

The Emerging Offshore Wind Industry

Briefing for Fairhaven Economic Development Committee

*Fairhaven, Massachusetts
June 20, 2019*

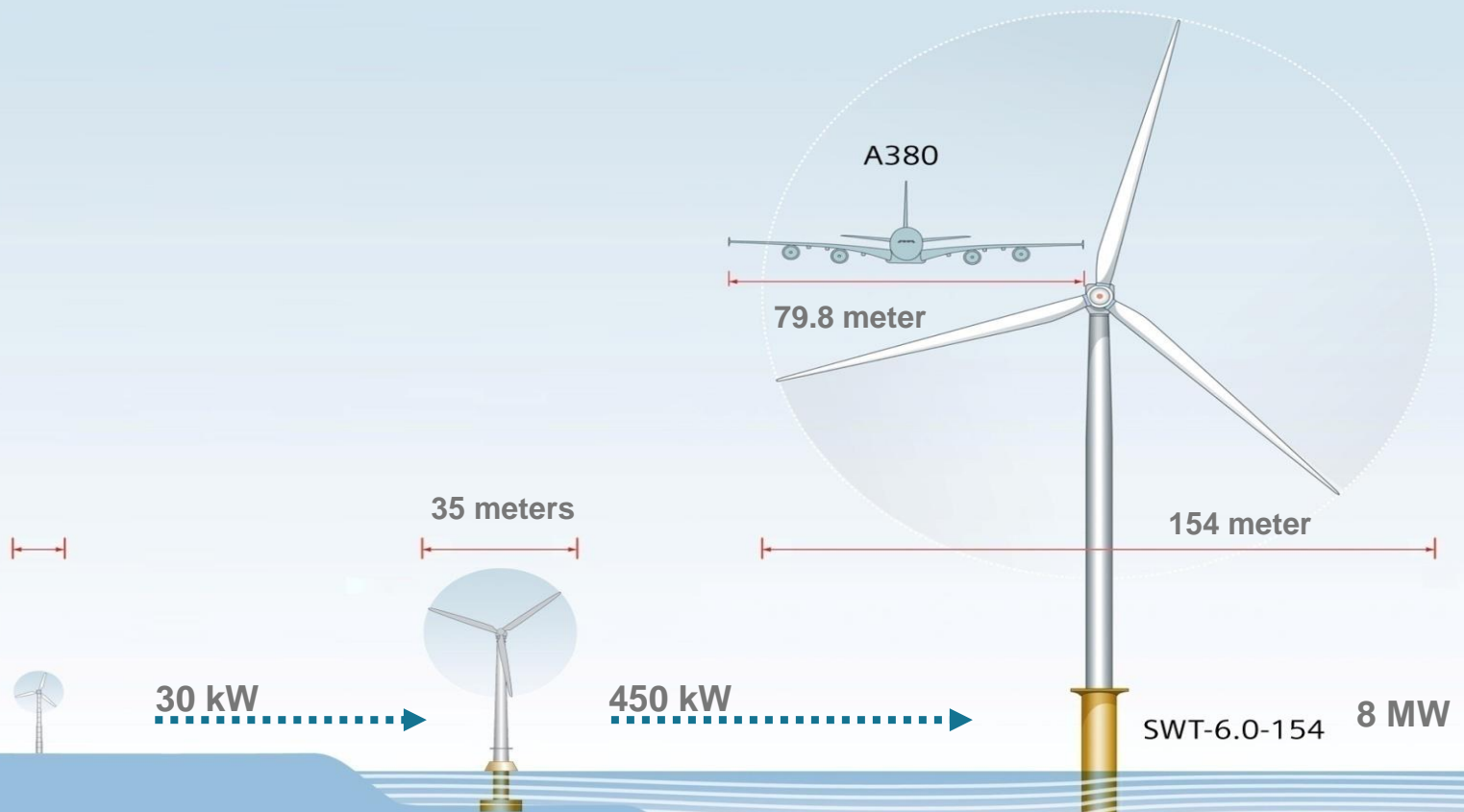


Key Facts about EU Offshore Wind

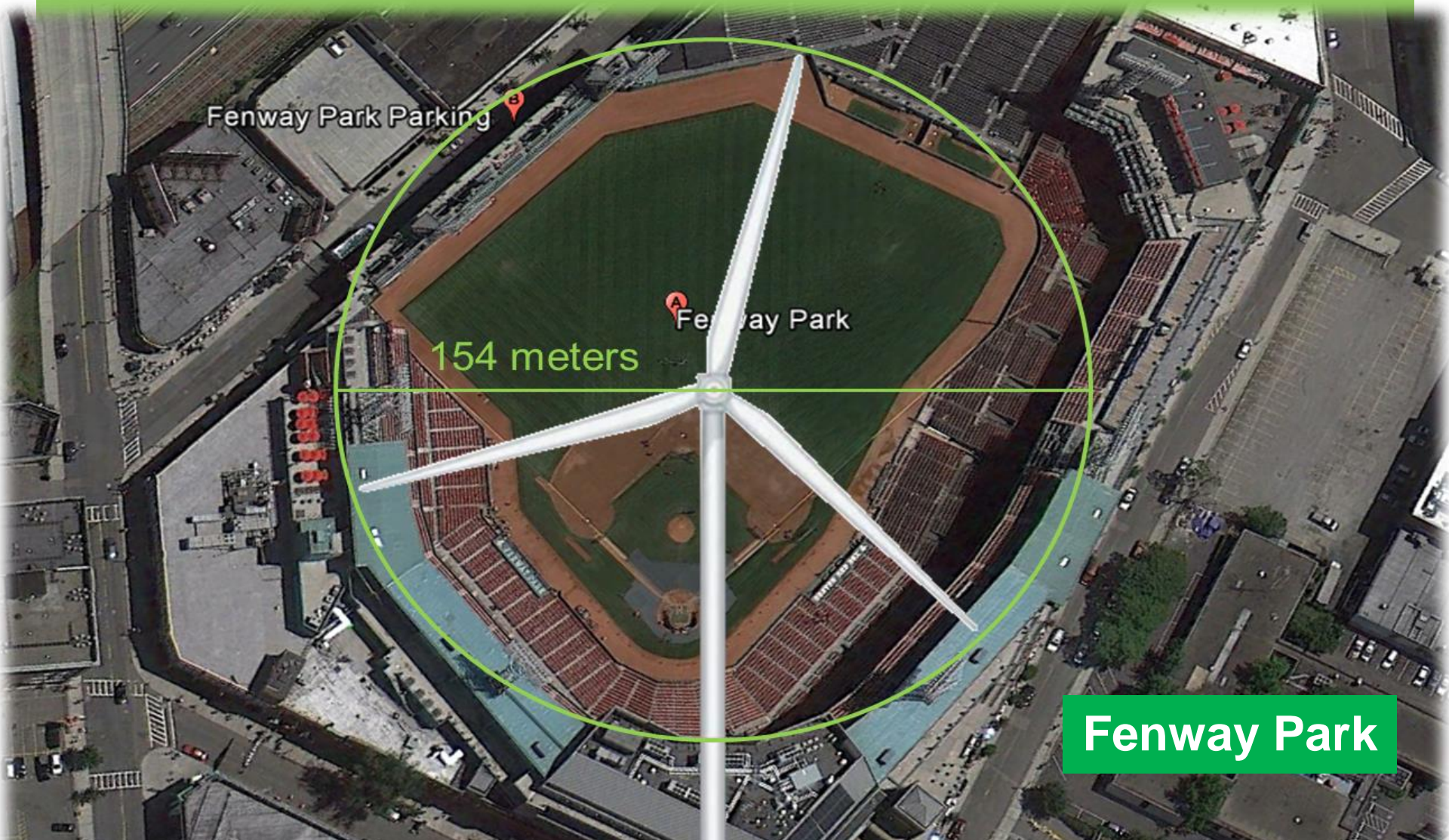
- * 1991 - first offshore wind park: Vindeby, Denmark; (11) 450kW turbines
- * Currently 12.6GW of offshore wind operating in Europe creating 84,000 jobs; ~ 3,700 towers producing power
- * Enough to power 13 million homes
- * 81 offshore wind farms in 10 European countries
- * OSW now 13% of the annual EU wind energy market
- * By 2020, this number is expected to reach 24.6 GW

Technology Development

From 30 kw to 8 MW in 30 years



How big is that?

