

Activity Area: Offshore Wind R&D

2019 Wind Program Peer Review

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April 30 – May 2, 2019



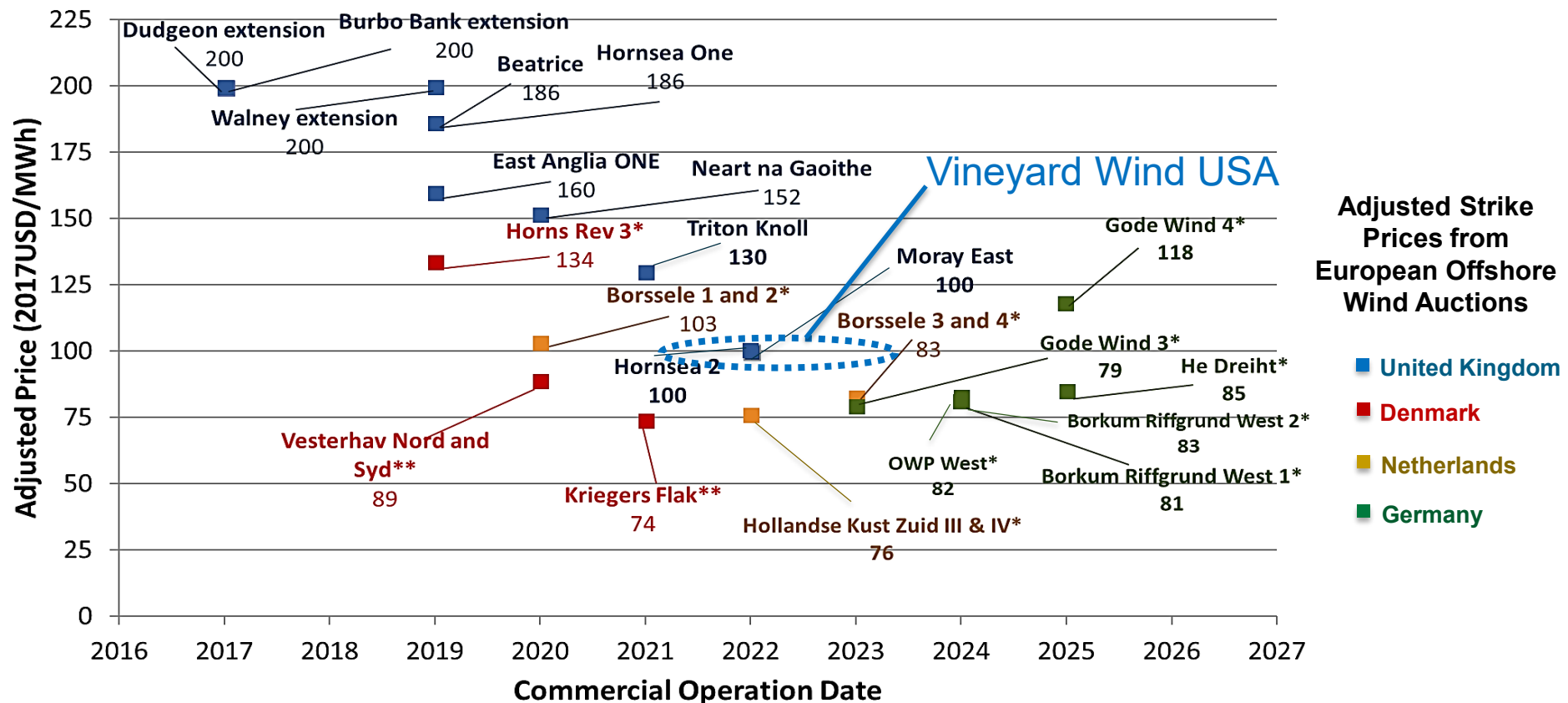
Wind Office Strategic Priorities

Clean, low-cost wind energy options nationwide

| | Land-Based Wind | Offshore Wind | Distributed Wind |
|---|--|--|-------------------------------------|
| Technology Development & Scientific Research | Atmospheric Science & Wind Plant Systems Engineering | Atmospheric Science & Wind Plant Systems Engineering | Atmospheric Science |
| | Standards and Certification | Standards and Certification | Standards and Certification |
| | Technology Innovation | Technology Innovation | Technology Innovation |
| | World Class Testing Facilities | World Class Testing Facilities | |
| | Tech to Market Commercialization | Tech to Market Commercialization | |
| | Integrated Systems Design | Integrated Systems Design | |
| | | Offshore Specific R&D | |
| | Advanced Technology Demo Projects | | |
| Market Acceleration & Deployment | Advanced Grid Integration | Advanced Grid Integration | Advanced Grid Integration |
| | Workforce and Education Development | Workforce and Education Development | Workforce and Education Development |
| | Stakeholder Engagement | Stakeholder Engagement | Stakeholder Engagement |
| | Environmental Research | Environmental Research | |
| | Siting & Wind Radar Mitigation | Siting & Wind Radar Mitigation | |
| Analysis & Modeling | Evaluate and Prioritize R&D | Evaluate and Prioritize R&D | Evaluate and Prioritize R&D |
| | Model Development and Maintenance | Model Development and Maintenance | Model Development and Maintenance |
| | Techno-economic Analysis | Techno-economic Analysis | Techno-economic Analysis |
| | Electricity Sector Modeling | Electricity Sector Modeling | Electricity Sector Modeling |

