Powering Ohio’s Economy with Offshore Wind

First in the Water, First in Jobs

The Cleveland Foundation - NorTech - Cleveland - Ashtabula - Lake - Lorain - Cuyahoga
2009 U.S. Electricity Generation by Source

- Coal: 44.9%
- Natural Gas: 23.4%
- Nuclear: 20.3%
- Hydroelectric Conventional: 6.9%
- Other Renewables: 3.6%
- Petroleum: 1.0%
Ohio & Wind Energy History

• Charles F. Brush
  • Born in Euclid, Ohio
  • In 1887, he created world's first wind-powered electric generator in Cleveland.
  • 144 blades, 50-ft. Rotor = 12 kilowatts
  • Brush’s company was sold and eventually became General Electric.

• NASA Glenn Research Center
  • Located in Brook Park, Ohio
  • Turbine development paved the way today
  • 3.2 MW turbine in Hawaii
  • Program eventually divested.

Question: “So where did Ohio’s turbines go?”
Europe:
- 2,500+ MW in operation
- $100 BB in projects planned
- Manufacturing is growing
- Ports are being converted
- Jobs are being created
- Export of IP & expertise

Asia:
- $30 BB Investment in Wind
- Using European experience & dramatically driving costs down
Formerly a region of high-unemployment, the German port of Bremerhaven has experienced a remarkable economic upturn, transforming into a major offshore wind power know-how centre and more.

At least four of Germany’s North Sea and Baltic Sea major ports have been transformed into the country’s main wind industry logistical centres and/or equipment manufacturing/supply bases during the past few years.

'Of the €500 million invested for offshore wind power development along the German North Sea coastal region during the past years, about half came to Bremerhaven.'
European Success = Asian Dominance

- Asia Plans domination by 2015
  - Sinovel Plans to be #1 by 2015
  - 9X Total American Wind Energy
  - Investment is Staggering
    - $20.5 Billion
    - $10 Billion (49%)

- Econ 101
  - The Technology is Proven
  - Sales to North & South America = Profits at Home
  - Drives Manufacturing and Jobs at Home

South Korea plans offshore wind project
South Korea plans to build an $8.2 billion offshore wind farm in the Yellow
Great Lakes Wind

Gross GW Potential (no exclusions)

700+ GW = 700 Coal/Nuclear Plants
Approx. Equals US Electrical Usage

Cleveland
Timeline

Cleveland Foundation funds anemometer on the City of Cleveland water intake crib 3.5 miles offshore.

2004

Cleveland Foundation Vision for an Ohio driven Lake Erie offshore wind industry.

Task Force proposes offshore wind as a regional economic development engine, calling for a Feasibility Analysis.

2005

Cuyahoga County forms Great Lakes Energy Task Force to promote advanced energy in Ohio.

2006

Feasibility Analysis is completed, confirming environmental and technical viability of offshore wind in Lake Erie.

2007

LEEDCo is formed as the vehicle to advance Ohio's offshore wind energy initiative.

2008

SC2019 Advanced Energy Generation Initiative

2009

GE selected as turbine partner

2010

Bechtel/GEWE/Cavallo selected as developer

Economic Impact Study by Kleinhenz Associates

2011

Avian Radar/Bat Survey

Geophysical Survey

Basic Fisheries Survey

Shipwreck Survey

2012

Comence construction on initial five-turbine, 20 MW wind project.

2020

1000 MW in Lake Erie

Ohio becomes hub for a Great Lakes offshore wind industry.
Regional
Public/Private
Private Investment

It’s the Jobs
Offshore Epicenter
20 MW Pilot Project

Lake Erie Energy Development Corporation

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<th>Turbine Partner</th>
<th>“Freshwater Wind”</th>
<th>Research Partners</th>
<th>Strategic Advisors</th>
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First Offshore Project
• In Lake Erie/Great Lakes

Develop Infrastructure
• Ohio Captures Majority of Jobs

Maximize Opportunity
• Ohio Becomes Epicenter
Kleinhenz impact study sponsored by NorTech shows thousands of jobs just from Ohio projects.
Ohio Currently...

- Ohio Already a Leader in Onshore Wind
- 7,500 Wind Manufacturing Jobs
- World Class Manufacturing Strengths
Ohio Ports Can Dominate

Large scale construction

- Initial Project fabrication & staging can be in Cleveland
- Jobs for 100’s of Clevelanders
- Later Projects will Employ 1000’s of Ohioans
...But There’s More in Offshore
Lake Erie’s Current Project

- Collaborative Process
- Consensus Building
- Lease Option – 9 nm²
- Project Size – 3 nm²
- Lease Process in Place
- Defined Path Forward
Offshore Nacelle
Offshore Turbine Blade
Offshore Wind Construction
QUESTIONS?

Need More Information?
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lwagner@leedco.org
Foundations
Gravity Foundation
Offshore Nacelle
Offshore Substation
Where Europe is Headed

Oceans of opportunity
Harnessing Europe’s largest domestic energy resource
Offshore Wind Construction
Offshore Wind Crew Transport
Offshore Wind Subsea Cabling
Current Cost of Offshore Wind

Trade-off:
- Small scale positions Ohio as first
- Small scale means higher price power
- In the balance “first” wins the jobs race

Cleveland Demonstration Project lands in this range – consistent with the current generation small scale projects
US Power Prices

U.S. Retail Average = 9.90 ¢/kWh
The Vision

Delivered Power Cost ($/MWh)

- Offshore Wind
- Regional Peaking Power
- Least Expensive Fossil Fuel Power

Costs are expected to reduce dramatically due to technology, manufacturing, and installation efficiency.