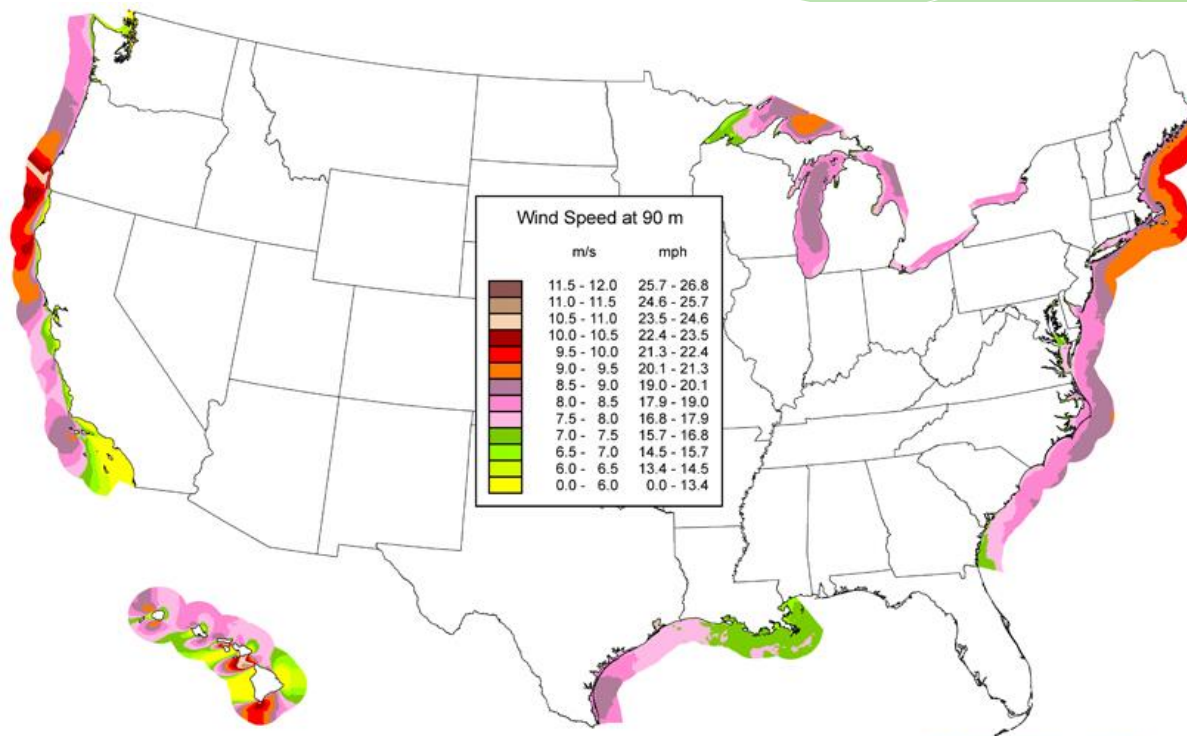


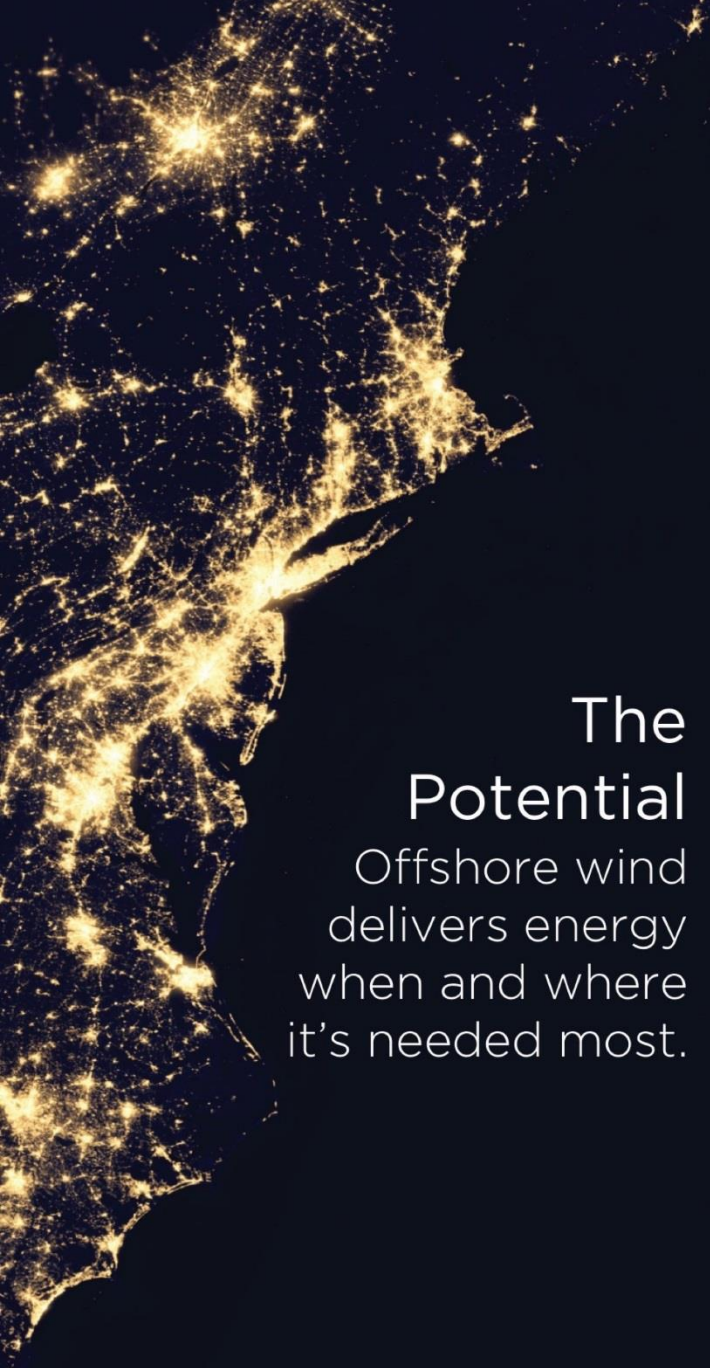




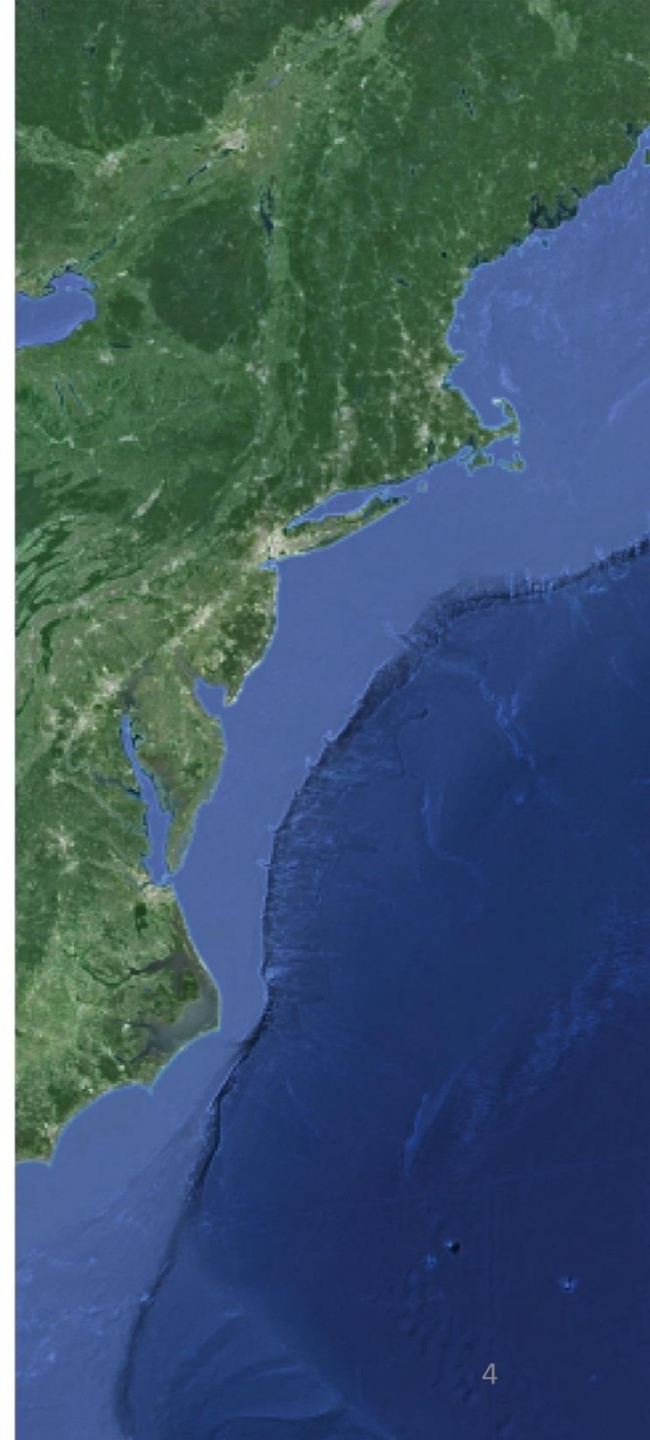
