

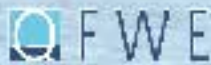
# Floating Wind Solutions

## R&D Challenges for Floating Wind

Carrie Cullen Hitt, Executive Director



Organized by



Quest Offshore

The logo for FWS (Floating Wind Solutions), featuring a stylized blue and white circular icon followed by the letters "FWS" in a bold, blue, sans-serif font.

**FWS**

The Marriott Marquis, Houston 1-3 March 2022

# NOWRDC-Funding Research To Address Key Challenges

**Mission:** Facilitate a nationally-focused, not-for-profit organization collaborating with industry on prioritized R&D activities to **reduce levelized cost of energy (LCOE)** of offshore wind in the U.S. and maximize other economic and social benefits

**Desired Impacts:**

- Innovations directly responsive to the technical and supply chain barriers faced by offshore wind project developers in the U.S.
- Build strong networks connecting technology innovators, investors, and industry
- Increase U.S. content and job opportunities

**Current Project Funding:** \$41 M (\$20.5 DOE funds, matched by NYSERDA) – plus state (NJ,ME, MA, VA, MD) and member contributions for a total of \$48M; NOWRDC is actively procuring additional research funds from public and private sources

**Additional Programs:** JIPs, consultant to entities with a similar mission, other state and federal grant programs related to our mission

