

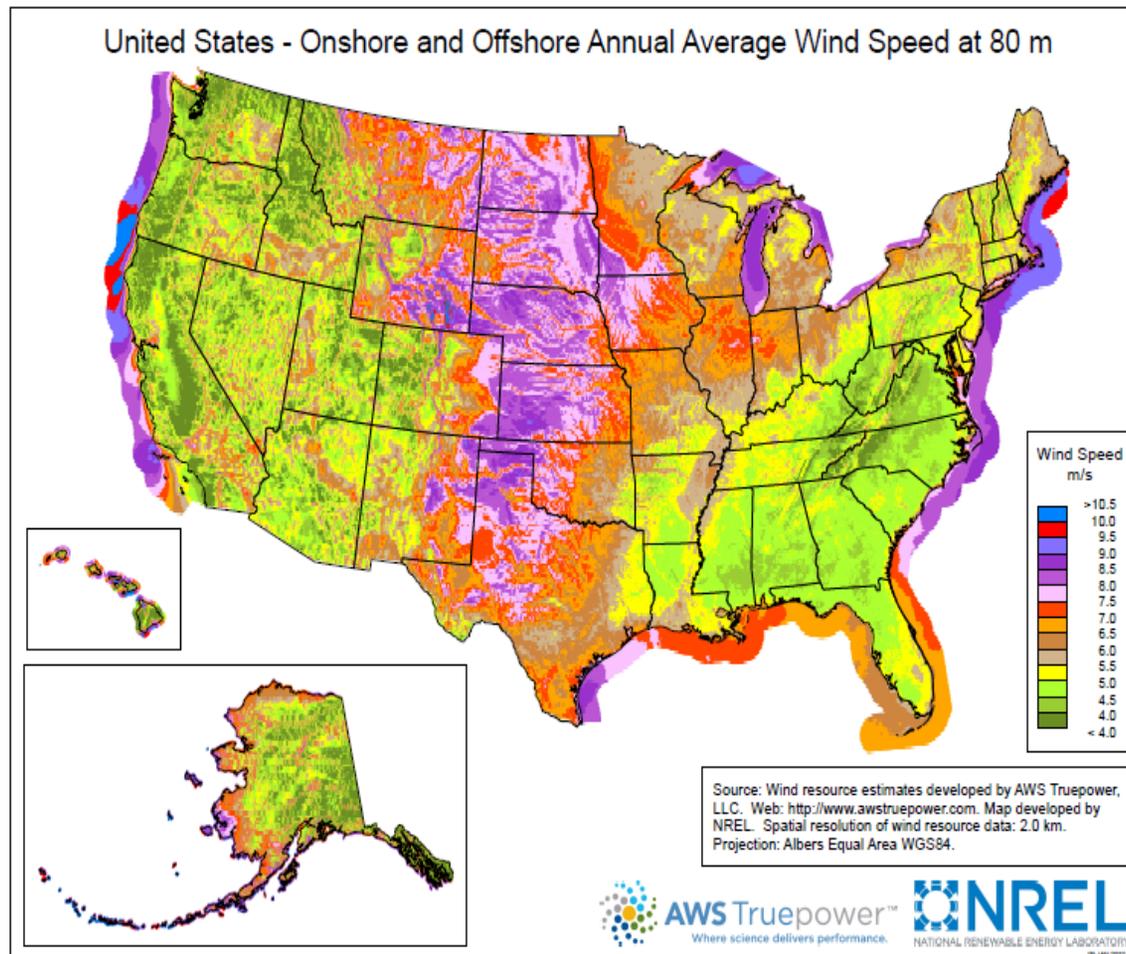


**DOE Offshore Wind:
Program Overview
September 17, 2015**

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Wind and Water Power Technologies Office
Office of Energy Efficiency and Renewable
Energy