Context: Falling Global Offshore Bid Prices

Industrialization, volume, and optimism about technology are driving falling EU (and now U.S.) procurement prices – but continued R&D is crucial to actual project economics



Context: U.S. - Specific Offshore Challenges




Steep learning curve required –
European solutions may not be optimal or appropriate to:

- Challenging physical conditions – e.g. hurricanes, ice, geophysical characteristics
- Available vessels and Jones Act restrictions
- Supply chain, port infrastructure and workforce training needs
- Permitting processes and state or federal regulations
- Wildlife considerations, visual impacts and potential marine use conflicts
- Deep water – nearly 60% of the offshore wind resource in the U.S. is in deep water, nearly 100% on Pacific Coast



National Offshore Wind Strategy (DOE & DOI)

- Issued jointly with BOEM in 2016 as an update of 2011 strategy; input from industry, states and other stakeholders
- Roadmap of actions supporting responsible development of a robust and sustainable offshore wind industry in the U.S
- Over 30 DOE and DOI initiatives to address 7 action areas; three strategic themes

| Strategic Themes | Action Areas |
|--|--|
|  <p>Reducing Technology Costs & Risks</p> | <ol style="list-style-type: none"> 1. Offshore Wind Power Resource & Site Characterization 2. Offshore Wind Plant Technology Advancement 3. Installation, Operation & Maintenance, & Supply Chain Solutions |
|  <p>Supporting Effective Stewardship</p> | <ol style="list-style-type: none"> 4. Ensuring Efficiency, Consistency & Clarity in the Regulatory Process 5. Managing Key Environmental & Human Use Concerns |
|  <p>Improving Understanding of the Benefits of Offshore Wind</p> | <ol style="list-style-type: none"> 6. Offshore Wind Electricity Delivery & Grid Integration 7. Quantifying / Communicating the Costs and Benefits of Offshore Wind |



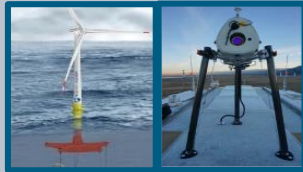
Key Offshore Projects Over Time

Major WETO Offshore Technology Development Investments and Actions

World-Class Test Facilities
FY09



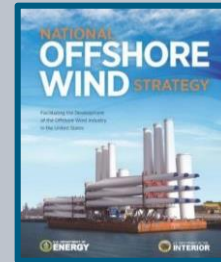
Initial Offshore R&D Funding
FOA 415 (FY11-12)
19 awards



Deployment of 1:8
Scale VoltturnUS
(FY13)



National Offshore Wind
Strategy (FY16)



FY 17 – FY 18

Final FOA 415
Projects Completed
Launch of Buoy Loan
Program

Demo Projects
Continued

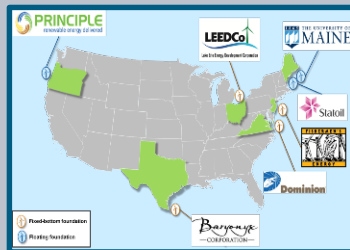
Multi-Year
Program Plan
(FY19)

Buoy Upgrades,
Acceptance
Testing,
Deployment
(FY19)

Funding
Opportunity
Announcement
(FY19+)



National Offshore Wind
Strategy (FY11)



Advanced Technology
Demonstration Projects
FOA 410 (FY12–FY21)



DOE Procures and
Deploys Metocean
Buoys (FY14)

Offshore Wind
Consortium
Established

Offshore Wind Test
Facilities RFI



Deployment and
Operation of the
Demo Projects
(FY21+)

Offshore Wind Advanced Technology Demonstration Projects – Brief History

Objective: Reduce Cost and Risks of Offshore Wind Development

2013 - Seven Projects

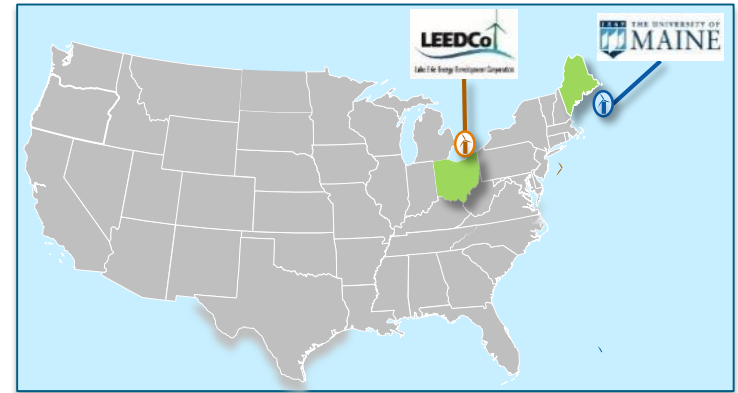
- Regionally and technologically diverse
- Down-Select based on progress and technical viability

