Offshore Wind Energy

A Developer's Perspective

Michigan Great Lakes Wind Council

June 10, 2009

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A Developer's Perspective

- About Bluewater Wind
- The Development Process
- A Case Study – Delaware
- The Benefits of Offshore Wind
- Unique Opportunities for the Great Lakes
- Materials

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About Bluewater Wind

BluewaterWind℠

Bluewater Wind is a developer of offshore wind energy committed to bringing clean, reliable and affordable electricity to New York, Delaware, Maryland, New Jersey, New England and the Great Lakes.

State	Project Size	Notes
Delaware	360-450	230 MW now contracted; RFP in Maryland
Maryland	600	In addition to purchase from DE project
New Jersey	350	1,000 MW by 2012; 3,000 by 2020 per State
New York	350-700	Expect RFP in 2009
New England	450	
Rhode Island		
Massachusetts		
Vermont		On short list; any award depends on nuke re-licensing
Great Lakes	TBD	Development potential still being examined by governors and state legislatures. Developers such as Bluewater and consultants are providing assistance as requested. The Great Lakes Wind Collaborative reports that the U. S. Department of Energy estimates the potential wind production capacity of the 8 states in the Great Lakes region at about 250 gigawatts (GW) offshore.
Ohio		
Michigan		
Wisconsin		
New York		

The Bluewater Wind Team
Development Team Members

- Meteorologists
- Geologists and geo-technical professionals
- Electrical engineers and grid interconnection specialists
- Foundation structural engineers
- Construction, transport and logistics specialists
- Wind turbine manufacturers
- Marine and avian biologists
- Project equity investors
- Bank debt analysts
- Legal and insurance professionals

The Bluewater Wind Team

One or more members have participated in the development of 23 of the world's 30 offshore wind parks

Category	Company
Wind turbine	Vestas
EPC Contractor	Fluor
Owner's Engineer	Ramboll
Permitting	Tetra Tech
Offshore Electrical Engineering	SEAS
Interconnection/Onshore Electrical Engineering	Energy Initiatives Group
Electrical Equipment Supply and Installation	ABB
Wind Resource Assessment	AWS Truewind
Wind Resource Assessment	Garrad Hassan
Wind Resource Assessment	EMD
Marine Field Studies	Aqua Survey
Marine Field Studies	Ocean Surveys
Federal Regulatory Affairs	Hill & Kehne
Insurance	Marsh Insurance

Offshore Wind Energy Works

- Offshore wind turbines In Europe generate electricity 70-90% of the time
- Sites identified by Bluewater will generate electricity 85 – 89% of the time

European offshore wind experience

- 18 years experience with offshore wind projects
  - 30 wind parks totaling 1,500 MW in 8 countries
  - Tens of thousands of MW in development & construction
- Leaders: Denmark, UK, Netherlands, Sweden
  - Over 2,000 MW permitted in the UK, 25,000 MW goal in Germany
- Post-construction monitoring of potential environmental impacts is continuing – with no significant impacts identified

The Development Process

Desired Qualities of an Offshore Wind Energy Site

- Avg. winds stronger than 18 mph
- Constructible water depths
- No significant water use conflicts
- Environmentally compatible areas
- Accessible transmission & ports
- Large available project area footprint

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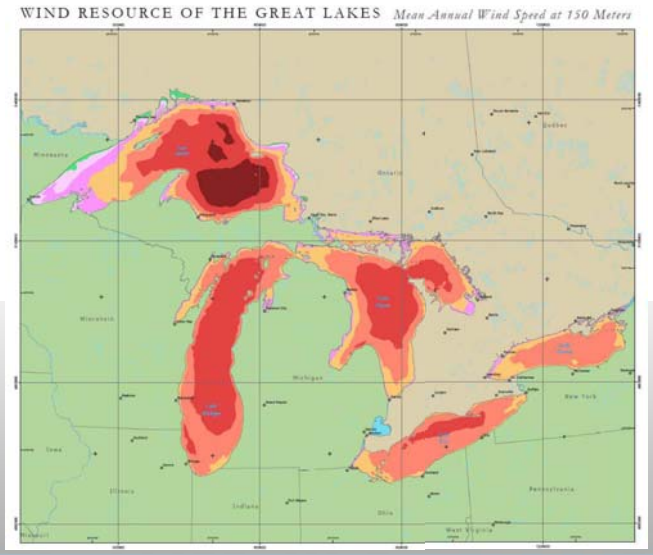
The Great Lakes Wind Resource



