New American Renewable Energy Manufacturing Company

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• Outlook for Wind industry
• Manufacturing Jobs in Wind industry
• Policy recommendations (non-PTC)
Electrical Generation Sources Shifting in U.S.

2010
- 2% Renewables
  - 6% Hydro
  - 19% Nukes
  - 24% Natural Gas
  - 47% Coal

2030
- 12% Renewables
  - 6% Hydro
  - 20% Nukes
  - 25% Coal
  - 35% Natural Gas

Source: U.S. Energy Information Association
Natural Gas Relative to Wind Power
(Wind installs increase when Natural Gas Prices Increase)

Sources: U.S. Energy Information Assoc
American Wind Energy Assoc
MAKE Consulting
## Example of Job Creation – Land-Based Wind Energy

<table>
<thead>
<tr>
<th>Indiana Examples</th>
<th>Power Gen</th>
<th>Capital Investment</th>
<th>Permanent Jobs</th>
<th>Capitalization Per Job</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind Farms (Benton County)</td>
<td>1,000 MW</td>
<td>$1 billion</td>
<td>300</td>
<td>$3,000,000</td>
</tr>
<tr>
<td>Wind Component Manufacturer (Delaware County)</td>
<td>n/a</td>
<td>$100 million</td>
<td>400</td>
<td>$250,000</td>
</tr>
</tbody>
</table>

*Manufacturing creates more jobs with less Capital investment than just the Wind Farm alone.*

12th Century European Wind & Hydro power to grind grain

Source: Book "History of Wind Power"
1940’s Smith-Putnam Turbine – experiment for Grid

Source: Book “History of Wind Power”
Jet Stream + Rocky Mountains = Windy Great Plains

(creating Wind Fields in Midwestern U.S.)
Offshore Wind Potential Greater than Onshore
(4-times U.S. Electrical Demand)

Wind Speed at 90 m

<table>
<thead>
<tr>
<th>m/s</th>
<th>mph</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.5 - 12.0</td>
<td>25.7 - 26.8</td>
</tr>
<tr>
<td>11.0 - 11.5</td>
<td>24.8 - 25.7</td>
</tr>
<tr>
<td>10.5 - 11.0</td>
<td>23.5 - 24.6</td>
</tr>
<tr>
<td>10.0 - 10.5</td>
<td>22.4 - 23.5</td>
</tr>
<tr>
<td>9.5 - 10.0</td>
<td>21.3 - 22.4</td>
</tr>
<tr>
<td>9.0 - 9.5</td>
<td>20.1 - 21.3</td>
</tr>
<tr>
<td>8.5 - 9.0</td>
<td>19.0 - 20.1</td>
</tr>
<tr>
<td>8.0 - 8.5</td>
<td>17.9 - 19.0</td>
</tr>
<tr>
<td>7.5 - 8.0</td>
<td>16.8 - 17.9</td>
</tr>
<tr>
<td>7.0 - 7.5</td>
<td>15.7 - 16.8</td>
</tr>
<tr>
<td>6.5 - 7.0</td>
<td>14.5 - 15.7</td>
</tr>
<tr>
<td>6.0 - 6.5</td>
<td>13.4 - 14.5</td>
</tr>
<tr>
<td>0.0 - 6.0</td>
<td>0.0 - 13.4</td>
</tr>
</tbody>
</table>

Source: U.S. Dept. of Energy
Horizon Distance – Objects Not Visible from Far Away

The World is Round

Horizon Distance in Miles equals the Square Root of Height of Object in Feet multiplied by 1.32 taking into account the radius of the Earth.

Lesson: the farther the Object, the smaller it appears, until it disappears.

Source: U.S. Naval Academy Training Manual 1978
Increasing Size – Logistics More Difficult & Costly

- 5-MW Turbines for Offshore Wind taller than Washington Monument

- 1.5-MW Wind Turbine predominant Land-Based size

- 80 meters
- 100 meters
- 200 meters
- 250 meters
Offshore Wind Power

North Sea

3,294 MW in 2011
40,000 MW in 2020

East Coast USA

0 MW in 2011
10,000 MW in 2020

Sources: European Wind Energy Association (EWEA)
U.S. Dept of Energy
Current Offshore Wind Turbines in Europe’s North Sea

Source: European Wind Energy Association (EWEA)
First offshore farm in Denmark in 1990
49 offshore farms in 9 countries with 3,294 MW in 2011

Plans for:
40,000 MW by 2020
150,000 MW by 2030
+700 turbines/yr 20 yrs

Cuxhaven & Bremerhaven Port Facilities in Germany

Sources: European Wind Energy Association
Tower Laydown Yard and Port Vessel Loading Facility

Cuxhaven Germany 2010

200M € Investment  4,500 jobs in 5-years  100 units/year
Towers (Diameter 24-ft, Length 130-ft, 150-ton per section)

Source: Global Wind Network (GLWN) USA
Vessels for Offshore Wind Turbine Installations

Cuxhaven Based Ships
10 transport vessels
12 foundation vessels
10 tower install vessels

