Agenda

Welcome & Overview	Bruce Carlisle, CZM
Mass Offshore Wind Updates & Initiatives	Bill White, MassCEC
Federal Update on Offshore Wind Leasing & Permitting	Luke Feinberg, BOEM
Project Updates from Offshore Wind Developers	
Vineyard Wind	Richard Andre
DONG Energy / Bay State Wind	Pernille Hermansen
Deepwater Wind	Aileen Kenney

Agenda

- Offshore Wind Overview
- Massachusetts Offshore Wind Initiatives
  1. Stakeholder Engagement
  2. Environmental Characterization
  3. Infrastructure
  4. Transmission Planning
  5. Supply Chain & Workforce & Ports
  6. Research & Innovation

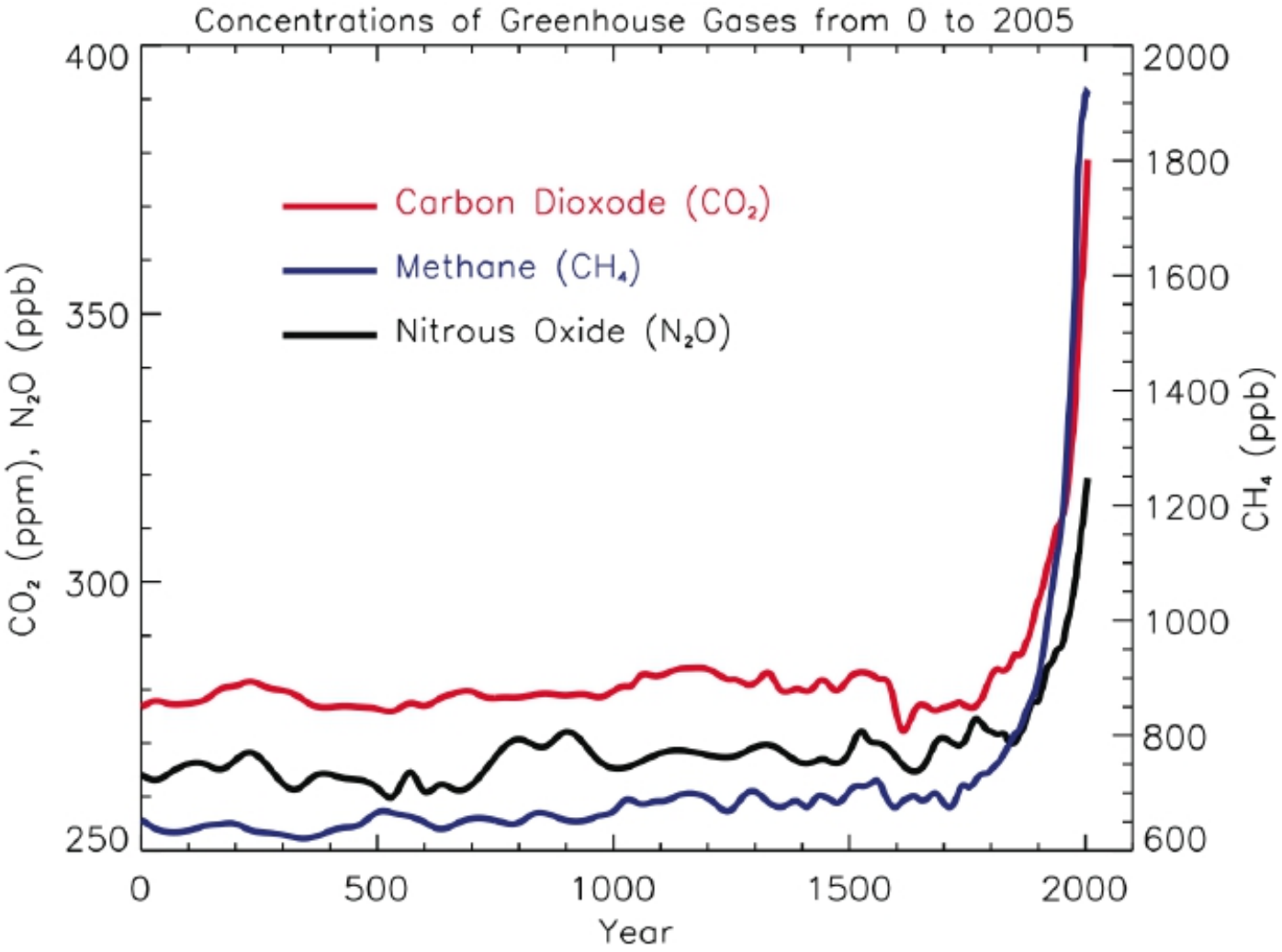
Offshore Wind Overview

Offshore Wind Energy Overview

- Huge Resource, Close to Load
