U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Offshore Demos

March 24, 2014

Wind Energy Technologies

Contents

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

GOWind Demonstration Project

EE0006103

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March 24th 2014

Budget, Purpose, & Objectives

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Total DOE Budget[1]: $4.00M

Total Cost-Share[1]:$0.51M

Problem Statement: Reduction of offshore wind LCOE by enabling placement of larger capacity, more efficient turbines in areas of superior wind resource with known hurricane risk.

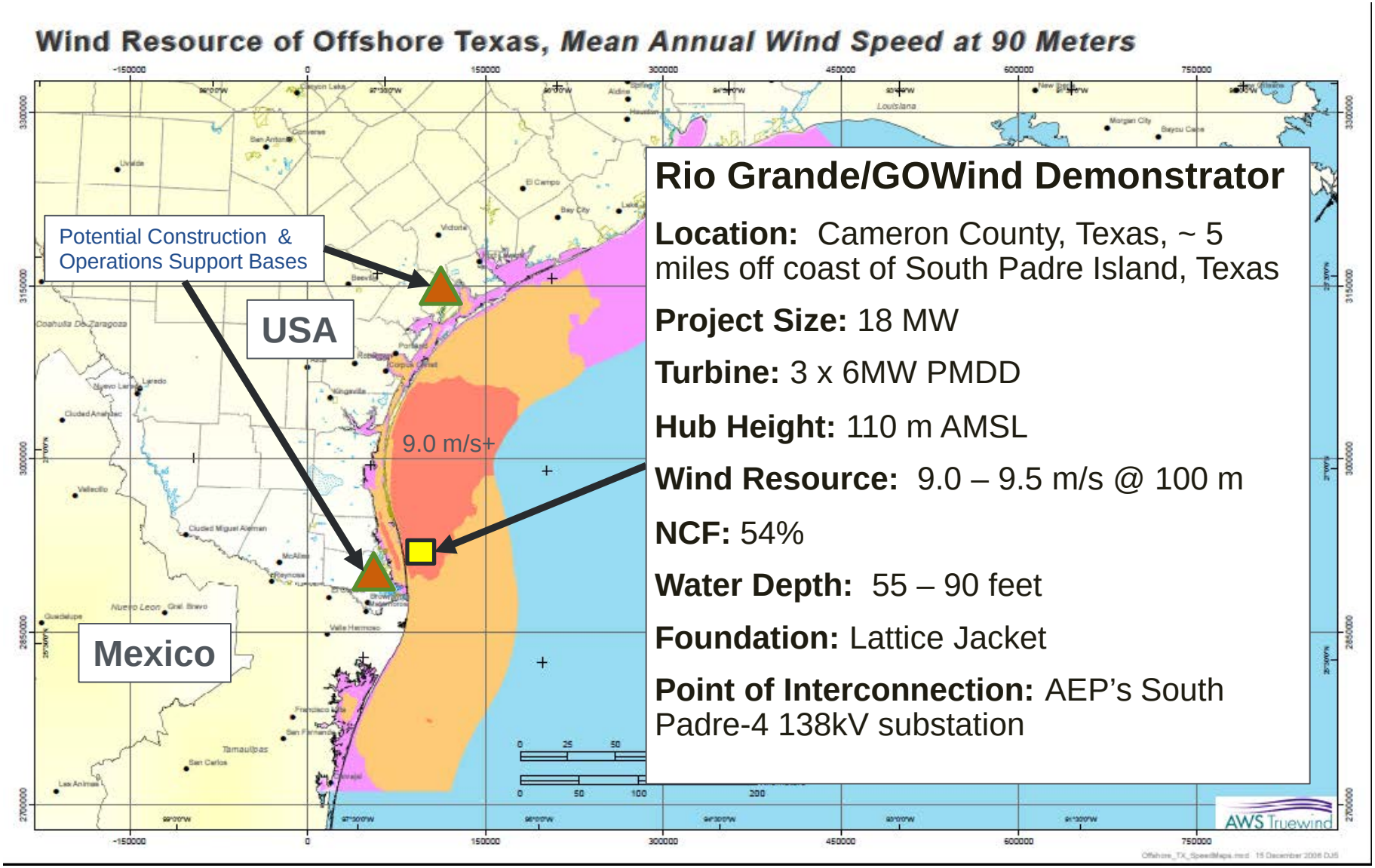
Impact of Project: Opens more USCS to development, industry to supply chain stimulation & export potential for derived technology & 'know-how'

This project aligns with the following DOE Program objectives and priorities

- **Optimize Wind Plant Performance:** Reduce Wind Plant Levelized Cost of Energy (LCOE)
- **Accelerate Technology Transfer:** Lead the way for new high-tech U.S. industries
- **Mitigate Market Barriers:** Reduce market barriers to preserve or expand access to quality wind resources
- **Advanced Grid Integration:** Provide access to high wind resource areas, and provide cost effective dispatch of wind energy onto the grid
- **Testing Infrastructure:** Enhance and sustain the world-class wind testing facilities at Universities and national laboratories to support mission-critical activities
- **Modeling & Analysis:** Conduct wind techno-economic and life-cycle assessments to help program focus its technology development priorities and identify key drivers and hurdles for wind energy technology commercialization

[1] ***Budget/Cost-Share for Period of Performance FY2012 – FY2013***

GOWind Location



Rio Grande/GOWind Demonstrator

Location: Cameron County, Texas, ~ 5 miles off coast of South Padre Island, Texas

Project Size: 18 MW

Turbine: 3 x 6MW PMDD

Hub Height: 110 m AMSL

Wind Resource: 9.0 – 9.5 m/s @ 100 m

NCF: 54%

Water Depth: 55 – 90 feet

Foundation: Lattice Jacket

Point of Interconnection: AEP's South Padre-4 138kV substation

GOWind General Arrangement

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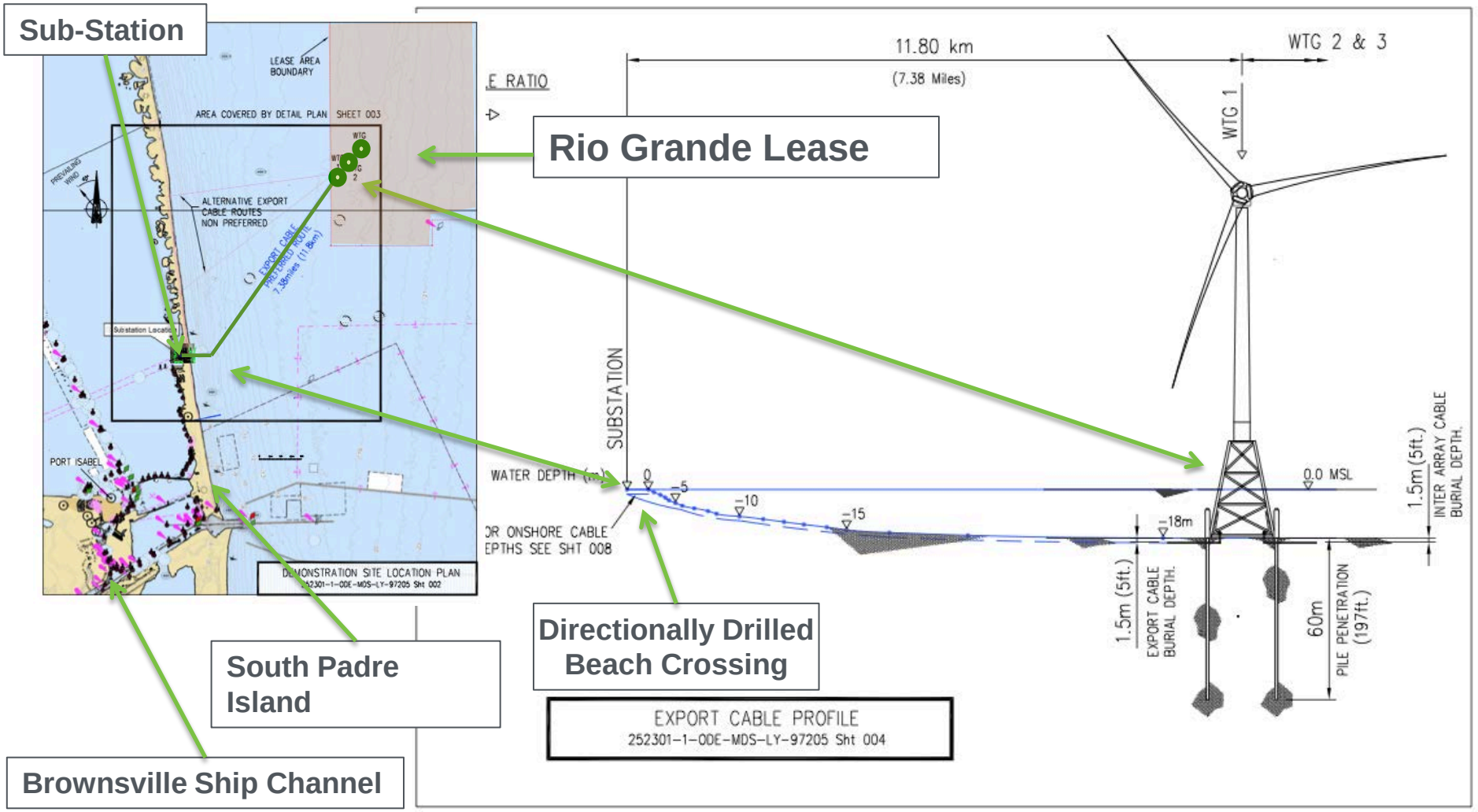
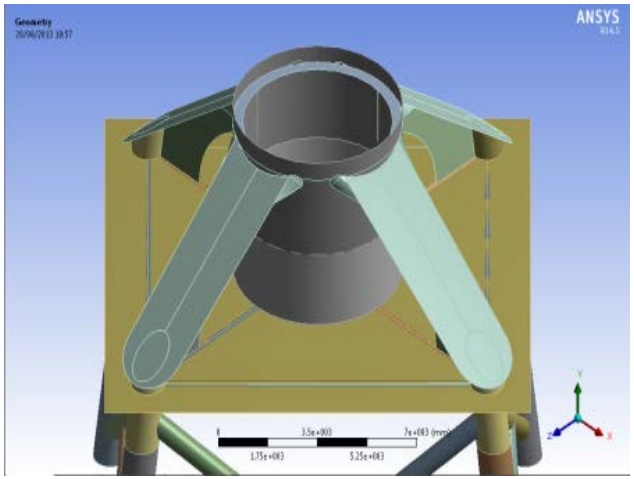


Technical Approach

- Sub-structure evaluation
  - Coupled load analysis with 6MW PMDD turbine
  - Incorporate lower cost plated transition piece – broadens fabrication market
- Addressing
  - Reconciliation of API & IEC codes and design specifications integrated turbine / foundation analysis.
  - Vessel strategy – modifying approach in order to avoid costly heavy-lift, via utilization of retrofitted vessels already in the Gulf of Mexico.



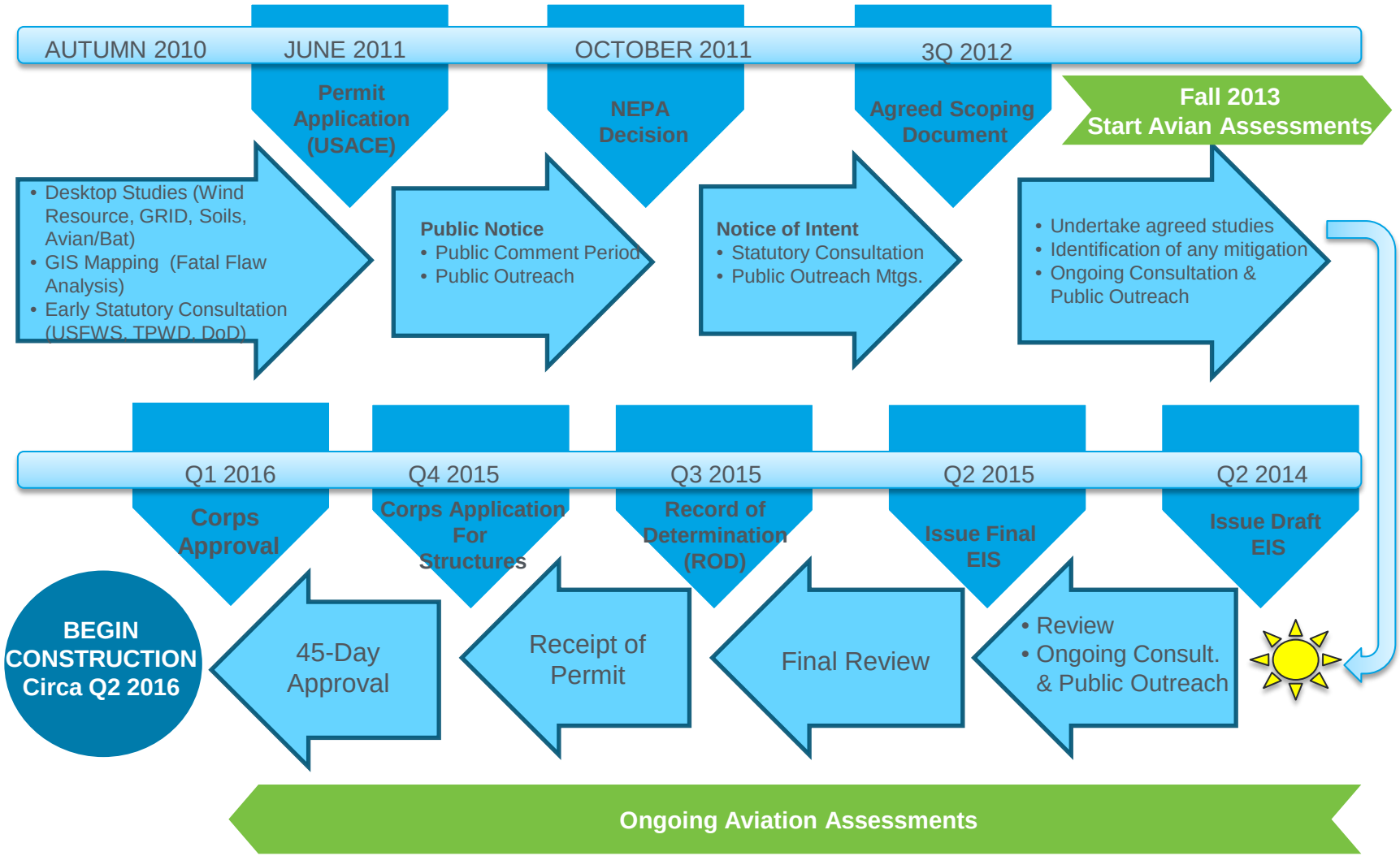
Technical Approach

- Wind Measurement Plan
  - Low cost options to optimize site-specific layout.
  - Enables project to achieve increased energy yield and lower LCOE.
  - Utilized Sgurr's second generation scanning LiDAR, Galion, to capture wind measurements offshore.
  - 7 Months data acquired.
  - Combination provides:
    - More accurate wind resource measurement at discrete locations at significantly less cost than a permanent met-mast
- First offshore deployment of Tethersonde

Technical Approach-Data Acquisition

- Site Permitting Plan
  - Buoy deployment of Acoustic Thermographic Offshore Monitoring.
  - Airflown continuous high-resolution imagery addressing avian and near surface aquatic species presence at the wind farm development area.
  - Produces accurate objective/verifiable avian measurements via combination of ATOM, High-Res imagery and NEXRAD analysis.
  - More accurate & eliminates human error from visual avian counts.

Technical Approach - Permitting



Accomplishments and Progress

- Significant progress made in Budget Period 1
- Key achievements:
  - Developing the required 50% Front End Engineering Design (FEED) to support the economic and financing activity (Sub-Task 1 – Design & FEED);
  - Deploying the Acoustic Thermographic Offshore Monitoring System (ATOM), the Galion 2nd Generation Galion LiDAR, and the balloon-borne buoy-mounted measurement system, the “tethersonde” (Sub-Task 2 – Innovation)
  - Advancing the EA and EIS Permits with the U.S. Army Corps of Engineers, receiving approvals for buoy installations and geophysical, and obtaining Determinations of No Hazard for the 3 turbines from the Federal Aviation Administration (Sub-Task 3 – Permitting & Environmental);
  - Completed ERCOT screening study and executed Interconnection Study Agreement advancing the grid integration (Sub-Task 4 – Grid Integration)
  - Assembly of wide-ranging expressions of interest from financial institutions and business entities for equity and structured project finance as well as off-take opportunities. (Sub-Task 5 – LCOE & Economic Analysis).