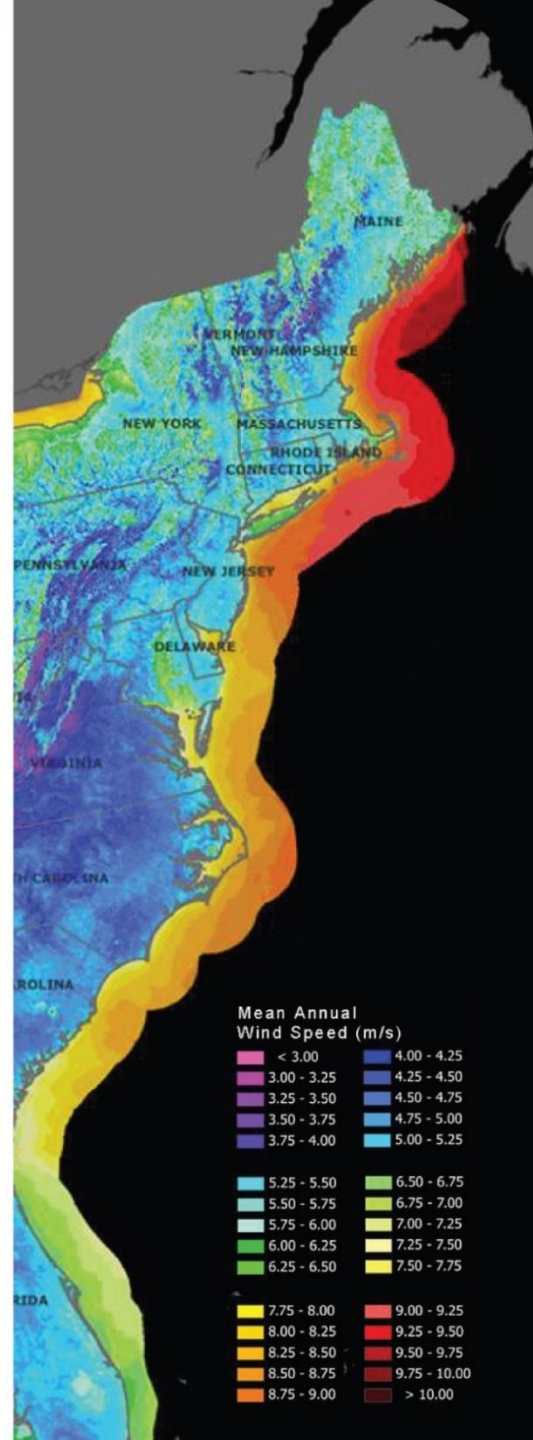


US Offshore Wind Resources





The
Potential
Offshore wind
delivers energy
when and where
it's needed most.