- New Technology, Higher Cost
- Massachusetts-Made Energy
- New Industry & Local Jobs
- Regional Generation Retirements
- Climate Change

Block Island Wind Farm

Global Increase of GHG Concentrations



ISO-NE Forecasted Power Plant Retirements

- 4,200 MW, almost 15% of the region's current generating capacity, will retire between 2012 and 2020

- Brayton Point Station in May 2017 and Pilgrim Nuclear Power Station by May 2019 will remove 2,200 MW

Offshore Wind in Europe

AS OF END OF 2016*

- 3,589 turbines in 81 wind farms
- 12,631 MW operating
- 75,000 jobs (2014)

IN 2017/2018

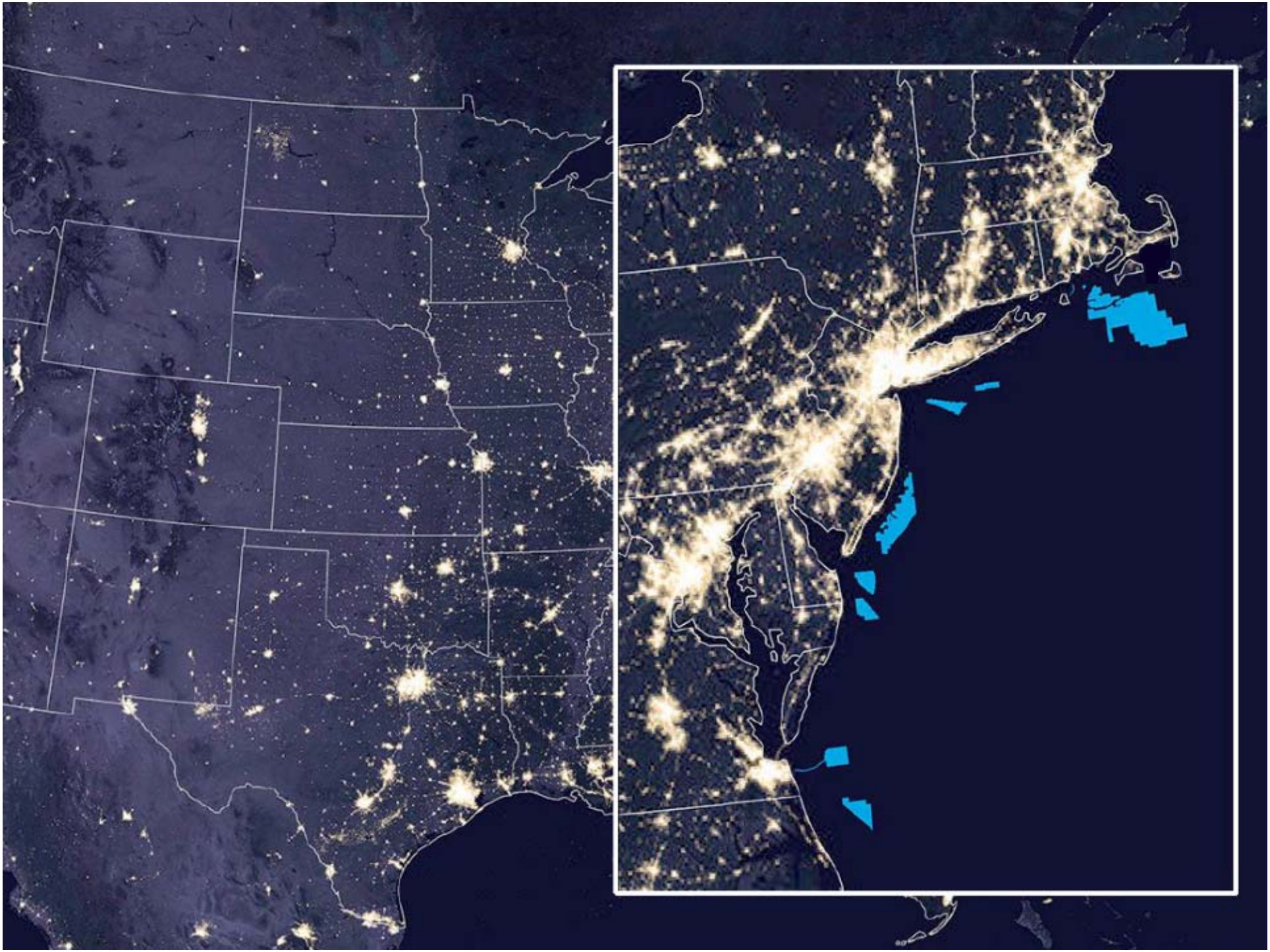
- 11 offshore projects totaling 4.8 GW under construction