**Members:** Developers, Manufacturers, State Agencies, Research Institutions, Utilities

# National Offshore Wind Research & Development Consortium



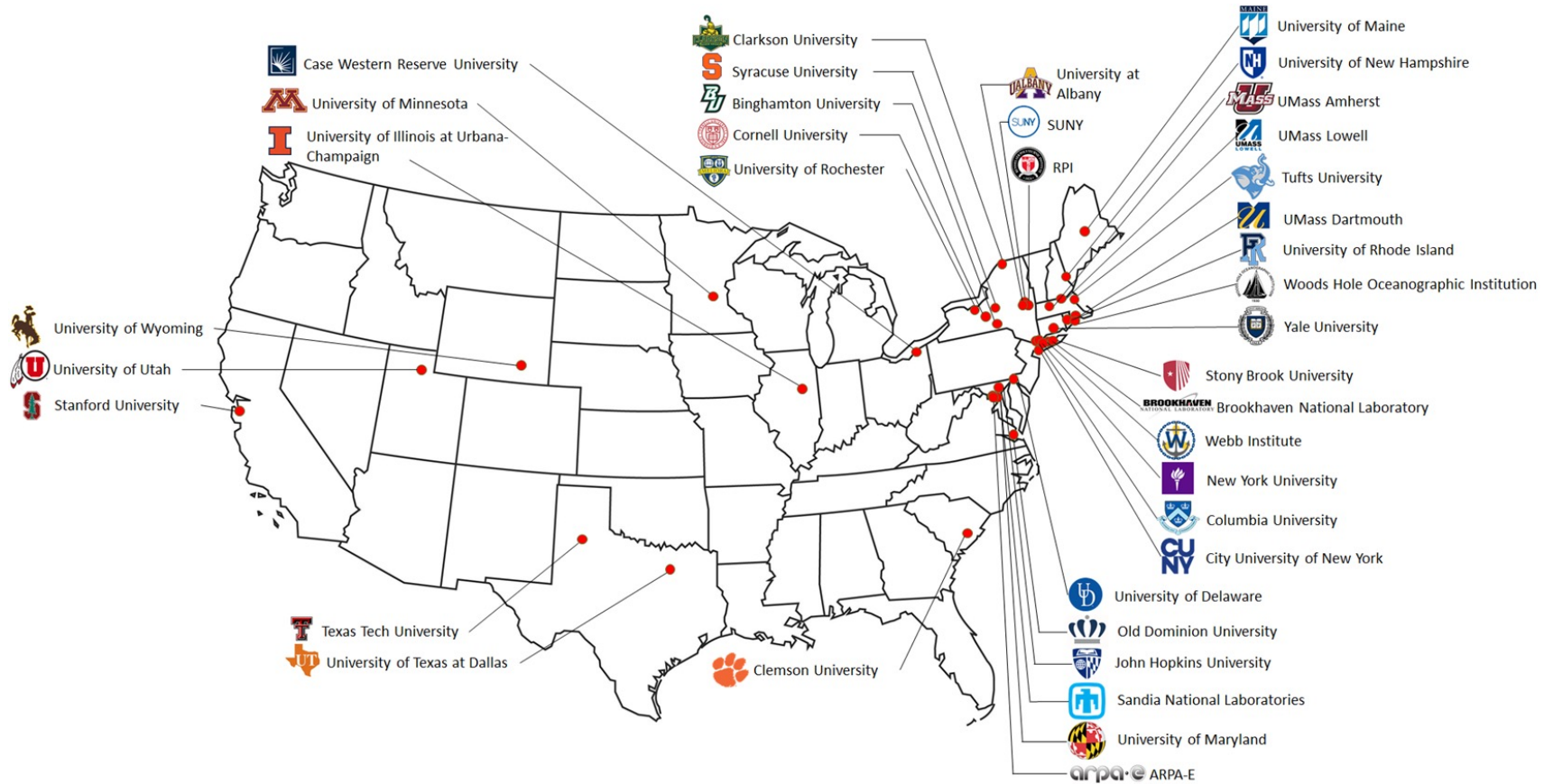
NY Power Authority



NYSERDA



# NOWRDC Research and Development Advisory Group

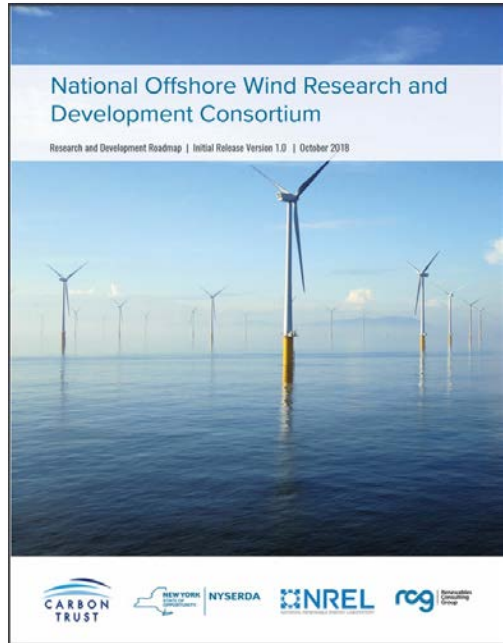


# Pain Points /Research Needs

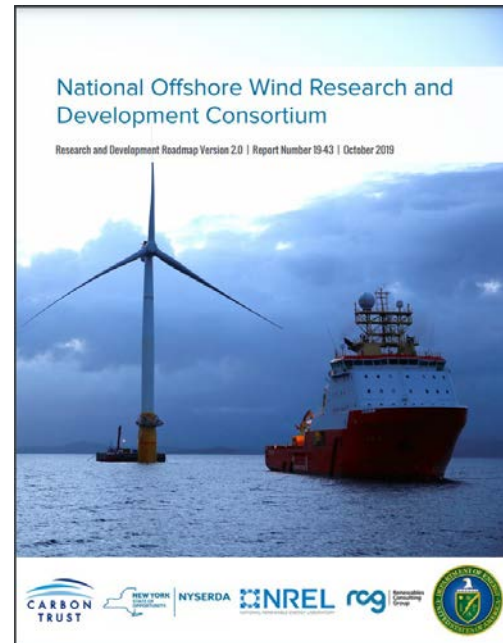
- **Grid** access, 2X expansion, and integration
- Battery and hydrogen **storage** technologies at Gigawatt scale
- Increasing the pace of **floating technology** advancements, increasing water depth
- **Reducing uncertainty** in quantifying wind resource, metocean design basis, and climate change impacts
- Building the **domestic supply chain** for \$100 billion++ U.S. industry
- Cumulative impacts of **inter-array wakes** and blockages
- The **large machine** dilemma: go bigger 20-MW+, OR, industrialize and mass produce?
- **Environmental** and scientific needs; social science



# NOWRDC Roadmaps



Roadmap 1.0  
Published November 2018



Roadmap 2.0  
Published November 2019



Roadmap 3.0  
Published June 2021

- The overarching technical guidance document for R&D topics
- Updated prior to new solicitations
- Research topics are prioritized and solicitations draw from the most current Roadmap version

