

# Offshore Wind

University of Connecticut  
March 2020

**EVERSOURCE**

# Our Partnership Continues to Grow



## Global Leadership

20+ years experience building offshore wind farms

## Proven Expertise

25 successful offshore wind farms totalling 5.6 GW capacity

## Record of Success

On-budget and on-time large-scale projects



## Transmission Expertise

Premier energy company and electric transmission builder in New England

## New England Roots

Deep-rooted knowledge of the region's electrical system

## Longstanding Leader

100+ year history of operation in Connecticut

## Our Partnership

Recently expanded unregulated partnership in Northeast offshore wind assets

Now the largest offshore wind developer in the U.S.

### Partnership includes:

- Bay State Wind (MA)
- Constitution Wind (CT)
- Revolution Wind (RI & CT)
- South Fork Wind (NY)
- Sunrise Wind (NY)
- Additional lease areas off Southern New England



# Other Offshore Wind Developers in the Northeast



- + Mayflower Wind is a joint venture project of Shell and EDP Renewables. We are backed by the combined capability, experience, commitment to innovation, and financial strength of a world-leading offshore energy developer and a world-leading wind power and renewable energy developer.

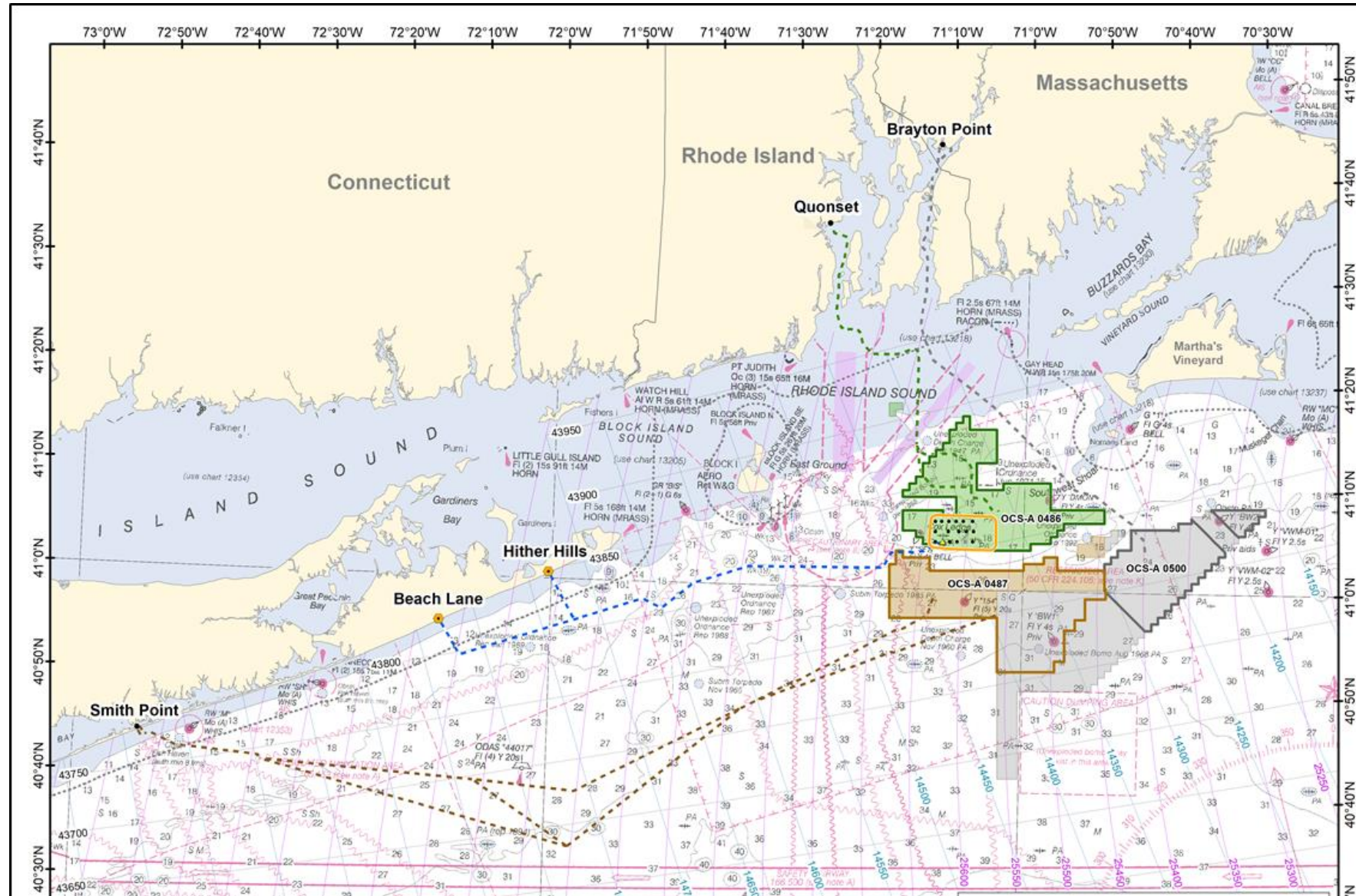


- + Vineyard Wind LLC, an offshore wind development company 50 percent owned by funds of Copenhagen Infrastructure Partners (CIP) and 50 percent owned by Avangrid Renewables, LLC, is currently in the permitting and financing process for the first large-scale offshore wind energy project in the United States.



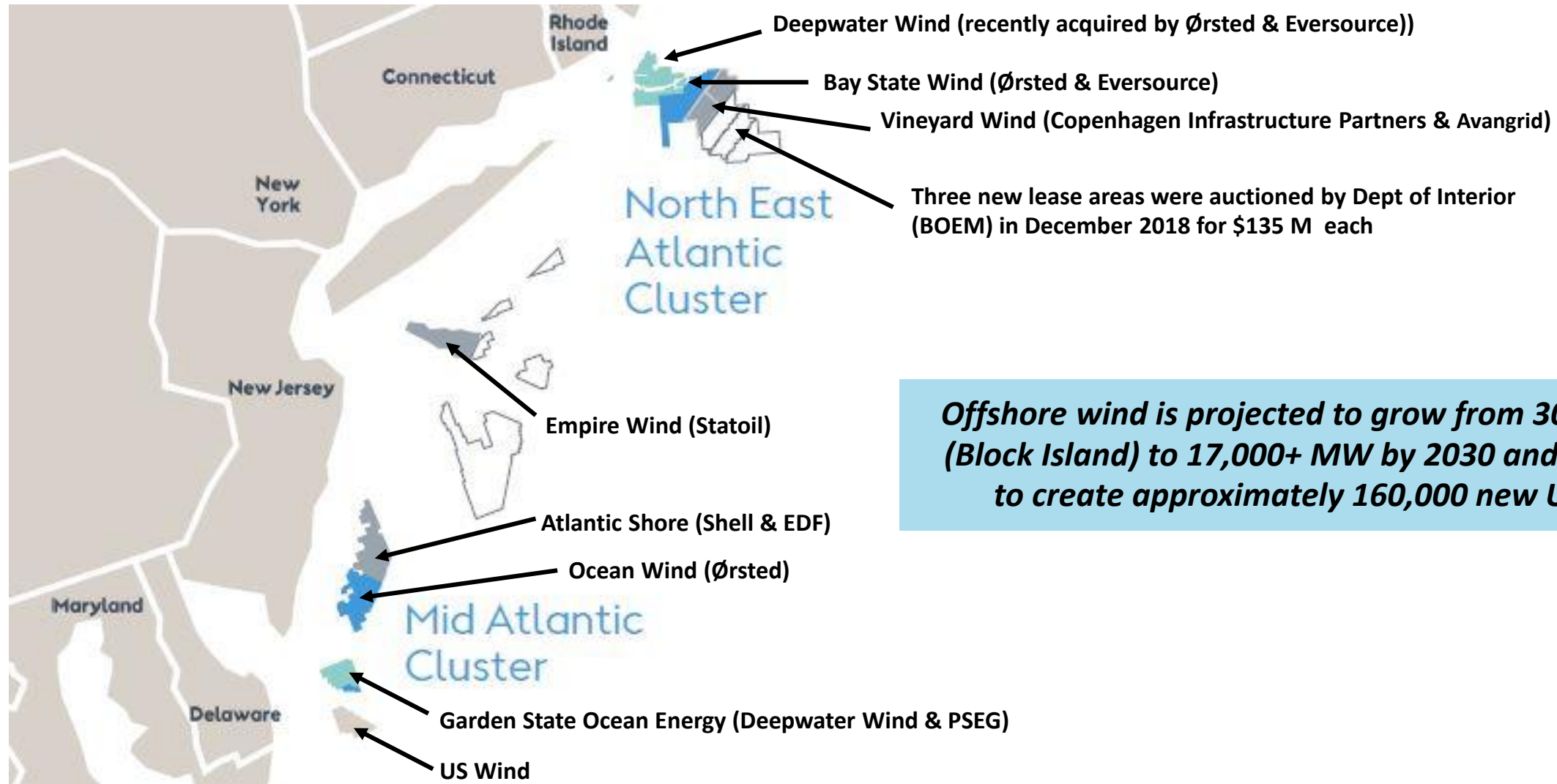
- + We're Equinor, a broad energy company with a proud history. We are 21,000 committed colleagues developing oil, gas, wind and solar energy in more than 30 countries worldwide. We're the largest operator in Norway, one of the world's largest offshore operators, and a growing force in renewables. Driven by our dedication to safety, equality and sustainability and our Nordic urge to explore beyond the horizon, we're shaping the future of energy.

