The Future of Offshore Wind Energy
Offshore Wind Works

- Offshore wind parks: 28 in 10 countries
- Operational since 1991
- Current installed capacity: 1,250 MW
- Offshore wind parks currently under construction: 13 with a capacity of 1,503 MW
- Over 20,000 MW permitted for construction in the waters around Europe
### US Offshore Wind Initiatives

<table>
<thead>
<tr>
<th>Project</th>
<th>State</th>
<th>MW</th>
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</thead>
<tbody>
<tr>
<td>Capewind</td>
<td>MA</td>
<td>468</td>
</tr>
<tr>
<td>Hull Municipal</td>
<td>MA</td>
<td>15</td>
</tr>
<tr>
<td>Buzzards Bay</td>
<td>MA</td>
<td>300</td>
</tr>
<tr>
<td>Rhode Island (OER)</td>
<td>RI</td>
<td>400</td>
</tr>
<tr>
<td>Winery</td>
<td>NY</td>
<td>10</td>
</tr>
<tr>
<td>New Jersey (BPU)</td>
<td>NJ</td>
<td>350</td>
</tr>
<tr>
<td>Delmarva</td>
<td>DE</td>
<td>450</td>
</tr>
<tr>
<td>Southern Company</td>
<td>GA</td>
<td>10</td>
</tr>
<tr>
<td>W.E.S.T.</td>
<td>TX</td>
<td>150</td>
</tr>
<tr>
<td>Cuyahoga County</td>
<td>OH</td>
<td>20</td>
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<tr>
<td><strong>Total MW</strong></td>
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<td>2173</td>
</tr>
</tbody>
</table>

No Offshore Wind Projects Installed In U.S. Yet

[bluewaterwind.com]
Big Themes

- Delaware PPA: DEMEC & Delmarva
- State, Federal, and Market Drivers
- Economic Policies Desired
- Economic Risks Avoided
- Market Challenges
- RPS Spurs NE offshore
- 4 New Horsemen
- Fossil Price Volatility
- Technology Advances
- US must embrace Serious Energy Policy
The Nation’s First Offshore PPA

- 200 MW signed PPA between Bluewater Wind & Delmarva Power
- Energy - $98.93/MWh (All 2007$)
- Capacity - $70.23/kW year
- RECs - $15.23/MWh
- 2.5% annual inflation escalator
- 70 cents -average monthly customer cost impact
  (PSC estimate in real levelized 2007$)
- The First State sets trend for Eastern Seaboard
- Delaware Model: Outreach & education succeed
Delaware Municipal Electric Corporation (DEMEC) PPA

- Negotiated before Delmarva PPA, but contingent on Delmarva signing
- Supply of energy, capacity, and RECs to nine municipally-owned electric distribution utilities
- 20 year agreement
- Valued at $200 - $300 million over life of contract
State And Federal Policies Resulting In Higher Fossil Costs

• RGGI - 10 states signed MOU
  – First auction this month
• National cap and trade legislation likely in 2009
• National RPS in House Bill this week
• Clean Air Act and state pollution laws raise price of fossil electricity
Market Drivers

- Rising and highly volatile energy prices
- Increasing demand for energy and RECs
- Aging fleet of coal and nuclear plants not easily replaced
- Transmission/congestion challenges
- Technology with a proven track record, and larger turbines on horizon
Growing Electricity Demand In Coastal Regions

- Close proximity to large and growing load centers along eastern seaboard
- Offshore wind resource superior to land-based sites in the Northeast
  - Offshore provides higher capacity factor
  - Strong correlation between production and peak loads
Linking supply with demand

28% of coastal states use 78% of the electricity in the U.S.
Economic Policies Desired

• New industry of well paying green collar clean tech jobs: Delaware union jobs
• State-wide economic development: Delaware as offshore staging hub
• Stable prices
• Clean energy
• Meet RPS obligation
• Future carbon and pollution costs covered
Economic Development: Delaware 450 MW Example

- $1.6 Billion investment
- 500+ local union jobs to be created during construction
- 80+ union O&M jobs for 25 years
- $200+ million direct economic impact for the Delaware workers
- Clean, high-tech industry
- Onshore and offshore construction
Economic Risks Avoided

• Health care costs of pollution: Indian River coal plant legacy and other Eastern US fossil plants
• RGGI compliance costs increasing fossil prices
• Carbon Cap and Trade legislation: unknowable and unfunded ratepayer cost
• Volatile electricity prices: new businesses go to lower electricity places
Market Challenges

- A longer development process requires an extended PTC
- Too few turbine vendors
- Untested federal and state regulatory regime
- Critical mass of projects needed to attract European vendors to manufacture in US
Growing Northeast RPS Requirements Spur Offshore

- Delaware 20% by 2019
- Maryland 20% by 2022
- New Jersey 22.5% by 2021
- Pennsylvania 18% by 2020/2021
  - Over 20 million MWhs by 2020 in DE, MD, NJ, and PA combined. Equal to 33 Delawares
- New York 24% by 2013
- Rhode Island 16% by 2020
State RES Legislation

Renewable electricity standards
26 states + D.C.