Credit Walt Musial, NREL

# Pillar 1 Offshore Wind Farm Technology Advancement

- *Technology for Both Fixed and Floating Offshore Wind*
  - Enabling Large-Scale Offshore Wind Turbines
  - Hurricane Resilient Wind Systems and Environmental Extremes
  - Floating and Fixed-Bottom Arrays in the Great Lakes
  - Offshore Power System Design and Innovation
  - Energy Storage Integration Resilience and Reliability
  - Decommissioning, Life Extension, and Infrastructure Repowering

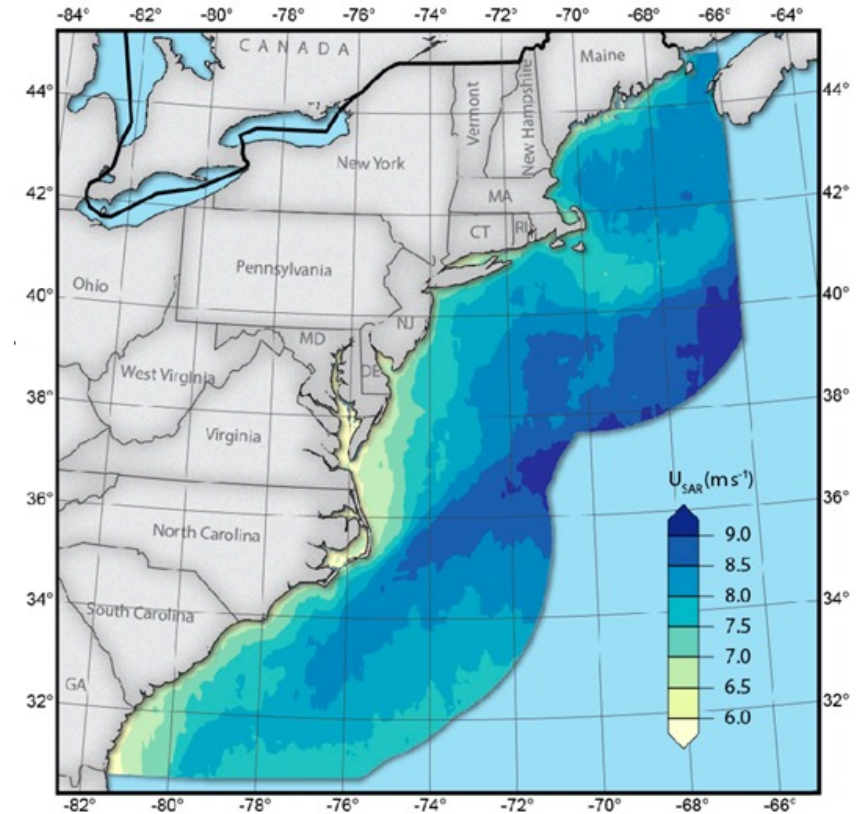


Hurricane Katrina 2005, Central Gulf of Mexico  
400 Year Return Conditions (courtesy of Keystone  
Engineering)

# Pillar 2 Offshore Wind Resource & Physical Site Characterization

- *Metocean Research*
  - Comprehensive Wind Resource Assessment
  - Characterization of Atmospheric and Ocean Conditions at U.S. Wind Energy Areas
  - Development of a Metocean Reference Site
- *Physical Site Characterization*
  - Seabed Survey Methods, Geophysical, and Geotechnical Database

[Ahsbahs et al., 2020](#)



Arithmetic Mean Wind Speed from SAR



# Pillar 3 Installation, O&M , and Supply Chain

- *Installation*
  - Technology to Reduce Siting, Construction, and Operating Conflicts
  - Installation Strategies for Large Turbines
- *Operation and Maintenance*
  - Offshore Wind Digitization Through Advanced Analytics
  - Large Turbine and Substructure Testing Methods
  - High Sea State Technician Transfer Solutions
  - Operations and Maintenance Strategies and Tools
  - Floating Wind Operations and Maintenance