# Joint Venture Lease Areas



# U.S. Offshore Wind Development

*There is significant offshore wind development underway along the eastern seaboard*



***Offshore wind is projected to grow from 30 MW today (Block Island) to 17,000+ MW by 2030 and is expected to create approximately 160,000 new U.S. jobs***



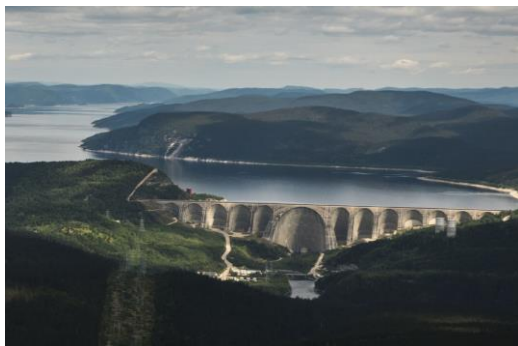
# Why Is It The Time Right For Offshore Wind?

- + **World-class offshore wind conditions:** one-third of the potential offshore wind resources of the U.S. are located on the East Coast
- + New England has a heritage of **innovation** and **bipartisan leadership support** for clean energy
- + Offshore Wind is available to produce electricity more than **93%** of the time
- + Offshore wind can be a reliable part of that mix with load factors of **50% or higher**
- + Utility scale offshore wind produces **zero emissions** and fills the energy gap in New England with a **green, reliable, cost-effective energy solutions**



