Virginia Offshore Wind Port Readiness Study

Briefing to

Virginia Offshore Wind Development Authority

Richmond, VA

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Port Evaluation Study Motivation

Domestic Manufacturing Impact on Offshore Wind Costs

“The greatest upside opportunity for reducing the cost of offshore wind energy in Virginia is to attract major elements of a Mid-Atlantic offshore wind supply chain to the state.”

VIRGINIA COASTAL ENERGY RESEARCH CONSORTIUM, 2010. VIRGINIA OFFSHORE WIND STUDIES, JULY 2007 TO MARCH 2010, FINAL REPORT. 67 PP.

Scale of Economic Opportunity (see backup slides)

- Foundation substructures: 3,300 direct jobs to supply VA, MD, DE, and NJ Wind Energy Areas for a decade
- Wind turbines & towers: for same market, at least 1,000 direct and 4,000 indirect jobs for a decade

Timing of Economic Opportunity (see backup slides)

- Study must be completed mid-2015 for recommended sites to be ready for supplying Virginia WEA by mid-2020
Primary objective: to evaluate the general readiness of Virginia’s waterfront sites (VEDP value proposition)

Secondary objective: to develop waterfront site build-out scenarios for producing and staging various specific offshore wind components

- wind turbines & towers
- foundation substructures
- offshore substation platforms
- submarine power cables
RFP Primary Sites (Potential Staging Areas)

<table>
<thead>
<tr>
<th>Site Name</th>
<th>Total Site Area (ac)</th>
<th>Largest Contiguous Parcel (ac)</th>
<th>Quay Length (ft)</th>
<th>Approximate Alongside Depth (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portsmouth Marine Terminal</td>
<td>50</td>
<td>50</td>
<td>4500</td>
<td>43</td>
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<tr>
<td>Newport News Marine Terminal</td>
<td>43</td>
<td>43</td>
<td>1100 ; 970</td>
<td>33 - 35</td>
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<tr>
<td>Norfolk Southern Lamberts Point</td>
<td>25</td>
<td>25</td>
<td>700-1000</td>
<td>36</td>
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<tr>
<td>Port of Cape Charles south shore</td>
<td>20</td>
<td>20</td>
<td>250</td>
<td>18</td>
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Legend:
- Virginia Wind Energy Area
- State / Federal 3-nmi Boundary
- Vessel Traffic Separation Scheme
- Fixed/Lift Bridges
- Potential Sites
- Potential Sea Routes
- Construction services port
- DMME Research Lease 1 for remote monitoring of commercial lease area
- DMME Research Lease 2 for two demonstration turbines
RFP Secondary Sites (Potential Manufacturing)
<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>10 Nov 2014</td>
<td>RFP issued</td>
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<td>10 Dec 2014</td>
<td>Proposals due</td>
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<td></td>
<td>(two received and reviewed)</td>
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<tr>
<td>Third week Dec 2014</td>
<td>Scoring completed and selection made</td>
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<tr>
<td>14 Jan 2015</td>
<td>Kick-off meeting</td>
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<td>Fourth week Feb 2015</td>
<td>Team site visits in Hampton Roads</td>
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<td>10 Mar 2015</td>
<td>Interim review meeting #1</td>
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<td>23 Apr 2015</td>
<td>Interim review meeting #2</td>
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<tr>
<td>24 Apr 2015</td>
<td>Meetings with Port, Maritime Association, shipyards</td>
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<tr>
<td>by 31 July 2015</td>
<td>Final report published</td>
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Thank You!

Any questions?

Email: hagerman@vt.edu
Scale of Economic Opportunity
Total Offshore Wind Potential Capacity in the “Smart from the Start” Mid-Atlantic WEAs

Assumes NREL 5 MW reference offshore wind turbine with 126 m diameter rotor, and 20 turbines per whole lease block, which represents a capacity density of 4.34 MW per square kilometer and 11,400 MW of total potential.

Ormonde project (next slide) uses turbines nearly identical to the NREL 5 MW reference turbine, but is four times more densely packed, with 30 x 5MW turbines and a project area of 8.7 sq. km, representing a capacity density of 17.2 MW per square kilometer.

Thus our estimate of total offshore wind potential in the NJ, DE, MD and VA WEAs is very conservative.
Project capacity = 150 MW (30 x 5 MW REpower turbines)
Mid-Atlantic total potential capacity with same turbine would be 11,400 MW
or 76 Ormonde Projects (2,280 turbines & 2,280 jacket foundations)

Sources:  http://www.vattenfall.co.uk/en/ormonde.htm
www.4coffshore.com/windfarms/ormonde-united-kingdom-uk17.html
Jackets for Mid-Atlantic WEAs Equivalent to 3,300 Direct Steel Fabrication Jobs for a Decade

Steel Weights in Ormonde Foundations
PIN PILES: 4 piles per jacket x 75 metric tons each
PRIMARY STEEL: 450 metric tons per jacket
SECONDARY STEEL: 50 metric tons per jacket

Steel Fabrication Unit Labor Estimates
PIN PILES: 10 hours per metric ton
PRIMARY STEEL: 50 hours per metric ton
SECONDARY STEEL: 100 hours per metric ton