Source: Michigan's Offshore Wind Potential, The Hannah Professor Research Program Land Policy Institute, Michigan State University, September 30, 2008

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Five Pillars of Developing an Offshore Wind Project

- Wind Resource
- Site Control / Access
- Permits
- Interconnection to Grid
- Buyer of Energy

Investigating the Wind Resource

- Meteorologists use data from NOAA buoys and satellites to pre-screen a site's wind resource
- Meteorological towers installed to obtain highly accurate production estimates

Site Control/Access

- Fatal flaw analysis is conducted to identify environmentally sensitive areas, shipping lanes, and other constraints
- An application is filed with MISO to obtain a queue position
- Developers file application with State to obtain lease block(s)

Permitting

- State regulations and guidance
- Developers must understand permitting cycle for state and federal permits
  - Early and frequent communication with regulators and the community is preferred
  - Developers and regulators should strive to avoid late-stage surprises

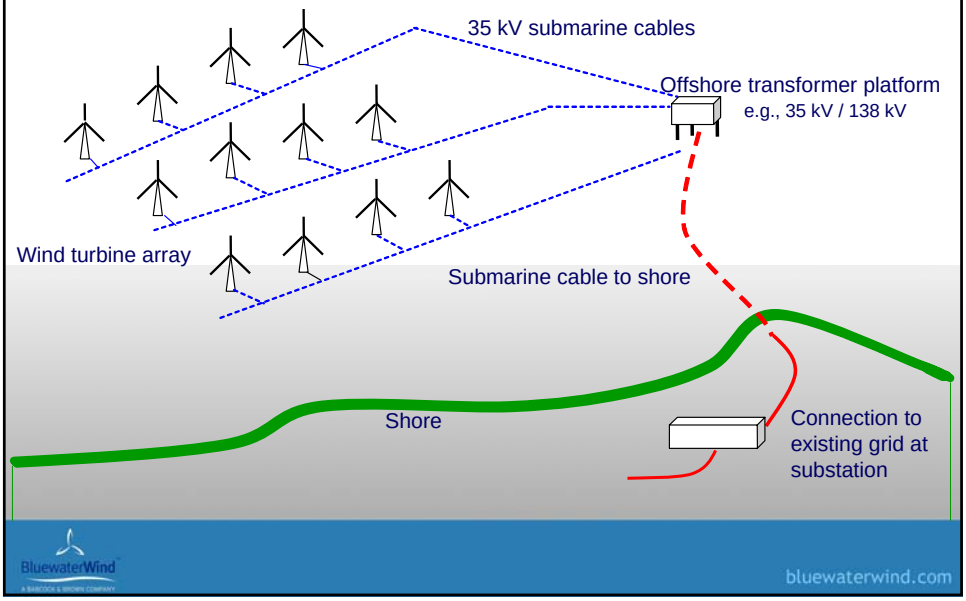
Interconnection to Grid

- Developers identify power substations along the coast where energy can be injected into the grid with minimal infrastructure upgrades
- Multiple studies are completed by MISO to determine grid upgrades and the costs of the upgrades
- Developers work with communities and regulators to obtain acceptance and permits

Buyer of Energy

- Developers need a market for the energy to be generated by the offshore wind park
- States have differing approaches to encouraging renewable energy development
  - Delaware – PPA for long-term contract
  - New Jersey – Carve out for offshore RECs
  - Maryland – Solicitation to supply government facilities
  - New York – RFPs for offshore wind energy anticipated from LIPA and NYPA in 2009

Offshore electrical design



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Building a Wind Park

- Site Assessment
- Detailed design
- Construction and Installation
- Operation and Maintenance
- Decommissioning

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Met Tower Installation

Met Tower Designs

Cape Wind

Horns Rev

W.E.S.T.