Project Plan & Schedule

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Milestone	Date Expected
Project Consent	2014 - May
USACE Permit	2014 - July
DOE FONSI	2014 - September
SGIA (Interconnect Agreement)	2014 - December
100% FEED Completer	2015 - January
Appoint Main Contractors	2015 - February
Receive Final EIS	2015 - June
Financial Close	2016 - January
Start Onshore Installation	2016 - February
Start Offshore Installation	2016 - July
Offshore Installation Complete	2017 - January
Commercial Operations Date	2017 - April

Comments

- Project Initiation - February 2013.
- Planned completion - December 2017
- Project on schedule

Research Integration & Collaboration

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Partners, Subcontractors, and Collaborators:

- Enterprize Energy
- ODE Ltd.
- Keppel-Amfels
- ASI / Iowa State University
- Sgurr Energy
- University of Texas, Austin & Brownsville
- Texas A&M University, College Station, Corpus Christi

Communications and Technology Transfer:

- Public EIS Scoping Meetings
- Development region presentations
- Stakeholder consultation in EIS process
- Industry presentations USA & Asia

Next Steps and Future Research

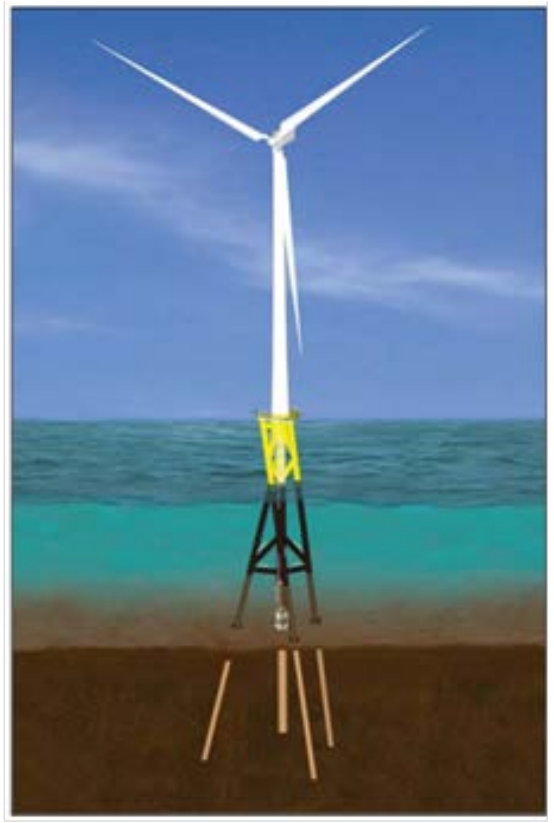
U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

FY14/ Next Steps :

- Design work to 100% FEED Status
- Construction of atmospheric circulation model
- Issuance of Environmental Permit by USACE
- Execution of Standard Generator Interconnection Agreement
- Secure off-take either via traditional PPA or modified market structure
- Equipment contracting
- Project Financing

Proposed future research:

- Engineering
  - Blade durability
  - Monitor tethersonde and deploy offshore LiDAR
  - Fine tune jacket/transition piece based on updated metocean & geophysical work
- Environment
  - Continue avian, bat and marine mammal migration studies and record presence/absence on site
  - Prepare alternatives report



Fishermen's Atlantic City Windfarm: Birthplace of Offshore Wind in the Americas

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609-350-7455

March 24, 2014

Budget, Purpose, & Objectives

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Total DOE Budget[1]: $4.000M

Total Cost-Share[1]:$0.917M

Problem Statement: Cost of energy from offshore wind needs to be driven down - The Project is an Advanced Technology Demonstration Project configured specifically to demonstrate technologies that promise to reduce the cost of energy when implemented at a commercial scale.

Impact of Project:

- Project identified optimal substructure
- Plans in place to build 5-turbine, 25 MW wind farm off of Atlantic City
- Plans in place to make the wind farm a virtual empirical laboratory to validate turbine performance, substructure performance, and various additional innovations
- Identified innovations that can reduce LCOE by 20%
- Wind farm location shares met-ocean characteristics with 51,000 square miles of ocean from MA to SC – suitable for 450,000 MW of OSW capacity.

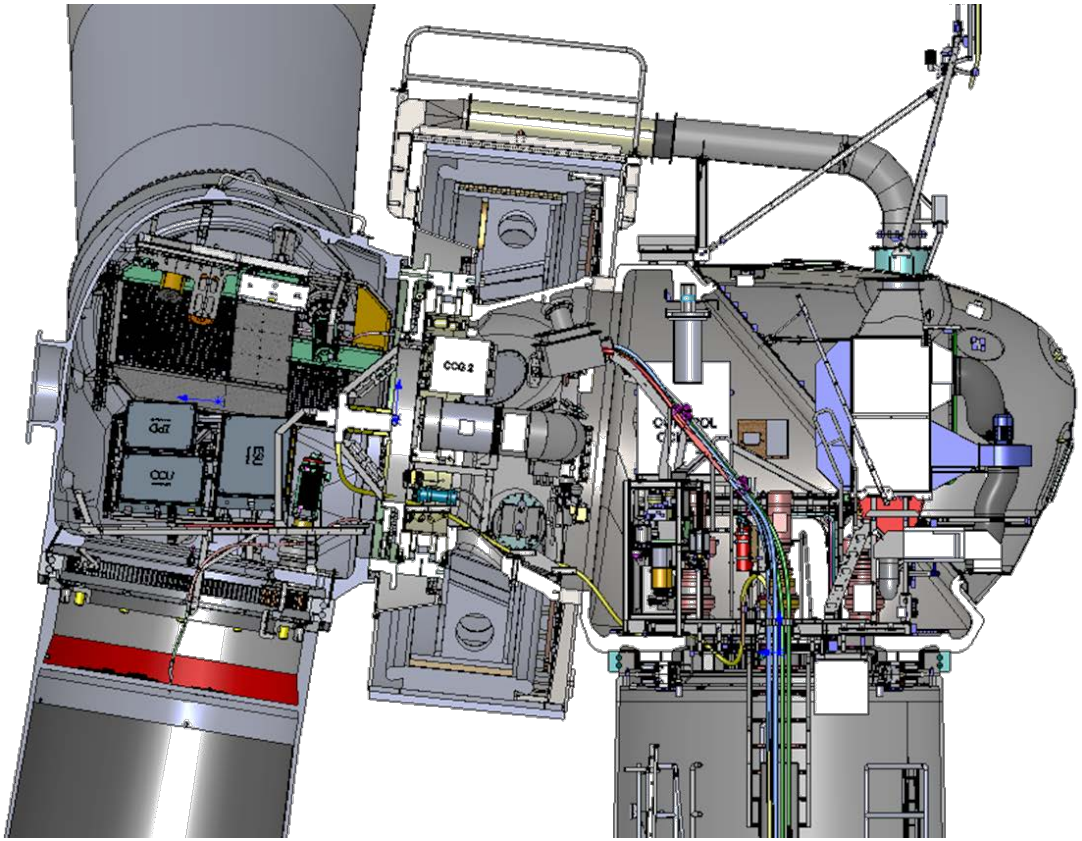
Project aligns with the following DOE Program objectives and priorities:

- **Optimize Wind Plant Performance:** Reduce Wind Plant Levelized Cost of Energy (LCOE)
- **Mitigate Market Barriers:** Reduce market barriers to preserve or expand access to quality wind resources
- **Testing Infrastructure:** Enhance and sustain the world-class wind testing facilities at Universities and national laboratories to support mission-critical activities
- **Modeling & Analysis:** Conduct wind techno-economic and life-cycle assessments to help program focus its technology development priorities and identify key drivers and hurdles for wind energy technology commercialization

[1] ***Budget/Cost-Share for Period of Performance FY2012 – FY2013***

Technical Approach - Turbines

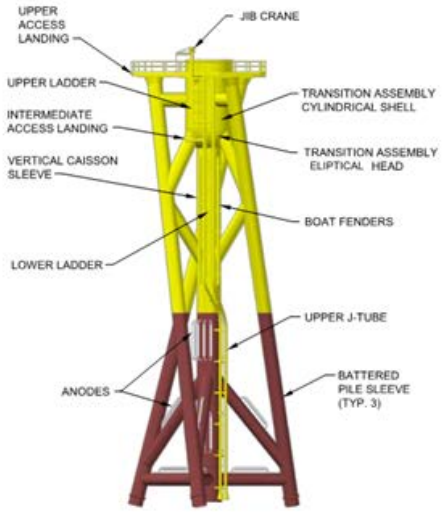
- Advanced Direct Drive
- 1st Generation of turbine purpose built for offshore duty
- XEMC Darwind XD-115-5MW turbine
- Yaw and independent blade pitch control
- Prototypes Operational 2 Years
- IEC Type Certified By DNV
- SOPO Task 1.1.7, Turbine Testing, plans complete (including using Clemson/DOE test facility in future budget periods)



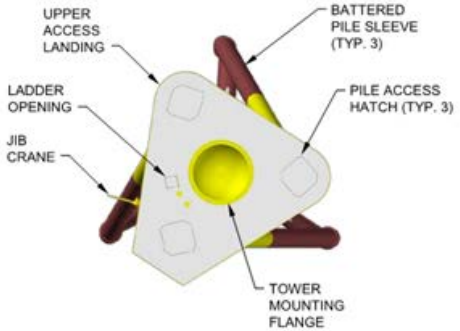
Technical Approach – Support Structure

- Project investigated 2 support structure types for both Demonstration Project and utility scale Project
- Inward Battered Guide Structure (IBGS) won The Carbon Trust competition
- Design in 2012-2013 proved:
  - IBGS 27.3% lighter than monopile for Demo Project
  - IBGS 32.2% lighter than monopile for Utility Scale Project
  - Further innovations will likely further reduce weights and costs

ISOMETRIC VIEW

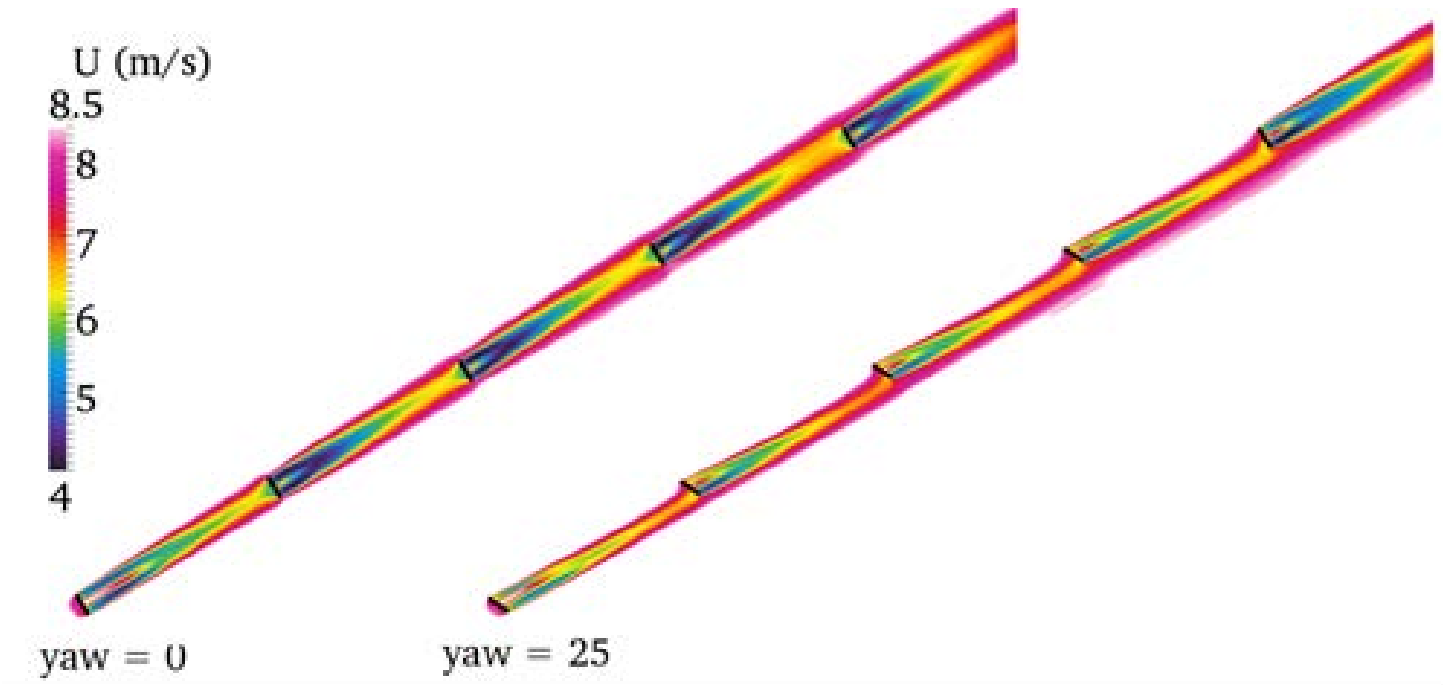


ELEVATION



PLAN

Technical Approach – Wake Redirection



- Optimizes wind farm performance in contract to optimizing individual turbines
- Modeled multiple alignment cases (0 and 25% shown above)
- Creates 10% more energy when prevailing wind aligned with array
- On an annual basis (all directions) indicates 1.5% increase in output
- Biggest impact may be in allowing turbine spacing to be tighter than typical 9 turbine diameters, without loss of production

Technical Approach – Construction Cost Estimating

- Core element of project was to determine most cost effective substructure
  - IBGS vs Monopile (the two finalists from earlier analysis)
- Methodology included:
  - Designs completed for *both* IBGS & Monopile for Demonstration and Utility Scale Projects (4 designs)
  - Formal solicitation for fabrication and installation & full comparative analysis
- Results were Conclusive (Table 1)
- Secondary Conclusions:
  - IBGS – Domestic fabrication, landward staging with traditional capacity cranes, no special ground capacity, offshore installation with locally available floating crane vessels
  - Monopile – Foreign fabrication, landward staging only with high capacity specialized cranes, 3000 psf ground capacity, offshore installation with specialized high capacity crane vessels

Table 1
Fabrication and Installation Cost Summary

Foundation	Demo. Project
Monopile	$53 million
IBGS	$42 million

Accomplishments and Progress

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The Project successfully accomplished all but one task which has been in progress since FY2011 and it is anticipated to be completed by Q3FY2014

Task 1 Design	
1.1 Research and Development	
1.1.1 Support Structure Design Basis	
1.1.2 Wind Turbine Design Basis	
1.1.3 Electrical System Design Basis	
1.1.4 Foundation Comparative Analysis	
1.1.5 Foundation Design & Certification	
1.1.6 Metocean Characterization	
1.1.7 Testing - Turbine Test Plan	
1.1.8 Wind Plant Design Criteria Evaluation	
1.1.9 Vibrohammer Feas. Study (Conditional on Monopile)	n/a
1.1.10 Windplant Performance and Wakes	
Task 2 Installation, Operation and Maintenance	
2.1 Foundations	
2.2 Cable	
2.3 Turbines	
2.4 Turbine Transport and Lift	
2.5 Substation	
2.6 Operations and Maintenance	
2.7 Finance, Preparation for Financial Close/Procumnt	
2.7.1 Procurement	
2.7.2 Financial Close	
Task 3 Environmental and Permitting	
3.1 Permits and Permit Modifications	
3.2 Avian Monitoring - System Development	
3.3 Marine Mammal Monitoring - System Development	
3.4 Bat Deterrent	
Task 4 Interconnection	
4.1 Interconnection Studies	
4.2 Power Offtake/NJBPU OREC Approval	90+%
Task 5 Economic Analysis and LCOE	
5.1 Establish Baseline for LCOE Analysis	
5.2 Refine LCOE Estimate for Proposed Project	
5.3 Evaluate System Impacts of Project Innovations	
Task 6 Project Management and Reporting	
6.1 Planning (Scheduling, Budgeting, Etc.)	
6.2 Project Management (Vendor, Financ., Contract, Etc.)	
6.3 Reporting (Financ, Progress, Qtr. and DOE Meetings)	
6.4 Education and Outreach	
6.5 Financial Forecasting, Management and Coordination	

Complete
Not Applicable
In Progress

Project Plan & Schedule

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Summary	
Funding Opportunity Announcement (FOA) Number:DE-FOA-0000410	
U.S. Offshore Wind: Advanced Technology Demonstration Projects	
Award Numbere: DE-EE0005984	

Legend	
	Work completed
	Pre-Award Work
	Current Work
	Milestones & Deliverables (Original Plan)
	Milestones & Deliverables (Actual)

