New & Renewable Energy Authority (NERA)
Program Components

- **Legal Framework:** Defines policies and responsibilities
- **Regulatory Framework:** Details the parties commitments and technical and contractual requirements
- **Tariff Framework:** Defines both tariff structure and values
- **Contractual Framework:** Provides standard templates for contracts
- **Supplementary Framework:** Contains supporting mechanisms including; resource assessment, technology transfer, soft finance funds,...etc
A presidential Law will be issued to provide the necessary legal framework. This include:

- Public land Allocation; land allocation and usufruct rights
- Mechanisms for building RE plants: Statuary, Competitive Bidding, FiT and merchant as well as define targets.
- Grid responsibility for priority of dispatch and take or pay commitment
- Customer responsibilities; Quota and its criteria
- Renewable Energy Trading; definition of the residual mix, GoC,..etc.
Regulatory Framework

Installed Capacity
- License the RE suppliers
- Prequalification requirements for developers and small system integrators.
- Public land allocation procedures
- Dispute Resolution

Transmitting
- Interconnection with the grid
- Grid Code
- Priority on Dispatching
- TPA Right

Trading
- Define the residual mix and apply Quota for Consumers
- Power Purchase requirements (including take or pay contracts in case the grid is the off-taker)
- Settlements and GoC regulations
- Issuance of Renewable certificates (GoC)
Procedures for Establishing RE Projects for Capacities Below 500 kW

1. Investor
2. Choosing a Certified PV-SI
3. Project file to Distribution Company
4. Studies, measurements & compliance with technical Codes
5. Signing Connection and FiT Contracts
6. Distribution Company
7. PV-SI
8. PV-SI
9. Distribution Company
10. Investor
Procedures for Establishing RE Projects for Capacities over 500 kW up to 50 MW

Central Unit for FiT → Evaluation → Investor

Authority availing Land → Project Company Establishment

Investor → Temporary License → EgyptERA

Project Company → Completion of Studies → Relevant Authorities

Financial Closure → Permanent License → EgyptERA

Final Signatures → Construction → Relevant Authorities

Commissioning and Commercial Operation → Relevant Authorities
Grid Codes

• It includes all technical requirements and limits for interconnecting and operation of the Re facilities with the grid. It is normally part of the general grid codes ((grid and Distribution Codes).

• They include several codes for both Solar and Wind and codes for different voltages level (Low, Medium, High/Ultra-High voltages)

• They include:
  – General requirements
  – Disconnection from the grid (voltage, frequency, ..etc)
  – Power quality
  – Active power control
  – Startup requirements
  – Conditions for connection.
  – Reactive power control
  – Temporary voltage drops
  – Grid protection
  – Real time data processing
  – Verification of electrical Characteristic
Tradable Guarantee of Origin certificates (TGOC)

- In this approach unbundling is carried out between electricity generation from a production device and its attribute as renewable.
- Electricity generation will be traded as just electricity, yet its renewable attribute will be traded through TGOC.
- The owner of the GOC is the owner renewable attribute.
- This system is similar to the Clean Development Mechanism (CDM), however the TGOC should express the premium cost for renewable energy above the cost of generating electricity from conventional sources.
- It is used as a settlement tool for any supplier or consumers obligations. Also it is used a declaration tool for the use of Re
Key Market Participants

- Support System Authority
- Producer
- Issuing Body
- Grid
- Distribution
- Meter readings
- Consumer
- Consumer 2
- Broker

Flow:
- Electricity
- Certificates/Cancellation
- Money
Tariff Framework (FiT)

• This include:
• Tariff structure,; tariff adjustment with technology, site conditions and capacity
• Value of tariff which depends on; financial terms, investments cost, competitiveness with other markets, consumers affordability.
• Payment terms
Tariff for Solar Energy

PV tariff structure is flat rate and for 25 years, it has been classified as follows:

– **Installations connected to the low voltage:**
  – Residential
    84.8 pt/kWh*
  – Other than residential and up to 200 kW
    90.1 pt/kWh*
  – From 200 kW up to 500 kW
    97.3 pt/kWh**

– **Installations connected to the medium voltage**

* based on soft loans of 4% interest rate made available by MoF
** based on soft loans of 8% interest rate made available by MoF.