# Capacity Factors

Offshore wind enjoys the highest capacity factors among renewable energy



Large Imported Hydro  
> 95%



Offshore Wind  
50-60%

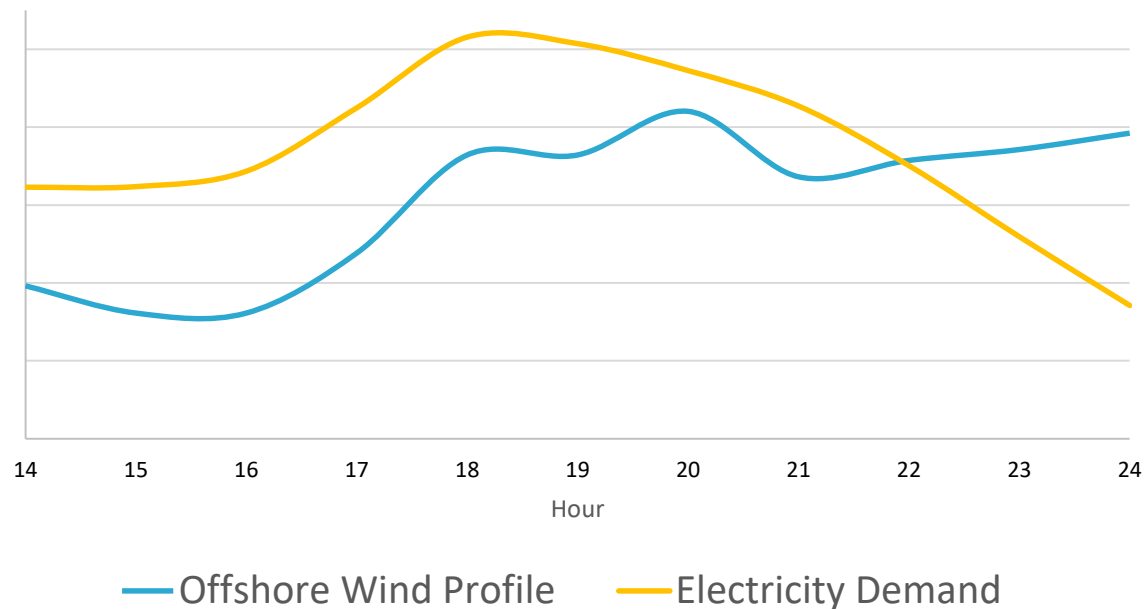


Onshore Wind  
37%



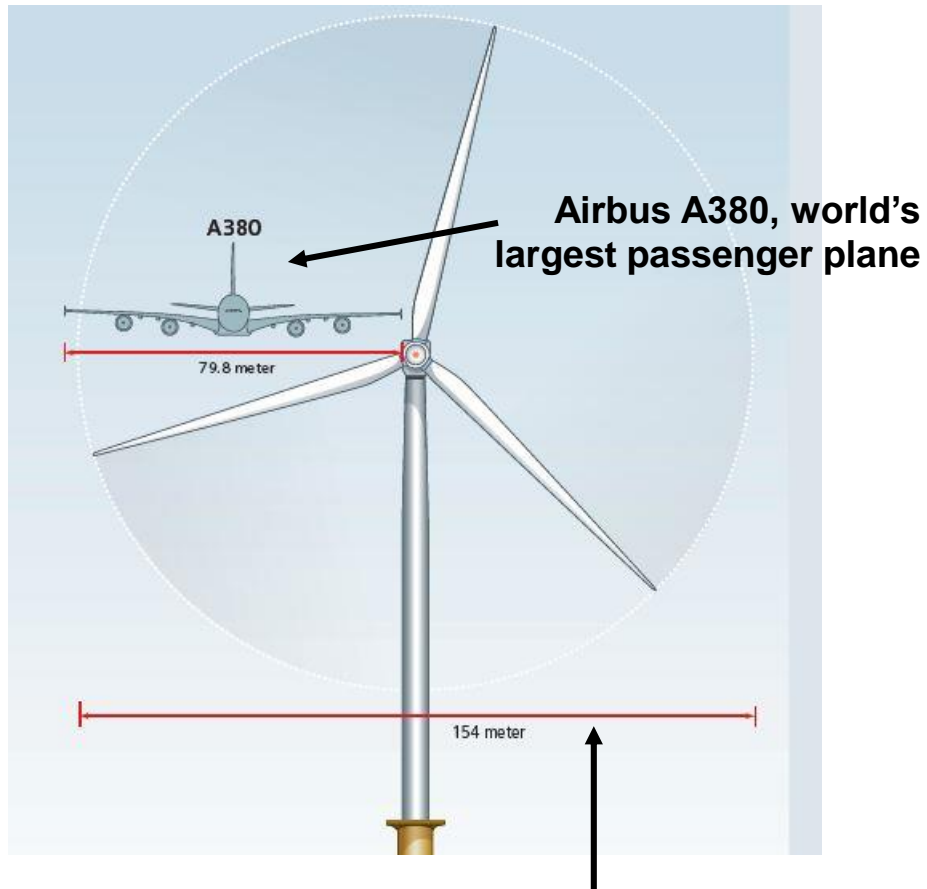
Solar  
15-25%

Offshore Wind Generation vs Electricity Demand  
During Afternoon Hours  
(January)