Cost Reduction

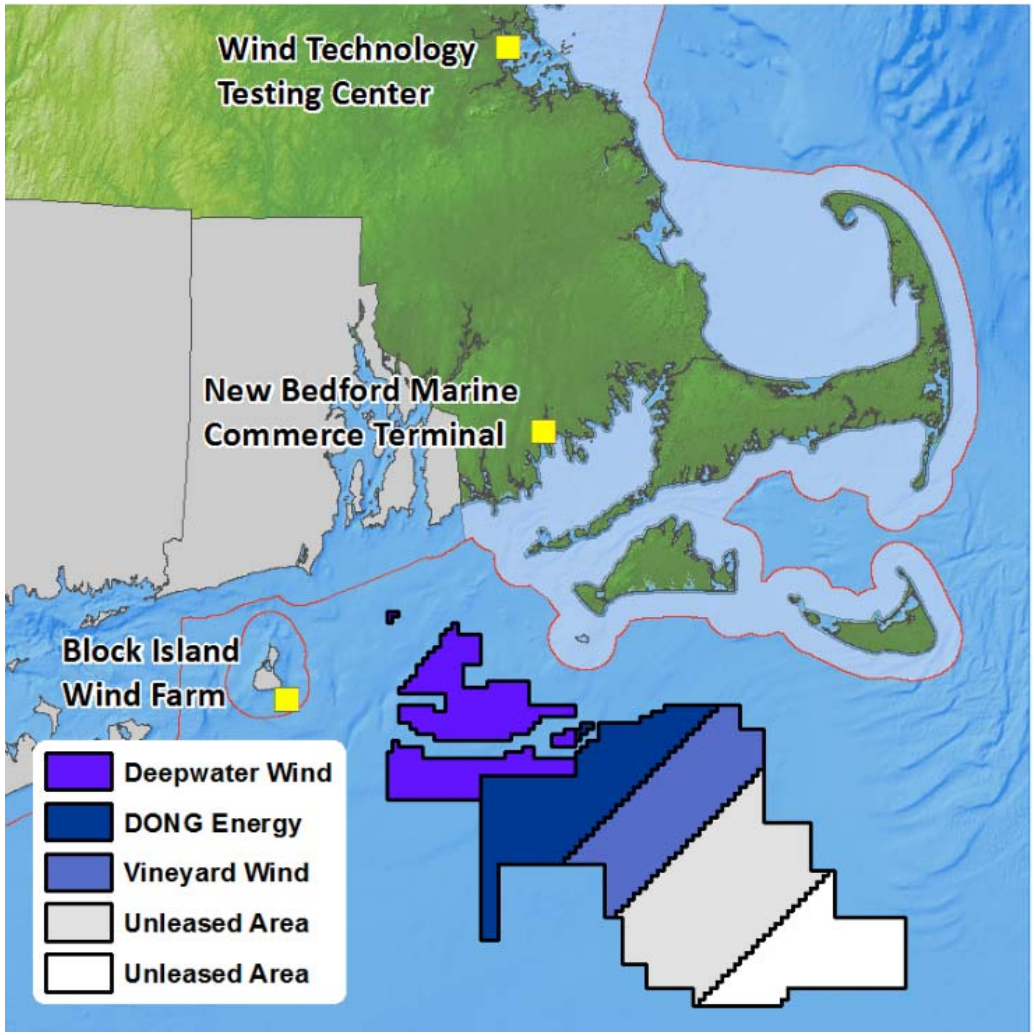
- Cost of offshore wind in UK has fallen by 32% since 2012