Task / Event	FY2012 Q1 (Octt-Dec)	FY2012 Q2 (Jan-Mar)	FY2012 Q3 (Apr-Jun)	FY2012 Q4 (Jul-Sep)	FY2013 Q1 (Octt-Dec)	FY2013 Q2 (Jan-Mar)	FY2013 Q3 (Apr-Jun)	FY2013 Q4 (Jul-Sep)	FY2014 Q1 (Octt-Dec)	FY2014 Q2 (Jan-Mar)	FY2014 Q3 (Apr-Jun)	FY2014 Q4 (Jul-Sep)
Project Name: Fishermen's Atlantic City Windfarm: Birthplace of Offshore Wind in the Americas												
1 Design Basis Support Structure, Turbine and Electrical System												
2 Foundation Comparative Analysis												
3 Foundation Design												
4 Wind Plant Design Criteria												
5 Wind Plant Performance and Wakes												
6 Environmental and Permitting (Study and Permits)												
7 Installation and O&M Planning (Including full solicitation budgets)												
8 Marine Mammal and Avian system development												
9 Interconnection Studies												
10 Refine LCOE												
Current work and future research												
1 BP1 Down Select Presentation and Work Plan BP2-BP5												
2 Power Offtake (Legislative submittion defense and approval)												

Comments

- Project for Budget Year 1 Complete
- Down Select to complete project to be announced in early May 2014
- Wind farm is nearly “Shovel Ready”, ready to initiate final EPC contracts in Q3 2014
- Sole remaining obstacle: Offtake agreement with NJBPU needs to be completed

Research Integration & Collaboration

Partners, Subcontractors, and Collaborators:

- XEMC-Darwind: Turbine and tower supply
- Weeks Marine: Turbine, tower and support structure transport and install
- Marmon Utilities: Cable furnish and install (offshore and onshore)
- DCO Energy: Substation design and construct
- Mott MacDonald: Project Management
- Keystone Engineering: Support structure design

Communications and Technology Transfer:

- AWEA 2013 Offshore Conference (Oct. 2013)
- Greenpower 2014 Conference (Feb 2014)
- AWC Conference (domestic supply chain)(Jan 2013)
- Interim report to DOE staff (Oct. 2013)
- Obtained precedent-setting acknowledgement from New Jersey BPU that project created “net benefits” to the state of New Jersey (published results at http://www.fishermensenergy.com/regulatory-process.php#docs)
- BOEM Workshop (Mar 2013)
- FACW Risk Management Workshop (Jul 2013)
- Bat Deterrent Workshop (Aug 2013)
- North East Bat Working Group (Jan 2014)

- Multiple interviews with publications
- Inspired multiple letters to publications and legislators

Next Steps and Future Research

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

FY14/Current research:

1. Submitted Down Select and Work Plan for BP2 – BP5
2. Obtain final power off-take approval Q3 2014 (last barrier)
3. Close financing, complete engineering and initiate procurement
4. Commence manufacturing of turbine to be tested at Clemson [formal name of facility]
5. Let contracts for all major packages
6. Finalize wake control plan, implementation plan and schedule

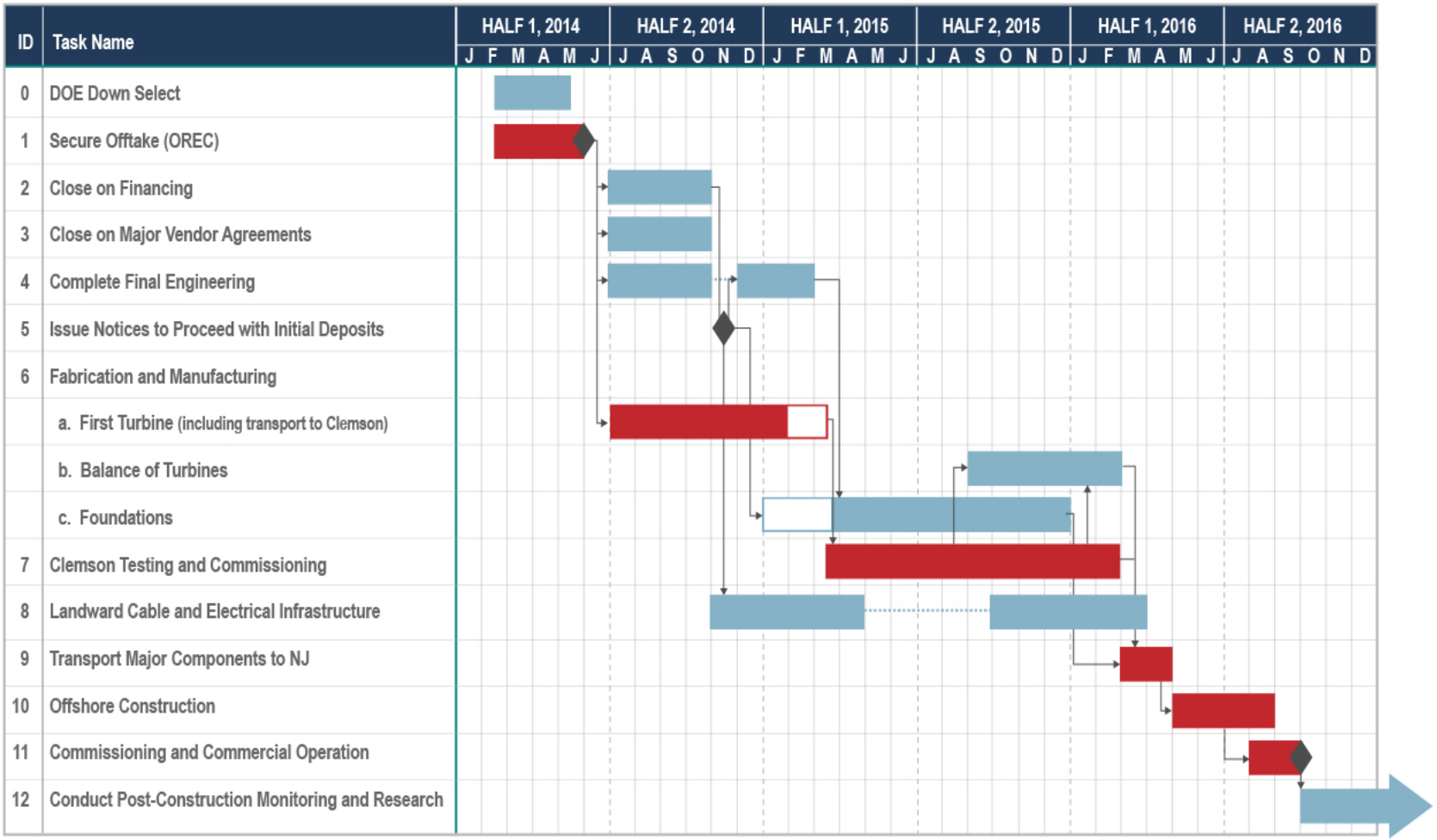
Proposed future research (BP2- BP5):

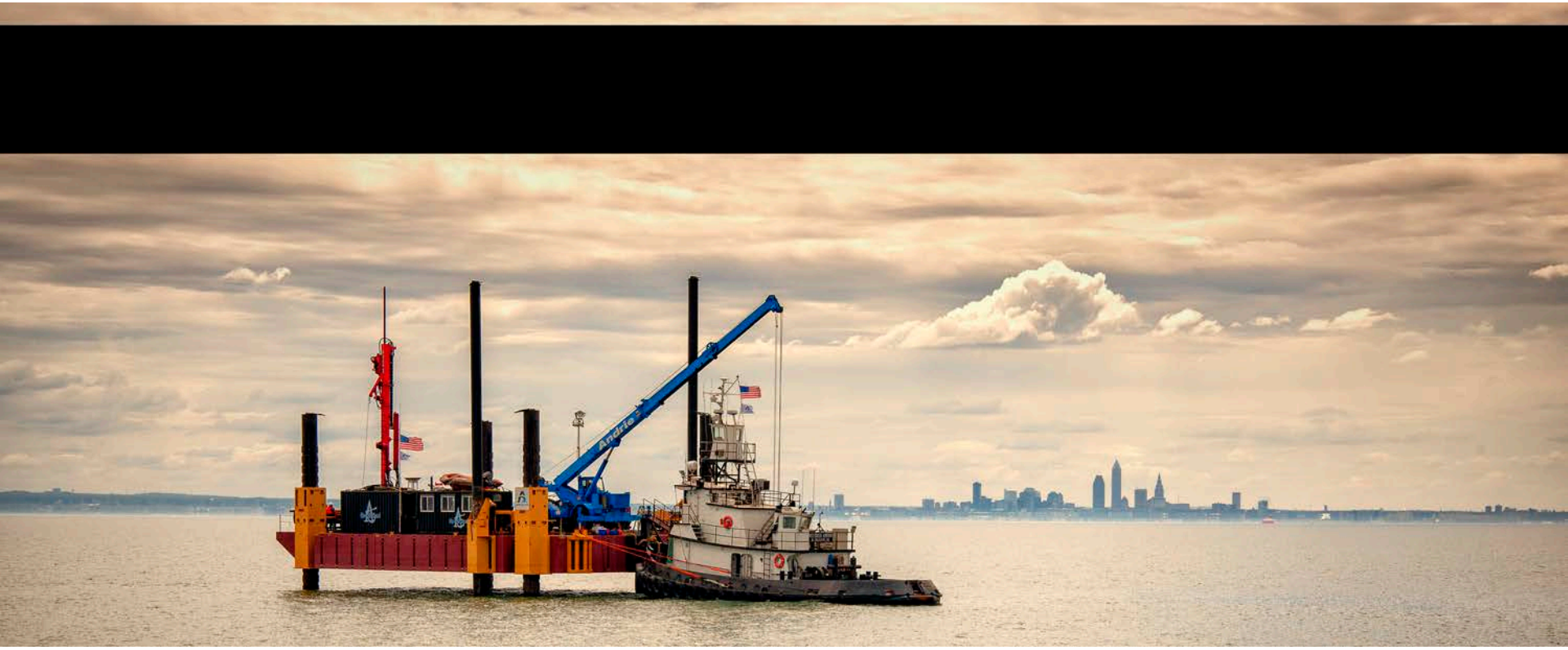
1. Empirical validation of substructure forces and performance
2. Empirical validation of turbine performance
3. Empirical validation of wake direction
4. Empirical validation of marine mammal acoustic net during construction
5. Empirical validation of avian detection during operations
6. Empirical validation of economic impact (costs and benefits)

Next Steps and Future Research

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

FY14/Current and proposed future research: Below is the planned schedule for BP2-BP5





Project Icebreaker™

Dr. Lorry Wagner

Lake Erie Energy Development Corporation (LEEDCo)

lwagner@leedco.org | (216) 965-0615

March 24, 2014

Budget, Purpose, & Objectives

Total DOE Budget[1]: $3.946M

Total Cost-Share[1]:$1.085M

Problem Statement: In order to unlock the 700+ GW of offshore wind potential in the Great Lakes, the challenges of ice and soil conditions must be resolved.

Impact of Project: Icebreaker will catalyze a new industry that creates thousands of jobs and helps to heal the environment.

This project aligns with the following DOE Program objectives and priorities:

- **Optimize Wind Plant Performance:** Reduce Wind Plant Levelized Cost of Energy (LCOE)
- **Accelerate Technology Transfer:** Lead the way for new high-tech U.S. industries
- **Mitigate Market Barriers:** Reduce market barriers to preserve or expand access to quality wind resources
- **Testing Infrastructure:** Enhance and sustain the world-class wind testing facilities at Universities and national laboratories to support mission-critical activities
- **Modeling & Analysis:** Conduct wind techno-economic and life-cycle assessments to help program focus its technology development priorities and identify key drivers and hurdles for wind energy technology commercialization

[1] ***Budget/Cost-Share for Period of Performance FY2012 – FY2013***

Technical Approach

Technical Approach

- Draw on European experience – adapt it for Lake Erie conditions
- Thoroughly assess the site with a special focus on ice loads
- Detailed design with coupled loads analysis and scale model testing
- Collaborate with regulators on siting
- Proactively engage key stakeholders and area residents
- Market-based power sales strategy
- Solicit commitments from European & local banks

Key Issues

- Engineering, permitting, public acceptance, power sales, supply chain development

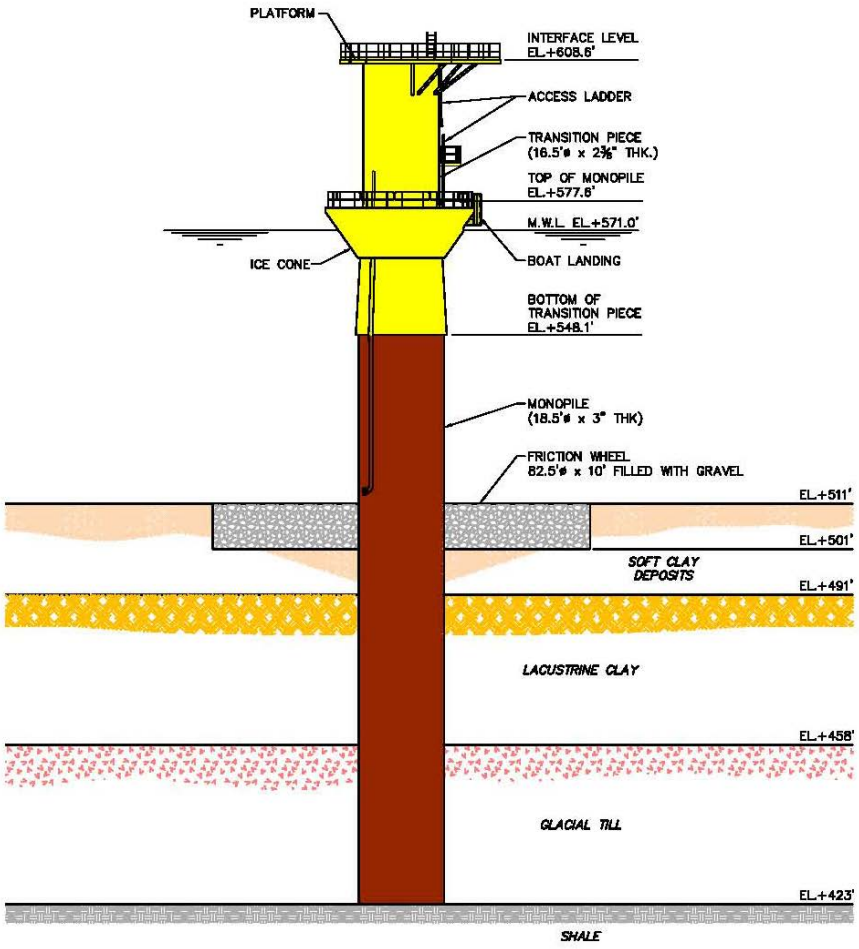
Unique Aspects

- Sell the power to the people who want to buy it
- Wind, wave, soil, and ice conditions common to the Great Lakes

Accomplishments and Progress

Engineering

- ✓ Preliminary design for an innovative monopile foundation suitable for Lake Erie's soil and ice conditions
- ✓ Six innovations that lower LCOE by $0.0419 per kWh
- ✓ Patent application for foundation innovations



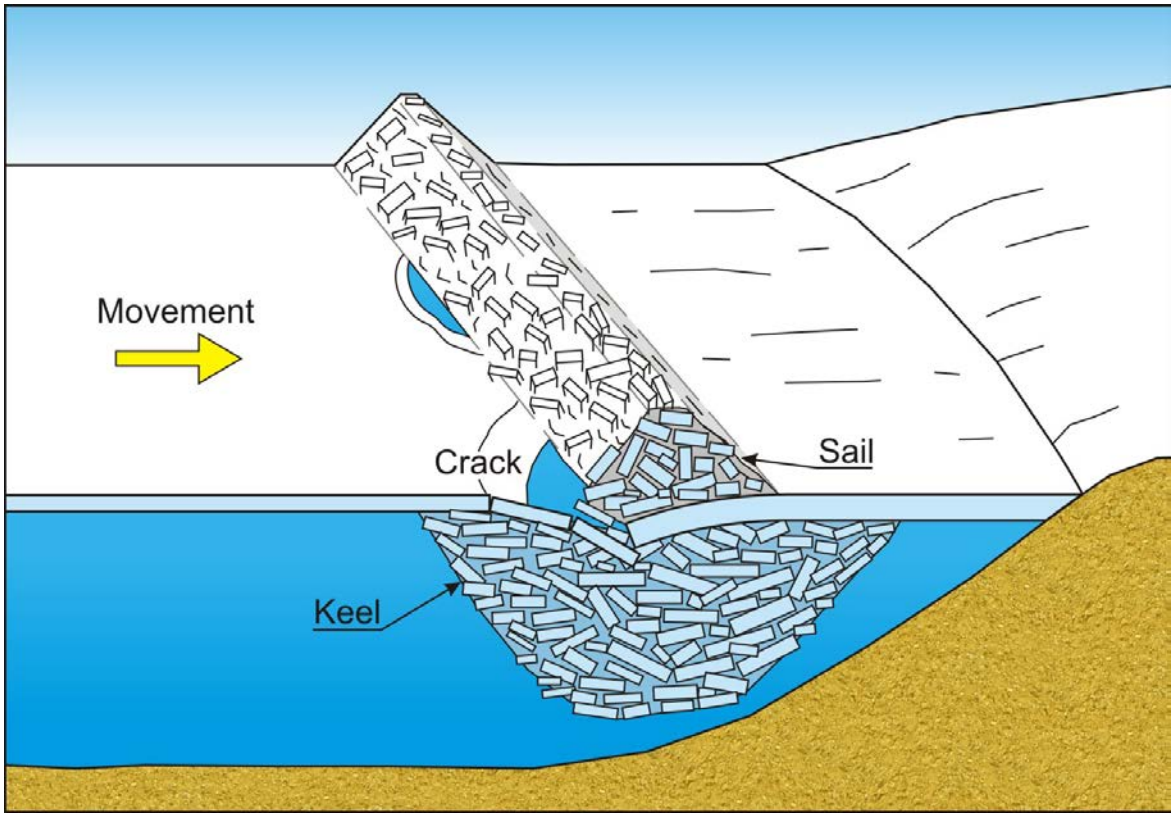
TYPICAL MONOPILE FOUNDATION ELEVATION

0 30 60 FT.