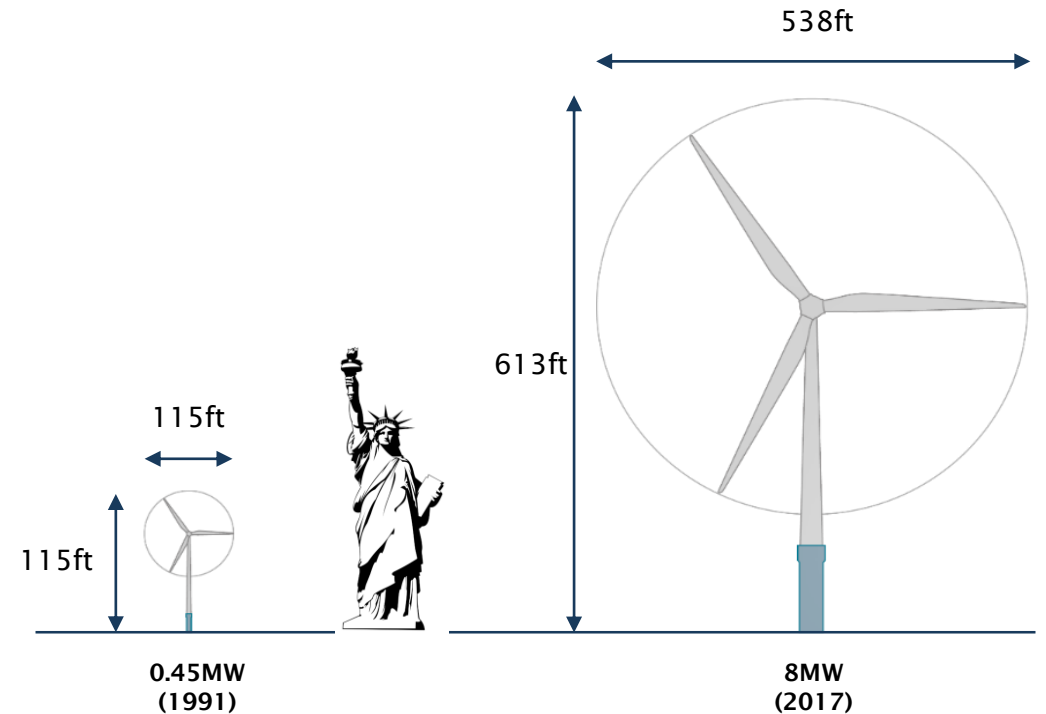
# Larger Turbine Size A Major Driver Of Cost Improvements