- UK reached target of GBP 100 per megawatt hour (MWh) four years ahead of schedule

**WindEUROPE Key Trends and Statistics 2016.*
*** 2016 ORE Catapult Cost Reduction Monitoring framework*



New England Offshore Wind Lease Areas



Pathway to Market: Massachusetts Energy Legislation

In August 2016, Governor Baker signed legislation to launch offshore wind:

- Utilities to solicit 1,600 MW of OSW, largest state commitment
- First solicitation June 30, 2017
- All 1,600 MW of cost effective OSW shall be contracted by June 2027
- Size of first solicitation:
  - Requires 400 MW bid
  - Alternate 200-800MW bids
- Requires costs to decrease over time
- Draft RFP at macleanenergy.com

How Much is 1,600 MW?

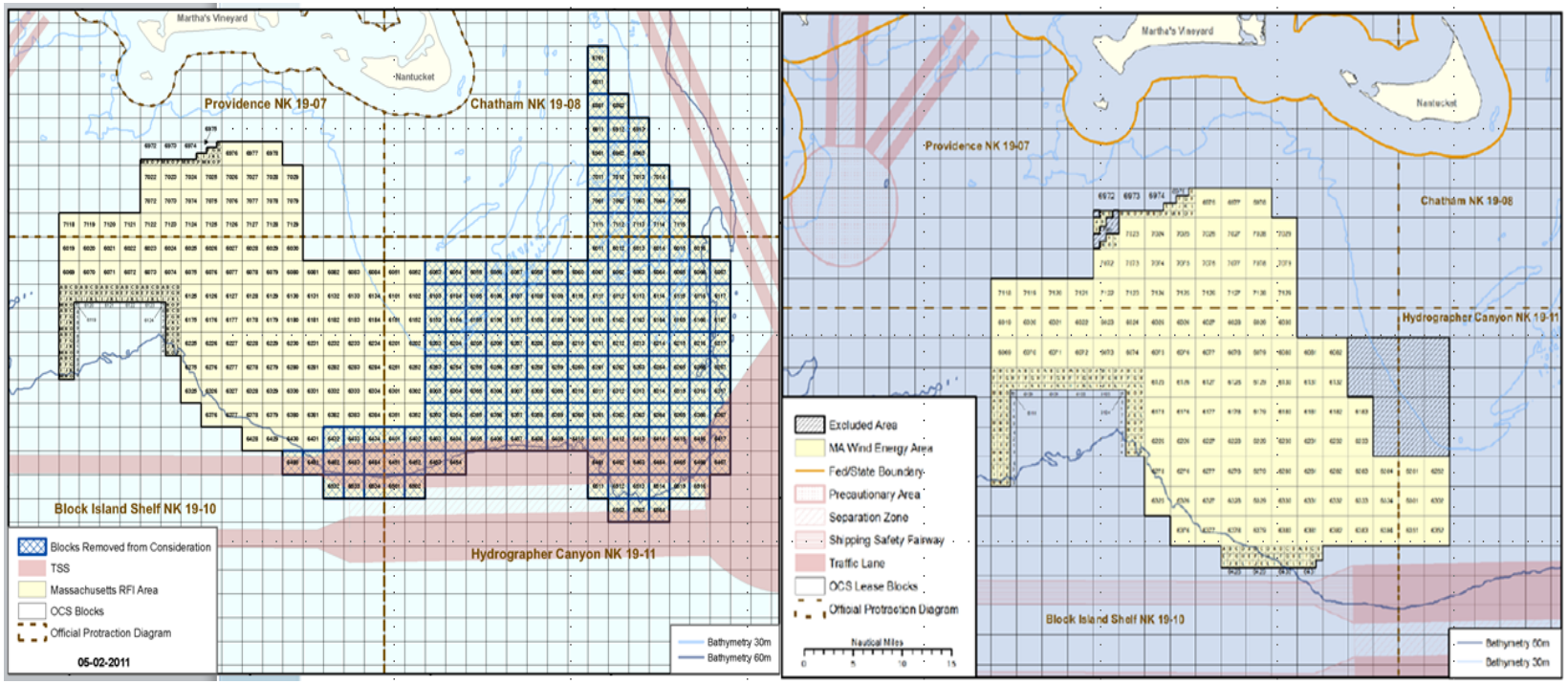
- Enough electricity to power over 1/4 of MA households (640,000 Homes)
- Up to 2.4 million tons of GHG emissions reductions per year (ISO New England)
- Produces 11% of annual Massachusetts electricity consumption