Target Zone
Environmental Risks (physical/biological)

- Seabed sediments
- Scour pits
- Riparian and coastal processes
- Seabed contamination
- Water and air quality
- Protected sites and species
- Benthic ecology
- Fish and shellfish/ Fisheries
- Birds

- Marine mammals and bats
- Cables and pipelines
- Military activities
- Disposal areas
- Electronic and magnetic fields
- Onshore grid connection
- Noise and vibrations
- Cumulative risks
- Climate change
- Decommissioning
Human Risks

- Worker health and safety
- Integrity of shoreline communities
- Tourism and recreation
- Aesthetics
- Cultural/historic views
- Property values
- Conflicting uses/accidents
- Shipping and navigation

- Noise
- Radar/radio disturbances (military/commercial uses)
- Transmission lines
- Electromagnetic fields
- Marine archaeology
- Cumulative risks (e.g., air quality)
Risk = Context

Subject To: regulations, expert opinions, and politics

- MMS Guidelines and NEPA compliance (data/procedures)
- Thresholds of adverse impact
- Public hearings
- Regulatory triggers, e.g., threatened and endangered species
- Joint permitting process
- Utility corridors
- Exclusion zones/GIS mapping *(ODNR a leader in Great Lakes)*
A Framework for Integrated Risk Analysis of Wind Energy

Risk Characterization and Uncertainty Analysis

Comparative Analysis

- Risk Communication
- Risk Research Prioritization
- Siting Strategy
- Risk Monitoring & Management
- Policy Issues
  - Tax Credits
  - Subsidies
Fill in Knowledge Gaps

- Validate wind resource assessments (Cleveland Crib/NREL)
- Initiate integrated risk analysis
- Establish knowledge base for comparative risks/benefits
- Designate renewable energy zones where demand
  - Wind Energy Areas – Smart from the Start (BOERME)
- One-stop shop for permitting/lease fees
- Finance baseline studies/research priorities
- Sustained public dialogue
Domestic Offshore Wind

What does this mean for Ohio?
• Sputnik moment…
• Ready or not: Offshore wind industry is coming
• Urgency: Race is on to capture economic benefits
• Utilize momentum to be first in the water

Select Great Lakes Projects*
- MI – Scandia Wind – 150 MW
- NY – NYPA – 100-500 MW
- WI – Aquilo Wind – 50 MW
- IL – Evanston – 200 MW
- OH – LEEDCo/Freshwater Wind – 20 MW
- OH – LEEDCo/Freshwater Wind – 1,000 MW

Select East Coast Projects*
- MA – Hull - 15 MW
- MA – Cape Wind – 468 MW
- RI – Deepwater Wind/Block Island – 30 MW
- RI – Deepwater Wind/RI Sound – 385 MW
- NY – Con Ed/LIPA – 350/700 MW
- NJ – Fishermens Energy Atlantic City – 20 MW
- NJ – Fishermens Energy Federal Waters – 350 MW
- NJ – Garden State Offshore Energy – 350 MW
- NJ – NRG Bluewater Wind – 350 MW
- DE – NRG Bluewater Wind – 300-450 MW
- VA – APEX Wind – 1,200 MW
- VA – Seawind Renewable Energy – 1,000 MW
Current Lake Erie Activity

- Canada - 4,500 MW ~1500 Turbines
- New York – 500 MW ~150 Turbines
- Penn. – 1000 MW ~ 300 Turbines

Ohio’s ports are ideally suited for serving the industry – maritime & logistics jobs

50% of Canadian projects content can be outsourced – manufacturing & engineering jobs
Ohio Positioned to Win

- Regulatory Leadership
  - ODNR
  - USACE
- Manufacturing Strengths
- Collaborative Process
- Consensus Building
- Active R&D Institutions
- Private Investment

Bird Habitat - Bird Migration - Distance from Shore - Fish Habitat
Industry & Restricted Areas - Lakebed Sediments - Shipping - Shipwrecks,
Development Plan Outcome

Initial Project – Start Small

- Implementation is More Predictable
- Guidance for Next Projects

Commercial Scale – Think Big

- 1 nm Spacing is Typical
- Turbines 10 – 15 nm Offshore

Located in favorable areas per ODNR suitability
Why Offshore Wind?

- Energy production potential is immense
  - Great Lakes region has wind production capacity to satisfy U.S. demand
- Proximity to major population centers
- Stronger and steadier than land-based winds
- Large-scale, virtually “out of sight” projects
  - Voids noise & aesthetics issues surrounding land turbines

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<tr>
<th>Depth</th>
<th>Lake Erie</th>
<th>All Great Lakes</th>
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<tr>
<td>&lt; 20 m</td>
<td>44 GW</td>
<td>151 GW</td>
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<tr>
<td>20-30 m</td>
<td>21 GW</td>
<td>58 GW</td>
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<tr>
<td>30-40 m</td>
<td>3 GW</td>
<td>40 GW</td>
</tr>
<tr>
<td>Total &lt; 40 m</td>
<td>68 GW</td>
<td>249 GW</td>
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LEEDCo has:
1. Created political momentum behind job creation
2. Completed many development activities.

Development inroads that have greatly accelerated the ability to build the project include:

- 4 years of Meteorological data
- Avian Studies
- Benthic Studies
- NEPA consultations
- Agency Consultations
- Vessel negotiations
- Political momentum to secure rate-based PPAs with power offtakers
- Agreement to socialize cable costs
- MOUs with Counties on agency to offer submerged leases
- MOU with GE regarding turbine supply and manufacturing

Bottom Line: LEEDCo’s activities have accelerated development by 2 years