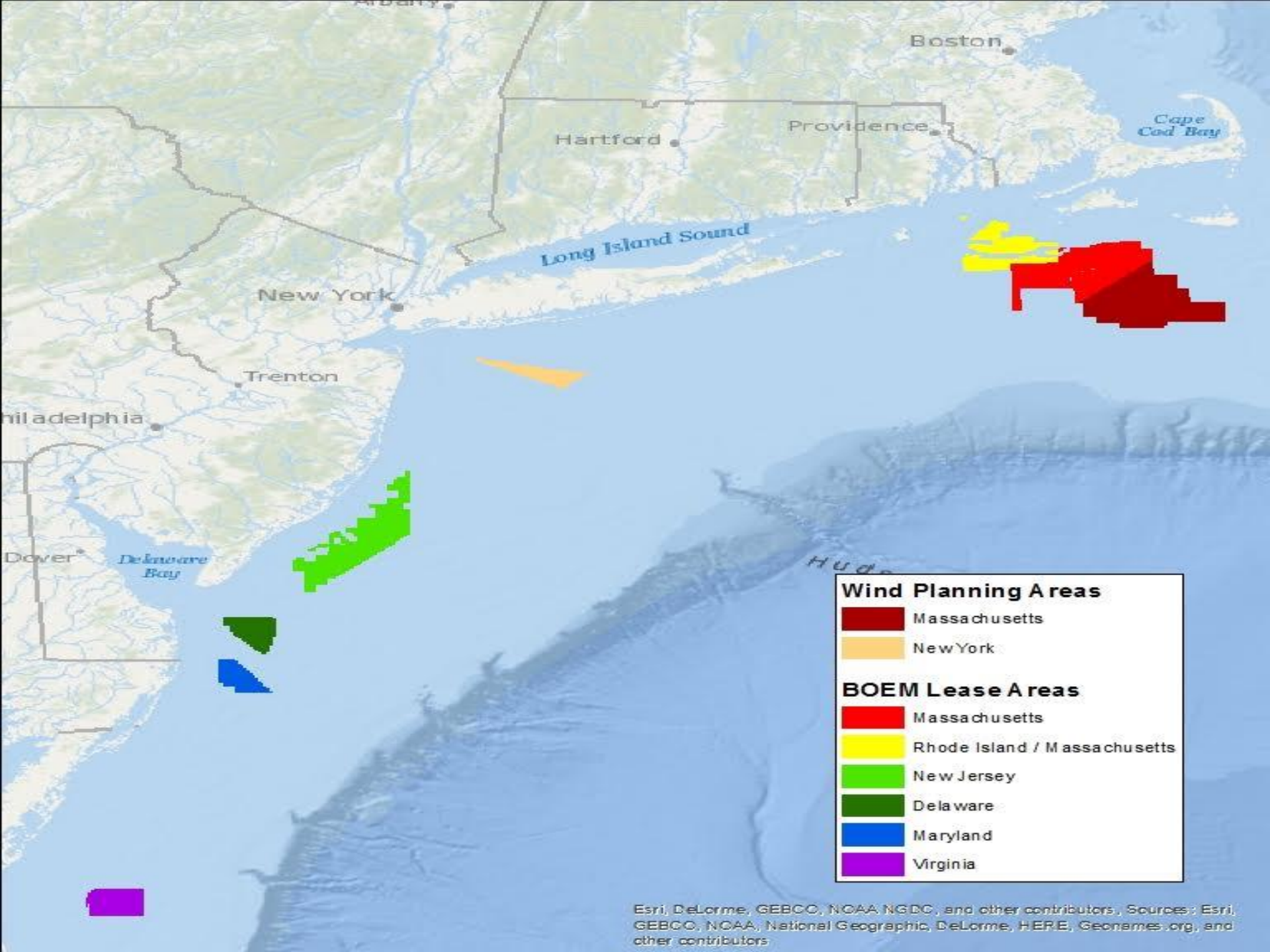
Key Facts about US Offshore Wind

- **Federal BOEM auctions lease rights to OSW developers**
 - ✓ *MAWEA: 2015 auction Top bid ~ \$282K*
 - ✓ *NYWEA: 2016 auction Top bid ~ \$42.5M*
 - ✓ *MAWEA: 2018 auction Top bid ~ \$135M*
- **2016 Mass. Energy Legislation requires Public Utilities to buy 1,600 MW of electricity from OSW**
 - ✓ *Vineyard Wind selected to develop 800MW*
 - ✓ *\$6.5cent “strike price”*
- **43,000 jobs projected for the U.S. offshore wind industry by 2030**