2014 – Five Projects (three projects, two alternates)

- Goal: 100% FEED, vendor quotes, installation and O&M, completion of NEPA, regulatory and interconnection requirements
- Go/No-Go based on progress to accomplishing goals, including power purchase agreement

2017 – Two Projects

- Goal: Fabrication, installation and commissioning of the project by 2022; environmental and performance data collection 5-years beyond project completion
- Regular Go/No-Go decision points



Current Portfolio

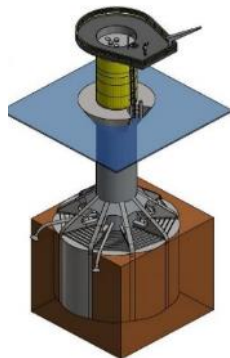
University of Maine

- Monhegan, ME
- 12 MW project, 2 turbines
- Floating concrete semi-submersible to handle deepwater offshore wind resources



LEEDCo

- Cleveland, OH
- 20.7 MW project, 6 turbines
- Monobucket (monopile large suction pile) to resist weak soils surface ice conditions of the Great Lakes



Future Priorities (FY19 and beyond)

Technology R&D

- National Wind R&D Consortium
- Offshore test facilities support: 2019 FOA
- Core capabilities in floating systems engineering (Lab)
- Improve and validate design tools (Lab)

Resource Characterization

- Buoy upgrades and deployment (Lab)
- Offshore wind resource sciences (Lab)

Demonstration

- Complete two demonstration projects
- Technology demonstration support: 2019 FOA

National Offshore Wind R&D Consortium

Goal A nationally-focused, not-for-profit organization collaborating with industry on prioritized R&D activities to reduce LCOE of offshore wind in the U.S. and maximize other economic and social benefits

Administrator (competitively awarded in 2018): New York State Energy Research and Development Administration (NYSERDA)

Project Value \$41 M (\$20.5 DOE funds, matched by NYSERDA)

Duration 4 years under current funding; goal is to become self sustaining through research partner funding

Desired Impacts

- Innovations directly responsive to the technical and supply chain barriers offshore wind developers face in the U.S.
- Build strong networks connecting technology innovators, investors, and industry

Near Term Milestones

11/2018 – Initial roadmap of R&D priorities

03/2019 – 1st solicitation published

05/2019 – Planned: Initial project award(s)

Consortium Members

Administration Team Partners Include:

Carbon Trust (UK)
RCG Renewables Consulting (UK and US)
National Renewable Energy Laboratory

Founding Board Members Include:

| | |
|----------------|-----------------|
| Avangrid | Deepwater Wind |
| EDF Renewables | EDP-R |
| Equinor | Innogy |
| National Grid | Northland Power |
| Orsted | Shell |

New Board Members 2019:

States: Virginia, Massachusetts, Maryland
Developers: Vineyard Wind, EnBW North America
Transmission Developer: Anbaric



2019 RFI Summary and FOA: Offshore R&D Test Facilities

Intent Assess, utilize and upgrade national-level U.S. test facilities to support innovative research and development related to offshore wind energy

Timeframe RFI Issued 7/30/2018; closed 9/14/2018
FOA issued 3/28/2019; closes 6/17/2019

RFI Responses 21 total, from a range of industry and engineering firms, university research centers, national laboratories, and state and national business development organizations

RFI responses and Congressional language helped inform FOA

FOA \$7M for up to 14 projects to conduct testing in support of innovative offshore wind R&D utilizing existing national-level testing facilities. A subtopic is included for projects that upgrade the capabilities of existing facilities to enable them to perform specific research activities.



2019 FOA:

Support for Demonstrating Innovative Technologies

Title Project Development for Offshore Wind Technology Demonstrations

Timeframe RFI Issued 7/30/2018; closed 9/14/2018
FOA issued 3/28/2019; closes 6/17/2019

Funding Up to \$10M; up to 2 awards

Scope (Based on Congressional Direction)

- Enable full-scale testing of innovative technology/methodology at an offshore wind plant that will be operational no later than 2025
- Project development process must be already underway at the time of application
- Funding will be for supplemental project development activities to enabling demonstration
- Demonstration could be stand-alone or portion of a larger commercial scale offshore wind plant
- Must substantiate potential to reduce LCOE and/or future commercial-scale project risk



U.S. DEPARTMENT OF **ENERGY**

Thank you.

<https://www.energy.gov/eere/wind/>

WETO News Subscription: <https://www.energy.gov/eere/wind/subscribe-wind-energy-technologies-office-news-updates>

Offshore Wind Market Update: <https://www.energy.gov/eere/wind/downloads/2017-offshore-wind-market-update>

National OSW Strategy: <https://energy.gov/sites/prod/files/2016/09/f33/National-Offshore-Wind-Strategy-report-09082016.pdf>

Environmental Knowledge Base for Marine and Wind Energy (Tethys): tethys.pnnl.gov