WIND POWER DEVELOPMENT: INDIA STATUS REPORT

Presentation for

‘Quantum Leap in Wind Power in Asia’
Asian Development Bank, Manila,
20-21 June 2011

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The views expressed in this presentation are those of the presenter and do not necessarily represent those of the Asian Development Bank.
INDIA MARKET OVERVIEW

- CWET/MNRE estimated potential of 49,130 MW.
- Wind power development in 8 states only.
- Cumulative installed capacity: 14,000+ MW (March 2011).
- Annual installation in FY 2010/11: 2351 MW.
- Dynamic RPS targets set in 25 states by state regulators.
- More than 50,000 MW additional wind power requirement to meet the 2020 target.
- New frameworks: Generation-based incentive, Tradable RECs.

Note: Installed capacity and projects in the pipeline, as on March 2011, tariff/RPS as on 15 June 2011
Indian Wind Industry Developments: Major three phases

- Prior to 1994/95: Demonstration phase driven by 100% AD and Sales Tax benefits.
## Institutional Mechanism

<table>
<thead>
<tr>
<th>Segment</th>
<th>Centre</th>
<th>State</th>
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</thead>
<tbody>
<tr>
<td>Institutional Framework</td>
<td>Centre</td>
<td>State</td>
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<tr>
<td>Policy</td>
<td>MNRE, MOP</td>
<td>State Govt., SNA</td>
</tr>
<tr>
<td>Plan</td>
<td>MNRE, MOP CEA, Planning Commission</td>
<td>State Govt., SNA</td>
</tr>
<tr>
<td>Regulation</td>
<td>CERC</td>
<td>SERC</td>
</tr>
<tr>
<td>Generation</td>
<td>Central Generating Units</td>
<td>GFNCOs, IPPs, Merchant &amp; Captive Plants</td>
</tr>
<tr>
<td>Transmission</td>
<td>CTU</td>
<td>STU</td>
</tr>
<tr>
<td>System Operation</td>
<td>NLDC, RLDC</td>
<td>SLDC</td>
</tr>
<tr>
<td>Distribution</td>
<td>-</td>
<td>Distribution Licensees</td>
</tr>
<tr>
<td>Trading</td>
<td>Traders, IEX, Power Exchange</td>
<td>Traders</td>
</tr>
<tr>
<td>Appeal</td>
<td>Appellate Tribunal</td>
<td>Appellate Tribunal</td>
</tr>
</tbody>
</table>
WIND RESOURCE POTENTIAL

Wind monitoring is being carried out by the Centre for Wind Energy Technology (C-WET), a federal government institution.

C-WET published the Indian Wind Atlas, showing areas with average WPD > 200 w/sq.m. at 50 m above ground level.

Wind monitoring done at 618 sites, out of which 233 sites declared as wind potential sites having WPD >200 w/sq.m.

In addition, wind turbine manufacturers and developers are also doing wind monitoring.

Different agencies have projected different estimates for wind potential in India. C-WET 49.13 GW, World Institute of Sustainable Energy (WISE) – 100 GW, Global Wind Energy Council (GWEC) > 160 GW. Hence, detailed reassessment is required in the immediate future.
WTG MANUFACTURING

• The annual wind turbine manufacturing capacity in India is about 9000 MW.

• Likely to increase to 17,000+ MW per annum by 2012 to make pace with the annual installations which are slated to go up from present 1,500 MW–1,600 MW to 5,000 MW by 2014-15 and catering to the export market in Asian region and other developed markets.

• More than 9 new wind turbine manufacturers are slated to enter the market in addition to the 17 existing manufacturers, taking the total number of turbine manufacturers to 26 by 2012/13.

• Altogether, about 35 wind turbine models may be on offer from the existing and new wind turbine manufacturers by 2012.

• India has already exported turbines of value $750 million to countries like USA, Brazil, Australia, Bulgaria, China, and Japan, besides exporting almost $220 million worth of wind power related components during April 2009 to December 2009.

• Export projection for 2010/11: US $1400 million.

• Huge export / import opportunity to /by Asian countries.
POLICIES, REGULATIONS AND INCENTIVES

POLICIES & INCENTIVES

• **Electricity Act 2003**: *Feed-in tariffs (FITs), mandatory quotas, delicensing and open access.*

• National Action Plan on Climate Change (NAPCC): national target of *15% renewable power by 2020.*

• Allowance of 80% Accelerated Depreciation (AD) for wind power projects.

