

# Bringing the Benefits of Offshore Wind Power to Delaware

A photograph of an offshore wind farm at sunset. The sun is low on the horizon, creating a bright orange glow and a shimmering reflection on the water. Several wind turbines are visible, their silhouettes against the bright sky. A small boat is visible on the right side of the water.

Peter Mandelstam, President

Bluewater Wind

Rob Propes, Delaware Project Director

Bluewater Wind

# Offshore wind energy works

- Offshore wind turbines  
In Europe generate electricity 70-90% of the time
- Atlantic Coast has equal output capability, based on measurements off our coasts



# An Experienced Team

- Bluewater Wind
- Ramboll
- Fluor
- Ballast-Nedam
- Vestas
- AWS TrueWind
- SEAS
- A2SEA
- Downes Associates

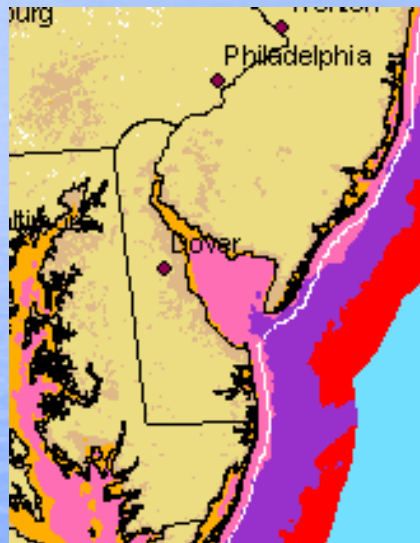
The Bluewater Wind project team has more cumulative experience in building offshore wind projects than any other assemblage of companies in the world. 21 of the 27 offshore wind projects in the world have been designed or built by this project team. Vestas has provided turbines for 64% of the world's offshore wind energy capacity.

# European offshore experience

- 15 years experience with offshore wind projects (since 1991)
- 25 projects operating in 8 countries; more under development
- No significant barriers identified



# Delaware's Renewable Energy Resource is Offshore Wind



Power Class	Wind Power (W/m <sup>2</sup> )	Speed*	
		(m/s)	(mph)
1	<200	<5.6	<12.53
2	200 - 300	5.6 - 6.4	12.53 - 14.32
3	300 - 400	6.4 - 7.0	14.32 - 15.66
4	400 - 500	7.0 - 7.5	15.66 - 16.78
5	500 - 600	7.5 - 8.0	16.78 - 17.90
6	600 - 800	8.0 - 8.8	17.90 - 19.69
7	>800	>8.8	>19.69
Three nautical miles			
At 50 m (164 ft)			
*Equivalent wind speed at sea level for a Rayleigh distribution.			

There is no significant opportunity for on-shore wind in the state.

# Offshore wind answers Delaware's energy needs...

- Stable Priced
- Increases Fuel Diversity
- Reduces Environmental Impacts
  - Helps to meet Delaware's RPS
- Enables Delaware to become part of the solution to Global Warming

# Fossil Fuel Volatility

DP&L Press Release - March 15, 2006

The proposed rate increases, announced on February 2nd, are due to significant increases in the cost of fuels used to generate electricity. Between 1999 and 2005, fuels used to generate electricity have increased significantly in price. Natural gas prices rose a total of 400 percent; fuel oil prices rose 300 percent; and coal prices rose 150 percent. In just one year, 2005, the price of fuel oil rose 76 percent and of natural gas, 67 percent.

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1 U.S. DOE/Energy Information Agency; U.S. DOL/Bureau of Labor Statistics

# Cost stability

- Stable-rate pricing can offer hedge against fuel price volatility risk
- Electricity from the wind is inflation-proof
  - High initial fixed cost, but low, predictable O&M variable costs
- Wind energy avoids unknown future costs of compliance with CO<sub>2</sub> limits and other pollution regulations



# Offshore wind can provide energy where it's needed most

- To growing shore communities
- By avoiding transmission bottlenecks
- By mitigating the need for the construction of new transmission lines
- All of the above can generate future savings for ratepayers

# Wind increases fuel diversity

- Domestic energy source
- Inexhaustible supply
- Low susceptibility to complete outages
  - Since many small generators, not one big one, operate at once
- “Fuel” is independent of market fluctuations and international politics

# Economic development

- 350+ Jobs to be created during construction
- \$1.5+ Billion investment
- Approx. 45 - 50 O&M jobs
- Clean, high-tech industry
- Onshore and offshore construction
- Trades, materials managers, vessel operators, equipment operators, and service businesses
- More energy dollars kept in Delaware