Staging Port Development

Receive and Pre-Assemble Components

Scroby Sands, Source: www.2004ewec.info

Special Installation Vessel

Provides Stable Work Platform

Met Tower Installation

Foundation Construction

Source: www.fino3.de

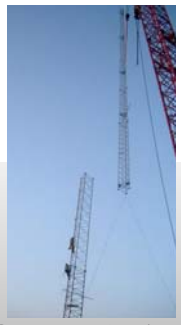
Source: www.fino3.de

Source: www.fino3.de

Met Tower Installation

Topside Construction

Source: www.mammoetvanoord.com



Source: www.mammoetvanoord.com

Source: www.mammoetvanoord.com

Setting the Foundations

Foundation Installation

Handling a Monopile

Source: RPS Energy Presentation

Foundation Installation

Handling a Transition Piece

Source: www.Q7wind.nl

Installing Transition Piece Between Tower And Foundation

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Turbine Installation

Assembling a Tower and Lifting a Bunny Ear

Source: www.mammoetvanoord.com

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Turbine Delivery and Installation

Multiple trips required to and from staging area

Preparing to Lift Rotor

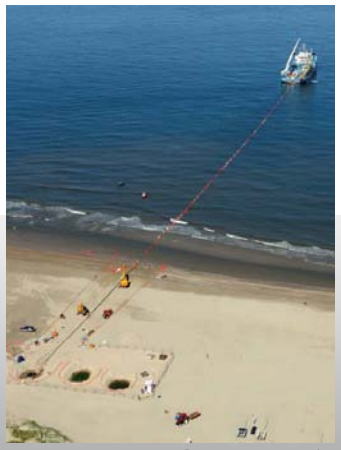
Construction continues 24/7

A Night Lift

Sub-sea Electrical Cable Installation

Cable Laying Vessels at Work

Source: www.q7wind.nl



Source: we at sea presentation

Source: www.hornsrev.dk

Offshore Substation Installation

Lifting a Transformer Platform

Delaware

A Case Study

The Country's First Offshore Power Purchase Agreement

- 200MW signed 25-year PPA between Bluewater Wind & Delmarva Power
- Energy - $98.93/MWh (2007$)
- Capacity - $70.23/kW year
- RECs - $15.23/MWh plus REC multiplier
- 2.5% annual inflation adjustor
- 70 cents – average monthly customer cost impact (PSC, real levelized 2007$)

How Offshore Wind Came to Delaware

- 1999 - Deregulation and artificial price caps for seven years
- July 2005 - Delaware's Renewable Portfolio Standard begins
- February 2006 - 59% rate increase announced for DP&L customers when rate cap expires
- April 2006 - House Bill 6 Passed, required Delmarva Power (DP&L) to issue RFP for long-term contract for energy supply
- December 2006 - RFP from DP&L issued; Delaware's Public Service Commission (PSC) and three other state agencies (Department of Natural Resources and Environmental Control, Office of Management and Budget, and the General Assembly) will oversee the RFP process

The RFP Process

- December 2006 – Bluewater Wind, Conectiv, and NRG file bids for offshore wind, natural gas, and coal, respectively.
- February 2007 – Independent Consultant issues report. Natural gas bid scores highest per bid criteria.
- March 2007 – Public comment sessions held in every county in Delaware. Overwhelmingly, the public supports offshore wind, despite higher initial prices.
- May 2007 – PSC Staff issues report recommending Delmarva Power negotiate with both Bluewater Wind and Conectiv. Bluewater will be primary PPA and Conectiv will provide natural gas backup to the offshore wind park. PSC and state agencies order Delmarva Power to begin negotiations of PPA with Bluewater Wind.

The RFP Process

- June – September 2007- Bluewater Wind and Delmarva Power negotiate long-term PPA for offshore wind power.
- September 2007 – Interim PPA submitted to the PSC. Significant issues remain unresolved.
- October 2007 – Bluewater Wind and Delmarva Power ordered by the PSC and state agencies to resolve PPA issues.
- December 2007 - PSC and state agencies convened to vote on the re-negotiated PPA – vote tabled; Controller General looking for guidance from leadership within the Delaware Legislature
- January 2008 - House Concurrent Resolution 38 introduced to direct Controller General to vote in favor of approving the PPA. Resolution passes House in March, but never comes to a vote in the Senate.

