Energy Storage Technologies; practice in Bangladesh

Power Division
Ministry of Power, Energy & Mineral Resources
&
Bangladesh Power Development Board (BPDB)
Bangladesh: Country Profile

- Total Area: 147,570 km²
- Water: 6.4%
- Latitude: 20°34’ & 26°38’N
- Longitude: 88°01’ & 92°41’E
- Population: 160 Million
- GDP/capita: US$ 1602 (FY 2015-16)
- GDP Growth Rate 6.8%
- Climate Condition: Subtropical Monsoon
### Power Sector: At a Glance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generation Growth</td>
<td>10.2% (Av.)</td>
</tr>
<tr>
<td>Total Gen. Capacity</td>
<td>15,500 MW</td>
</tr>
<tr>
<td>Consumers</td>
<td>24.9 Million</td>
</tr>
<tr>
<td>Transmission Line</td>
<td>10,436 Ckt. km</td>
</tr>
<tr>
<td>Distribution Line</td>
<td>4,01,000 km</td>
</tr>
<tr>
<td>Distribution Loss</td>
<td>10.96%</td>
</tr>
<tr>
<td>Per Capita Generation</td>
<td>407 kWh</td>
</tr>
<tr>
<td>Access to Electricity</td>
<td>80%</td>
</tr>
</tbody>
</table>
Fuel Mix: Present

- Coal: 2%
- Gas: 62%
- Regional Grid: 5%
- Furnace Oil: 21%
- Hydro: 2%
- Diesel: 8%

Total Capacity (Grid) 13,179 MW
Sectoral Distribution

- Public: 45%
- Private: 36%
- Captive: 14%
- Off-Grid (Renewable): 1%
- Import: 4%
Classification of EES

Electrical energy storage systems

- Mechanical
  - Pumped hydro - PHS
  - Compressed air - CAES
  - Flywheel - FES

- Electrochemical
  - Secondary batteries
    - Lead acid / NiCd / NiMh / Li / NaS
  - Flow batteries
    - Redox flow / Hybrid flow

- Electrical
  - Double-layer Capacitor - DLC
  - Superconducting magnetic coil - SMES

- Chemical
  - Hydrogen
    - Electrolyser / Fuel cell / SNG

- Thermal
  - Sensible heat storage
    - Molten salt / A-CAES
EES System Uses in Bangladesh

Uses only in Renewable Energy

- Electrochemical storage systems
  Secondary batteries (Lead Acid)
# Renewable Energy Share

<table>
<thead>
<tr>
<th>Technology</th>
<th>Off-Grid</th>
<th>On-Grid</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar</td>
<td>204.00</td>
<td>14.95</td>
<td>218.95</td>
</tr>
<tr>
<td>Wind</td>
<td>2</td>
<td>0.90</td>
<td>2.90</td>
</tr>
<tr>
<td>Hydro</td>
<td>0.68</td>
<td>230</td>
<td>230</td>
</tr>
<tr>
<td>Biogas to Electricity</td>
<td>0.68</td>
<td>-</td>
<td>0.68</td>
</tr>
<tr>
<td>Biomass to Electricity</td>
<td>0.40</td>
<td>-</td>
<td>0.40</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>207.08</td>
<td>245.85</td>
<td>452.93</td>
</tr>
</tbody>
</table>

- **Total Power Generation Capacity = 16,043.93 MW**
- **Including Off-Grid RE**
- **Renewable Energy Share = 2.82%**
Solar Power in Bangladesh

- Solar PV: 179.61 MW
- 4.5 Million Solar Home Systems
- 100k+ Green Jobs
- Reduction of 180,000+ tons Kerosene estimated value of USD 225M per year
- ‘Shurjogram’- Solar Powered village
- 719 solar water pumping system
- 2 MW Mini-grid + 1 MW Nano grid
- 10+ MW of solar roof-top Solutions
- 800+BTS

Solutions
### Electrical Energy Storage Uses

**Solar Mini Grid Generation**

<table>
<thead>
<tr>
<th>No of Projects</th>
<th>Technology</th>
<th>Capacity (MW)</th>
<th>Agency</th>
<th>Finance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 No's</td>
<td>Solar Mini Grid</td>
<td>0.65</td>
<td>BPDB</td>
<td>CCTF</td>
</tr>
<tr>
<td>25 No's</td>
<td>Solar Mini Grid</td>
<td>4.71</td>
<td>IDCOL</td>
<td>IDCOL</td>
</tr>
</tbody>
</table>