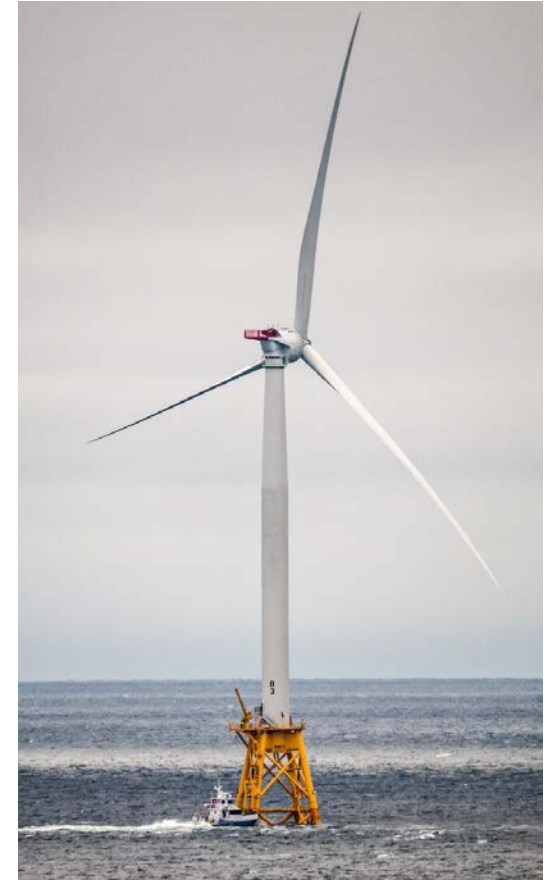


Photo Credit : Dennis Schroeder, NREL

# Pillar 3 Installation, Operations and Maintenance, and Supply Chain

- *Supply Chain*
  - Technology Solutions to Accelerate U.S. Supply Chain
  - Industrialization of the Floating Supply Chain
  - Grid Access, Expansion, and Transmission Upgrades
  - Grid Integration and Market Impacts
  - Detailed Port Designs and Cost Studies
  - Workforce Development



TetraSpar foundation components manufactured at the facilities of the Danish wind turbine tower manufacturer Welcon and transported to the port of Grenaa.

Photo Credit: <https://www.stiesdal.com/offshore-technologies/the-tetraspar-full-scale-demonstration-project/>

# NOWRDC Project Awards 1/5

## Floating Structure Engineering

Solicitation	Project No.	Awardee	Project Title
PON4424	154626	Principle Power Inc.	Demonstration of Shallow-Water Mooring Components for FOWTs (ShallowFloat)
PON4424	154676	University of Maine	Design and Certification of Taut-synthetic Moorings for Floating Wind Turbines
PON4424	154631	Virginia Tech	Dual-Functional Tuned Inerter Damper for Enhanced Semi-Sub Offshore Wind Turbine
PON4424	154632	Triton Systems, Inc	Innovative Anchoring System for Floating Offshore Wind
PON4424	145018	Principle Power, Inc.	Innovative Deepwater Mooring Systems for Floating Wind Farms (DeepFarm)
PON4424	142869	NREL	Shared Mooring Systems for Deep-Water Floating Wind Farms
PON4424	154629	University of Massachusetts Amherst	Techno-Economic Mooring Configuration and Design for Floating Offshore Wind
PON4476	165317-105	ESTEYCO SL	Self-Installing Concrete Gravity-Base Substructure Sizing for 15MW Turbine
PON4476	165317-118	PCCI	Quarter Scale Testing of the Intelligent Mooring Systems for FOWT Platforms
PON4476	165317-119	ESTEYCO SL	Design Evolved Spar Concrete Substructure for Floating Offshore US-Based Design

# NOWRDC Project Awards 2/5

## Fixed Structure Engineering

Solicitation	Project No.	Awardee	Project Title
PON4424	147503	Stony Brook University	Computational Control Co-design Approach for Offshore Wind Farm Optimization
PON4424	147506	NREL	Wind Farm Control and Layout Optimization for U.S. Offshore Wind Farms
PON4424	146220	RCAM Technologies	A Low-Cost Modular Concrete Support Structure and Heavy Lift Vessel Alternative
PON4476	165317-106	Texas A&M	Vibratory-Installed Bucket Foundation for Fixed Foundation Offshore Wind Towers
PON4476	165317-116	Keystone Systems	Tapered Spiral Welding for US Offshore Wind Turbine Towers
PON4476	165317-117	DEME Offshore US	TSPC Foundation Concept
PON4476	165317-120	Deep Reach Technology	Application of Novel Offshore Oil & Gas Platforms to Large Wind Turbines