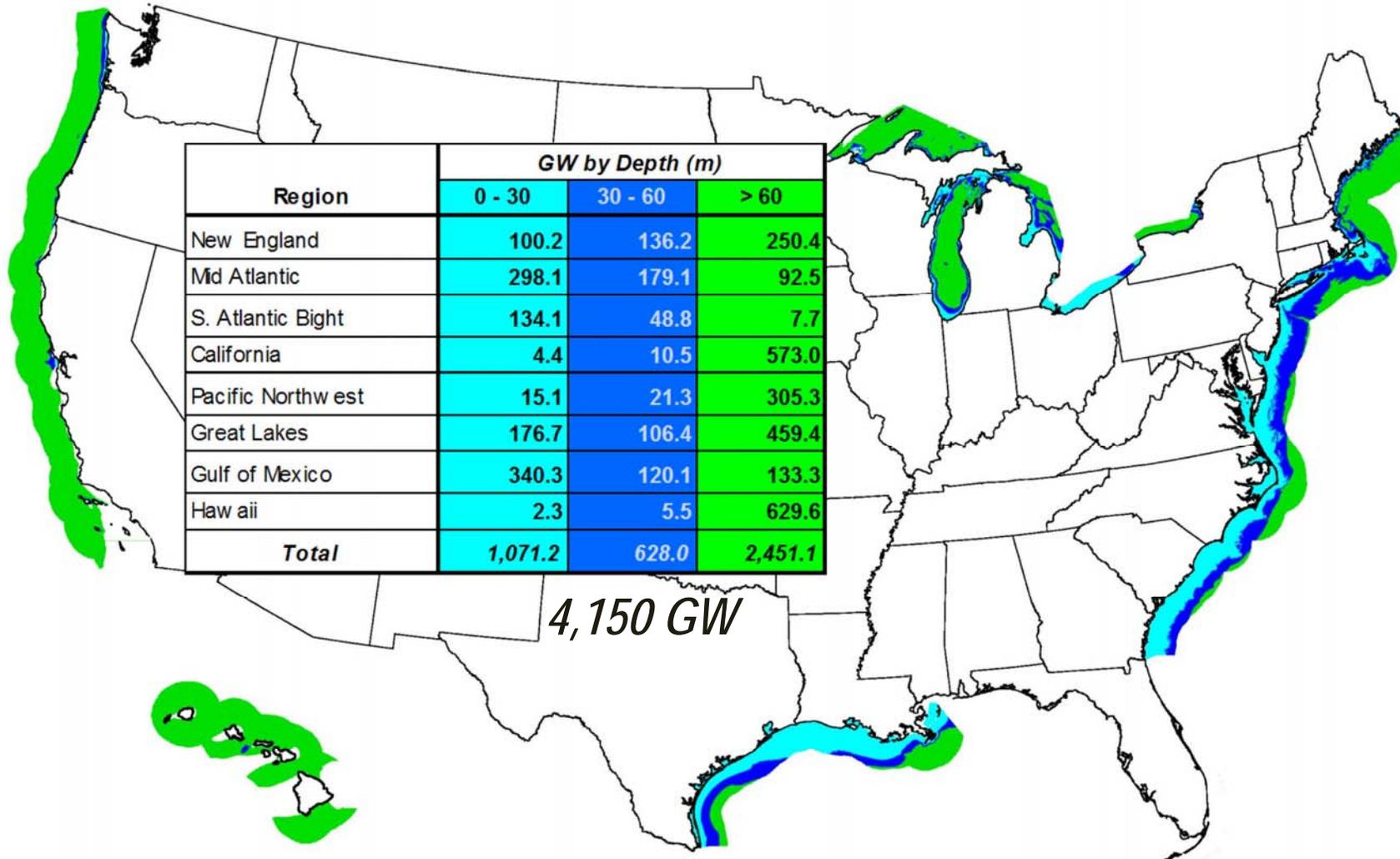
Why Offshore Wind?

Energy Potential: *Land: 9,000 GW* | *Offshore: 4,000 GW*



- Stronger winds offshore
- Power is generated where it is needed
 - 28 coastal and Great Lakes states consume 78% of the nation's electricity
- Provides new jobs
 - Revitalizes ports and domestic manufacturing
- Advances in technology lead to energy capture further offshore
 - Decreased visual impact and user conflicts
- Energy diversification

U.S. Gross Offshore Wind Resource



The European offshore wind industry

key trends and statistics 2014

January 2015



408
new offshore wind turbines
in **9** wind farms and **one**
demonstration project

1,483
MW of offshore wind
capacity was connected to
the grid

2,488
turbines are installed
and grid connected

work
carried out in: **12** wind farms
Once completed will
increase installed
capacity by a further
2.9 GW