Total: 5.36 MW

**Wind off Grid Generation**

<table>
<thead>
<tr>
<th>No of Projects</th>
<th>Technology</th>
<th>Capacity (MW)</th>
<th>Agency</th>
<th>Finance</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 No's</td>
<td>Wind off Grid</td>
<td>2 MW</td>
<td>BPDB</td>
<td>BPDB</td>
</tr>
</tbody>
</table>

**Solar Home System**

<table>
<thead>
<tr>
<th>No of Homes</th>
<th>Capacity (MW)</th>
<th>Total No</th>
<th>Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5 Million</td>
<td>179.61 MW</td>
<td>719</td>
<td>7.35 MW</td>
</tr>
</tbody>
</table>

**Irrigation**

<table>
<thead>
<tr>
<th>No of Homes</th>
<th>Capacity (MW)</th>
<th>Total No</th>
<th>Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5 Million</td>
<td>179.61 MW</td>
<td>719</td>
<td>7.35 MW</td>
</tr>
</tbody>
</table>
## Projects: At a Glance

<table>
<thead>
<tr>
<th><strong>Solar Home System</strong></th>
<th><strong>Solar Powered Floating School Boat</strong></th>
<th><strong>Solar Powered Easy Bike</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Solar Home System" /></td>
<td><img src="image2" alt="Solar Powered Floating School Boat" /></td>
<td><img src="image3" alt="Solar Powered Easy Bike" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Solar Street Lighting System in Dhaka</strong></th>
<th><strong>Solar Irrigation System</strong></th>
<th><strong>Solar Drinking Water System in the Coastal Area</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4" alt="Solar Street Lighting System in Dhaka" /></td>
<td><img src="image5" alt="Solar Irrigation System" /></td>
<td><img src="image6" alt="Solar Drinking Water System in the Coastal Area" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Wind Power Plant (Kutubdia)</strong></th>
<th><strong>25 kWp Solar Roof Top System</strong></th>
<th><strong>100 kWp Solar Mini-grid at Swandip Island, Chittagong</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image7" alt="Wind Power Plant (Kutubdia)" /></td>
<td><img src="image8" alt="25 kWp Solar Roof Top System" /></td>
<td><img src="image9" alt="100 kWp Solar Mini-grid at Swandip Island, Chittagong" /></td>
</tr>
</tbody>
</table>
Initiatives for Efficient Energy Usage

- Installation of solar panels in all the Government, Non-government and Autonomous institution;
- Installation of energy saving CFL, T-5 tube light;
- Incorporating energy efficiency and solar energy issues in the new building code;
- Replacement of inefficient Rice Per-Boiling Systems by Improved Rice Per-Boiling System;
- Initiated public awareness programs for energy conservation;
- Gradual discontinuation of incandescent bulb and electric heater;
- Limiting the use of air conditioners, or keeping temperature 25 degrees Celsius and above;
- Standardization of LED and solar products;
- Energy Star Labelling Program;
- Discouraging the use of neon sign
Roles of Energy Storage

• High generation cost during peak-demand periods.
  Base load, Peak load, Off Peak load.

• Need for continuous and flexible supply.
  Uninterrupted power supply.

• Long distance between generation and consumption.
  Force Majeure, natural disasters (e.g. lightning, hurricanes) and artificial causes.

• Congestion in power grids.
  EES established at appropriate sites such as substations at the ends of heavily-loaded lines.

• Transmission by cable.
  Environmentally friendly transport system.
EES, A Potential Investment Options

- Electricity is consumed at the same time as it is generated.
- Places where electricity is generated are usually located far from the locations where it is consumed.
- EES can lower electricity costs since it can store electricity bought at low off peak prices and they can use it during peak periods in the place of expensive power.
- With high PV and wind penetration in some regions, cost-free surplus energy is sometimes available. This surplus can be stored in EES.
Energy Storage Development Challenges

- Lack of Skilled Man Power.
- Formulation of a Regulatory Framework regarding EES.
- Lack of Research and Development.
- Conventional mindset.
- Market Demand is volatile.