The RFP Process

- February – April 2008 - Senate Energy & Transit Committee to hold hearings on offshore wind.
- April 2008 – Majority and Minority reports are issued by the Senate Energy & Transit Committee.
- May – June 2008 – Bluewater Wind and Delmarva Power start third round of PPA negotiations, under guidance of Senate Majority Leader.
- June 2008 – Power Purchase Agreement signed
- July 2008 – Received approval of PPA from Delaware's PSC – Bluewater Wind has a "Financeable Project" for Delaware and moves forward in the permitting process

Post-PPA Activities

- July 2008 - Mineral Management Service (MMS) Issued Draft Rules and Environmental Assessment
- August 2008 – BWW starts finalization of PPA with DEMEC
- October 2008 – BWW's Maryland team submits REOI for sale of power from DE project to the State and universities
- November 2008 – BWW meets with MMS for approval of lease for meteorological tower ("met tower")
- March 2009 – MMS Issues Final Regulations for Offshore Wind on the Outer Continental Shelf
- May 2009 – Bluewater Wind granted MMS approval for met tower
- July 2009 – Bluewater Wind will submit RFP to University System of Maryland to purchase power and RECs from the Delaware project

Current Steps

• Avian	Spring 09 studies just completed
• Foundation	Wave analysis on buoys
	Boring testing
• Wind Resource	Meteorological tower installation '10
• Cabling	Seabed floor analysis
• Interconnection	Analysis of options
• Ports	Lay-down (Construction)
	Operation & maintenance
• Regulations	Regular meetings with DNREC
	are ongoing

Positive Economic Impact Coming to Delaware

- $1.6 Billion investment (450 MW park)
- $200+ million direct economic impact for Delaware
- State-wide economic development: Delaware as offshore staging hub
- Brings up to 500 construction and up to 80-100 O&M jobs to Delaware
- Brings large contracts to Delaware ports
  - Construction
  - Operations and Maintenance
- Wind technician training at DelTech
- Delaware union jobs
- New businesses locate in places where electricity is affordable and stable-priced
- No negative, possible positive effect on tourism

Supporters of the Bluewater Delaware Wind Park

- Vice President Joe Biden
- US Senator Tom Carper
- Lt. Governor John Carney
- Delaware Treasurer Jack Markell
- Delaware Insurance Commissioner Matthew Denn
- Delaware Municipal Electric Corporation
- Citizens for A Better Sussex
- Citizens for Clean Power
- Coalition for Climate Change Study and Action
- Delaware Audubon Society
- Delaware Building & Construction Trades Council
- Delaware Nature Society
- Endecon, Inc.
- Epworth United Methodist Church
- Green Delaware
- League of Women Voters
- Natures Path of Integrated Health
- News Journal Editorial Board
- Delaware Chapter of Sierra Club
- Society of Natural History
- St. Andrews School
- Unitarian Universalists of Southern Delaware
- City of Dover
- City of Lewes
- City of Milford
- City of New Castle
- City of Newark
- City of Seaford
- Town of Clayton
- Town of Middletown

Lessons From Delaware Success

- Engage the public early and often:
  - Identify all stakeholders
  - Educate, educate, educate
  - Honest and transparent communication
  - Visualizations play a critical role in acceptance

The Benefits of Offshore Wind

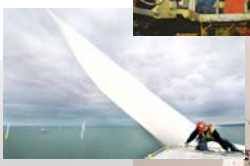
Wind Energy Creates Jobs

- Biologists (marine and terrestrial)
- Civil, mechanical, and electrical engineers
- Marketing, communication and public affairs professionals
- Finance and project development
- Iron workers, electricians, heavy equipment operators, and boat captains

Economic impact during construction

The Delaware Example

- Min. $800 million investment
- Up to 500 local union jobs during construction, $90 - $180 million in direct wages
- Up to 780 indirect jobs
- $238 million in GDP for Delaware (2 yr. const.)
- $38.5 million in transmission line upgrades
- $7.2 million direct economic impact for the Port of Wilmington



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Economic impact during operation & maintenance

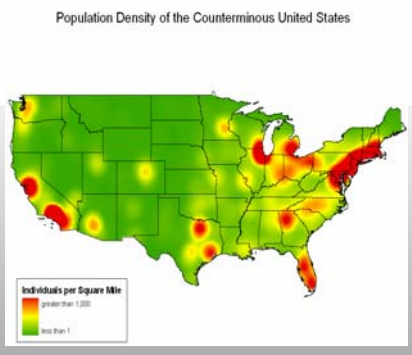
- Up to 80 direct union O&M jobs, and 200 indirect jobs for 25 years, $12.3 million in wages and salaries each year (direct and indirect jobs)
- $1.5 million in state and local taxes paid each year by employees (direct and indirect)