CABLE SUPPLIERS
to offshore wind farms
European market

INTER ARRAY
34.2% | **26.8%**
Nexans | Prysmian

EXPORT
51.4% | **25.7%**
Prysmian | NKT



32.9 km
average distance to shore

22.4 m
average
water
depth

MONOPILE
91%

JACKET
8.1%

TRIPOD
0.9%

**SUBSTRUCTURES
FOUNDATION TYPES**
(2014 annual market shares)

**AVERAGE SIZE OF
CONNECTED WIND FARMS
IN 2014**

368 MW



wind turbine
MANUFACTURERS
(2014 Annual market shares of connected MW)

86.2% Siemens
9.5% MHI-Vestas
Offshore Wind
3% Areva
0.8% Senvion
0.5% Samsung

DEVELOPERS
(2014 Annual market shares of connected MW)

19.4% WindMW
14.1% RWE
14% DONG
Energy
12.1% Iberdrola
11.2% Stadtwerke
Munchen

Atlantic
Ocean
22.5%

North
Sea
63.3%

Baltic
Sea
14.2%

8,045.3 MW
CONNECTED TO THE GRID
IN EUROPE

~3.3 MILLION HOMES

DOWNLOAD
FULL REPORT PDF

www.ewea.org/stats/eu-offshore-2014

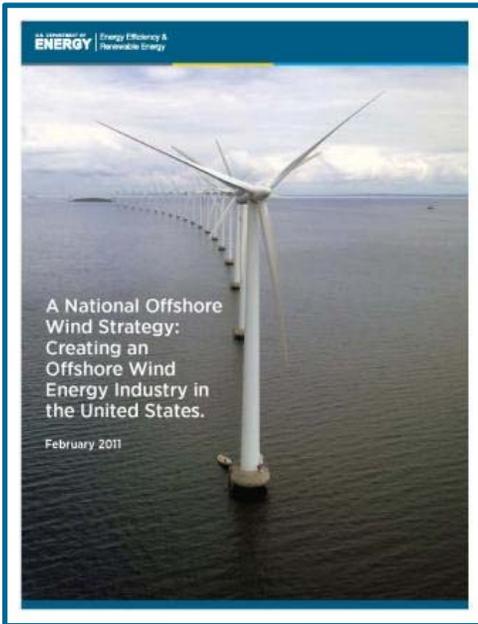
How Big?



National Offshore Wind Strategy

Two Critical Objectives

- 1) Reducing the cost of energy through technology development
- 2) Reducing deployment timelines and uncertainties



Developed jointly by DOE and DOI

World-Class Test Facilities	Removing Market Barriers	Next Generation Drivetrain R&D	Developing Innovative Technology	Demonstrate Next-Generation Designs
(ARRA Projects) Clemson 15 MW Dynamometer Massachusetts Large Blade Test Facility (to 90m)	(Offshore FOA 1) Siting and Permitting Infrastructure Resource Planning	(Tech. Viability FOA) Aggressively Targets Key Cost Components	(Offshore FOA 2) Computational Tools Turbine Design Marine Systems Engineering	(Offshore FOA 3) Demonstration Project Partnerships with 50% Cost Share
\$70M	\$16.5M	\$7.5M	\$26.5M	\$168M