• 10 year tax holiday.

• Generation Based incentive of INR 0.5 /kWh for wind power projects not availing accelerated depreciation.

• Creation of NCEF (National Clean Energy Fund) to support RE.

• Central financial fund allocation of $1100 million (INR 5000 crore) to states doing well in grid connected RE.

• Concessions on import duty on certain wind turbine components.

• Allowance of 100% FDI in RE generation projects.

• Special incentives for setting up projects/manufacturing in special economic zones (SEZs).
### POLICIES, REGULATIONS AND INCENTIVES

#### REGULATIONS:

#### POWER SALE OPTIONS

<table>
<thead>
<tr>
<th>Power Sale Options</th>
<th>Corporate (Tax appetite)</th>
<th>Independent Power Producer/ Foreign Investor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Captive</td>
<td>Captive</td>
</tr>
<tr>
<td></td>
<td>Third party</td>
<td>Third party</td>
</tr>
<tr>
<td></td>
<td>PPA at FIT</td>
<td>PPA at FIT</td>
</tr>
<tr>
<td></td>
<td>PPA at APPC and sale of REC</td>
<td>PPA at APPC and sale of REC</td>
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- CERC (Central Electricity Regulatory Commission) – wind power feed-in tariff ranging from $0.078/kWh to $0.117/kWh on wind power density based zoning.
- Various SERC (State Electricity Regulatory Commissions) – specific wind power feed-in tariffs that range from $0.074/kWh to $0.117/kWh.
- 25 SERCs have specified renewable purchase quotas ranging from 1% to 14%.
- Tradable renewable energy certificates (RECs) have been declared to facilitate obligated utilities to fulfill quota obligation. Floor price of $0.033 (INR 1.5/kWh), and Cap price of $0.086 (INR 3.9/kWh).
NEW OPPORTUNITIES: REPOWERING

• Potential for repowering – 1400 MW
  The best windy sites have the oldest machines (low capacity and efficiency)…about 46% machines rated below 500 kW.

Scope for improving overall system efficiency/capacity and investment returns and most importantly,— land utilisation.

• Barriers
  Regulatory/policy barriers – No guidelines on incentives, PPA extension/modification, etc.
  Legal and administrative challenges – Turbine ownership, land lease extension, etc.
  Technical issues – Limited possibility to retrofit, system redesigning, capacity upgradation, disposal.

• Repowering in India - Status
  All the major WTG manufacturers are interested. One project on repowering has already been commissioned by Gamesa India in Tirupur district of Tamil Nadu.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Before repowering</th>
<th>After repowering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machines</td>
<td>8 nos of 300 kW and 2 nos of 500 kW</td>
<td>15 nos of 850 kW (DFIG)</td>
</tr>
<tr>
<td>PLF range (%)</td>
<td>12%-17%</td>
<td>25%-27%*</td>
</tr>
<tr>
<td>Generation (MUs)</td>
<td>12.5</td>
<td>30*</td>
</tr>
</tbody>
</table>

* Expected figures as per data by Gamesa India
NEW OPPORTUNITIES: OFFSHORE

- India has a coastline of 7516 kms.
- Despite vast coastline, offshore potential is limited, upwards of 3000 MW. Actual assessment not carried out.
- Few detailed studies done, MNRE has constituted a committee for exploring pilot project development and policy development.
- No policy targets, no regulation.
- Several potential zones for offshore wind have been mapped off the coast of Gujarat, Maharashtra, and south of Tamil Nadu.
- Two offshore pilot projects planned by MNRE; one each in Tamil Nadu and Gujarat.
NEW OPPORTUNITIES: IPP DEVELOPMENT

- The Indian market was traditionally dominated by large corporates with tax appetites, who accounted for >70% of the market.

- The advent of Independent Power Producers (IPPs) is an indication of the maturity of the wind power sector in India and growing awareness about RE.

- Considering the existing business plans, IPPs are expected to command 40%-60% market share in the next 3-4 years.