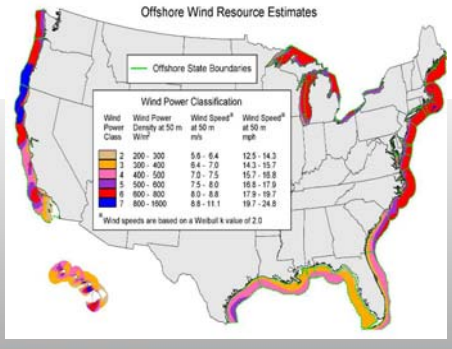
Regional Economic Benefits

- Local professional jobs
- Local union jobs
- Manufacturing jobs
- Maritime sector growth
- Tourism

Supply Aligned With Demand

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





Environmental Benefits

- No carbon contribution to global warming, ocean acidification
- No air pollution (SO2, NOx, mercury)
- No water pollution or sea level rise
- No CO2
- No waste
- No fuel deliveries
- No mining or drilling
- No intake/discharge of water for cooling
- No land use for generation equipment offshore
- On land wind is compatible with farming and ranching
- No noise pollution
- Promotes recreational/ commercial fishing with artificial reefs created by foundations

Offshore wind energy can reduce the need for electricity from polluting sources

Pollution avoided per year from a 600 MW offshore wind park

CO_2 (lbs)	1.8 billion
SO_X (lbs)	19.2 million
NO_X (lbs)	6.9 million

Source: Analysis based on data provided in 'Assessment of Delaware Offshore Wind Power', University of Delaware. Dhanju, Whitaker, Burton, Tolman, and Jarvis. September 2005.

Offshore wind answers our energy needs…

- Stable Priced
  - Avoids unknown future compliance costs associated with CO_2 limits and pollution regulations such as RGGI and Federal Carbon legislation
  - Price of wind electricity is stable over the life of a wind farm: Fixed up-front costs and *no* fuel costs and low, predictable O&M costs
- Increases Fuel Diversity
- Reduces Environmental Impacts
- Enables a state to become part of the solution to Global Climate Crisis

Wind power – energy security, fuel diversity

- Wind is a domestic energy source and inexhaustible
- "Fuel" is independent of market fluctuations and international politics
- The risk is low for complete power outages – since many small generators, not one big one, operate together
- Safest target from attack: half mile apart in open water, with no combustibles

Activities can continue around the turbines

- Boats are welcome in our wind parks, can maneuver freely inside of them
- Clearance from water surface to blade tip at "six o'clock" position is about 100 feet

Opportunities for the Great Lakes

Important Drivers for Offshore Wind

- **Policy**
  - Increasing number of states with RPS requirements
  - Potential national RPS in 2009
  - Long-term Production Tax Credits
- **Offshore Resources**
  - Stronger, more consistent winds near load centers
  - Decreased access to high wind land-based sites
  - Fewer wildlife barriers far offshore (avian and bat)
- **Market Signals**
  - Rising fossil fuel prices
  - Climate change considerations; emissions reduction requirements

Offshore Wind: Seizing the Opportunity

- 10 – 12 offshore wind projects projected by the end of 2009
- $15B - $18B opportunity
- 60% of project costs for turbine components sourced from Europe
- Immediate jobs can be created to lay the foundation for this industry
  - Electric grid upgrades
  - Port upgrades
  - Vessel construction
  - Turbine equipment manufacturing

Maintaining Wind Energy's Growth

Federal

- Extend PTC 10 years for offshore wind projects
- Extend DOE Grant Program for offshore wind projects beyond 2010
- Stimulus investments in ports, transmission lines, and manufacturing

State

- Establish a floor price for RECs generated by offshore projects
- Consider purchasing renewable energy for government facilities
- Clearly defined permitting process in the state

For Materials

- Today's presentation is available at (insert URL here)
- Additional background materials on Bluewater Wind are available at bluewaterwind.sharefile.com
  - State presentations, project summaries, etc.
  - Username greatlakeswind@yahoo.com, password windmill

For More Information On Offshore Wind Energy

- American Wind Energy Assoc: awea.org
- British Wind Energy Assoc: bwea.org
- Danish Wind Power Industry: windpower.dk
- Utility Wind Integration Group: uwig.org
- University of Delaware: www.ocean.udel.edu/windpower/

Thank You

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