# Activities can continue around turbines

- No exclusion zone around wind project area
- Clearance from water surface to blade tip at “six o’clock” position is about 100 feet



# Environmental benefits

- No contribution to global warming
- No air pollution (SO<sub>2</sub>, NO<sub>x</sub>, mercury)
- No water pollution
- No CO<sub>2</sub>
- No waste
- No fuel deliveries
- No mining or drilling
- No intake/discharge of water for cooling
- No land use for generation equipment
- No interruption of commercial fishing
- Promotes recreational fishing with artificial reefs created by foundations

# Foundations create artificial reefs



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

## Pollution avoided each year from a 600MW offshore wind farm

CO <sub>2</sub> (pounds)	2,522,880,000
SO <sub>x</sub> (g)	12,929,760,000
NO <sub>x</sub> (g)	4,099,680,000

Source for pollutants avoided: Conservation News, a quarterly publication of the U.S. Environmental Protection Agency's Facilities Management and Service Division (FMSD) Conservation Information Clearinghouse, as reported on Alliance to Save Energy website

# Extensive studies of birds at European projects have found no significant problems

Observation platform

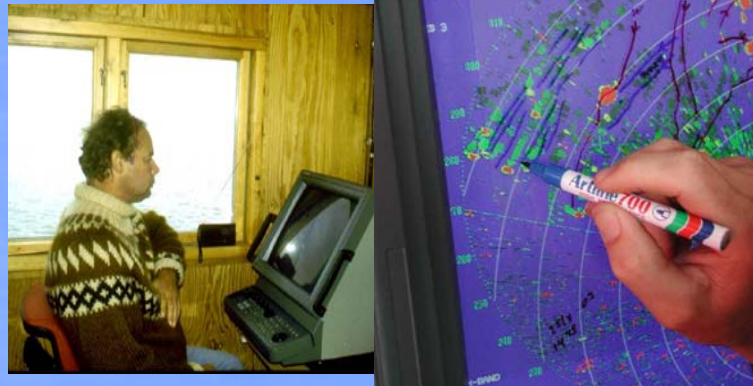


Aerial surveys

Infrared camera



Radar

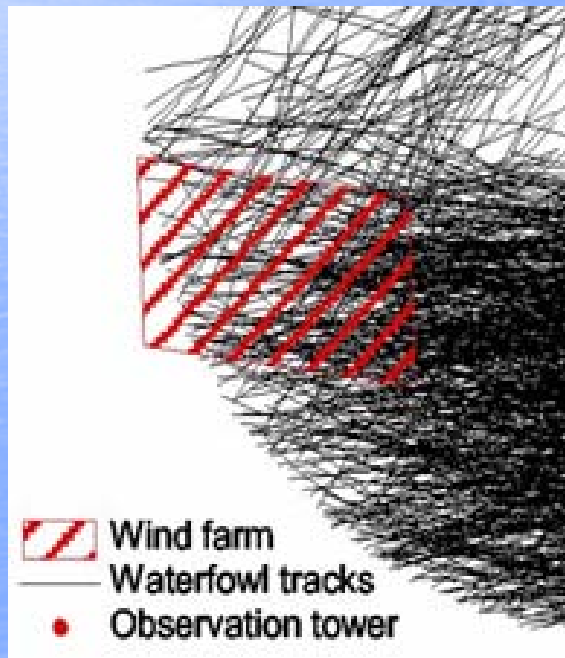




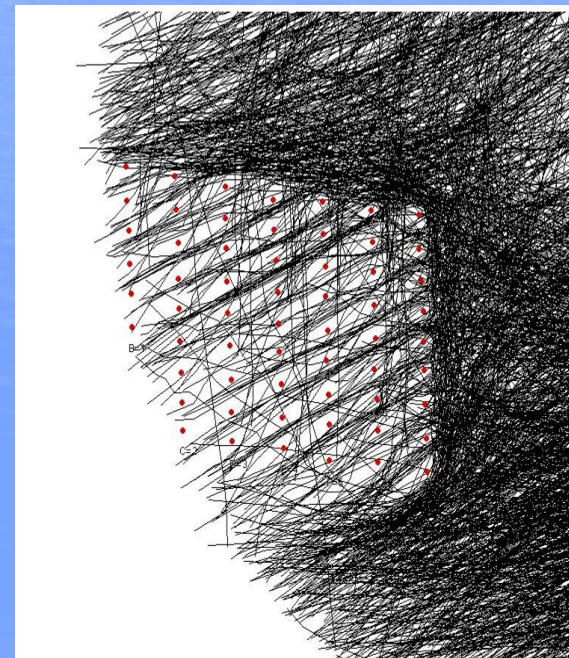
# Studies show birds avoid wind turbines