Preparing for Offshore Wind

1. Stakeholder Engagement

Offshore Wind Stakeholder Engagement

- MA - BOEM Task Force with Federal Agencies, Native American Tribes, State, Local (EEA/CZM/MassCEC)
- Convened over 100 public & stakeholder meetings
- Lead Fisheries & Habitat Working Groups
- Reduced OSW Area by 60%



Preparing for Offshore Wind

2. Environmental Characterization

Wildlife Surveys

Large Whales and Turtles

New England Aquarium

- 4 year effort in partnership with BOEM and EEA
- Aerial Surveys and passive acoustic devices

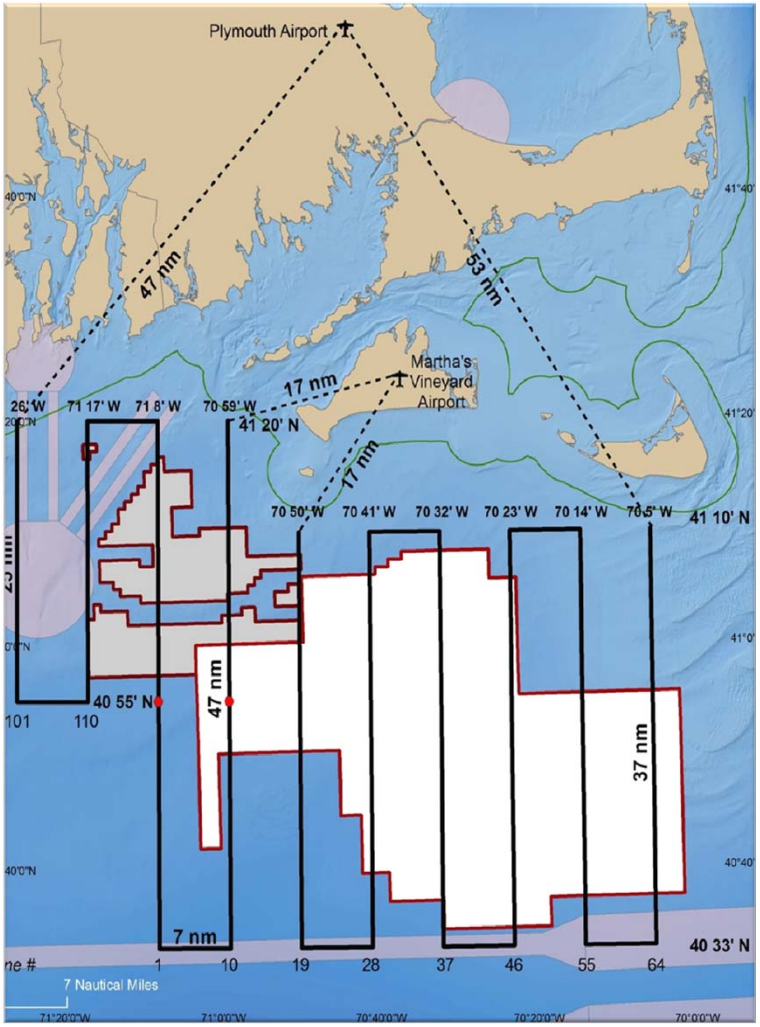
Avian

College of Staten Island

- 3 year effort in partnership with BOEM and EEA
- Aerial Surveys

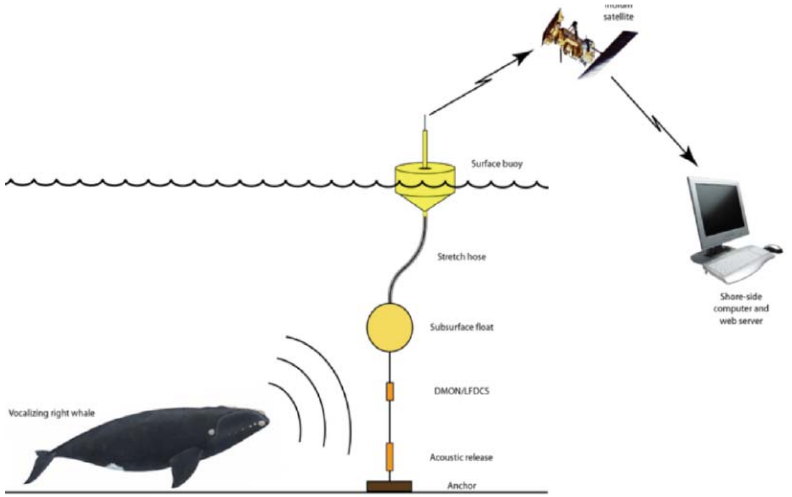
Benthic Survey

UMass Dartmouth, SMAST



Real-time Acoustic Detection Technology of Marine Mammals

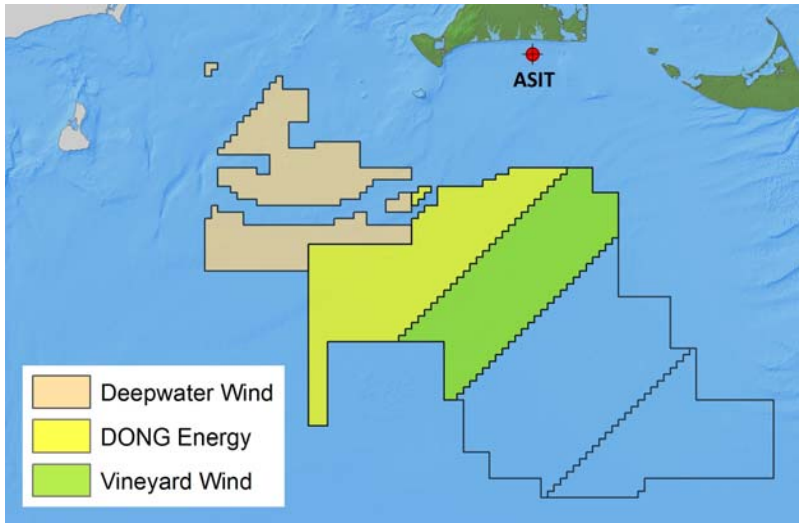
- Develop management tool to detect, classify and localize large whales during OSW construction
- Mitigate or avoid impacts of OSW construction noise on marine mammals
- Building off existing technology developed by WHOI
- State/Federal/Industry Collaboration



Metocean Data Initiative

- Partnership w/ MassCEC, WHOI, AWS Truepower
- Installed October 7, 2016
- So far, wind speeds measuring 10.47m/s (23.4mph) at 100m

Month	Mean Wind Speed @ 100 m (m/s)
October	9.82
November	9.33
December	10.48
January	10.47
February	10.76