SCALE 1"=30'-0"

Site Assessments

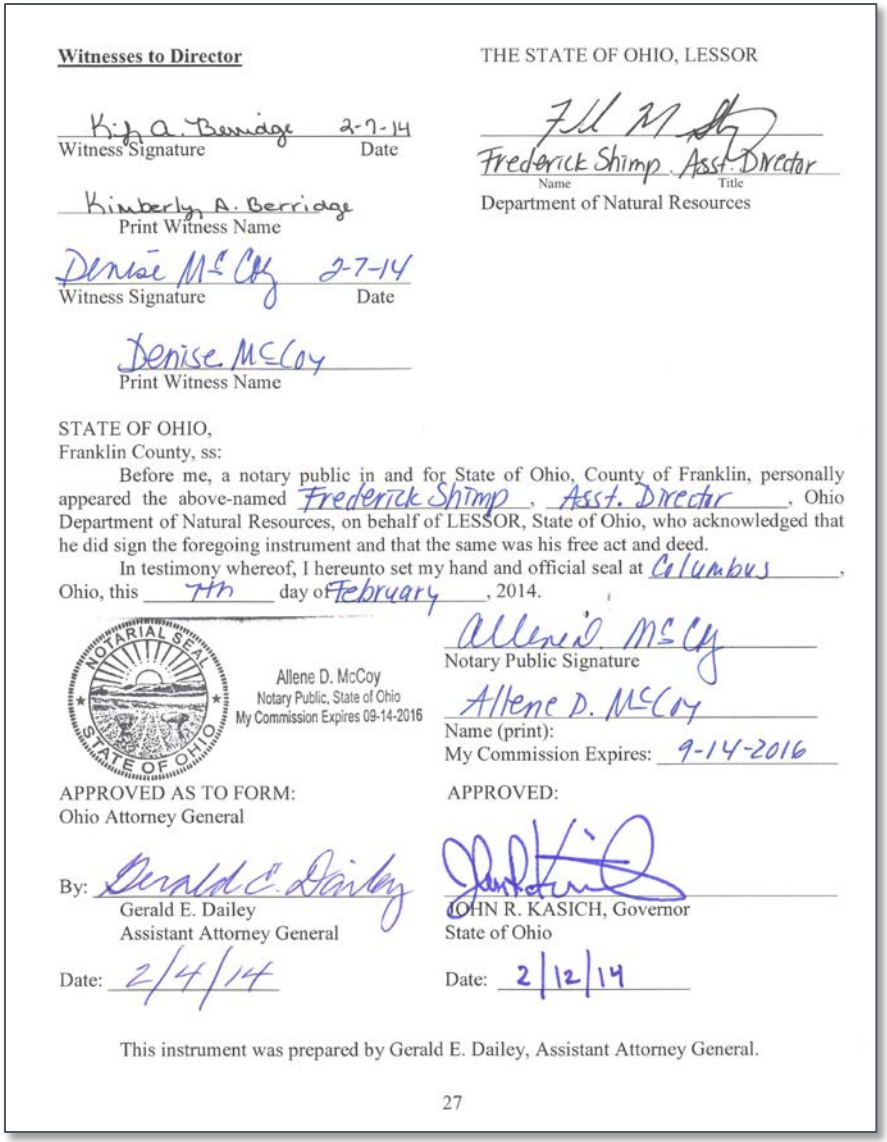
- ✓ Geotechnical analysis; soil samples & pressure tests
- ✓ 6 years of wind data
- ✓ Metocean analysis
- ✓ Ice formation and load characterization
- ✓ Avian & bat risk assessments
- ✓ Environmental Assessment



Accomplishments and Progress

Permitting & Site Control

- ✓ Permit Applications Filed for all Federal and State approvals
- ✓ Endorsements from key stakeholder organizations
- ✓ Submerged lands lease from the State of Ohio
- ✓ Grid Interconnection Application Filed



Witnesses to Director

Witness Signature — Date: 2-7-14

Print Witness Name: Kimberly A. Berridge

Witness Signature — Date: 2-7-14

Print Witness Name: Denise McCoy

THE STATE OF OHIO, LESSOR

Name: Frederick Shimp — Title: Asst. Director

Department of Natural Resources

STATE OF OHIO,
Franklin County, ss:

Before me, a notary public in and for State of Ohio, County of Franklin, personally appeared the above-named Frederick Shimp, Asst. Director, Ohio Department of Natural Resources, on behalf of LESSOR, State of Ohio, who acknowledged that he did sign the foregoing instrument and that the same was his free act and deed.

In testimony whereof, I hereunto set my hand and official seal at Columbus, Ohio, this 7th day of February, 2014.

NOTARIAL SEAL STATE OF OHIO

Allene D. McCoy
Notary Public, State of Ohio
My Commission Expires 09-14-2016

Notary Public Signature

Name (print): Allene D. McCoy

My Commission Expires: 9-14-2016

APPROVED AS TO FORM:
Ohio Attorney General

By: Gerald E. Dailey
Gerald E. Dailey
Assistant Attorney General

Date: 2/4/14

APPROVED:

JOHN R. KASICH, Governor
State of Ohio

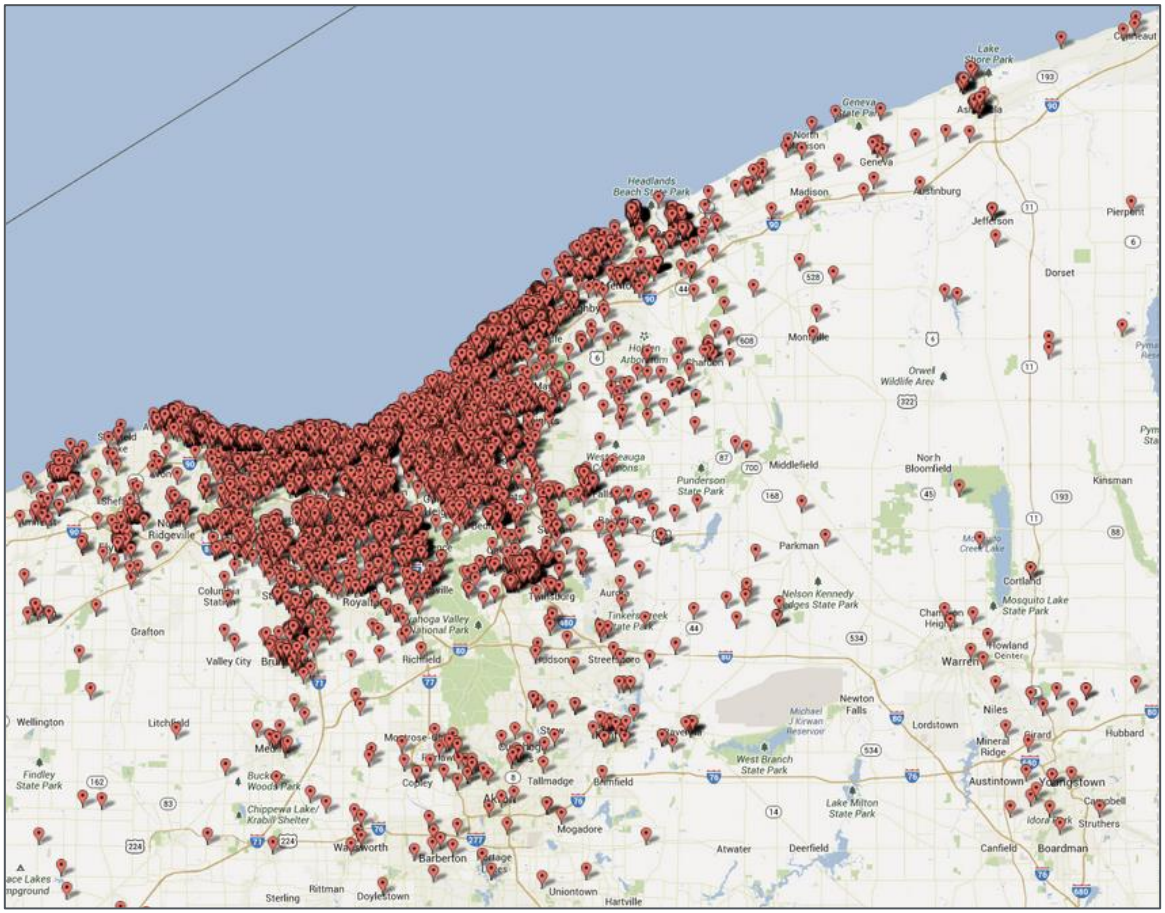
Date: 2/12/14

This instrument was prepared by Gerald E. Dailey, Assistant Attorney General.

27

Power Sales, Finance, and Public Support

- ✓ Nearly 8,000 POWER Pledges Collected
- ✓ Over 100 public meetings in FY12-FY13
- ✓ Off-take commitments for 105% of power
- ✓ Finance commitments from 9 banks
- ✓ Cost share commitment from the State of Ohio



Project Plan & Schedule

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Summary	
WBS Number or Agreement Number	DE-EE0005989
Project Number	
Agreement Number	

Legend	
	Work completed
	Active Task
	Milestones & Deliverables (Original Plan)
	Milestones & Deliverables (Actual)

Task / Event	FY2012 Q1 (Oct-Dec)	FY2012 Q2 (Jan-Mar)	FY2012 Q3 (Apr-Jun)	FY2012 Q4 (Jul-Sep)	FY2013 Q1 (Oct-Dec)	FY2013 Q2 (Jan-Mar)	FY2013 Q3 (Apr-Jun)	FY2013 Q4 (Jul-Sep)	FY2014 Q1 (Oct-Dec)	FY2014 Q2 (Jan-Mar)	FY2014 Q3 (Apr-Jun)	FY2014 Q4 (Jul-Sep)
Project Name: Project Icebreaker												
Q3 Milestone: Turbine layout and energy production							◆					
Q3 Milestone: Geotechnical sampling							◆					
Q4 Milestone: PJM Interconnection application / feasibility study agreeement							◆					
Q4 Milestone: Foundation concept development, evaluation, and selection								◆				
Q2 Milestone: Secure commitments for power off-take										◆		
Q2 Milestone: Secure commitments for project debt										◆		
Current work and future research												
Complete planning for Budget Period 2												

Comments

- Initiation date: February 15, 2013
- Completion date: May 14, 2014
- Go/no-go Decision Points: Foundation concept selection

Research Integration & Collaboration

Partners, Subcontractors, and Collaborators:

LEEDCo leveraged the DOE funded ice work of the University of Michigan and DNV GL.

Research Partners include:

Communications and Technology Transfer:

Research results are in preparation for publication and public dissemination.

Next Steps and Future Research

FY14/Current research: The current DOE funding program ends on May 14, 2014. LEEDCo is completing final planning for Budget Periods 2 – 5.

Proposed future research: Future research will test and validate the innovations that will lower the cost of energy for future utility scale offshore wind projects in the Great Lakes.

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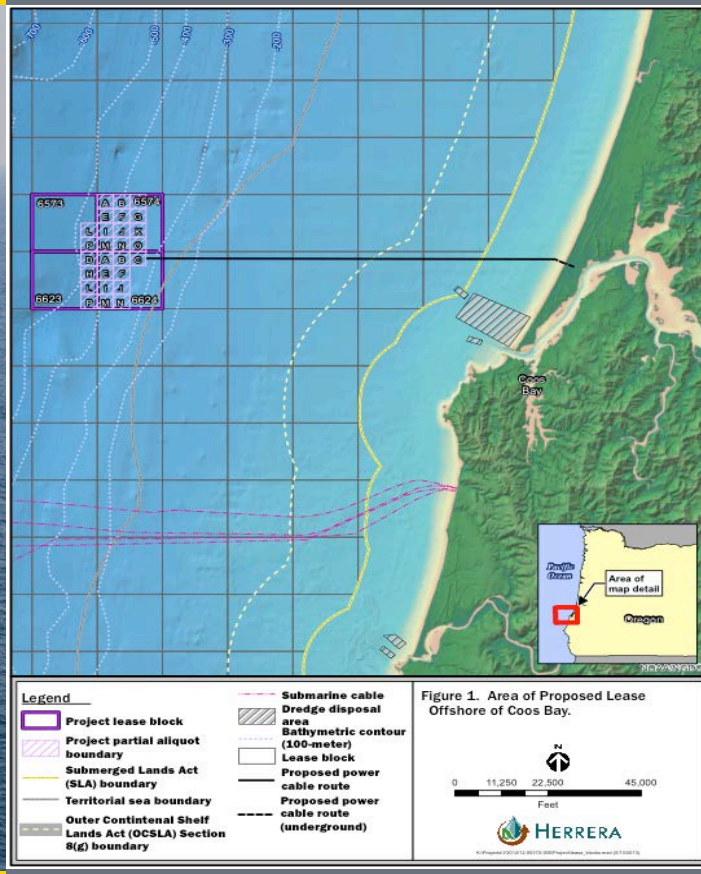


WindFloat Pacific OSW Demo Project

Advanced Technology Demonstrations: Offshore Wind

Alla Weinstein

Principle Power, Inc.

allaw@principlepowerinc.com 425-430-7924

March 24, 2014

Budget, Purpose, & Objectives

Total DOE Budget[1]: $4.00M

Total Cost-Share[1]:$2.39M

Problem Statement: Provide technical solution for installation of OSW in water depth > 40 meters that represents 2/3 of the US offshore wind resources.

Impact of Project: The WindFloat Pacific will demonstrate a cost-effective solution for deep water OSW applications. The 30 MW project will provide critical data relative to: wind resource assessment, environmental effects, permitting, engineering, manufacturing, installation, O&M and energy production.

This project aligns with the following DOE Program objectives and priorities

- **Optimize Wind Plant Performance:** Reduces Wind Plant Levelized Cost of Energy (LCOE)
- **Accelerate Technology Transfer:** Leads the way for new high-tech U.S. industries
- **Mitigate Market Barriers:** Demonstrates mitigation of market barriers – permitting, energy prices, and public acceptance
- **Advanced Grid Integration:** Provides access to high wind resource areas, and provide cost effective dispatch of wind energy onto the grid
- **Modeling & Analysis:** Demonstrates techno-economic and LCC modeling and analysis results that identify key drivers for wind commercialization of deep-water OSW.