## Radar tracking of bird flights

Before construction



After construction



# Avian Evaluations

- 8-year study on two Danish offshore wind parks estimated the bird mortality at one bird per turbine per year
- On land, bird strikes are estimated at 2.3 birds, per turbine, per year
- Bluewater will work with state and federal agencies as well as local avian organizations to design a comprehensive study that will evaluate flight patterns, feeding, nesting, and migration during all four seasons

# In comparison...

"Efforts to make turbines safer for birds seem to be working. According to a 2003 study of 4,700 turbines located outside California, each killed 2.3 birds per year. That's a tiny number compared with the hundreds of millions of birds that fall prey to cats every year, or the 4 million, at a minimum, that collide with communication towers. And it pales in comparison to the number of birds and other creatures that would be killed by catastrophic global warming."

-Bill McKibben

Jan/Feb 2007 issue of *Sierra*, "Energizing America".

# Approval Process

## Federal, State & Local Reviews

- Federal Regulations and Reviews

- Energy Policy Act 2005
- Coastal Zone Management Act of 1972
- Rivers and Harbors Acts of 1890 and 1899
- Clean Water Act of 1977
- Navigation and Navigable Waters
- Federal Aviation Administration
- National Environmental Policy Act
- Archaeological and Historic Preservation Act of 1974
- Fish and Wildlife Coordination Act of 1958
- Endangered Species Act of 1973
- Estuary Protection Act
- Marine Protection, Research, and Sanctuaries Act
- US Coast Guard
- Marine Mammal Protection Act
- Magnuson-Stevens Conservation and Management Act
- Migratory Bird Treaty Act
- Abandoned Shipwreck Act
- Approval for Private Aids to Navigation

- Local Authorities

- To be participant in NEPA/State review
- Municipalities with potential visible impacts
- Local communities transited by onshore cable route
- Building permits as required

- State Regulations, Permits & Approvals

- DNREC- State Environmental Review (associated with NEPA)
- Coastal Zone Act Status Decision
- Coastal Zone Act Permit
- Coastal Federal Consistency Certification
- Subaqueous lands permits and leases
- Wetlands permit
- Section 401 Water Certification
- NPDES Storm Water Permit
- Air Quality Permits
- DNREC- Div. of Fish and Wildlife
- DNREC- Div of Parks and Recreation
- Beach Preservation Act of 1972
- Delaware PSC
- DE River Basin Commission
- DE Heritage Commission
- DE Economic Development Office
- DE Energy Office
- DeIDOT