*** Exchange rate for US$ = 7.15 EGP

Installations from 500 kW and above including both the medium and high voltage connected installations, are defined considering international financial terms.
Although payment will be offered in local currency, the Government of Egypt will bear the exchange rate risk.
Tariff for Solar Energy

PV tariff structure is flat rate and for 25 years, It has been classified as follows:

– **Installations connected to the medium voltage**

  – From 500 kW up to 20 MW
    
    US$\text{c/kWh} = 13.6\text{ (equivalent to 97.3 pt/kWh)****}^{***}

– **Installations connected to the high voltage**

  – From 20 MW up to 50 MW
    
    US$\text{c/kWh} = 14.34\text{ (equivalent to 102.5 pt/kWh)****}^{***}

*** Exchange rate for US$ = 7.15 EGP

installations from 500 kW and above including both the medium and high voltage connected installations, are defined considering international financial terms. Although payment will be offered in local currency, the Government of Egypt will bear the exchange rate risk.
Tariff for Wind Energy

- For wind energy the tariff structure is two times blocks tariff of a total lifetime 20 years.
- The value of the first block will be fixed for all sites, which will be for five years, while the value of the second block will be varied according to the site specifics.
- Site has been defined by the full operating hours.
## Wind Tariff

<table>
<thead>
<tr>
<th>Full Operating Hours</th>
<th>Tariff during the first 5 years</th>
<th>Tariff during the second 15 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>US$/c/kWh</td>
<td>Equiv. Pt./kWh**</td>
</tr>
<tr>
<td>2500</td>
<td>11.48</td>
<td>82.08</td>
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<td>2600</td>
<td>10.56</td>
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<td>2700</td>
<td>9.71</td>
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<td>2800</td>
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<td>2900</td>
<td>8.19</td>
<td>58.58</td>
</tr>
<tr>
<td>3000</td>
<td>7.15</td>
<td>53.68</td>
</tr>
<tr>
<td>3100</td>
<td>6.73</td>
<td>48.12</td>
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<td>3200</td>
<td>6.26</td>
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<td>3300</td>
<td>5.81</td>
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<td>3400</td>
<td>5.39</td>
<td>38.51</td>
</tr>
<tr>
<td>3500</td>
<td>4.98</td>
<td>35.6</td>
</tr>
</tbody>
</table>

**Based on exchange rate of 7.15 EGP/US$**

The same payment terms for PV are valid for the wind projects.
Contractual Framework

• This include the following contracts
  – Land Use Agreement (between the plant and the land owner)
  – Interconnection contract (between the plant and the grid)
  – Third Party Access (in case if the transmitter is not the off taker) (between the plant and the grid “commercial contract”)
  – Commercial contract “Power Purchase Agreement” (between the plant (supplier) and off-taker)
  – In case of biomass plants feed stock supply agreement (between the feed stock supplier and the plant)
  – Implementation Agreement (cross linked Agreement between All Parties involved in the project (plant, transmitter, land owner and purchaser)
Land Use Agreement

USUFRUCT AGREEMENT

• It specifies the relation between the land owner and the plant developer.
• It includes access arrangements
• Payment arrangement (for public land it is approved to be 2% of the produced energy or its value).
• Liability clearance of the plant owner
• Terms for dual land use.
• Terms regarding plant demolition
Interconnection Contract

• It is primarily technical contract between the plant and the transmitter
• It is subjected to the grid code.
• It specifies the point of common coupling
• It specifies the responsibilities of each party on his side from the “POC”.
• It includes operation requirements and obligations
Power Purchase Contract  
(for FiT and Bidding Projects)

• This Contract is designed to ensure the bankability of the projects.
• In this contract the following criteria have been considered.
  – Take and pay
  – Fixed Tariff
  – Foreign exchange risk.
  – Change in Law
  – Force Majeure
  – Dispute resolution
  – Termination criteria and termination payments
  – Sovereign guarantee for the off-taker commitments
  – Pre-Notification to the lenders and Step in rights (direct agreement)
Third Party Access Contract (Merchant Projects)

• It allows contracting the grid to transmit electricity in case of merchant projects, where Re plant sells electricity directly to customers.

• It specifies the relation between the plant and the transmitter in case if the grid is not the off taker.

• It is usually subjected to grid access fee.

• It specifies metering requirements.

• Conditions of limiting access.

• Methodology for calculating dimmed capacity and compensations.
Government Guarantees

• The government has committed itself to offer the necessary government guarantee to back the PPA for projects with capacities above 500 kW, in case the grid is the off-taker.

• The guarantee template from the MoF includes guarantee for the project investment in case of breaching the contract as well as 6 months of payments.
Implementation
Agreements

• It is usually needed to coordinate between the multi-parties engaged in the project, such as the direct contract, energy banking in case of merchant projects, or any other contracts can be needed to cover the cross linked responsibilities among the project relevant parties.
Supplementary Framework

This include:

- Soft loans for small projects (4% interest rates).
- Land development and supply with infrastructure
- One stop shop facility
Conclusions

Re is cost effective for almost one third of the electricity generated in Egypt based on the fuel supply mix.

Re program is a multi-dimensional program, which include legal, regulatory, tariff, contractual and supplementary frameworks.

Setting cost effective targets are necessary to ensure economical affordability of the program, this will be based on the Re mix (technologies and size ranges and best sites).
Thank you for your attention

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