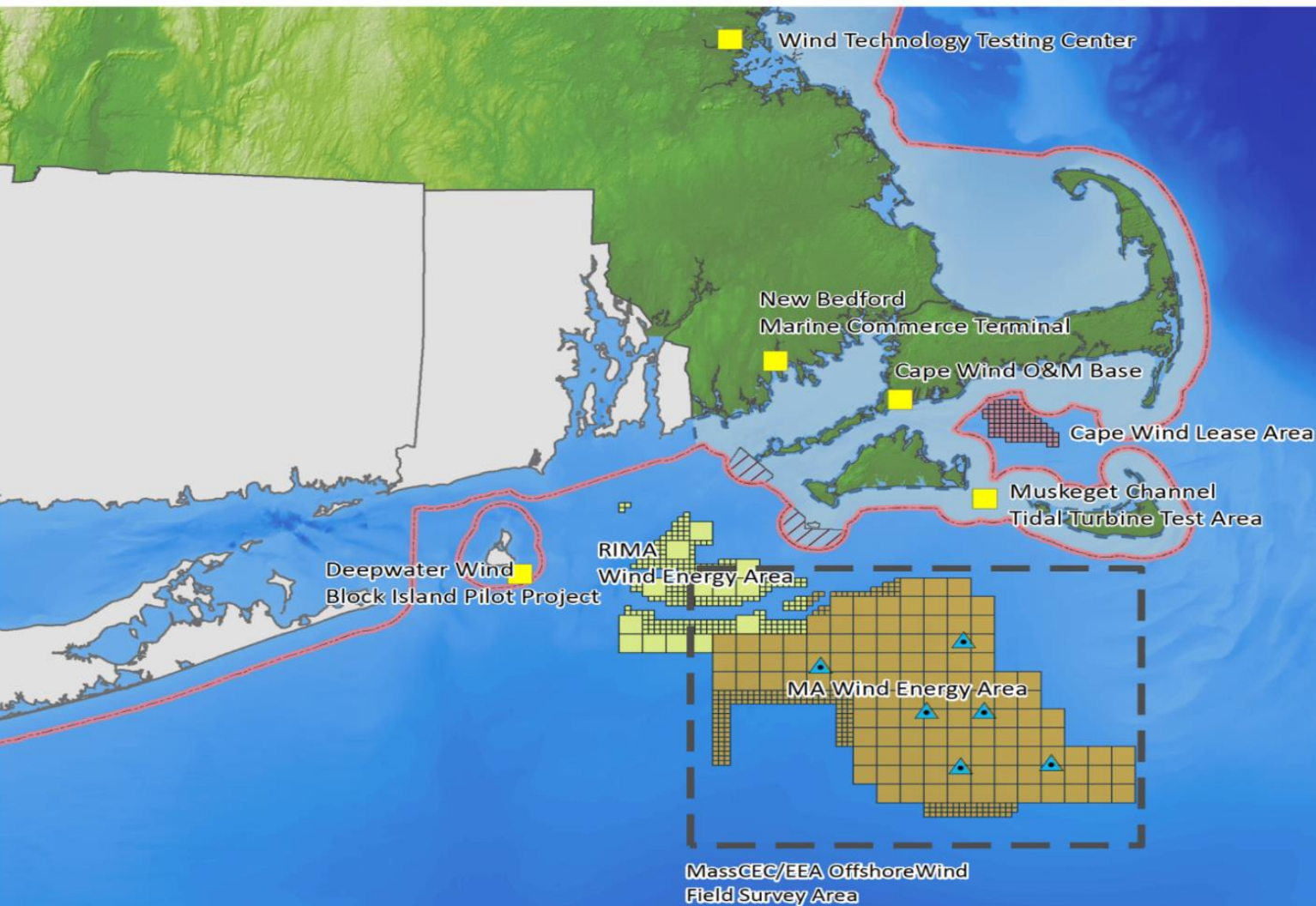
Atlantic Renewable Energy Leases



- Eight competitive federal lease sales generated over \$473 million in high bids for ~1.7m acres
- More than 15 GW capacity or 5 million homes powered
- 15 active OSW lease areas totaling 19 GW of energy
- OSW energy leases off every state from Cape Cod to Cape Hatteras



Massachusetts Wind Energy Area



Massachusetts Offshore Wind Hub

WIND TECHNOLOGY
TESTING CENTER



NEW BEDFORD
MARINE COMMERCE
TERMINAL



Block Island
Wind Farm



- Deepwater Wind North
- Deepwater Wind South
- Bay State Wind
- Vineyard Wind
- Equinor Wind US
- Mayflower Wind Energy
- Vineyard Wind

MAWEA Offshore Wind Resource

The U.S. Department of Energy estimates the MAWEA could generate more than 10,000 MW (10GW) of clean energy.....

That's enough to generate 18X the current electricity demand Massachusetts!

Massachusetts 83C Solicitation

Round One -

- DOER issued RFP in 2017 for 400MW-800MW
- Selected Vineyard Wind in December 2017
 - ✓ 6.5 cents/KwH
- Begin construction December 2019
- Foundations in water 2020
- Towers & turbines in water 2021
- Turbines generating electricity 2022

Massachusetts 83C Solicitation

Round Two -

- DOER issued RFP on May 23, 2019 for additional 800MW
- Reply date August 9, 2019
- Winner announced November 8, 2019
- PPA in place by January 10, 2020

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Fastest Growing Occupations

Fastest growing occupations: 20 occupations with the highest percent change of employment between 2014-24.

Click on an occupation name to see the full occupational profile.

OCCUPATION	GROWTH RATE, 2014-24	2016 MEDIAN PAY
Wind turbine service technicians	108%	\$52,260 per year
Occupational therapy assistants	43%	
Physical therapist assistants	41%	
Physical therapist aides	39%	
Home health aides	38%	
Commercial divers	37%	