March	12
April	10.37
7-month Avg.	**10.46**



Preparing for Offshore Wind

3. Infrastructure

Wind Technology Testing Center

- Among the largest indoor wind blade test facilities in the world.
- Enabling the industry to advance blade technology and drive down costs.

New Bedford Marine Commerce Terminal

Multi-purpose facility designed to support staging & deployment of OSW projects, and handle other marine cargo

Terminal Letter of Intent

In September 2016, Governor Baker signed a Letter of Intent with three OSW developers

- Provides framework for future pipeline of projects to be staged at the new Bedford Marine Commerce Terminal
- Signed by DONG Energy, Deepwater Wind and Vineyard Wind

Preparing for Offshore Wind

4. Transmission Planning

2014 Offshore Wind Transmission Study

http://files.masscec.com/research/MassCECOSWTransmissionStudy.pdf

Preparing for Offshore Wind

5. Supply Chain & Workforce & Ports

Massachusetts Supply Chain Initiative

- **Objective** – Maximize economic development and jobs benefits from OSW deployment

- **Multi-pronged approach**:
  - Engage with developers, turbine manufacturers and other major supply chain players
  - May 31 Supply Chain Forum - connect the OSW industry with Massachusetts manufacturers, service providers and suppliers
  - Partner with institutions to create roadmap for offshore wind workforce development and safety training