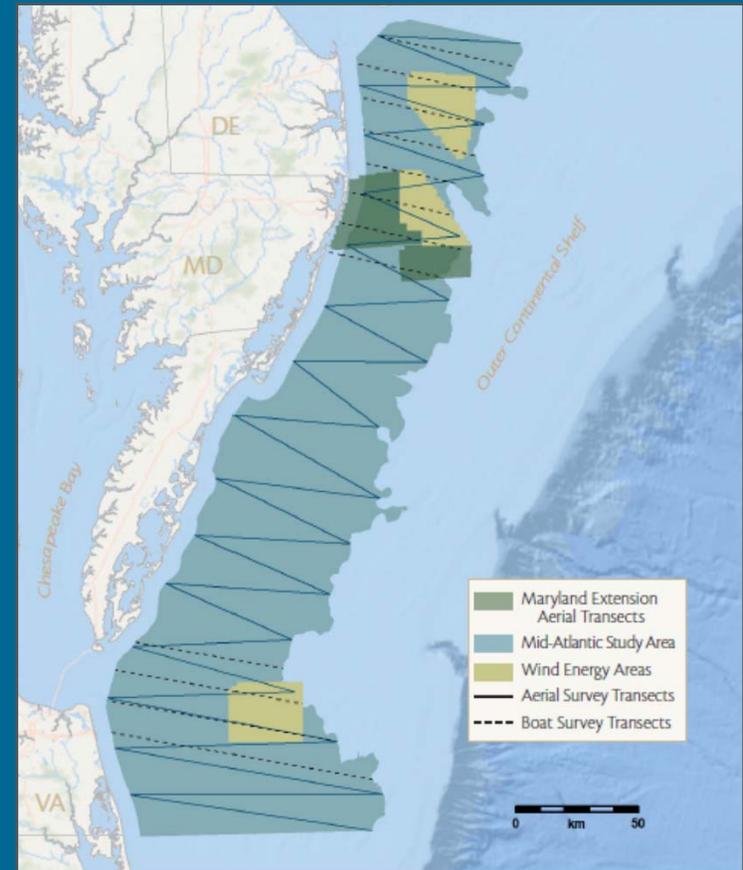
Biodiversity Research Institute

HiDef Surveying; NCSU; CUNY
Duke U; USFWS; USGS
Memorial U-Newfoundland



Gathering data and modeling wildlife densities and habitat use across temporal and spatial scales on the mid-Atlantic continental shelf

- Synthesizing existing data on bird, sea turtle, and marine mammal abundance and movement in the mid-Atlantic
- Performing baseline surveys of species at high risk to turbine interactions using high definition aerial video and boat-based techniques
- Developing predictive and risk assessment frameworks.
- Results forthcoming (2015)