[1] *Budget/Cost-Share for Period of Performance FY2012 – FY2013*

Technical Approach

Task 1: 50% FEED

- Collect site-specific metocean data for design studies and numerical modeling
- Turbine and site-specific metocean data used to develop global sizing for the WindFloat design
- Use initial design with ABS to obtain an “Approval in Principle” for Class
- Initial design is ready to be completed FEED

Task 2: Installation, O&M

- Develop methodologies using WindFloat (WF1) prototype results
- Issue initial RFQs
- Obtain initial cost estimates

Task 3: Environmental and Permitting

- Early identification of potential issues, benefitting from WF-based case studies (PNNL: environmental protocols framework)

Technical Approach

Task 4: Offshore Grid and Interconnection

- Load studies and economic trade-offs analysis
- PPA negotiations
- Standard interconnection procedures

Task 5: LCOE Analysis

- Using NREL's expertise establish base case, WFP specific and commercial size project LCOE projections

Task 6: Project Management

- Manage all sub-awardees
- Timely delivery and submittal of reporting requirements
- Assess and defined risks for the implementation phase

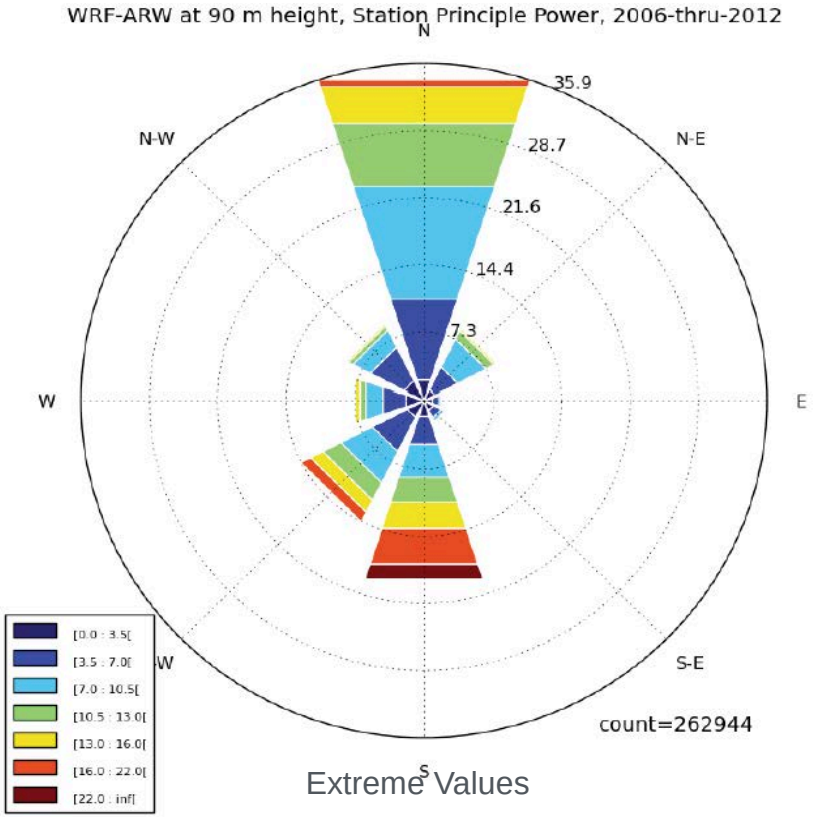
Task 7: Down-select reporting

- Submit required reports on time

Accomplishments and Progress

Task 1: 50% FEED

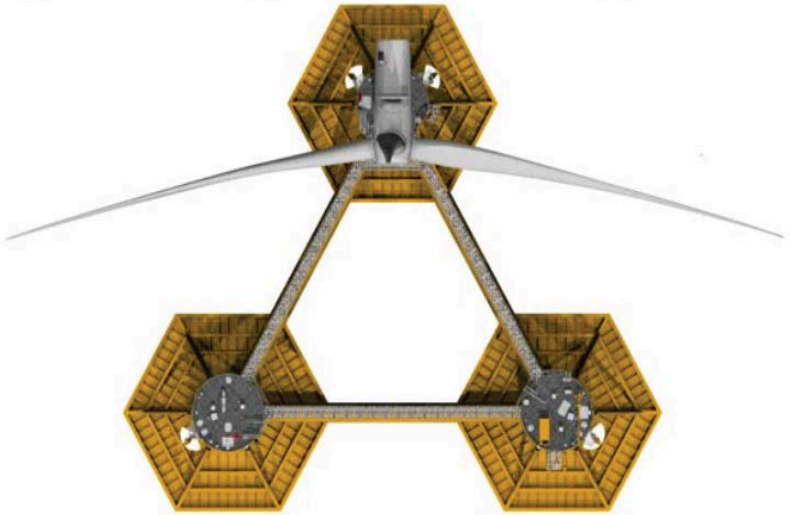
- Metocean conditions at project site:
  - Significant wave conditions and strong winds
  - ~ 42% NCF
- Determined WF 6MW global sizing
- Received “Approval in Principle” from ABS



Extreme Values

Years	H_S (m)	T_P (sec)	WS (m/sec)	Current (m/sec)
1	7.95	13.34	22.56	0.98
10	10.84	13.84	25.64	1.12
100	13.55	14.30	28.04	1.24
1000	16.17	14.76	30.11	1.33

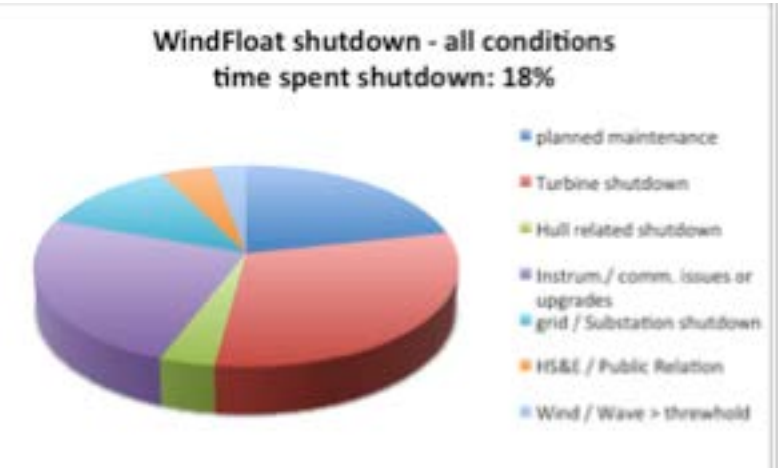
Accomplishments and Progress

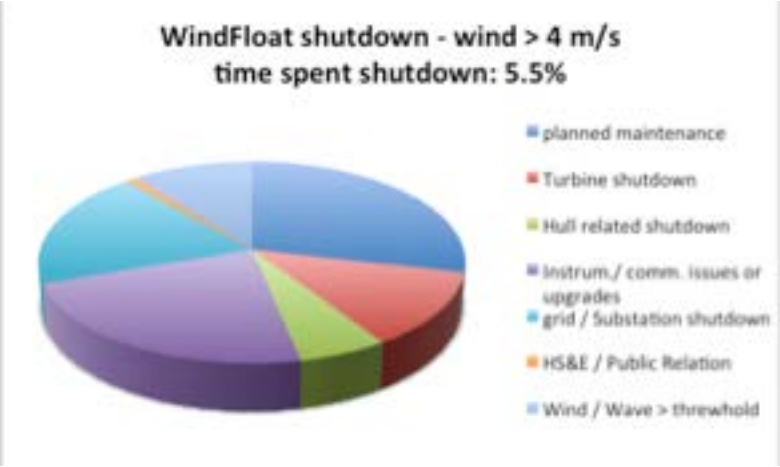


Accomplishments and Progress

Task 2: Installation, O&M

- Initial Installation and O&M plans developed using lessons learned from WF1
- Initial RFQ issued and costs identified





WF1: Jan 2014 Storm (Hs – 9m)

WF1: Jan 2014 Storm (Hs – 9m)

Accomplishments and Progress

Current means of Access

Planned means of Access

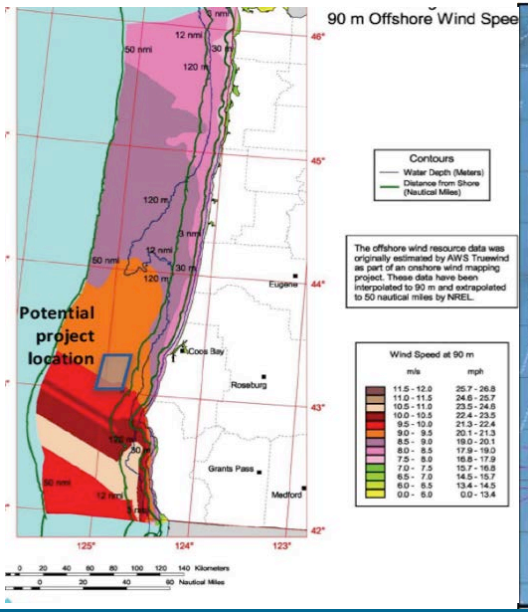
Accomplishments and Progress

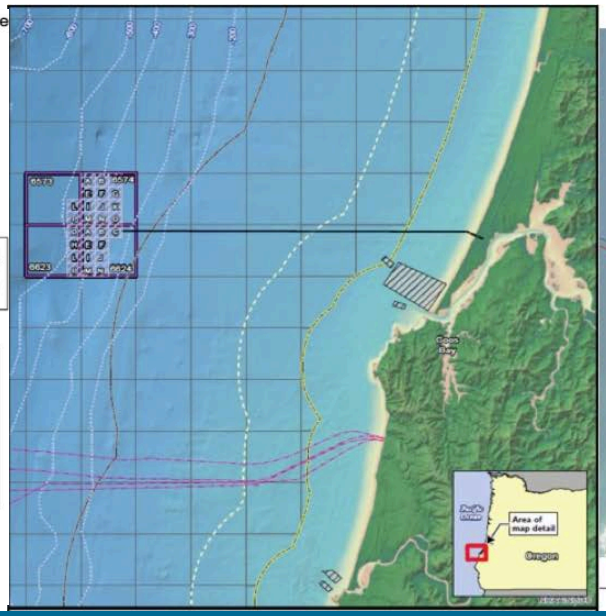
Task 3: Environmental and Permitting

- Lease application deemed complete
- Received “Determination of No Competitive Interest” (DNCI) from BOEM for the project site

Task 4: Offshore Grid and Interconnection

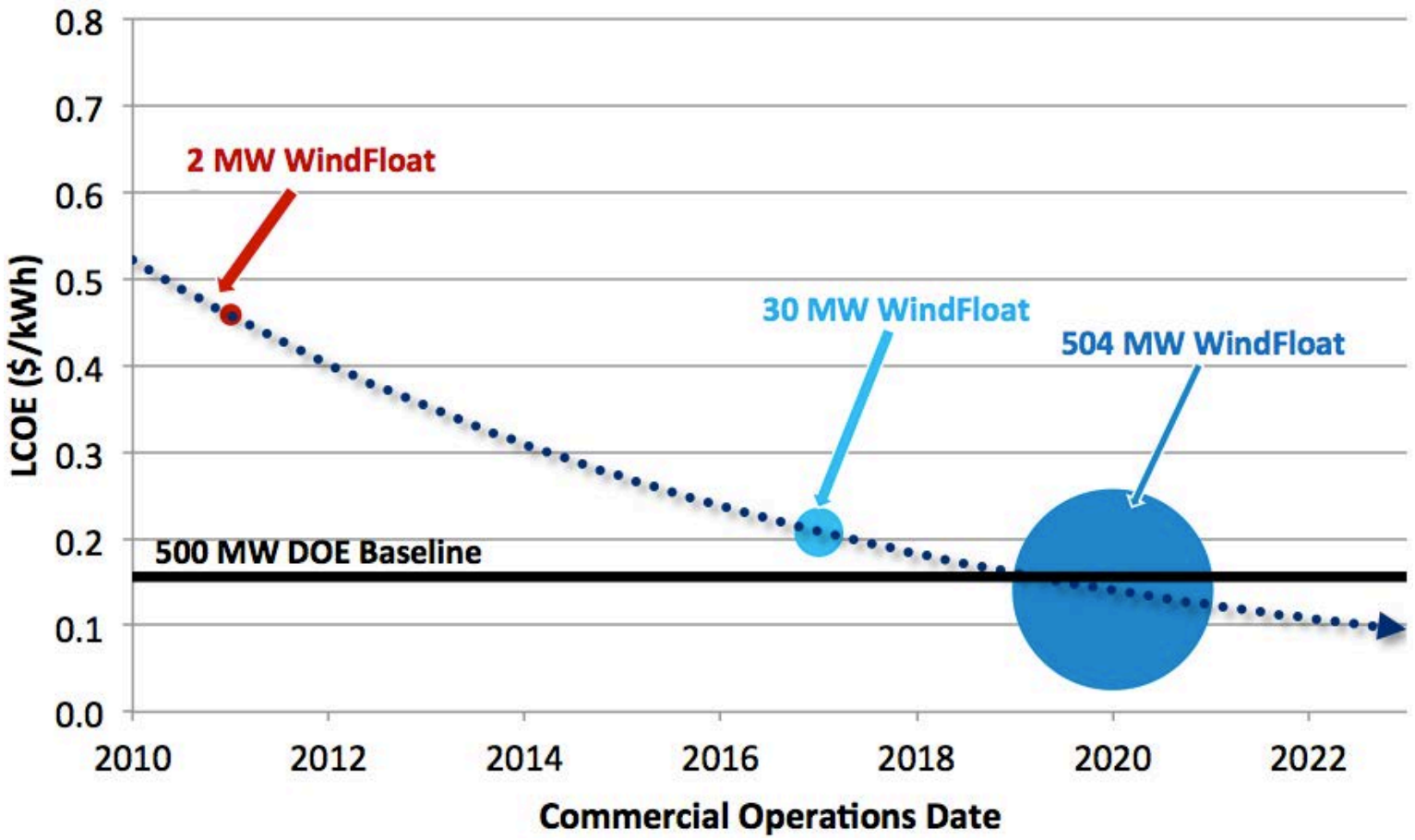
- Developed preliminary plan and obtained initial costs
- Beach crossing location and plan established





Task 5: LCOE Analysis

– NREL analysis project commercial WF project LCOE below DOE baseline



Accomplishments and Progress

Task 6: Project Management

- All sub-awardees were managed successfully with timely adjustments as was necessary
- All reporting requirements were met on time

Task 7: Down-select reporting

- Down-select package was submitted on time

Project Plan & Schedule

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Summary	
WBS Number or Agreement Number	
Project Number: DE-FOA-0410-1527	
Agreement Number	

Legend: Work completed; Active Task; Milestones & Deliverables (Original Plan); Milestones & Deliverables (Actual)

Task / Event	FY2012 Q1 (Oct-Dec)	FY2012 Q2 (Jan-Mar)	FY2012 Q3 (Apr-Jun)	FY2012 Q4 (Jul-Sep)	FY2013 Q1 (Oct-Dec)	FY2013 Q2 (Jan-Mar)	FY2013 Q3 (Apr-Jun)	FY2013 Q4 (Jul-Sep)	FY2014 Q1 (Oct-Dec)	FY2014 Q2 (Jan-Mar)	FY2014 Q3 (Apr-Jun)	FY2014 Q4 (Jul-Sep)
Project Name: WindFloat Pacific Offshore Wind Demonstration Project												
Q3 Milestone: Process Management Plan to enhance communication for permitting												
Q3 Milestone: Commercial Lease Request to BOEM												
Q4 Milestone: Report on Priority Environmental Interactions												
Q1 Milestone: Site Geophysical conditions report												
Q1 Milestone: Site metocean conditions report												
Q1 Milestone: Site selection report												
Q1 Milestone: Plan for high resolution resource monitoring												
Q2 Milestone: Design Report												
Q2 Milestone: Installation, Operations and Maintenance Report												
Q2 Milestone: Environmental and Permitting Process Report												
Q2 Milestone: Grid Interconnection Report												
Q2 Milestone: Summary Report												
Current work and future research												
Construction and Operations Plan (BOEM)												
FEED												
PPA discussions/negotiations												

Comments

Project Timeline: Budget Period 1 February 15 – May 14, 2014

- Project completion: by end of December 2017

Research Integration & Collaboration

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Partners, Subcontractors, and Collaborators:

- Houston Offshore Engineering
- RPS Evans Hamilton
- Herrera Environmental Consulting
- American Bureau of Shipbuilding (ABS)
- DNV GL
- Forristall Ocean Engineering
- Siemens Wind Power
- PNNL
- NREL

Communications and Technology Transfer:

- Project widely communicated through conferences and press-releases
- Dedicated website: www.windfloatpacific.com
- Filed lease data, including proposed site and environmental info, is public through BOEM
- Newly collected environmental data will be disseminated through Tethys
- Manufacturing and installation know-how will be developed through WFP

Next Steps and Future Research

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FY14/Current research:

- Complete FEED
- Develop and submit COP to BOEM
- Conclude PPA negotiations
- Begin formal interconnection process
- Drive cost effectiveness in fab/installation philosophies
- Obtain final cost estimates
- Prepare overall project package for the Final Investment Decision

Proposed future research:

- Adaptive management protocols post deployment
- In-situ wake effects studies
- Manufacturing/Fabrication gap analysis
- O & M data collection and studies
- Lessons learned analysis
- Risk analysis vs measured and demonstrated risks

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Hywind Maine

Floating Offshore Wind Project

Trine Ingebjørg Ulla

Statoil

triu@statoil.com Tel: +47 95157385

Budget, Purpose, & Objectives

Total DOE Budget[1]: $4.000M

Total Cost-Share[1]:$4.592M

Problem Statement: Demonstrate a floating offshore wind pilot park - the next step towards developing industrial scale floating wind parks 0