# Well-sited projects will be very difficult to see from shore

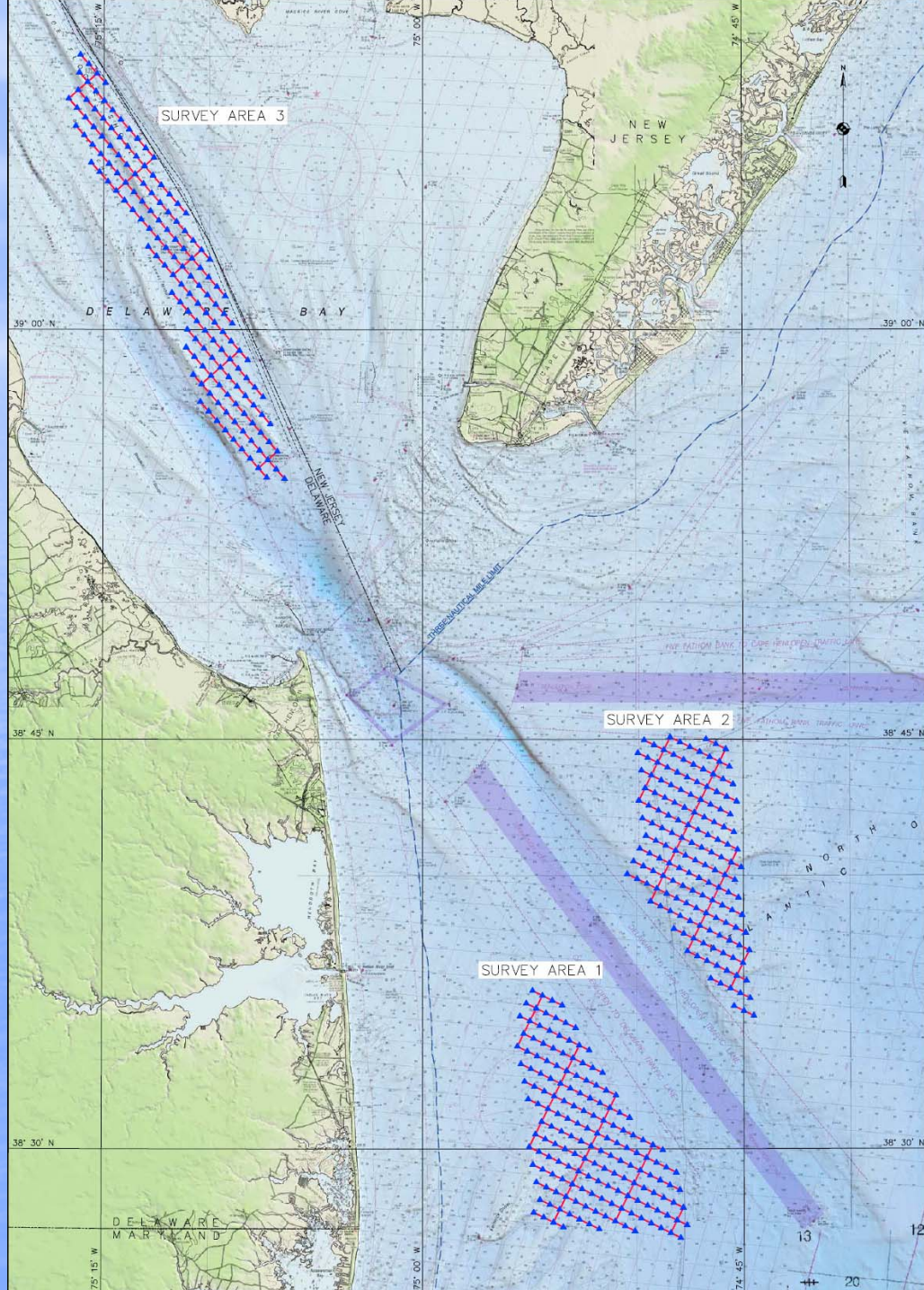
- Closest turbine to shore will be six nautical miles (6.9 “highway” miles) from ocean sites, and 6 “highway” miles from Bay site
- Closest turbine to the Rehoboth Boardwalk is 12.7 statute miles and 7.1 statute miles to Bethany’s Boardwalk.

# Bluewater Wind is committed to a project that...

- Responds to desires of Delawareans for stable priced, clean power
- Keeps more of Delaware's energy dollars in the local economy
- Gives Delaware good choices