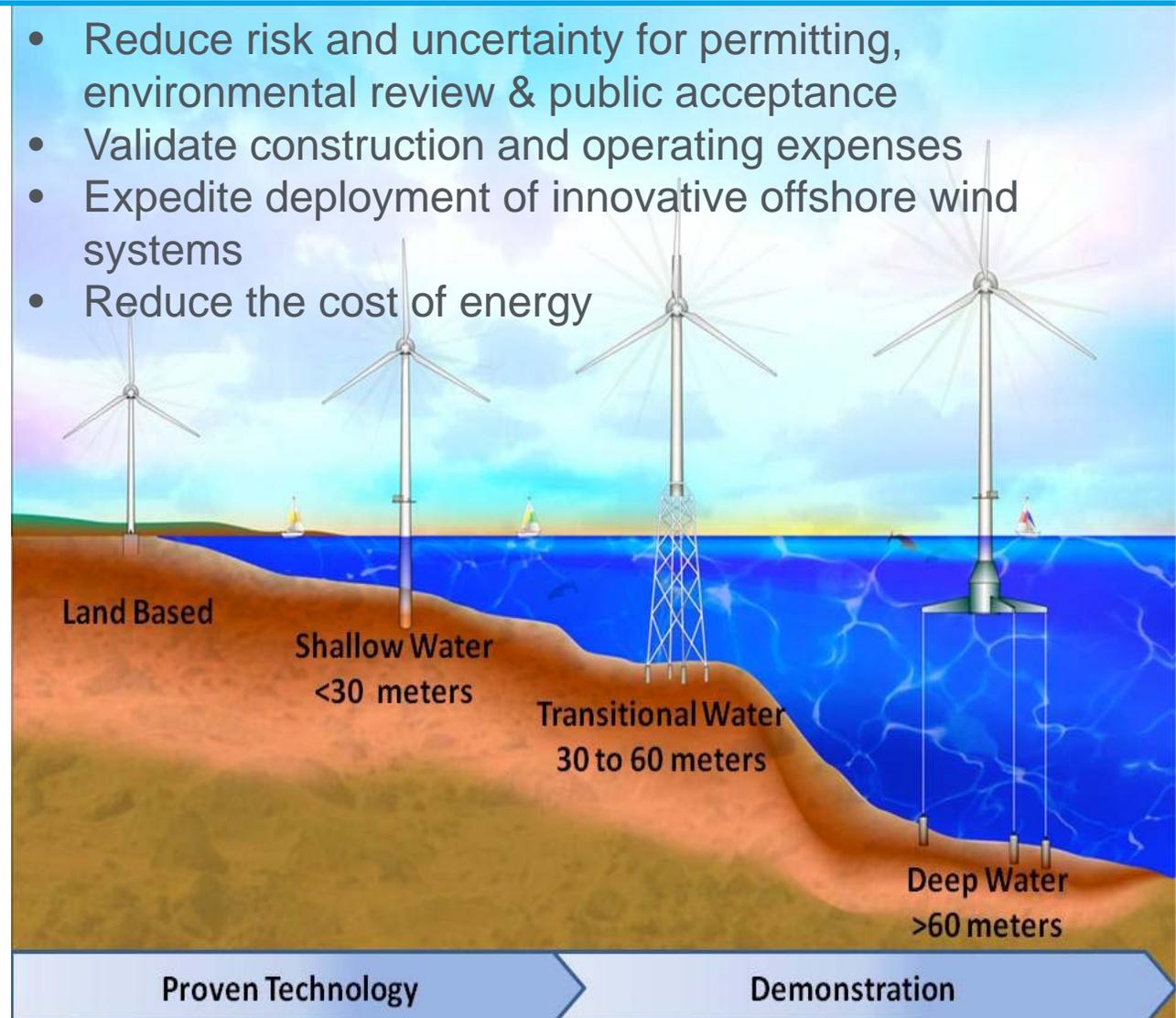


Advanced Technology Demonstration Projects

**Demonstrate
Next
Generation
Offshore
Technology**

**\$168M
5 Years
7 Awards for
Design
3 Awards for
Construction**

- Reduce risk and uncertainty for permitting, environmental review & public acceptance
- Validate construction and operating expenses
- Expedite deployment of innovative offshore wind systems
- Reduce the cost of energy



Demo FOA Timeline

Budget Period 1

- Y Start Date: February 15, 2013
- Y Duration: 1-year
- Y Down-select: February 15- May 15, 2014
- Y Goal: 50% FEED, viable path for 2017 commissioning
- Y DOE Cost Share: \$28 Million

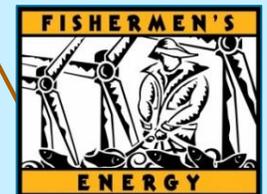


Budget Periods 2-5

- Y Start Date: May 15, 2014
- Y Duration: Through 2017
- Y Up to 3 projects
- Y Goal: Deployment and grid connection by 2017
- Y DOE Cost Share: \$140 Million

Budget Period	Length (months)	No. of awards	DOE Cost Share, Million USD					Funding Per Award	Total Federal Funds	Required Cost Share
			2012	2013	2014	2015	2016			
Budget Period 1	12	7	\$20	\$8				\$4	\$28	20%
Budget Period 2	12	3			\$20			\$6.7	\$20	20%
Budget Period 3	12	3				\$40		\$13.3	\$40	50%
Budget Period 4	12	3					\$40	\$13.3	\$40	50%
Budget Period 5	12	3						\$13.3	\$40	50%
Total Federal Funding									\$168	

Offshore Wind Demonstration Projects: Original Selection



2013: 7 awards
 \$4M each for 50% planning, design & permitting

2014: Down-select to 3 projects Up to \$47M each for construction; operational by 2017