# NOWRDC Project Awards 3/5

## Wind Resource & Site Characterization

Solicitation No.	Project No.	Awardee	Project Title
PON4424	147504	General Electric	Impact of Low Level Jets on Atlantic Coast Offshore Wind Farm Performance
PON4424	147505	Cornell University	Reducing LCoE from Offshore Wind by Multiscale Wake Modeling
PON4424	147502	NREL	A Validated National Offshore Wind Resource Dataset with Uncertainty Quantification
PON4424	154677	WHOI	Development of a Metocean Reference Site near the MA & RI Wind Energy Areas

## Supply & Logistics

Solicitation No.	Project No.	Awardee	Project Title
PON4424	154675	NREL	30GW by 2035: Supply Chain Roadmap for Offshore Wind in the US
PON4476	165317-103	Crowley Marine Services	Technical Validation of Existing U.S. Flagged Barges as a “Feeder” Solution for the U.S. Offshore Wind Industry
PON4476	165317-104	Exmar Offshore Company	Feasibility of a Jones Act Compliant WTIV Conversion
PON4476	165317-107	MARIN USA	Comparative Operability of Floating Feeder Solutions



# NOWRDC Project Awards 4/5

## O&M & Safety

Solicitation	Project No.	Awardee	Project Title
PON4424	154630	General Electric	Enabling Condition Based Maintenance for Offshore Wind
PON4424	154719	Tufts University	Physics Based Digital Twins for Optimal Asset Management
PON4424	154678	General Electric	Radar Based Wake Optimization of Offshore Wind Farms
PON4424	154628	Tagup Inc.	Survival Modeling for Offshore Wind Prognostics
PON4476	165317-121	ULC Robotics	UAS to Transform Offshore Wind
PON4476	165317-122	GE Renewable Energy	Self-Positioning Single Blade Installation Tool

## Environmental & Conflicting Use

Solicitation	Project No.	Awardee	Project Title
PON4476	165317-113	Advisian	Technology Development Priorities for Scientifically Robust and Operationally Compatible Wildlife Monitoring and Adaptive Management
PON4476	165317-114	Cornell University	Right Wind: Resolving Protected Species Space-Use Conflicts in Wind Energy Areas
PON4476	165317-111	CODAR Ocean Sensors	Oceanographic HF Radar Data Preservation in Wind Turbine Interference Mitigation

\*Awards in negotiation or under review remain tentative pending contract execution

# NOWRDC Project Awards 5/5

## Electrical Power Systems

Solicitation	Project No.	Awardee	Project Title
PON4424	154627	NREL	Development of Advanced Methods for Evaluating Grid Stability Impacts
PON4476	165317-115	ThayerMahan	Transmission and Export Cable Fault Detection and Prevention Using Synthetic Aperture Sonar
PON4476	165317-109	GE Research	DC Collection and Transmission for Offshore Wind Farms
PON4476	165317-112	Offshore Wind Consultants (AqualisBraemar)	Shared Landfall and Onshore Cable Infrastructure for Cable Colocation (AqualisBraemar) Feasibility Study
PON4476	165317-110	Tufts University	Transmission Expansion Planning Models for Offshore Wind Energy
PON4476	165317-108	Battelle Memorial Institute	An Offshore Wind Energy Development Strategy to Maximize Electrical System Benefits in Southern Oregon and Northern California

# NOWRDC Innovations in Offshore Wind Solicitation 2.0

- Round 2 concept papers are due today March 9, 2022.
  - submissions in Challenge Area 1, **Facilitating Ocean Area Co-Existence**
  - submissions in Challenge Area 2, **Electrical and Grid Challenges Unique to OSW Transmission**
- Four Scoring Committee review sessions have been organized to evaluate concept papers. A single Leadership Team meeting will be held on March 28<sup>th</sup> to affirm the recommendations of our Scoring Committees.
- Concept papers are being scored against the traditional NOWRDC scoring rubric by internal and external subject-matter experts. R2 concept papers that receive a passing score (>70/100 points) will be invited to submit full proposal submissions. R2 full proposal submissions will be due April 28, 2022.
- A big thank you to all our Concept Paper reviewers! We are still accepting scorer nominations for the concept paper review sessions and for full proposal submissions later in the Spring.





**NATIONAL  
OFFSHORE WIND**  
RESEARCH & DEVELOPMENT CONSORTIUM



# Title

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