Steel Fabrication Total Labor Estimates
PIN PILES: 3,000 hours per jacket
PRIMARY STEEL: 22,500 hours per jacket
SECONDARY STEEL: 5,000 hours per jacket

30,500 hours per jacket x (30 jackets for Ormonde project) x 76 Ormonde-equivalent projects in Mid-Atlantic WEAs = 69,540,000 direct hours or 33,430 direct job-years
Jacket Foundations for Mid-Atlantic WEAs Equivalent to Structural Steel Weight of \(~38\) CVNs

**Total Steel in two Ormonde Projects**

\(\text{PIN PILES + PRIMARY STEEL + SECONDARY STEEL} = 800\) metric tons per jacket \(\times 30\) jackets per project

\(= 24,000\) metric tons per project \(\times 2\) such projects

\(= 48,000\) metric tons (47,240 long tons)

**Foundation steel for two Ormonde Projects equivalent to one Nimitz-class nuclear aircraft carrier (CVN)**

- **Nimitz-class Nuclear Aircraft Carrier (CVN)**
  - 47,000 long tons of structural steel

Source: [www.dailypress.com/news/dp-cvn77-01,0,5744629.htmlstory](http://www.dailypress.com/news/dp-cvn77-01,0,5744629.htmlstory)
Four new plants to supply Alstom’s 1,400-MW French tender award, producing 100 turbines per year, will create 1,000 direct jobs and 4,000 indirect jobs.
Timing of Economic Opportunity
Virginia WEA Leased One Month after RI-MA AMI

Deepwater commercial lease effective date: 01 Oct 2013

Dominion commercial lease effective date: 01 Nov 2013
Finding of No Significant Impact for Mid-Atlantic Offshore WEA Lease Issuance and Site Assessment

Assumptions:
- Non-competitive lease issuance (add an additional two years to process if competitive interest determined)
- Timely regulatory review & coordination
- Other state & local permits reviewed and approved in parallel
- EIS required for lease issuance (minimum 24 months to complete) (if EA accepted, could take 12 months)
- EIS is needed for COP & it takes 24 months to complete
- Developer met construction & equipment procurement not delayed
- No major changes to SAP or COP need to be addressed based on review

Concurrent Activity:
- Met installation
- Resource assessment
- State & local permitting
- FERC approvals
- Baseline surveys
- CZMA review
- Coordination and consultation with federal and state agencies

Construction Start mid-2019 (or mid-2020 if EIS takes 36 months)

5 (or 6) years of site assessment – from 01 May 2014 through mid-2019 (or mid-2020 if EIS takes 36 months)

VA lease effective date 01 Nov 2013

Add 2 to 3 years for construction of first 500 – 600 MW phase & achieving full Phase I power
For **Lease Effective Date** of Oct or Nov 2013, as in RI-MA or VA, the earliest possible offshore construction start would be **mid-2019** (or **mid-2020** if COP environmental review takes 36 months)

UK Round 3 timeline reflects a supply chain that has evolved through two prior rounds of project development, while no US supply chain now exists.
Prudent Commercial Project Development Should be Informed by VOWTAP Experience

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<tr>
<td>VOWTAP Phase 1</td>
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<td>February</td>
<td>May</td>
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<td>DMME Research Lease 2 Application</td>
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<td>February</td>
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<tr>
<td>BOEM Research Lease 2 RFI</td>
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<td>August</td>
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<td>DMME Submits General Activities Plan for RL2</td>
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<td>November</td>
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<td>VOWTAP Phase II-Phase V</td>
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<td>May</td>
<td>December</td>
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<td>Test Turbines Deployed Adjacent to WEA</td>
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<td>June - December</td>
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<td>5-year Post Construction Monitoring and Data Gathering</td>
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<td>January 2018 - December 2022</td>
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<td>BOEM Issues Call for Info &amp; Nominations</td>
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<td>February</td>
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<td>DMME/BOEM Regional Ocean Survey (Fugro Atlantic)</td>
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<td>May - June</td>
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<td>BOEM Lease Auction</td>
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<td>Lease &amp; Development Activities</td>
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<td>October</td>
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<td>RFPs, Approvals, Supply Lead Time and Construction</td>
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At least one year VOWTAP operating experience needed to effectively inform commercial project engineering & design.
New Bedford Commerce Marine Terminal: Five Years from Evaluation Report to Completion


Feb 2010: Massachusetts Clean Energy Center port survey final report issued, recommending expansion of South Terminal at the Port of New Bedford

Nov 2012: Project environmental approval

Dec 2012: Solicitation of bids to construct

May 2013: Groundbreaking

Dec 2014: Completion, 28 acres ready for tenant occupancy

TOTAL COST: $113 million

See overview video at www.youtube.com/watch?v=-_iaJEfQ4Vw and photo sequences at www.flickr.com/photos/mass_cec/sets/72157633230120194
New Bedford Commerce Marine Terminal:
Site Aerial Photo Looking East, 30 July 2013

Source:  www.flickr.com/photos/mass_cec/sets/72157633230120194
New Bedford Commerce Marine Terminal: Site Aerial Photo Looking East, 10 July 2014

Source: www.flickr.com/photos/mass_cec/sets/72157633230120194
New Bedford Commerce Marine Terminal:
Site Aerial Photo Looking East, 06 January 2015

Source: www.flickr.com/photos/mass_cec/sets/72157633230120194