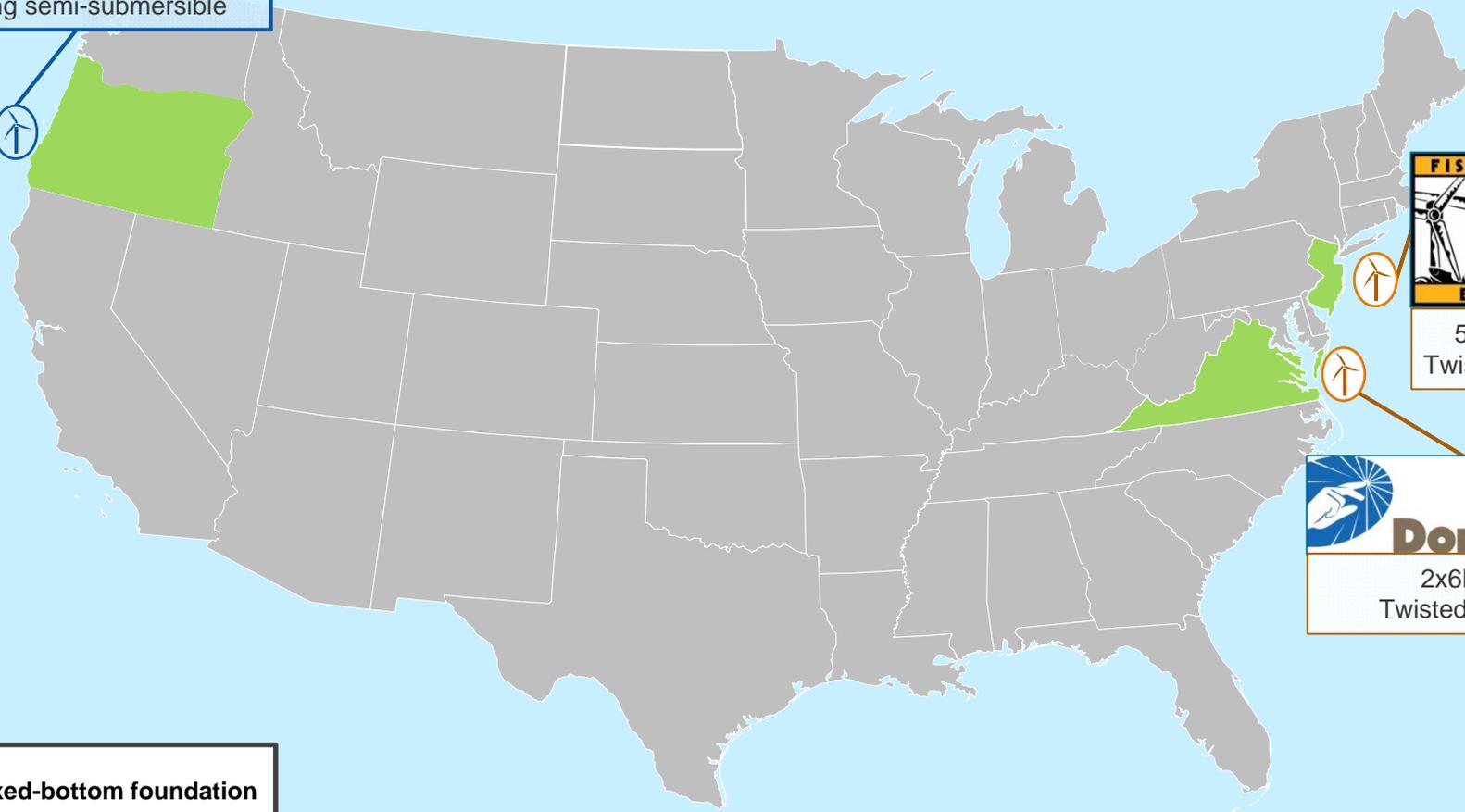
Fixed-bottom foundation

Floating foundation

Offshore Wind Demonstration Projects: Down-Selected Projects



5 x 6 MW
Floating semi-submersible



5 x 5 MW
Twisted Jacket



Dominion

2x6MW
Twisted Jacket



Fixed-bottom foundation



Floating foundation

Principle Power: WindFloat Pacific Overview

Location State/Federal Waters	Distance from Shore Depth	Technology	Rated Power
Oregon Federal	16 NM (30 km) 435m (1,430 ft)	Up to 5, Steel Semi-submersibles 6-8 MW Turbines	Up to 30 MW

Project Highlights

- WindFloat foundation will open a vast deep water US offshore wind resource including the entire West Coast, over 60% of total offshore wind resource
- Significant potential for mass production
- Technology has been tested at a pilot scale (2 MW) off Portugal since 2011
- No expensive vessels required – quayside assembly, tow-out installation and tow-in O&M strategy
- Active ballast system to compensate for wind speed and direction changes



Dominion Power: VOWTAP Project Overview

Location State/Federal Waters	Distance from Shore Depth	Technology	Rated Power
Virginia Federal	23 NM (42 km) 25 m (82 ft)	2, IBGS Foundations 6 MW Alstom Turbines	12 MW

Project Highlights

- Twisted-jacket foundation is suitable for both the demonstration project and the development
- Ability to test feed-back and feed-forward advanced controls systems on the Alstom 6-MW turbine
- Opportunity to test turbine hurricane ride through capabilities
- Geotechnical conditions are different than the conditions in Europe
- Utility developed project



FOA Goals: Permitting and Siting

- Evaluating current siting and approval processes and identifying opportunities for improvement
- Advance the regulatory frameworks vital to implementing offshore wind in the U.S.
- Address public concerns associated with the concept of offshore wind



US Army Corps
of Engineers®





U.S. DEPARTMENT OF
ENERGY

Thank you.