**Siemens 6 MW offshore wind turbine**  
**505 foot rotor diameter**



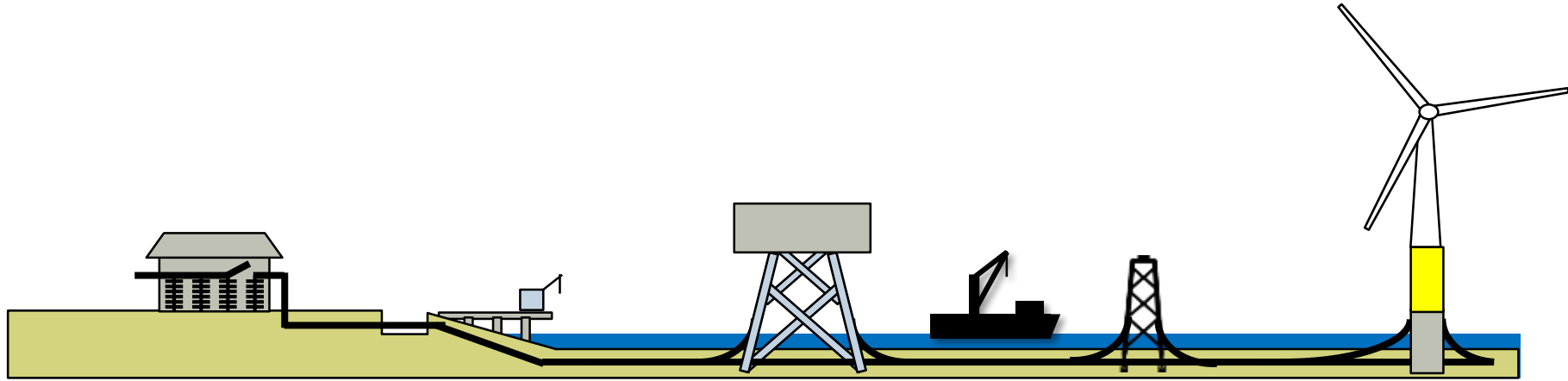
**505 foot rotor diameter**

**Wind turbine evolution 1991 to today**





# Offshore Wind Components



	<u>Onshore Electrical</u>	<u>Operation &amp; Maintenance</u>	<u>Export Cables</u>	<u>Offshore Substations</u>	<u>Installation Vessels</u>	<u>Founda- tions</u>	<u>Inter-Array Cables</u>	<u>Turbines</u>
In-scope for US offshore wind projects	✓	✓	✓	✓	✓	✓	✓	✓

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# Selected Areas of Study to Support Siting (BOEM)

- + 4.1.1 Seafloor/Land Disturbance
- + 4.1.2 Sediment Suspension and Deposition
- + 4.1.3 Noise
- + 4.1.4 Electromagnetic Field
- + 4.1.7 Traffic (Vessels, Vehicles, and Aircraft)
- + 4.1.8 Air Emissions
- + 4.1.9 Visible Structures
- + 4.1.10 Lighting
- + 4.2.1 Air Quality
- + 4.2.2 Water Quality and Water Resources
- + 4.2.3 Geological Resources
- + 4.2.4 Physical Oceanography and Meteorology
- + 4.3.1 Coastal and Terrestrial Habitat
- + 4.3.2 Benthic and Shellfish Resources
- + 4.3.3 Finfish and Essential Fish Habitat
- + 4.3.4 Marine Mammals
- + 4.3.5 Sea Turtles
- + 4.3.6 Avian Species
- + 4.3.7 Bat Species
- + 4.4 Cultural Resources
  - + 4.4.1 Above-Ground Historic Properties
  - + 4.4.2 Marine Archaeological Resources
  - + 4.4.3 Terrestrial Archaeological Resources
- + 4.5.3 Environmental Protection Measures
- + 4.6 Socioeconomic Resources
  - + 4.6.1 Population, Economy, and Employment
  - + 4.6.2 Housing and Property Values
  - + 4.6.3 Public Services
  - + 4.6.4 Recreation and Tourism
  - + 4.6.5 Commercial and Recreational Fishing
  - + 4.6.6 Commercial Shipping
  - + 4.6.7 Coastal Land Use and Infrastructure
  - + 4.6.8 Other Marine Uses
  - + 4.6.9 Environmental Justice

# Connecticut Initiative on Environmental Research of Offshore Wind (CIEROW)

Who we are:

Interdisciplinary team of scientists

Expertise in offshore research

- physical & biological oceanography
- marine mammal, fish & shellfish biology/ecology

Goal: *Conduct targeted research in marine environments potentially impacted by offshore wind-energy industry*

Research capacity:

R/V Connecticut - 90' offshore research vessel

R/V Lowell Weicker - 36' coastal research vessel

Remotely operated vehicles and gliders

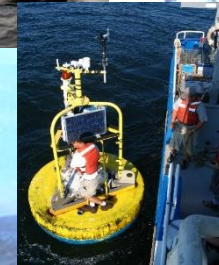
SCUBA-diver supported underwater capabilities