Impact of Project: 1) Demonstrate technical and commercial feasibility of floating offshore wind technology; 2) Demonstrate cost reductions

This project aligns with the following DOE Program objectives and priorities:

- **Optimize Wind Plant Performance:** Reduce Wind Plant Levelized Cost of Energy (LCOE)
- **Accelerate Technology Transfer:** Lead the way for new high-tech U.S. industries
- **Mitigate Market Barriers:** Reduce market barriers to preserve or expand access to quality wind resources
- **Modeling & Analysis:** Conduct wind techno-economic and life-cycle assessments to help program focus its technology development priorities and identify key drivers and hurdles for wind energy technology commercialization

[1] ***Budget/Cost-Share for Period of Performance FY2012 – FY2013***

Hywind Floating Concept

- Robust slender cylinder substructure design
- Design & dimensions optimized for mass production and installation
- Standardized mooring system with three mooring lines
- Standard offshore turbine
- Inshore assembly and pre-commissioning

Hywind Demo, Norway - the world's first full scale prototype

- In operation from September 2009
- Produced 36 GWh from start-up
- Net capacity factor 2011: 50%
- Experienced wind speed of 40 m/s and maximum wave height of 19 m
- Floater motions have no negative impact on turbine performance
- Concept verified

Commercialisation of Hywind
From Idea to Commercial deployment

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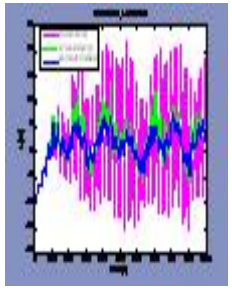
- The technical concept is considered proven
- **Next step: Pilot park to demonstrate improvements and cost reductions**
- Commercial scale parks 500-1000 MW is the final objective

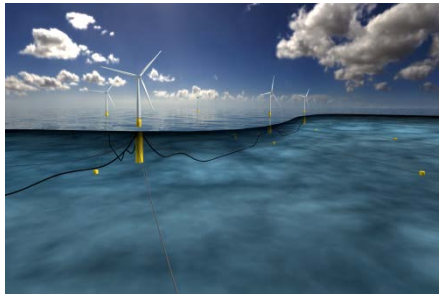
→ Goal: Cost competitive with bottom fixed in 2020's



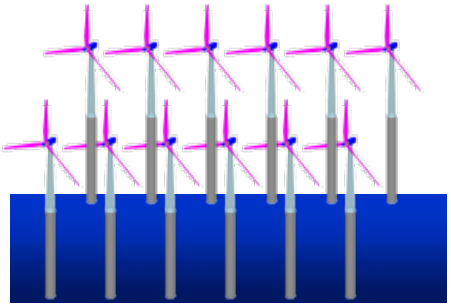
Concept
2001

Model test
2005

Full-scale Prototype
2.3 MW
2009



Pilot Park
Up to 30 MW
2016/17



Industrial scale
500-1000 MW
2020+

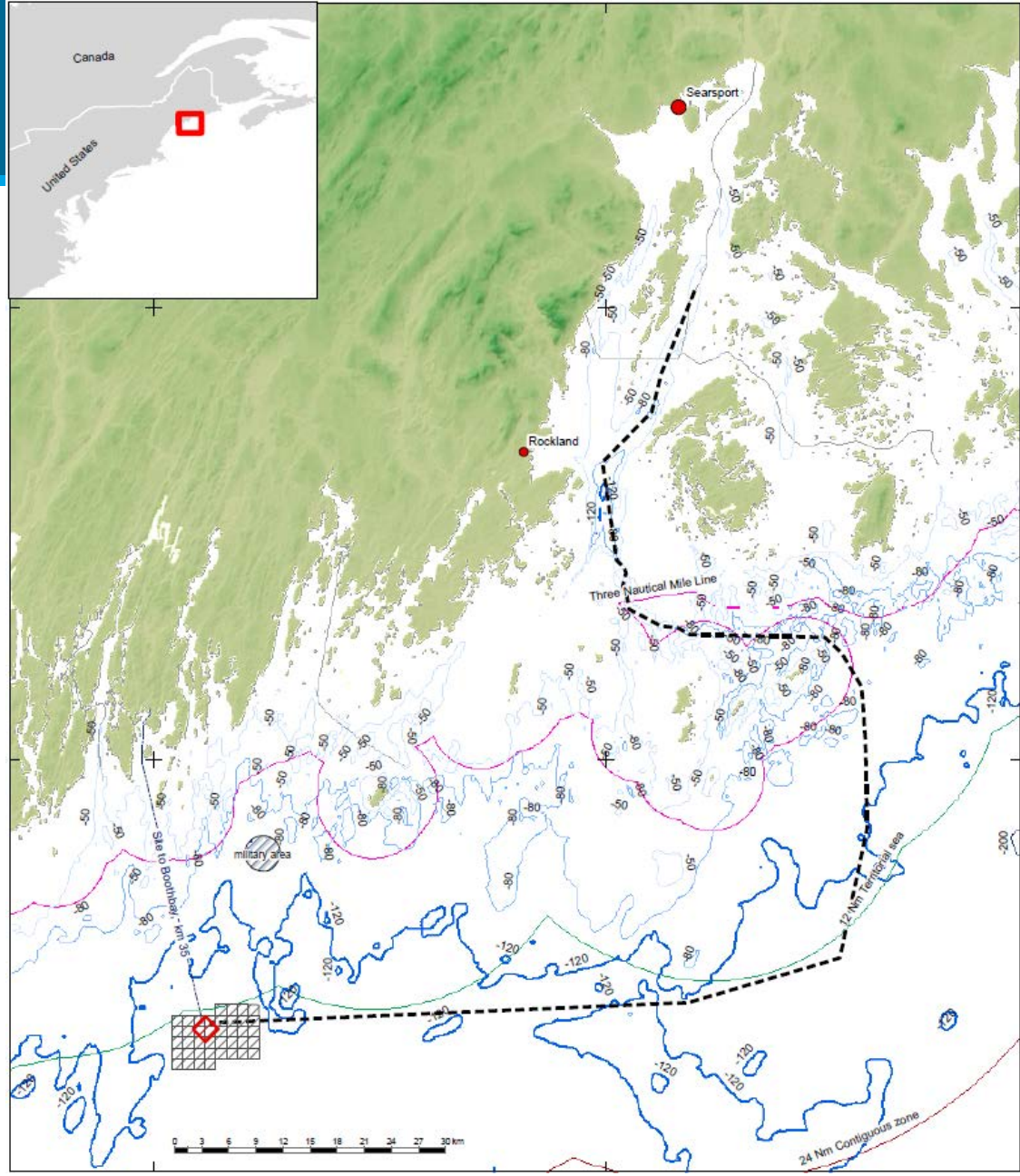
Hywind Maine project

Project description

- Four 3MW turbines park
- 12 nautical miles off the coast of Maine
- Water depth ~475 ft.
- 2-4 square miles lease area
- Submerged power cable to Boothbay

Key objectives

- Optimize design - larger turbine, lighter substructure with reduced draught
- Reduce CAPEX/MW by 60 - 70%
- Reduce substructure weight/MW by 35%
- Test additional complexity in load due to to wake effects and redesign
- Improve fabrication and installation efficiency



Accomplishments and Progress

2012

- Lease: Determination of Non-Competitive Interest
- Environmental surveys incl. avian & bat
- Preparations for state and federal permitting
- Design studies
- Capability studies US/Maine supply chain
- Grid application

2013

- PPA Term sheet approval by Maine PUC, detailed negotiations with CMP
- NREL collaboration: Mooring, instrumentation, design and analysis, up-scaling, cost of energy, to be continued in 2014
- Geophysical and benthic survey undertaken
- Studies marine operations, installation, grid connection (substation upgrade and onshore cable)
- Grid Interconnection negotiations

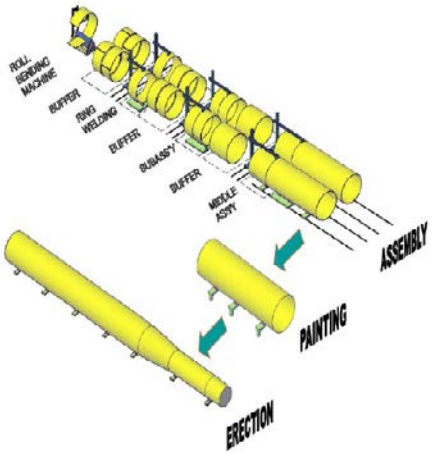
Statoil will continue to develop the Hywind concept and to explore the US market

7

Further Technology Development Steps

Improved Design

Industrial Fabrication



Industrial scale deployment

Proposed future research:

- NREL: Design and Analysis, Wake modelling, Concept resource assessment, Array cable study
- Cost of Energy improvements

Partners, subcontractors and collaborators

BRACEWELL & GIULIANI

GENERAL DYNAMICS Bath Iron Works

RLC ENGINEERING

NREL National Renewable Energy Laboratory

BERNSTEIN SHUR COUNSELORS AT LAW

CIANBRO

REED

THE UNIVERSITY OF MAINE

TETRA TECH

4subsea

Lloyd's Register Consulting

Alpine

POWER ENGINEERS

REEF SUBSEA™

CENTRAL MAINE POWER

PANAMERICAN CONSULTANTS, INC.

ISLAND INSTITUTE

Communications and Technology Transfer:

- "Foundations and substructures". Invited Presentation Offshore Energy Exchange Workshop, DOE and DOI, Washington DC April 11-12, 2012
- "Experimental Validation of offshore wind foundations – can we learn from the offshore oil and gas experience?" Invited Presentation on Expert Meeting on Computer Code Validation for Offshore Wind System Modelling, IEA Wind task 30, NREL. Boulder, Colorado, May, 15-16, 2012
- Introductory public informational sessions for the Hywind Maine pilot project, Boothbay 25 Jun, Rockland 26 Jun, Portland 27 Jun, 2012
- "Hywind floating wind", presentation AWEA, Virginia, Oct 10, 2012
- "Hywind. Deep offshore wind operational experience", Key note address, Deep Wind, Trondheim, Jan. 2013,
- Hywind Presentations, Offshore Wind Power Conference, Boston, Feb 28, 2013 and Feb 2012
- "Hywind opportunities in Maine", presentation Fishermen's Forum, Rockland Maine, Mar 1, 2013
- "Floating offshore wind – Further development", NORCOWE, When Science meets Industry, Stavanger, April 2013.
- "Hywind Experience", presentation Bilbao Energy Week, Bilbao, 17 Apr, 2013
- "Hywind Pilot Park - Floating Spar Buoy Structures in the Gulf of Maine", presentation AWEA, Providence RI, Oct 2013
- "Hywind Maine", National Ocean Industries Association's fall meeting, Colorado, October 2, 2013.
- "Update on the Status of the Hywind Concept". Future Offshore Foundations, Bremen, Oct 23 -25, 2013.
- "Commercialization of Hywind", ENOVA conference, Trondheim, Jan 29, 2014
- "Hywind", Deeper Offshore Wind Conference, London, Mar 5, 2014.

Project Plan & Schedule

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Summary	
WBS Number or Agreement Number	DE-EE0005988.000
Project Number	
Agreement Number	

Legend

- Work completed
- Active Task
- Milestones & Deliverables (Original Plan)
- Milestones & Deliverables (Actual)

Task / Event	FY2012 Q1 (Octt-Dec)	FY2012 Q2 (Jan-Mar)	FY2012 Q3 (Apr-Jun)	FY2012 Q4 (Jul-Sep)	FY2013 Q1 (Octt-Dec)	FY2013 Q2 (Jan-Mar)	FY2013 Q3 (Apr-Jun)	FY2013 Q4 (Jul-Sep)	FY2014 Q1 (Octt-Dec)	FY2014 Q2 (Jan-Mar)	FY2014 Q3 (Apr-Jun)	FY2014 Q4 (Jul-Sep)
Project Name: Hywind Maine												
Environmental Studies												
Federal Permits												
Concept design of Substructure & Mooring system												
Offshore site surveys												
Grid application and grid feasibility study												
Marine operations concept study												
Market/Vendor Assessment/pre-qualification												
NREL studies BP1												
Reporting to DOE for BP1												
Current work and future research												
NREL Studies, extension BP1 (to be delivered by Q1 FY2015)												

- Hywind Maine put on hold July 2013 and ended October 2013
- DOE Project and collaboration with NREL continued with extended scope

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New England Aqua Ventus I

Using the University of Maine's VolturnUS Technology

Dr. Habib Dagher, P.E.

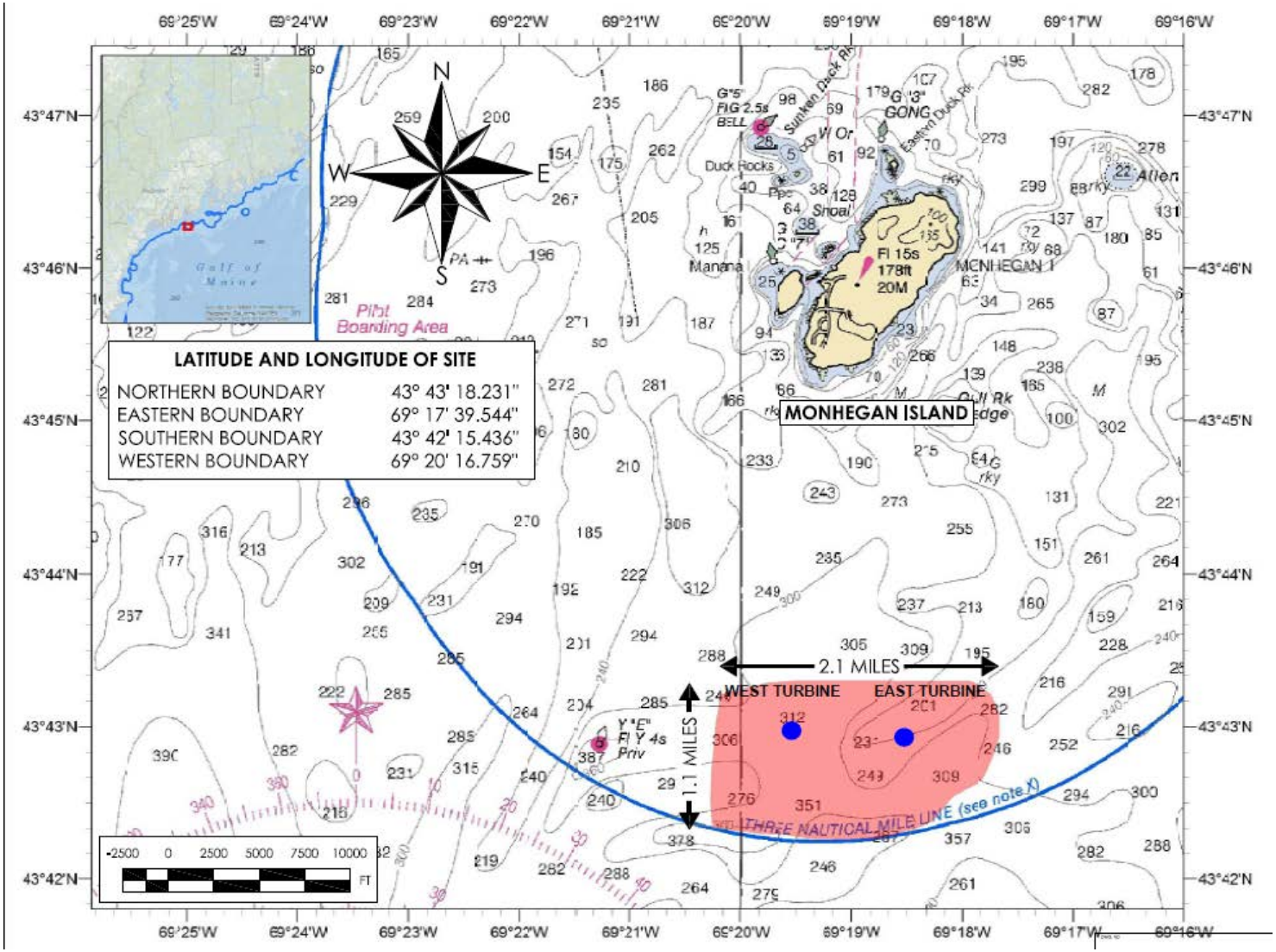
University of Maine

hd@maine.edu

207-581-2138

March 24, 2014

Project Site Map



Budget, Purpose, & Objectives

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Total DOE Budget[1]: $4.00M

Total Cost-Share[1]:$2.17M

Problem Statement:

Logistics and cost issues related to construction, deployment, and permitting slowing development of U.S. offshore wind farms.

