Case Study of Wind Resource Assessment: Sri Lanka

Quantum Leap in Wind Power Development in Asia and the Pacific

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Wind Resource Map of Northern Region, Sri Lanka
OBJECTIVE

• Provide insight into the need and process for long-term wind measurements and mapping of wind resources of the country

• Assist policy /planners by
  ▪ Wind resource estimations
  ▪ Initial step of wind power development roadmap

• Assist wind industry by
  ▪ Reduce start-up time and resource risk
  ▪ Use of data and services for wind industry’s planning purpose
OVERALL PROJECT

• Project implementation by Sri Lanka Sustainable Energy Authority (SEA)
• Financial assistance from ADB
• 3 wind met-masts
• Planning, approval and installation (2014 Aug - 2015 Feb) followed by one year data measuring campaign

Jaffna (Moolai) Met-Mast
• 60m Height
• Tubular Met-mast
• DoC: 24/02/2015

Kokkilai Met-Mast
• 60m Height
• Tubular Met-mast
• DoC: 25/02/2015

Pooneryn Met-Mast
• 80m Height
• Lattice Met-mast
• DoC: 23/02/2015

Wind Power Classification

<table>
<thead>
<tr>
<th>Wind Power Class</th>
<th>Resource Potential</th>
<th>Wind Power Density at 50 m W/m²</th>
<th>Wind Speed at 50 m m/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Poor</td>
<td>0 - 200</td>
<td>0 - 5.6</td>
</tr>
<tr>
<td>2</td>
<td>Marginal</td>
<td>200 - 300</td>
<td>5.6 - 6.4</td>
</tr>
<tr>
<td>3</td>
<td>Moderate</td>
<td>300 - 400</td>
<td>6.4 - 7.0</td>
</tr>
<tr>
<td>4</td>
<td>Good</td>
<td>400 - 500</td>
<td>7.0 - 7.5</td>
</tr>
<tr>
<td>5</td>
<td>Excellent</td>
<td>500 - 600</td>
<td>7.5 - 8.0</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>600 - 800</td>
<td>8.0 - 8.3</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>&gt; 800</td>
<td>&gt; 8.8</td>
</tr>
</tbody>
</table>

*Wind speeds are based on a Weibull k value of 2.0
TOWER & INSTRUMENTS INSTALLATION
DATA ACCESS & DATA MANAGEMENT

• Developers, researches and general public can access this data by
  

• Wind data service provider for data management
WIND STATISTICS – I (Pooneryn)

Wind Speed (@ 80m)

Wind Direction (@75m)

Monthly Average Wind Speed

<table>
<thead>
<tr>
<th>Mar-15</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
<th>November</th>
<th>December</th>
<th>January</th>
<th>Feb-16</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.4</td>
<td>4.5</td>
<td>9.0</td>
<td>11.4</td>
<td>10.6</td>
<td>9.8</td>
<td>9.4</td>
<td>6.0</td>
<td>5.3</td>
<td>5.8</td>
<td>6.2</td>
<td>5.7</td>
</tr>
</tbody>
</table>
WIND STATISTICS – II (Pooneryn)

Diurnal Wind Pattern (South-west Monsoon)

- U : 7.46 m/s
- P : 436 W/m²

Weibull Plot

- U : 7.46 m/s
- P : 436 W/m²
- A : 8.0 m/s
- K : 1.94
WIND STATISTICS – III (Comparison)

### Monthly Average Wind Speed Pooneryn Vs Jaffna & Kokkilai (@60m)

<table>
<thead>
<tr>
<th>Location</th>
<th>Avg. Annual Wind Speed (@60m) m/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pooneryn</td>
<td>7.27</td>
</tr>
<tr>
<td>Jaffna</td>
<td>6.61</td>
</tr>
<tr>
<td>Kokkilai</td>
<td>6.46</td>
</tr>
</tbody>
</table>
GOING BEYOND
Resource Mapping, Capacity & Energy Yield Estimation

Site Selection, Met-Mast & Equipment

Wind Data

Measure-Correlate-Predict

Wind Resource Modelling

Turbine Layout(s)

Gross & Net AEP, and Capacity Factor etc

Wind Resource Map/Grid

Estimation on Regional Wind Power Capacities

Estimation on E. Yields, and Capacity Factors

Comparison with long-term wind data
Application of Software (eg. WAsP), with terrain features
Technical, Enviro.; Socio-economic Constraints
Estimation on Losses

(Regional) Wind Resource Maps

Regional Wind Power Capacity, energy yield estimations
WIND RESOURCE MAP, WIND POWER CAPACITY ESTIMATION

Pooneryn
125-175 MW

Jaffna, Palai, Chavakachcheri
150-200 MW
ISSUES, LESSONS LEARNED & NEXT STEPS

- **Technical**
  - Best practices are important to maintain overall quality of the project
    - Experience local service provider
    - Remote data access
    - Power system is very critical

- **Other**
  - Site security / vandalism

- **Next Steps**
  - Requirement for a Comprehensive Wind Resource Development Roadmap
  - Need for expansion of the project in the region looking at wind resource
    - To facilitate developers and investors of wind industry with the use of data and related services
    - Facilitate accelerated development of wind resources
Thank You!

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