Coastal observing system with buoys and sensors

Wind industry partners:

Vineyard wind

Ørsted





# Enhanced Environmental Monitoring and Modeling Capabilities of Offshore Wind Energy

## Expertise in offshore research

- High-resolution numerical weather prediction
- Large-Eddy Simulation (LES)
- Satellite and underwater remote sensing of marine environment (wind, waves, underwater sound)
- Infrastructure integrity modeling
- Power grid modeling

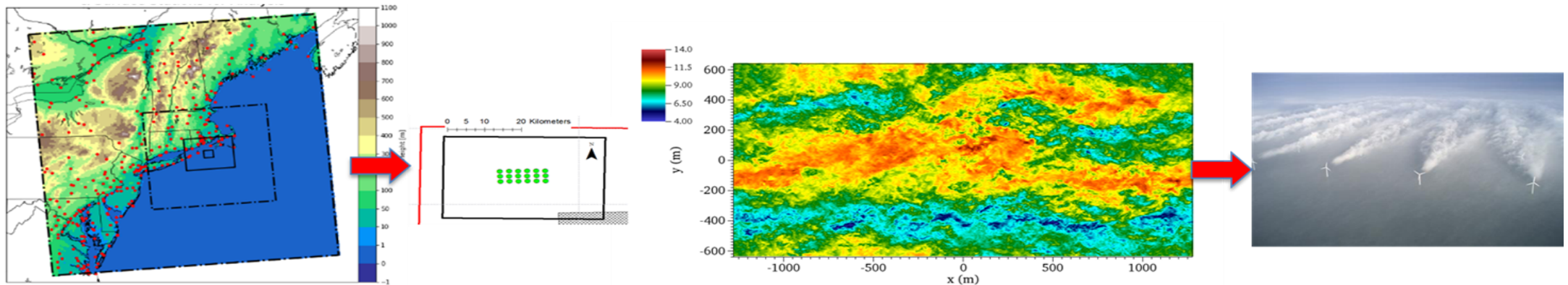
***Goal: Support the offshore wind-energy industry with enhanced monitoring, data analytics and modeling capabilities to assess & predict the performance of wind energy generation and inform operations.***

## Current research project:

- Analysis of in-situ and remote wind observing data
- Underwater monitoring of marine acoustic environment
- High-resolution offshore wind prediction
- High-fidelity wind farm simulations