- 15 states have requirements of 20% or higher

Source: American Wind Energy Association
4 New Horsemen: Wind as solution to price spikes, energy security and climate emergency

I. Global Energy Price Crisis
II. Global Battle for Energy Supply
III. Developing World New Burdens: Fuel v. Food; Environmental Refugees
IV. Carbon Explosion: Truth Increasingly Inconvenient
Global Energy Price Crisis

- Demand overwhelms Supply
- US energy prices inexorable rise:
  - World Natural Gas $20 v. US Price $7-12.40
  - Russian, Iranian growing Nat Gas cartel
  - Coal price rise in US: Appalachian coal up 82% in last year
  - Nukes: Uranium futures up. IEA shows only stable supply with new replacing retirees
Energy Supply Battles:
Supply Globalized; Affects Localized

- Oil, Natural Gas, even Coal now globally priced and transported
- Appalachian mountaintops sliced off and burned in Chinese power plants
- 77% of all oil owned by governments who act in non-economic ways increasingly: Chavez, Putin, OPEC
Developing World Deadly Burdens

- Fuel v. Food Biofuel competition
- Food shortages and Asian rice riots
- Darfur drought example, as noted by Nick Kristof N Y Times Op Ed
- Global conflicts correlated with climate disruptions, Jeffery Sachs new book **Common Wealth: Environmental Refugees**; for example Bangladesh tens of millions in Delta predicted to be inundated by rising seas
- Myanmar (Burma) Cyclone
- Sub-Saharan internal Refugees
Carbon Explosion: Truth Increasingly Inconvenient

- Al Gore chart that launched a thousand Op Eds; changed debate in Delaware
- Obama and McCain both support Carbon cap and trade
- Climate models forecast accelerated disruptions: Arctic Sea Lanes now both open
20% Wind ➔ Annual CO₂ Avoided: 825 million tons by 2030
Natural Gas, Coal, and Oil Trend Upwards: Tipping Point for US Consumers, Candidates, and Regulators
Pricing Trends - Natural Gas
Pricing Trends - Appalachian Coal (NYMEX Quality)
Advances In Technology

- Larger turbines
- Improved blade designs
- Decreased mfg. costs
Advancing Technology in U.S.

- Critical mass of projects required to attract European manufacturers
- Wind technician training
  - DelTech
- Reduction of installation costs
- Overcome accessibility issues

Credit: GE Energy

bluewaterwind.com
Offshore Wind Technology

Land-based

Shallow Water

Commercially Proven Technology

Estimated US Resource

0m-30m
430-GW

Transitional Depth

Demonstration Phase

0m-30m
430-GW

Deepwater Floating

60m-900m
1533-GW
## Estimated Distribution Of Foundation Types

<table>
<thead>
<tr>
<th>Foundation Type</th>
<th>Installed by end of 2008</th>
<th>2009 – 2011 (planned)</th>
<th>2011 – 2015/20 (projected)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monopile</td>
<td>75%</td>
<td>80%</td>
<td>50% - 60%</td>
</tr>
<tr>
<td>Concrete Base</td>
<td>24%</td>
<td>15%</td>
<td>5%</td>
</tr>
<tr>
<td>Jacket/Tripod</td>
<td>1%</td>
<td>~ 5%</td>
<td>35% - 40%</td>
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</table>
Serious Energy Policy in U.S.

- Congressional Policies
  - Short Term - stable production incentive (PTC)
  - Mid Term - national RPS and transmission legislation
  - Long Term - meaningful carbon regulation

- R&D to improve technology

- Regulatory Policies: Fair MMS lease and operating fees for nascent industry
More Information

- University of Delaware - www.ocean.udel.edu/windpower/
- American Wind Energy Assn - awea.org
- British Wind Energy Assoc. - bwea.org
- Utility Wind Integration Group - uwig.org
Thank You

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