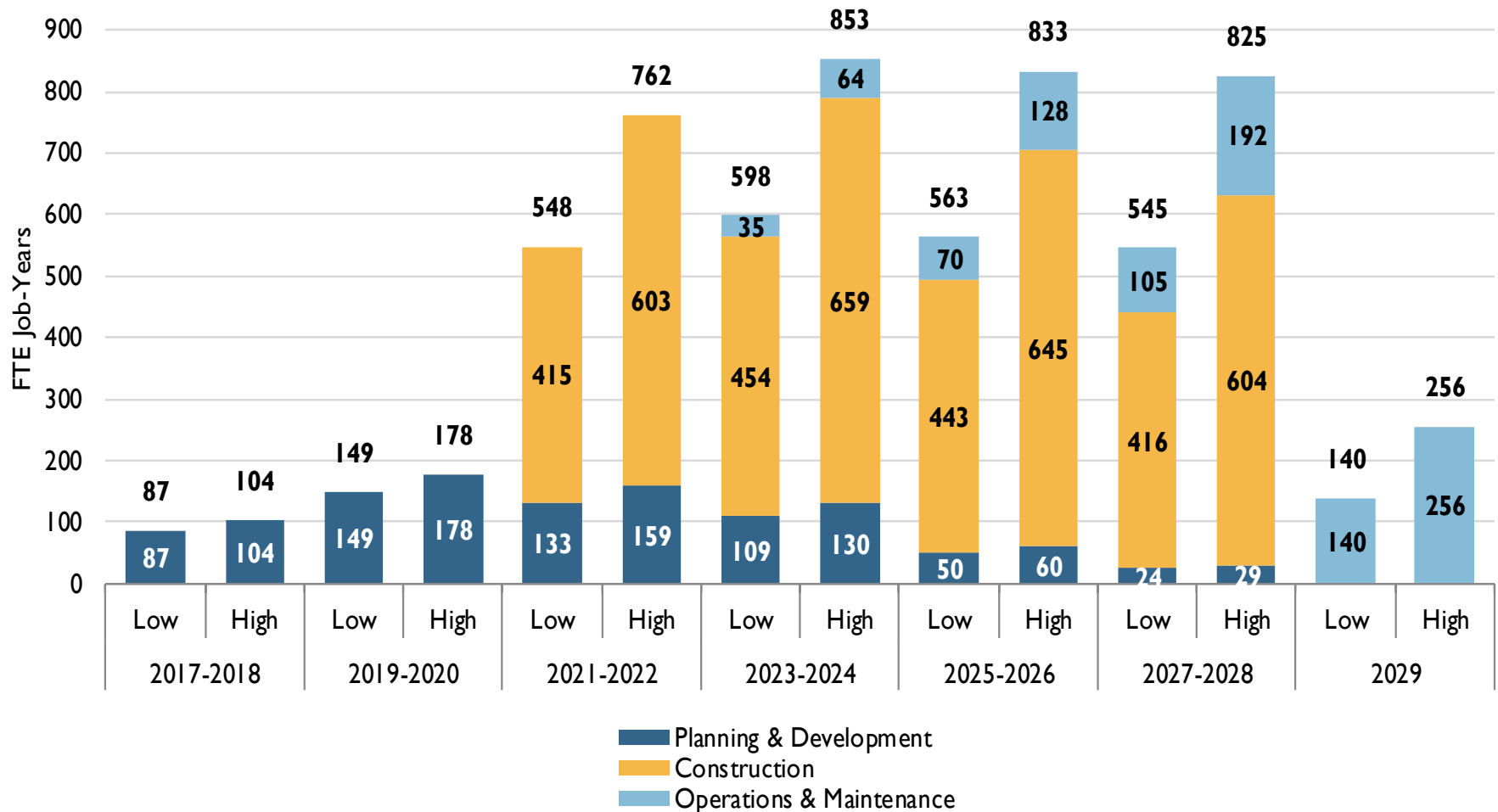


New Job-Years by Occupation 2017-2030

Occupations	2017-18	2019-20	2021-22	2023-24	2025-26	2027-28	2029-30	Total Job-Years
Planning & Development	94	160	142	116	54	26		592
Engineering	33	33	33	33				132
Surveying and Scientific Monitoring	11	22	22	22	11			88
Finance	11	10						21
Permitting		22	22					44
Legal	6	6						12
PR and Marketing	5	11	5					21
Machine Maintenance and Port Services	11	22						33
Site Managers			26	27	26	26		105
Water Transportation Workers	6	12	12	12	6			48
Other	11	22	22	22	11			88
Construction			520	569	556	522		2167
Project Engineers			18	20	20	18		76
Construction Managers			45	49	49	45		188
Machine Maintenance and Port Services			11	22	11	11		55
Water Transportation Workers			108	110	109	108		435
Trade Workers			323	352	351	325		1351
Longshoremen/Stevedores			45	49	49	45		188
Structural Iron & Steel Workers			90	98	98	91		377
Electricians			60	66	65	61		252
Material Moving Machine Operators			45	49	49	45		188
Other Installation Technicians			30	33	33	30		126
Laborers			53	57	57	53		220
Other			15	16	16	15		62
Operations & Maintenance				47	47	47	47	188
Site/Plant Managers				8	8	8	8	32
Project Engineers				6	6	6	6	24
Water Transportation Workers				6	6	6	6	24
O&M Technicians				24	24	24	24	96
Other				3	3	3	3	12
Total Annual Job-Years	94	160	662	732	657	595	47	2947