Impact of Project:

- VolturnUS drives costs down by using the principles of modular concrete construction whereby for a farm, hundreds of similar precast components are produced, leading to true “industrialization” of the hulls.
- Eliminates the need for heavy offshore construction assets. .
- The VolturnUS technology can generally be installed in water depths exceeding 120 ft. This allows the VolturnUS technology to harness nearly 75% of the US offshore wind resource

This DOE Program objectives and priorities:

- Reduce the LCOE for offshore Wind
- Place innovative demonstration projects in service by 2017
- De-risk technologies so that larger commercial farms can be financed

[1] *Budget/Cost-Share for Period of Performance FY2012 – FY2013*

VolturnUS Paradigm Shift:

Civil Engineering versus Offshore Oil and Gas Costs

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New England Considerations

- Highly efficient modular concrete construction
- Limited cost-effective heavy steel fabrication capabilities.
- Limited or no access to large vessels/ floating cranes.
- Significant experience constructing concrete for heavy bridges

Access to better wind resource

>50% gross Capacity Factors farther offshore

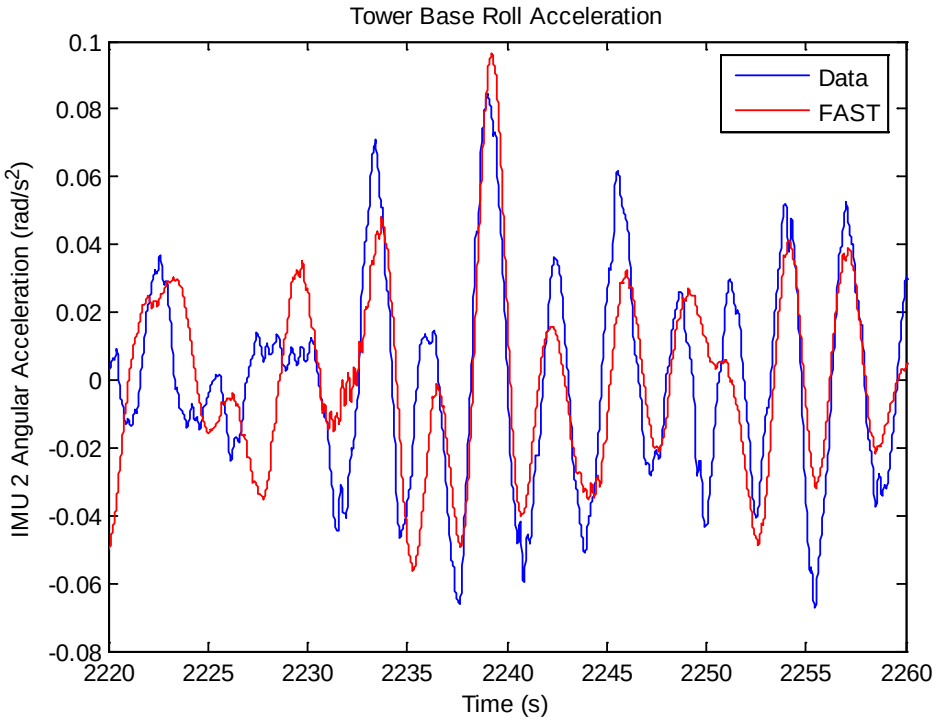
> 9 m/s wind

Accomplishments and Progress

- Designed, built, deployed and tested VolturnUS 1:8.
- Successfully towed 30 miles to Castine.
- First grid-connected offshore wind turbine in the Americas.

Extreme Event on Nov. 1, 2013:
Measurements vs Predictions

Wave (m)	Return Period (years)
19.0	50
19.5	100
21.5	**Measured - scaled**
22.3	500



Removed Technology Risk:
Close Agreement Measured vs Simulation

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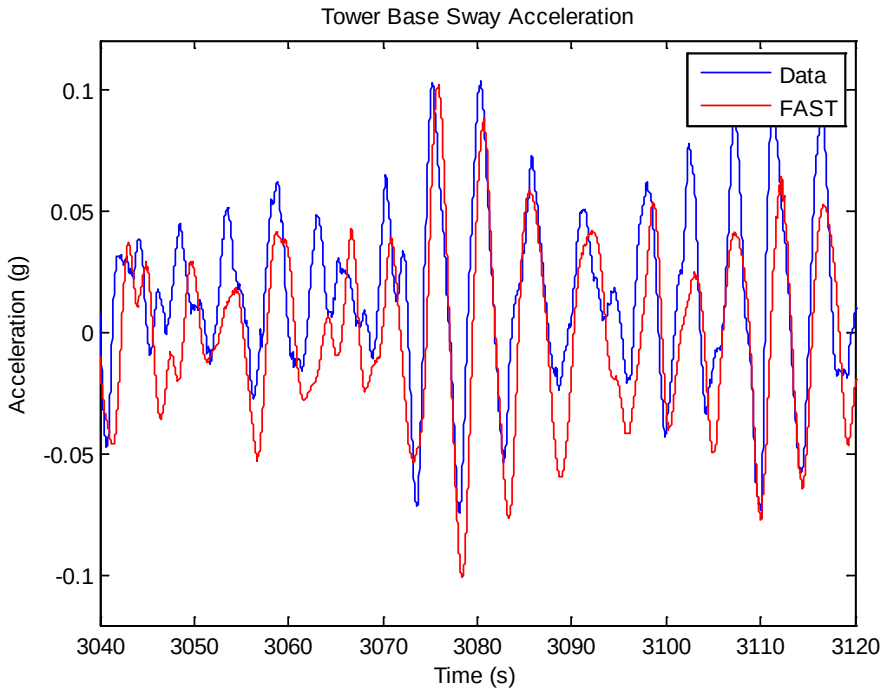
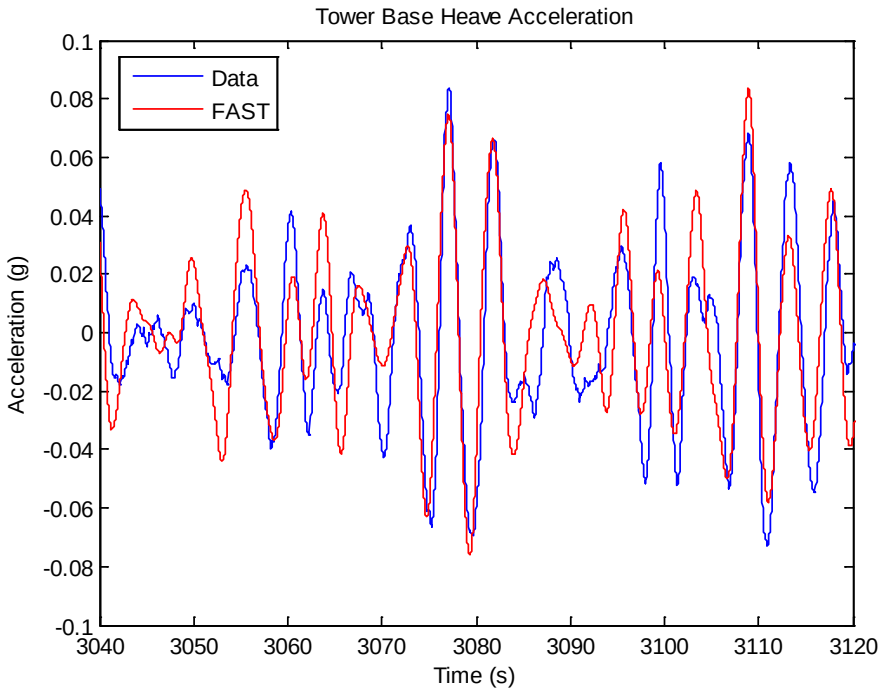
Base Sway acceleration



Base Heave acceleration



½ Scale Tower Testing

- Demonstrate full-scale composite tower fabrication methods and confirm quality through structural testing
- Verify tower design numerical prediction methods through component testing following DNV-OS-C501 (2010) Sec. 6 B103 p69
  - Bending natural frequency
  - Bending stiffness
  - Connection fatigue capacity
  - Torsional and Bending resistance (buckling controlled)

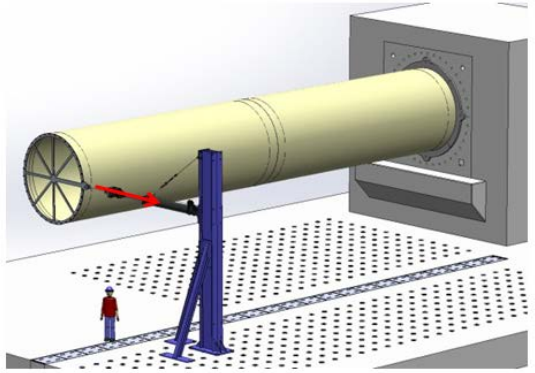


Figure 18: 10ft diameter tower specimen undergoing thrust loading

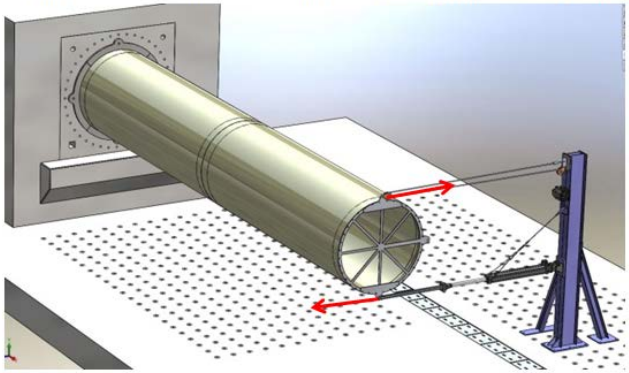
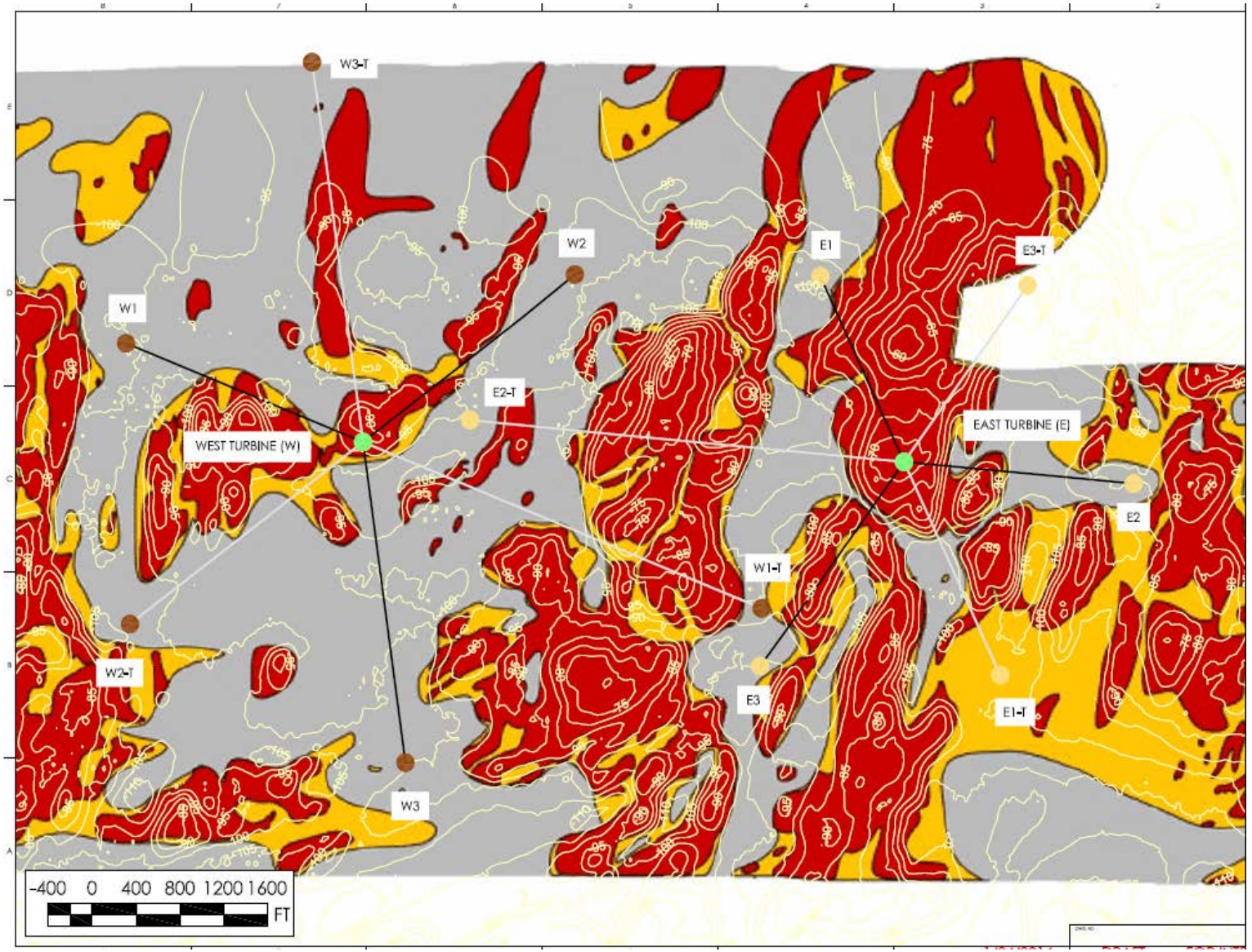


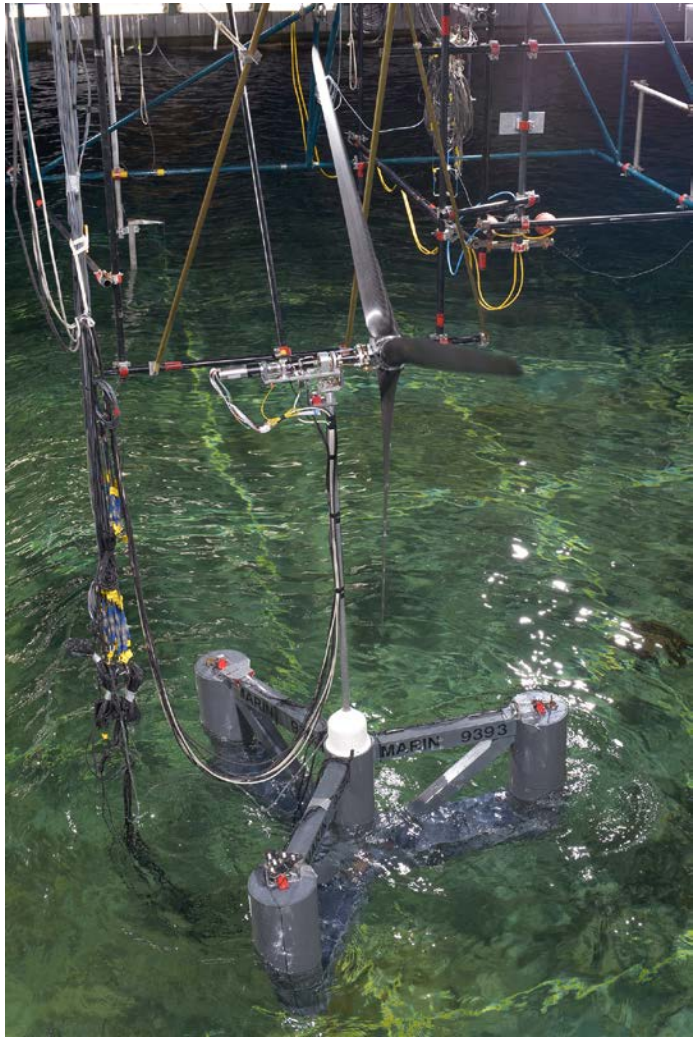
Figure 19: 10ft diameter tower specimen undergoing torsional loading

Site Characterization



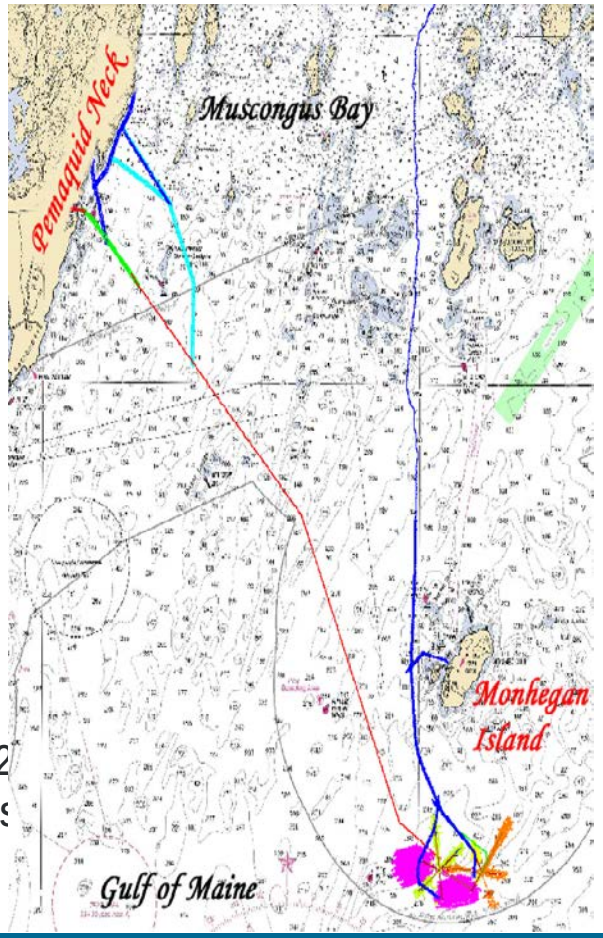
Accomplishments and Progress

- **1:50 scale basin testing completed**
- **A private company "Maine Aqua Ventus I, GP, LLC" formed** to oversee the financing, construction and operations of the pilot farm**.**
- Received a **20-year PPA** from the Maine PUC.
- **Plans for a 500-MW Aqua Ventus II project developed**.
- **Five patents pending**.
- **Best Paper Award** by the Society of Naval Architects and Marine Engineering, 2014 Annual Symposium in Houston, Texas**.**



Accomplishments and Progress

- Obtained ABS “Approval in Principle”
- Lease in hand for the test site and a FONSI for a previous project.
- All permits and regulatory approvals by Spring 2015. The permitting process in Maine state waters has a 2-month turnaround.
- Surveyed undersea electrical lines and anchor locations
- Verified interconnect feasibility
- Developed a five-year comprehensive testing program.