## Industry partners:

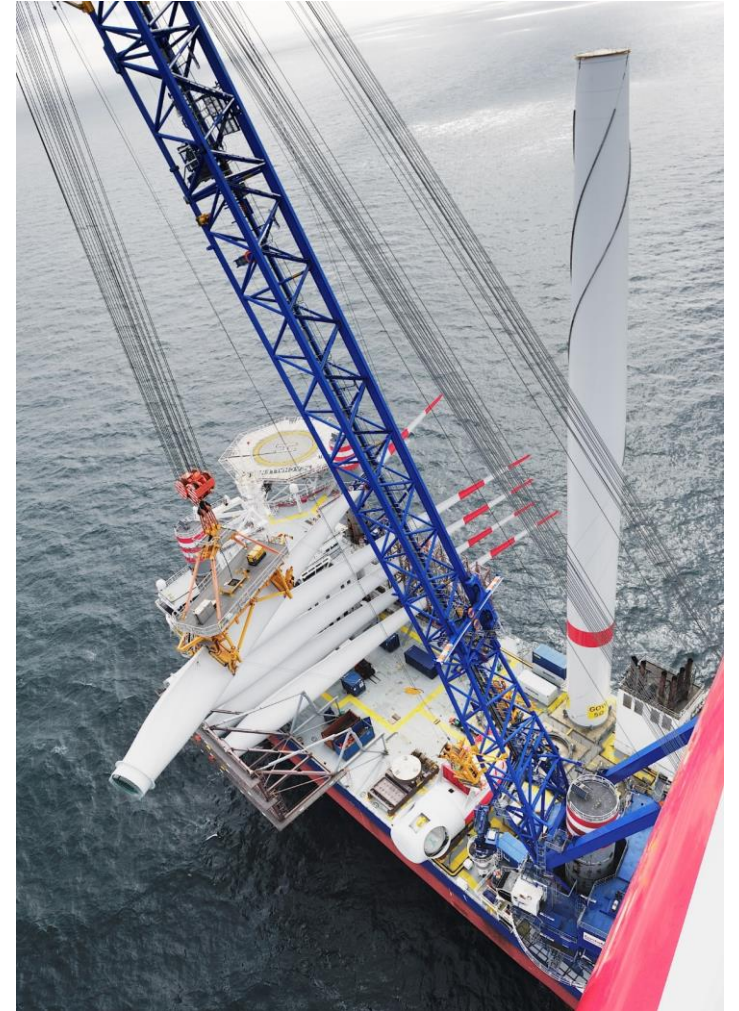
Bay State wind,  
Eversource, Ørsted



# Economic Development Opportunities During Construction and Beyond



- ✓ Onshore Electrical
- ✓ Export Cables
- ✓ Offshore Substations
- ✓ Installation Vessels
- ✓ Foundations
- ✓ Inter-array cables
- ✓ Turbines
- ✓ Port Development
- ✓ Operations and Maintenance



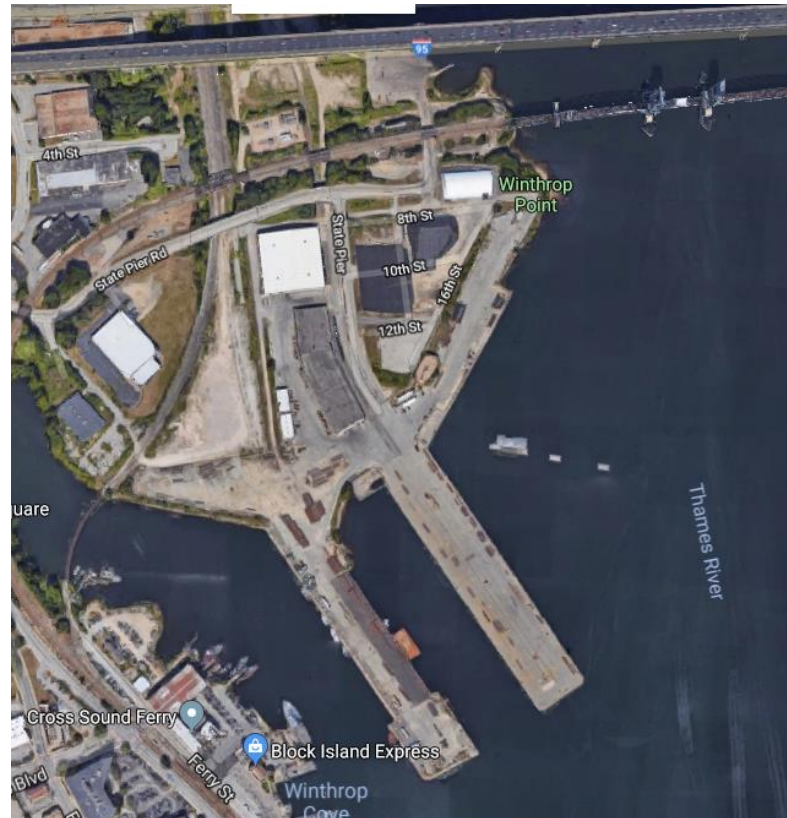


# Ports & Installation Vessels Are A Key Infrastructure Constraint

**Our vision is to develop New London State Pier Into World Class Offshore Wind Hub**

- Strategically located close to Lease Areas
- Well-protected harbor with deep-water access enables utilization of next-generation Installation Vessel
- Existing sophisticated marine industries and workforce

**Before**



**After**





# Thank you

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