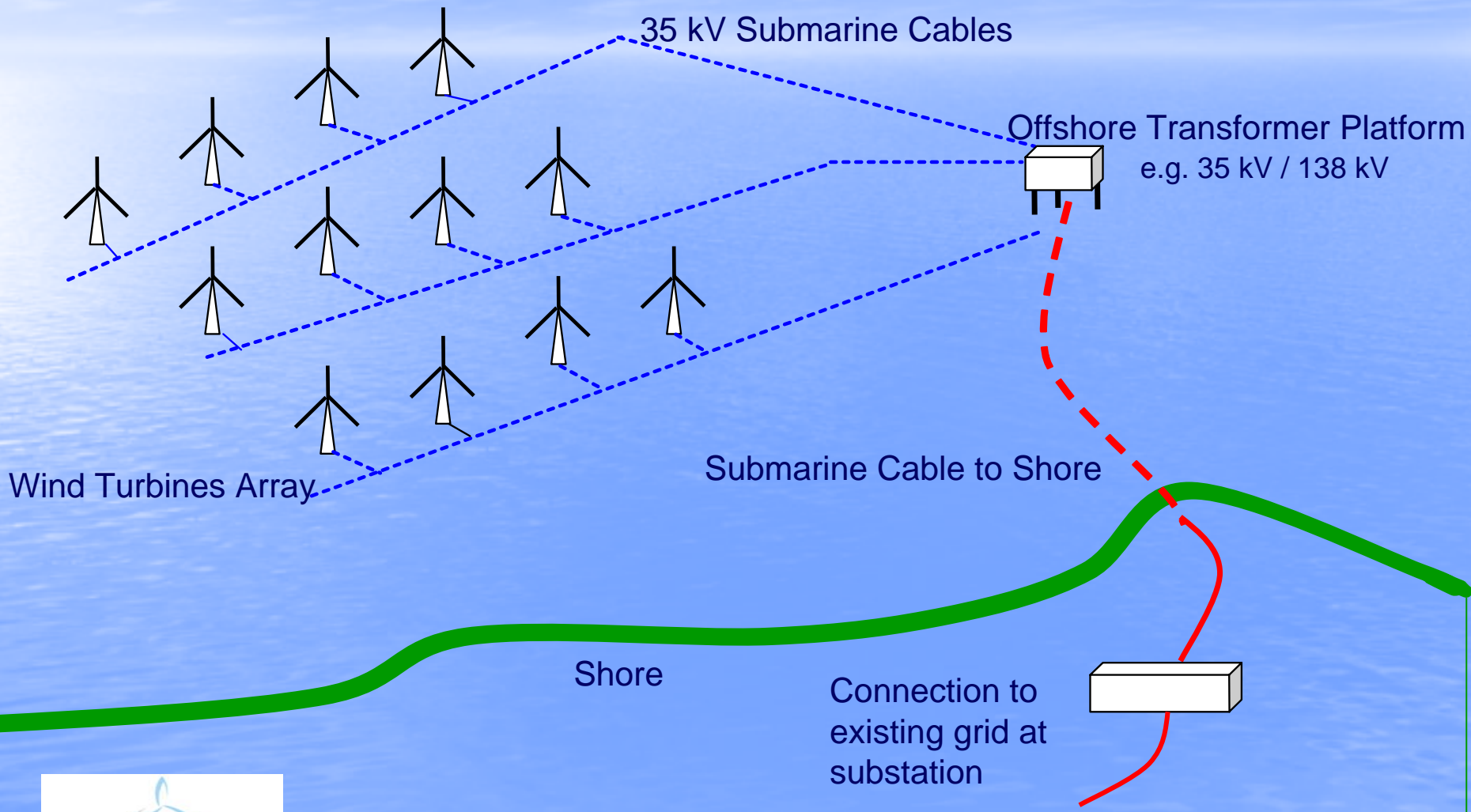
# Bluewater listens and responds to the public and stakeholders

- Extensive outreach and listening campaign underway
- Committed to being welcomed by the community, not simply “permitted”





# Offshore electrical design



# Project phases

- Development, planning and design
  - Including initial environmental impact assessment
  - Interconnection with grid
- Construction and installation
- Operation & maintenance
- Decommissioning
- All of these costs are factored into price of electricity



# Staging turbines onshore



# Assembling rotors onshore



# Monopile hammer



# Special installation vessel

## Provides stable work platform



# Loading the jack-up barge



# Delivering and installing turbines

Multiple trips required to/from staging area





# Installing transition piece between tower and foundation



# Lowering transition piece



# Preparing to lift a rotor



# Lifting a rotor at night





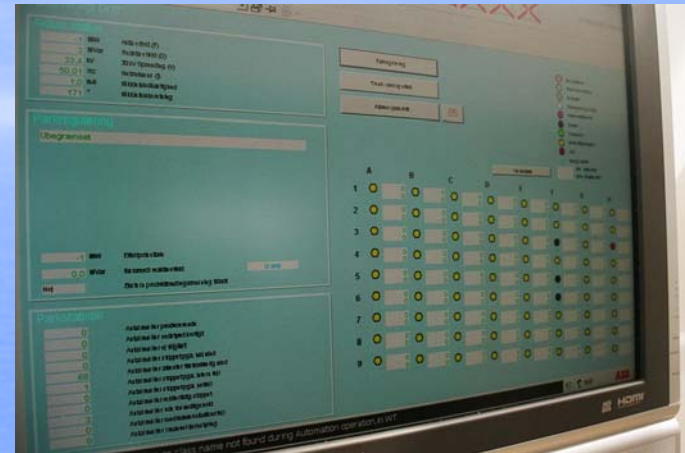
# Installing a transformer platform





# Operations and maintenance

- Vestas Offshore will perform scheduled O&M on the turbines for the first 5 years with warranties and guarantees
- Fluor will perform O&M on the foundation, cable, and onshore and offshore substations for the first 5 years







# For more information on offshore wind energy

- American Wind Energy Assoc. - [awea.org](http://awea.org)
- British Wind Energy Assoc. - [bwea.org](http://bwea.org)
- [Windpower.dk](http://Windpower.dk)
- Utility Wind Integration Group - [uwig.org](http://uwig.org)
- [www.ocean.udel.edu/windpower/](http://www.ocean.udel.edu/windpower/)

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