Nov. 1, 2
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Project Plan & Schedule

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Project Has Met or Exceeded All Milestones

Aqua Ventus I Program		313d	10-Feb-2013 A	14-May-2014
Budget Period 1		313d	10-Feb-2013 A	14-May-2014
Contract & Program Management		281d	15-Feb-2013 A	14-May-2014
Physical / Ecological / Envioronmental Monitoring & Permitting		176d	18-Mar-2013 A	03-Jan-2014 A
3.0.1	Provide List of Agencies to hold Consults with	5d	27-Mar-2013 A	03-Apr-2013 A
3.0.2	Hold Agency Kickoff Meetings	30d	13-May-2013 A	26-Jun-2013 A
3.1.000	Monitoring Group Kickoff Meeting	2d	11-Jun-2013 A	12-Jun-2013 A
State / Federal Permitting		176d	18-Mar-2013 A	03-Jan-2014 A
Physical Environmental Modeling & Data Collection		132d	13-May-2013 A	17-Dec-2013 A
Ecological Environmental Monitoring		111d	03-Jun-2013 A	20-Dec-2013 A
Design		269d	10-Feb-2013 A	13-Mar-2014
4.1.310	Iberdrola Scope SUMMARY	82d	05-Apr-2013 A	17-Jan-2014 A
0.430	ABS Scope SUMMARY	77d	05-Aug-2013 A	31-Jan-2014 A
Site Planning / Layout		113d	22-Apr-2013 A	30-Sep-2013 A
Floating Platform Design		209d	25-Feb-2013 A	31-Jan-2014 A
Mooring & Anchor Design		142d	22-Apr-2013 A	17-Dec-2013 A
Composite Tower Design		221d	29-Apr-2013 A	13-Mar-2014
Turbine Design & Controls		159d	29-Mar-2013 A	31-Jan-2014 A
Electrical Infrastructure		241d	20-Feb-2013 A	17-Jan-2014 A
Mechanical Systems		70d	05-Aug-2013 A	18-Nov-2013 A
Preliminary Fabrication, Construction & Deployment Methods		104d	16-Jul-2013 A	06-Feb-2014 A
Instrumentation Controls and Monitoring AVI		127d	10-Feb-2013 A	15-Nov-2013 A
Installation, Operations, Maintenance		159d	22-Jul-2013 A	14-Feb-2014 A
Total Project Cost Estimate		105d	02-Aug-2013 A	24-Feb-2014
LCOE Analysis		63d	28-Oct-2013 A	13-Feb-2014 A
Reports for Down Select & Presentation		263d	22-Apr-2013 A	05-May-2014

Schedule for BP2 – 5 & Follow-on 500 MW Farm

Maine Aqua Ventus I BP2-5	2143d	14-Feb-2014 A	15-Jul-2022
Contract / General	2143d	14-Feb-2014 A	15-Jul-2022
Environmental	2128d	18-Feb-2014	15-Jul-2022
Permitting	923d	18-Feb-2014	09-Oct-2017
Design / Engineering	292d	18-Feb-2014	13-Apr-2015
Procurement	813d	18-Feb-2014	03-May-2017
Construction	769d	27-Aug-2014	11-Sep-2017
Deployment	30d	30-Jun-2017	11-Aug-2017
Commissioning / Testing	70d	02-Jun-2017	11-Sep-2017
Operations & Maintenance	1255d	31-Jul-2017	15-Jul-2022
Maine Aqua Ventus 500MW Project	2736d	02-Jan-2017	06-Oct-2027
Contract / General	2476d	02-Jan-2017	07-Oct-2026
Environmental / Permitting	2496d	02-Jan-2017	04-Nov-2026
Design / Engineering	433d	19-Sep-2018	05-Jun-2020
Procurement	1583d	29-Jul-2019	28-Oct-2025
Preferred Construction (4 Graving Docks, Precast)	1825d	29-Jul-2019	07-Oct-2026
Deployment	790d	06-Jun-2023	15-Jul-2026
Commissioning / Testing	60d	16-Jul-2026	07-Oct-2026
Operations & Maintenance	260d	08-Oct-2026	06-Oct-2027

Research Integration & Collaboration

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Collaborated with over 30 partners. Our World-leading team includes:

Iberdrola, the largest wind developer in the world;

Emera, a leading clean energy services company;

Technip, a world leader in project management, engineering and offshore construction;

American Bureau of Shipping, third-party review;

T.Y. Lin International the most experienced prestressed concrete design firm in the world;

Ershigs, the largest composite materials fabricator in the US;

UMaine, **UMass,** and **Maine Maritime Academy**, with leading programs in advanced materials and offshore wind;

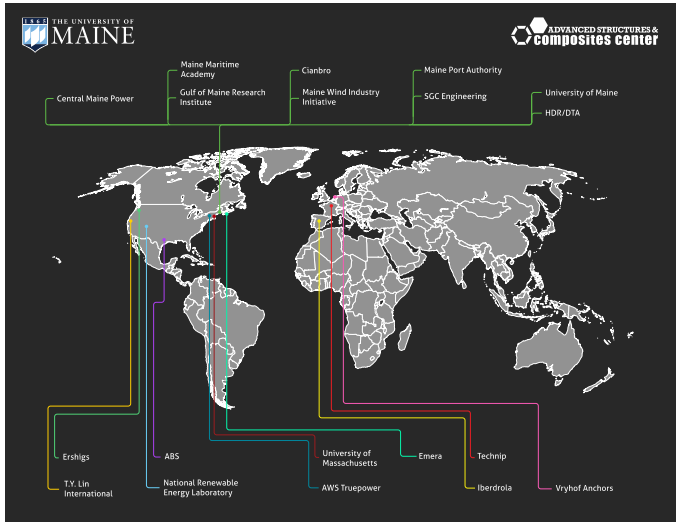
NREL, coupled analyses and type certification;

AWS Truepower, metocean data collection;

Cianbro the largest private company in Maine, GC on the project;

Senergy who has connected over 50% of all UK wind projects to the electricity network;

HDR and **Kleinschmidt Associates** with expertise in permitting large energy projects;



- Over 200 tours, conferences, meetings, Presentations.
- Overwhelming (>90%) public support in Maine
- Research findings and event information can be found on MaineAquaVentus.com, DeepCwind.org, and on our Facebook page.

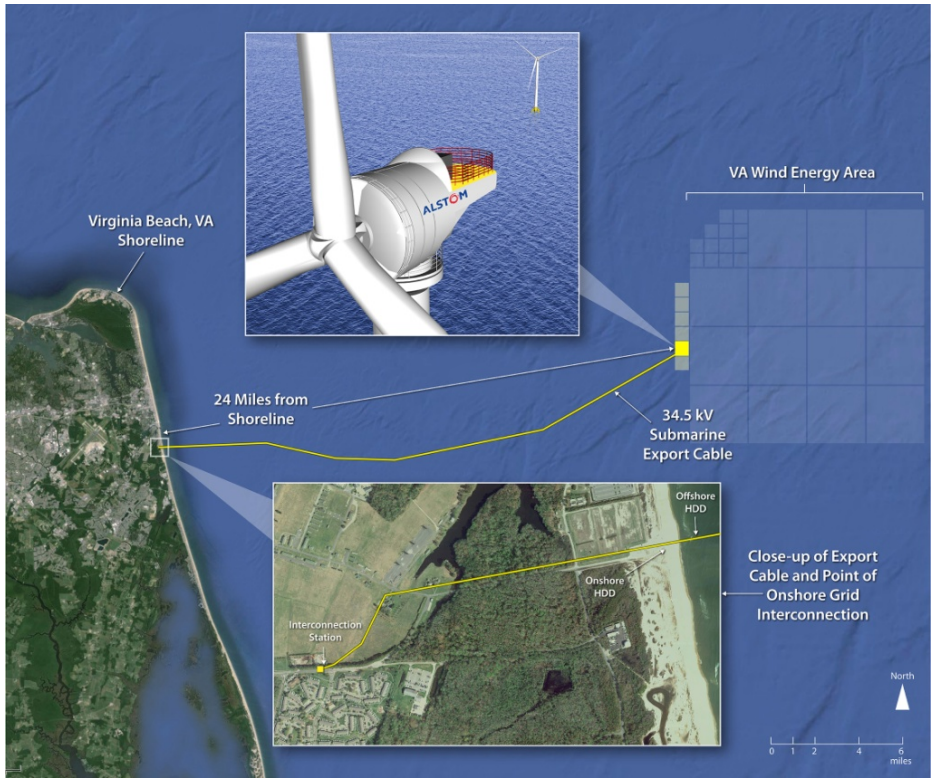
Next Steps and Future Research

FY14/Current research:

- In the next budget period, will complete the design and permitting to 100%.
- Construction will begin in Dec 2015
- The two-turbine project will be operational in 2017.
- Monitoring will continue for five years

Proposed future research:

1) Five-year monitoring program for pilot farm
2) Industrialization of fabrication for a 500MW farm
3) Active controls
4) Advanced materials durability (concrete and composites)
5) Test methods & standards for floating offshore wind.



Virginia Offshore Wind Technology Advancement Project

John Larson

Dominion

John.Larson@dom.com; 804-819-2902

March 24, 2014

Budget, Purpose, & Objectives

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Total DOE Budget[1]: $4.000M

Total Cost-Share[1]:$1.000M

Problem Statement:

- Offshore wind is significantly more costly than other forms of generation. The primary purpose of the Virginia Offshore Wind Technology Advancement Project (VOWTAP) is to advance the offshore wind industry in the U.S. by demonstrating innovative technologies and process solutions that will establish offshore wind as a cost-effective renewable energy resource.

Impact of Project:

- VOWTAP will reduce the cost and deployment timelines of future commercial offshore wind development through innovation and removal of market barriers.
- Because of the close proximity between the research lease site and the wind energy area, this project will directly inform commercial design, installation, and O&M.

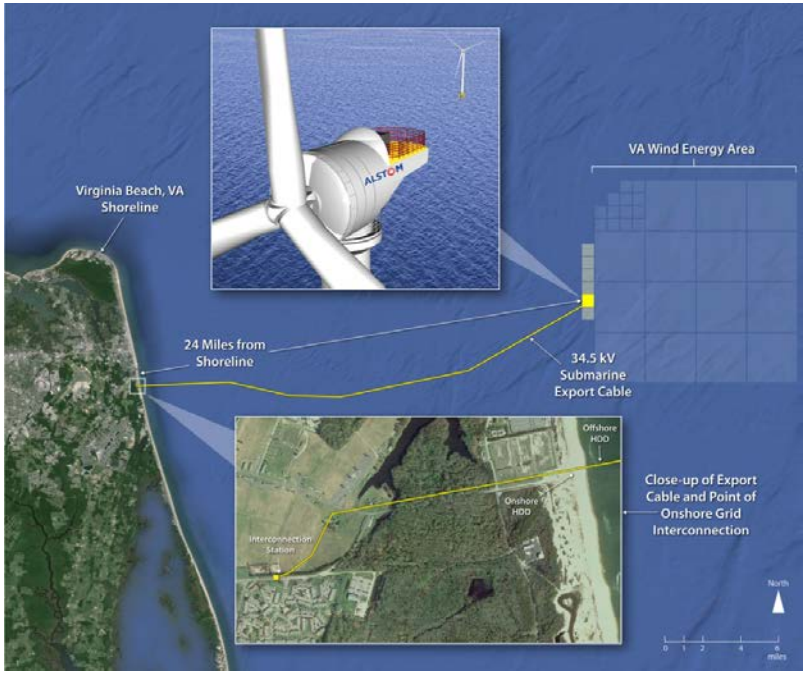
This project aligns with the following DOE Program objectives and priorities:

- **Optimize Wind Plant Performance:** Reduce Wind Plant Levelized Cost of Energy (LCOE)
- **Mitigate Market Barriers:** Reduce market barriers to preserve or expand access to quality wind resources
- **Testing Infrastructure:** Enhance and sustain the world-class wind testing facilities at Universities and national laboratories to support mission-critical activities
- **Modeling & Analysis:** Conduct wind techno-economic and life-cycle assessments to help program focus its technology development priorities and identify key drivers and hurdles for wind energy technology commercialization

[1] ***Budget/Cost-Share for Period of Performance FY2012 – FY2013***

Technical Approach

- 12 MW offshore wind facility located approximately 24 nautical miles off the coast of Virginia.
- The Project will consist of two Alstom Haliade™ 150-6 MW turbines mounted on inward battered guide structures (IBGS).
- Robust testing plan to validate VOWTAP innovations & dissemination plan to communicate the results.
- VOWTAP balances technology innovation with commercial readiness such that turbine operations can commence by 2017.



Accomplishments and Progress

Budget Period 1 Accomplishments (February 2013 through February 2014)

- ✓ 50% FEED completed
  - Site selected
  - Initial design complete
  - Preliminary test plan complete
- ✓ Initial vessel strategy identified and construction plan drafted
- ✓ Preliminary O&M plans complete
- ✓ Research Lease application submitted and a Determination of No Competitive Interest issued by BOEM
- ✓ Research Activities Plan and Site Assessment Plan submitted to BOEM, NEPA review underway
- ✓ PJM queue application submitted

Project Plan & Schedule

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Summary		Legend	
WBS Number or Agreement Number			Work completed
Project Number			Active Task
Agreement Number	DE-EE-0005985		Milestones & Deliverables (Original Plan)
			Milestones & Deliverables (Actual)

	FY2013				FY2014			
Task / Event	Q1 (Octt-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)	Q1 (Octt-Dec)	Q2 (Jan-Mar)	Q3 (Apr-Jun)	Q4 (Jul-Sep)
Virginia Offshore Wind Technology Advancement Project								
DOE Selection	◆							
Marine Surveys Complete			◆					
Site Selection and Characterization Complete				◆				
PJM Queue Submitted					◆			
Research Activities Plan Submitted to BOEM						◆		
50% FEED Complete						◆		
DOE Down-Select Report Submitted						◆		
Current work and future research								
DOE Down-Select Decision							◇	
Geotechnical surveys complete								◇

Research Integration & Collaboration

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Partners, Subcontractors, and Collaborators: Alstom; Kellogg, Brown, and Root (KBR); Keystone Engineering, Inc.; the Virginia Department of Mines, Minerals and Energy (DMME); the National Renewable Energy Laboratory (NREL); the Virginia Coastal Energy Research Consortium (VCERC) represented by Virginia Polytechnic Institute and State University (Virginia Tech); Tetra Tech, Inc. (Tetra Tech); and Newport News Shipbuilding (NNS), a division of Huntington Ingalls Industries

Communications and Technology Transfer: VOWTAP presentations at AWEA Offshore Wind Conference in October 2013 and Offshore Wind Power USA Conference in February 2013 and February 2014. Public Open House in Virginia Beach in August 2013.

Next Steps and Future Research

BP 2 Plans:

- Finalize 100% FEED
- Complete detailed construction and installation plan
- Prepare Request for Proposals for primary contracts
- Complete BOEM NEPA process
- Finalize PJM Interconnection process