Job-Years 2017–2029

Low and High Scenarios



Economic Output in Massachusetts Construction

Low and High Scenarios

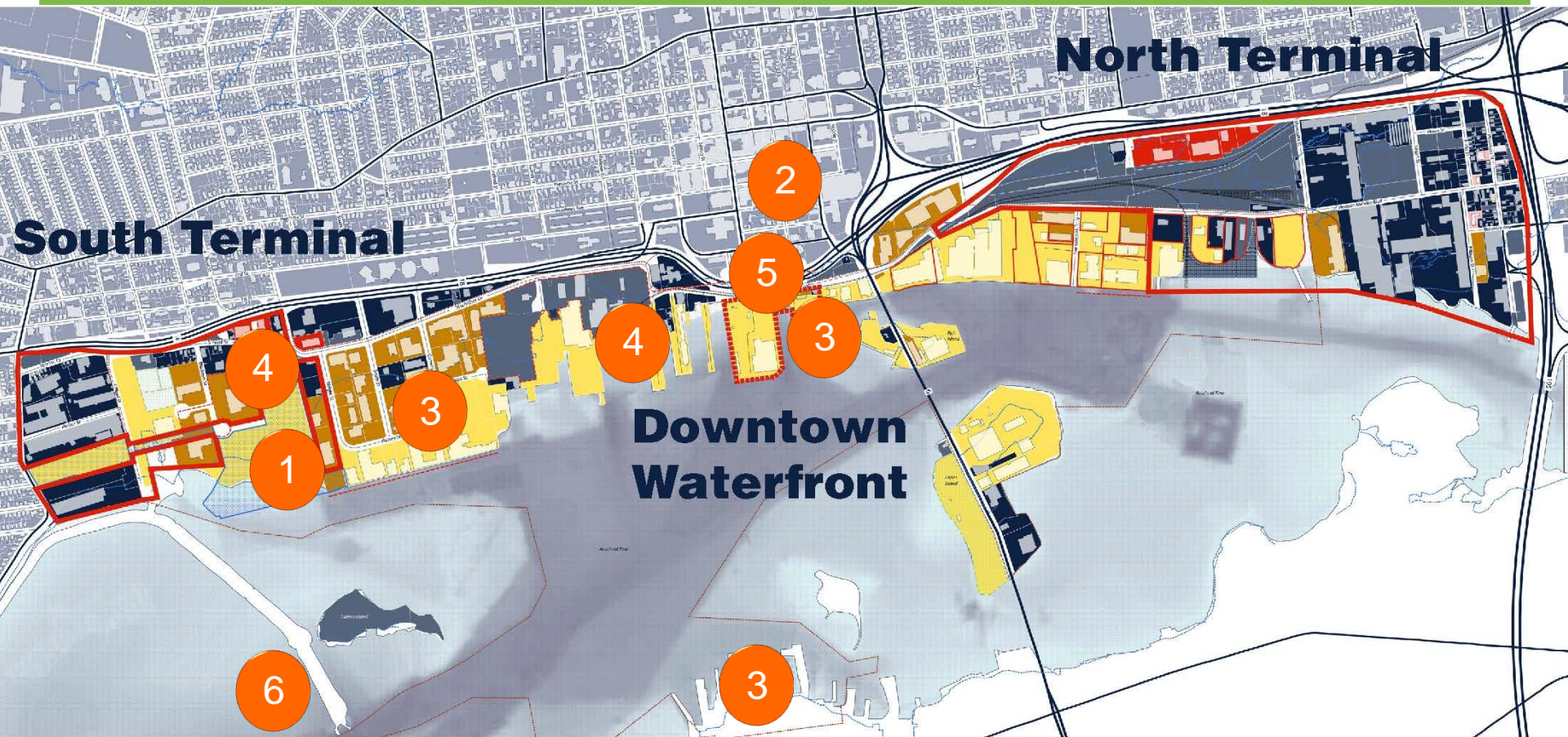
	Project Development & Onsite Labor (Direct) (\$M)	Turbine & Supply Chain (Indirect) (\$M)	Induced (\$M)	Total (\$M)
Project 1	\$161.9 - \$208.3	\$87.1 - \$173.3	\$95.7 - \$129.6	\$344.7 - \$511.2
Project 2	\$170.0 - \$205.5	\$90.2 - \$208.3	\$96.9 - \$133.5	\$357.1 - \$547.3
Project 3	\$172.6 - \$199.4	\$91.1 - \$199.8	\$95.9 - \$127.0	\$359.6 - \$526.2
Project 4	\$174.3 - \$191.9	\$91.6 - \$196.7	\$94.7 - \$121.3	\$360.6 - \$509.9
Total	\$678.8 - \$805.1	\$360.0 - \$778.1	\$383.2 - \$511.4	\$1,422.0 - \$2,094.6

Annual Economic Output in Massachusetts for O&M

Low & High Scenarios

	Project Development & Onsite Labor (Direct) (\$M)	Turbine & Supply Chain (Indirect) (\$M)	Induced (\$M)	Total (\$M)
Project 1	\$3.7 - \$6.7	\$41.0 - \$74.6	\$12.1 - \$22.0	\$56.8 - \$103.3
Project 2	\$3.7 - \$6.7	\$36.7 - \$66.2	\$11.0 - \$19.9	\$51.4 - \$92.8
Project 3	\$3.7 - \$6.7	\$33.7 - \$60.8	\$10.2 - \$18.5	\$47.6 - \$86.0
Project 4	\$3.7 - \$6.7	\$31.9 - \$57.8	\$9.8 - \$17.7	\$45.3 - \$82.2
Total	\$14.8 - \$26.8	\$143.3 - \$259.4	\$43.1 - \$78.1	\$201.1 - \$364.3

Port of New Bedford



1 Marine Commerce Terminal

3 Full Marine Support

5 Access to Supply Chain

2 Research & Workforce Training

4 Sites & Incentives

6 Close to BOEM Wind Areas

The Marine Commerce Terminal



The state of the art 26-acre facility has a 1,200 foot quayside and a 300-foot wide navigational channel dredged to -30 feet. The site has the ability to sustain uniform loads of 4,100 pounds per square foot and concentrated loads of 20,485 per square foot.

OSW Career Pathway

- * **Access** to Certificates or Higher Education degree
- * **Opportunity** to achieve
 - ✓ *Pre-apprentice Certificate & College Credits*
 - ✓ *HiSET/GED & Wind Power Certificate*
- * **Technology** to reinforce skills and meet academic standards
- * **STEM core** focused on Electrical, Mechanical and Hydraulic skills
- * **Bristol has only OSW associates degree program in US**



Augmented by Health, Safety and Environmental Training (HSE)

- Aligned with industry standards and best practices for (HSE) Global Wind Organization “Basic Safety Training” certificate
 - ✓ Fire Awareness
 - ✓ First Aid
 - ✓ Manual Handling
 - ✓ Working at Heights
 - ✓ Sea Survival
- In US, other than OSHA requirements (land-side only).... there are currently no HSE regulations, standards, protocols or recommended practices in place for offshore wind



Offshore Wind Memorandum of Agreement

- * BCC, UMD, MMA
- * Other CONNECT partners and Cape Cod Community College
- * Joint student admission and concurrent enrollment
- * Accelerated baccalaureate degrees
- * Coordinate and delineate research, workforce training roles; shared facilities

OSW Community Stakeholders Issues

- * Ocean stewardship, environmental protection and risk mitigation
- * Impacts and risks of structures on biomass and marine commerce
- * Interface with commercial fishing interests
- * “State’s Rights” and resolving competition
- * Developing port HUBS for OSW
- * Host community impacts and compensation
- * Social justice regarding economic impacts
- * Access to training and jobs
- * Workplace safety

Offshore Wind

A New Base Industry for U.S.

*Thank you for your interest.
Happy to answer any questions
you may have.*