5,000-ton Jack-up vessel with 2,000-ton payload

Source: Global Wind Network (GLWN) USA
Cuxhaven Port Transport of Offshore Foundations

950 ton Tripods

Source: European Wind Energy Association (EWEA)
### Offshore Wind Potential
(4-times U.S. Electrical Demand)

<table>
<thead>
<tr>
<th>Region</th>
<th>Depth of Water (meters)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-30 m</td>
<td>30-60 m</td>
</tr>
<tr>
<td>New England</td>
<td>100</td>
<td>136</td>
</tr>
<tr>
<td>Mid-Atlantic</td>
<td>298</td>
<td>179</td>
</tr>
<tr>
<td>South Atlantic Bight</td>
<td>134</td>
<td>49</td>
</tr>
<tr>
<td>California</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>Pacific Northwest</td>
<td>15</td>
<td>21</td>
</tr>
<tr>
<td>Great Lakes</td>
<td>177</td>
<td>106</td>
</tr>
<tr>
<td>Gulf of Mexico</td>
<td>340</td>
<td>120</td>
</tr>
<tr>
<td>Hawaii</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total GigaWatts</strong></td>
<td><strong>1,071</strong></td>
<td><strong>628</strong></td>
</tr>
</tbody>
</table>

298 GW is enough power for **74 million homes**

# Estimates for Job Creation – Offshore Based Wind Energy

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Offshore Wind Goal</th>
<th>Capital Investment</th>
<th>Jobs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offshore Wind Farm</td>
<td></td>
<td>$10 Billion ?</td>
<td>600</td>
</tr>
<tr>
<td>Sea Going Vessels</td>
<td></td>
<td>?</td>
<td>1,000</td>
</tr>
<tr>
<td>Cable Laying</td>
<td>10,000 MW by 2020</td>
<td>?</td>
<td>500</td>
</tr>
<tr>
<td>Steel Fabrications</td>
<td>1,000 MW per year or 200 turbines / year of 5 MW sized turbines</td>
<td>?</td>
<td>2,000</td>
</tr>
<tr>
<td>Undersea Foundations</td>
<td></td>
<td>?</td>
<td>1,000</td>
</tr>
<tr>
<td>Engineering</td>
<td></td>
<td>?</td>
<td>400</td>
</tr>
<tr>
<td>Turbine Components</td>
<td></td>
<td>?</td>
<td>500</td>
</tr>
<tr>
<td><strong>Total Infrastructure</strong></td>
<td></td>
<td>~ 5,000</td>
<td></td>
</tr>
</tbody>
</table>

Sources: Vela Management estimates, Global Wind Network estimates, Virginia Economic Development study
Wind Turbines parts are also becoming huge
More than 5,000 Components within each Wind Turbine
Wind Turbine = 60% Imported

- **Germany & China**
  - $290,000 Gearbox

- **Italy & Europe**
  - $90,000 Pitch & Yaw Drives

- **Germany & Europe**
  - $290,000 Gen & Electronics

- **China & Asia**
  - $600,000 Tower
Gear Market – Size vs. Quality

- Aerospace
- Auto
- Off Hwy Trucks
- Rail
- Defense
- Power Gen
- Wind Energy
- Oil & Gas
- Mining
- Mining

Vela’s niche

Large size High Quality Gears

Gear Part Size (Diameter in Inches):
- 6”
- 30”
- 60”
- 90”

Quality (AGMA Level):
- 4
- 6
- 8
- 10
- 12
- 14

Vela Gear Systems
Large Gears needed in Frac Pumps
Vela Team – Setup Broadwind Facility in Chicago
Vela Team – Setup Broadwind Facility in Chicago
U.S. Turbine Fleet Aging – Maintenance Increasing

Note: Currently 45,000 utility grade wind turbines installed in the U.S., by 2017 thousands will need gear repairs.
Global Strategy – Regional Supply Chains

Eickhoff manufactures gearboxes in Germany for export to the U.S.

Nordex assembles turbines in Jonesboro, Arkansas but desires a domestic supply chain.

Vela's plans are to contract manufacture Eickhoff gearboxes in the U.S. for Nordex, and repair all wind turbine drives for the U.S. market, by acquiring Brevini Wind USA.
Global Strategy – Regional Supply Chains

Note: Nordex turbines use Eickhoff gearboxes which are imported from Germany at high cost, GE imports nearly $1 billion from China.
Strategic Central U.S. Location

- **Midwest** 60%
  - 35,323 MW
  - 19,624 Turbines
  - 16 hrs (1,800km)

- **East** 10%
  - 5,916 MW
  - 3,287 Turbines
  - 6 hrs (580km)

- **West** 31%
  - 18,131 MW
  - 10,073 Turbines

Each dot represents a large U.S. Wind Farm.
Strategic Central U.S. Location

Note: Distance to various customer locations, Eickhoff has a repair facility in Pittsburgh but without machine tools or test stand.
New American Renewable Energy Manufacturing Company

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