<table>
<thead>
<tr>
<th>Developer</th>
<th>Capacity (Operational + committed)</th>
<th>Business Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLP</td>
<td>~639 MW</td>
<td>250-300 MW per annum</td>
</tr>
<tr>
<td>Caparo Energy</td>
<td>-</td>
<td>5,000 MW by 2017</td>
</tr>
<tr>
<td>Orient Green</td>
<td>~537 MW</td>
<td>238 MW under development</td>
</tr>
<tr>
<td>Green Infra</td>
<td>~289 MW</td>
<td>600 MW under evaluation</td>
</tr>
<tr>
<td>Acciona</td>
<td>~86 MW</td>
<td>N.A.</td>
</tr>
<tr>
<td>AES Corporation</td>
<td>~39 MW</td>
<td>200 MW per annum</td>
</tr>
</tbody>
</table>
## 15% RE BY 2020: ROLE OF WIND POWER

### Additional RE capacity for meeting NAPCC Target
(Requirement in Billion Units)

<table>
<thead>
<tr>
<th>Year</th>
<th>09/10</th>
<th>10/11</th>
<th>11/12</th>
<th>12/13</th>
<th>13/14</th>
<th>14/15</th>
<th>15/16</th>
<th>16/17</th>
<th>17/18</th>
<th>18/19</th>
<th>19/20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required * (BU)</td>
<td>848</td>
<td>906</td>
<td>969</td>
<td>1035</td>
<td>1105</td>
<td>1181</td>
<td>1262</td>
<td>1348</td>
<td>1440</td>
<td>1538</td>
<td>1643</td>
</tr>
<tr>
<td>RE Share (%) as per NAPCC</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>RE Quantum (BU)</td>
<td>42.42</td>
<td>54.38</td>
<td>67.81</td>
<td>82.79</td>
<td>99.49</td>
<td>118.10</td>
<td>138.78</td>
<td>161.74</td>
<td>187.19</td>
<td>215.35</td>
<td>246.49</td>
</tr>
</tbody>
</table>

* All India energy requirement as per CEA

### Estimated Technology-wise Cumulative Capacity Addition Required by 2020

<table>
<thead>
<tr>
<th>RE Technology</th>
<th>Assumed Plant Load Factor (%)</th>
<th>Capacity required (MW)</th>
<th>Units Generation (BU)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wind</strong></td>
<td>25</td>
<td>65,000</td>
<td>142.35</td>
</tr>
<tr>
<td><strong>Solar</strong></td>
<td>21</td>
<td>35,000</td>
<td>64.39</td>
</tr>
<tr>
<td><strong>Biomass &amp; Cogeneration</strong></td>
<td>64</td>
<td>5,100</td>
<td>28.59</td>
</tr>
<tr>
<td><strong>Small Hydro Power</strong></td>
<td>38</td>
<td>3,600</td>
<td>11.98</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>1,08,700</strong></td>
<td><strong>247.31</strong></td>
</tr>
</tbody>
</table>

Source: WISE

15% RE by 2020 Needs 50 GW Additional Wind Power in India
Indian Wind Power Capacity Addition 2005-2020

Annual capacity, MW
1716 1742 1663 1485 1565 2500 2900 3364 3902 4527 5251 6091 7066 8196 9507
Cumulative capacity, MW
5352 7094 8757 10242 11807 14307 17207 20571 24473 29000 34251 40342 47407 55603 65111
Annual market growth rate, %
1.5 -4.5 -10.7 1.4 59.7 16.0 16.0 16.0 16.0 16.0 16.0 16.0 16.0 16.0 16.0
Note: FY 2010/11: WISE estimate, Actual annual capacity addition was 2351 MW, growth rate > 50% on previous year. Just 16% year-on-year growth rate in annual wind power capacity addition from now till 2020 can achieve the target! Growth rate in FY 2010/11 was ~ 50%

15% RE BY 2020: ROLE OF WIND POWER (contd...)

Actual
Projection
MARKET CHALLENGES

Grid Infrastructure
- Inadequate evacuation capacity.
- Lack of transmission planning.
- Cost burden of grid augmentation on developers.

Wind power Forecasting
As per IEGC (Indian Electricity Grid Code), 2010, wind power producers are expected to forecast generation from April 2012. Deviation beyond +/- 30% of the forecast will be subjected to UI (unscheduled interchange) charges. These additional costs may impact wind power economics substantially.

Project Financing
- Bias against stand alone projects as they are deemed risky.
- Financing is at a premium as wind is still not mainstream.
- Lower loan tenures and higher interest rates.

Shortage of Trained/Skilled Human Resources.

Regulatory compliance
- Delay in payments
- Risk of non compliance of RPO by state owned utilities
- Delay in signing of PPAs

Protracted approval processes, administrative hurdles and land issues.

THANK YOU!