BCC BRISTOL COMMUNITY COLLEGE

UMass Dartmouth

Massachusetts Maritime Academy

Massachusetts Offshore Wind Ports & Infrastructure Assessment

- While New Bedford Marine Commerce Terminal will host majority of OSW activities, industry has indicated additional locations may be needed

- MassCEC hired Apex-Ramboll-Institutes team to evaluate existing port and waterfront infrastructure in Massachusetts for private investment

Near Term	Longer Term
• Foundations (monopiles, jackets, gravity-based) • Tower sections • O&M base facilities	• Transmission cables • Nacelles • Substations • Blades

Preparing for Offshore Wind

6. Research and Innovation

Massachustts Offshore Wind Research Partnership

Objective: Make Massachusetts a major national and international hub for offshore wind research

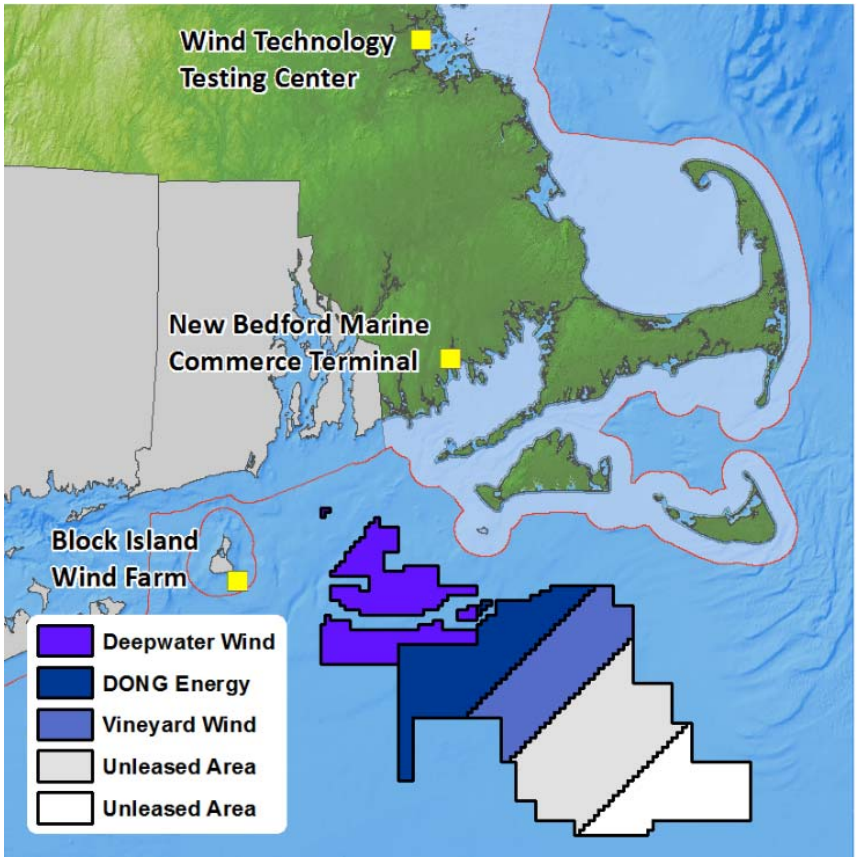
Work Products:

- A systems-based framework for offshore wind research (developed in coordination with U.S. DOE, NSF, BOEM, NSF)
- An organizational plan for a national research consortium

BCC Bristol Community College
UMassAmherst
UMass Lowell
UMass Boston Sustainable Solutions Lab University of Massachusetts Boston
UMass Dartmouth
Massachusetts Maritime Academy
Tufts University
Northeastern University
Woods Hole Oceanographic Institution

Active Research Areas

- **Workforce and jobs** - Bristol Community College, UMass Dartmouth
- **Health and safety training** - Massachusetts Maritime Academy
- **Monitoring and detection of whales** - Woods Hole Oceanographic Institution
- **Geophysical assessment methods; Design and certification standards** – UMass Amherst
- **Blade structural health monitoring; Composites Manufacturing** - UMass Lowell
- **Large-scale testing** – Northeastern, UMass Lowell, UMass Amherst, Tufts



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