Development of Solar PV Deployment in Sri Lanka and its Challenges

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• Status of solar PV Development in Sri Lanka

• Challenges in Deployment of Solar PV

• Future Plans
Status of solar PV Development in Sri Lanka
Status of Electricity Generation: 2015

<table>
<thead>
<tr>
<th>Type of Plant</th>
<th>Total Installed (MW)</th>
<th>Generation (GWh)</th>
<th>% Share in Generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Hydro</td>
<td>1,377</td>
<td>4,904</td>
<td>37%</td>
</tr>
<tr>
<td>Other Renewables</td>
<td>455</td>
<td>1,467</td>
<td>11%</td>
</tr>
<tr>
<td><strong>Total Renewable</strong></td>
<td><strong>1,832</strong></td>
<td><strong>6,371</strong></td>
<td><strong>48%</strong></td>
</tr>
<tr>
<td>Thermal-Oil</td>
<td>1,115</td>
<td>2,275</td>
<td>17%</td>
</tr>
<tr>
<td>Thermal-Coal</td>
<td>900</td>
<td>4,443</td>
<td>34%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3,847</strong></td>
<td><strong>13,090</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Electrification level

- 99.9% of the households are provided with grid electricity, no potential for off-grid solar in the household sector
Solar Energy Resource Map of Sri Lanka

Spatial distribution of annual average Global Horizontal Irradiation (kWh/m²/year)
Types of Solar PV Plants in Sri Lanka

• Small IPPs of less than 10 MW each
  - Total Installed Capacity 41 MW (2016)
  - Operate on “Standardized Power Purchase Agreement (SPPA) on a fixed tariff for 20 year contract period

• Roof Top Soar PV Systems
  - Total Installed Capacity 60 MWp (May 2017)

• Hybrid Renewable Energy Mini-grids
  Solar – Wind – Diesel hybrid systems with battery backup, for electrification of isolated islands (one system in operation and three more are under development)
Roof-top Solar PV Systems

Net Metering

• Introduced in 2010 June, consumers were allowed to install solar or any renewable energy plant (with capacity equivalent or less than the contract demand) connected to the grid as “micro power producers”. Consumer pays the “Net amount of Electricity Use”, no payment for surplus energy to grid but allowed to carry forward, grid works as an energy bank.

• Two additional options were introduced on 2016 September
  - Net Accounting and
  - Net Plus
Net Metering Contd.

• Net Accounting

If generation is more than the own consumption, Consumer is paid for the net amount of electricity exported to grid (total generation - own consumption) at LKR 22.00 (US $ 0.15) for 7 years, LKR 15.50 (US $ 0.10) thereafter for the contract period of 20 years.

• Net Plus

Consumers are allowed to installed roof top solar PV plants, equivalent or less than their contact demand and export the total generation to national grid at LKR 22.00 (US $ 0.15) for 7 years, 15.50 (US $ 0.10) thereafter for the contract period of 20 years. (Two separate meters: existing meter measures consumption, new meter for exports.)
Status of Solar Roof Top PV Systems

• Slow start, accelerated growth at present
Hybrid Renewable Energy Systems

• Hybrid renewable power plants in four selected islands off the Jaffna mainland, namely Eluvativu, Analaitivu, Nainativu and Delft were introduced through a loan/grant package offered by ADB.

• These islands were served by CEB-owned diesel generating plants, through a distribution network that covers most parts (not all parts) of each island.

• The fuel cost incurred in producing electricity and other maintenance costs and overheads exceed LKR 50 per kWh, which is about three times the national average cost of supply of electricity.

• Reliability and quality of power supply was poor.
## System Capacities for Island

<table>
<thead>
<tr>
<th>Component</th>
<th>Eluvativu</th>
<th>Analaitivu</th>
<th>Delft</th>
<th>Nainativu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar PV</td>
<td>64 kW</td>
<td>200 kW</td>
<td>400 kW</td>
<td>250 kW</td>
</tr>
<tr>
<td>Wind</td>
<td>21 kW</td>
<td>60 kW</td>
<td>160 kW</td>
<td>-</td>
</tr>
<tr>
<td>Battery Storage</td>
<td>134 kWh</td>
<td>200 kWh</td>
<td>400 kWh</td>
<td>300 kWh</td>
</tr>
<tr>
<td>Converter</td>
<td>134 kWh</td>
<td>200 kW</td>
<td>400 kW</td>
<td>250 kW</td>
</tr>
<tr>
<td>Diesel Genset 1</td>
<td>30 kW</td>
<td>100 kW</td>
<td>200 kW</td>
<td>150 kW</td>
</tr>
<tr>
<td>Diesel Genset 2</td>
<td>-</td>
<td>100 kW</td>
<td>350 kW</td>
<td>300 kW</td>
</tr>
<tr>
<td>Number of Consumers</td>
<td>150</td>
<td>208</td>
<td>949</td>
<td>751</td>
</tr>
</tbody>
</table>
Grid connected Renewable Energy Capacity (Excluding Major Hydro)
Challenges in Deployment of Solar PV
Challenges in Deployment of Solar PV

• Limitations on availability of lands for large scale solar projects

• Impacts on the transmission grid
  - additional spinning capacity (to support intermittency)
  - additional reserve capacity
  - implications in tariff due to additional investment required for above

• Impacts on the electricity distribution network
  - Line capacity, power quality issues
Forest Cover and Wild Life Sanctuaries

Spatial distribution of annual average Global Horizontal Irradiation (kWh/m²/year)

Legend
- Wildlife
- Forests

- 1,247 - 1,556
- 1,557 - 1,653
- 1,654 - 1,727
- 1,728 - 1,789
- 1,790 - 1,840
- 1,841 - 1,889
- 1,890 - 1,932
- 1,933 - 1,967
- 1,968 - 2,005
- 2,006 - 2,106
Forests, Wild Life Sanctuaries and Land Use in Agriculture

Spatial distribution of annual average Global Horizontal Irradiation (kWh/m²/year)
Challenges in Deployment of Solar PV

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Generation Pattern at Various Weather Conditions

Clear Sky

Cloudy day

Normal Rainy day..

Heavy Rainy day..
Future Plans
Future Plans

• Establishing a credit line for promotion of roof top systems
  - US $ 50m ADB loan, estimated roof top solar PV capacity to be added 60 MW

• Develop 60 nos of 1 MW each distributed solar plants in 20 locations through open competitive bidding process.

• Establishing solar energy parks for large scale grid connected solar projects.
Daily Load Curve

19th April 2017

Demand (MW)

- Solar
- Wind
- Mini Hydro
- Hydro
- Thermal
Thank You.