



Offshore Wind Overview

Advanced Energy Conference, New York, NY
March 28, 2018



Offshore Wind Worldwide

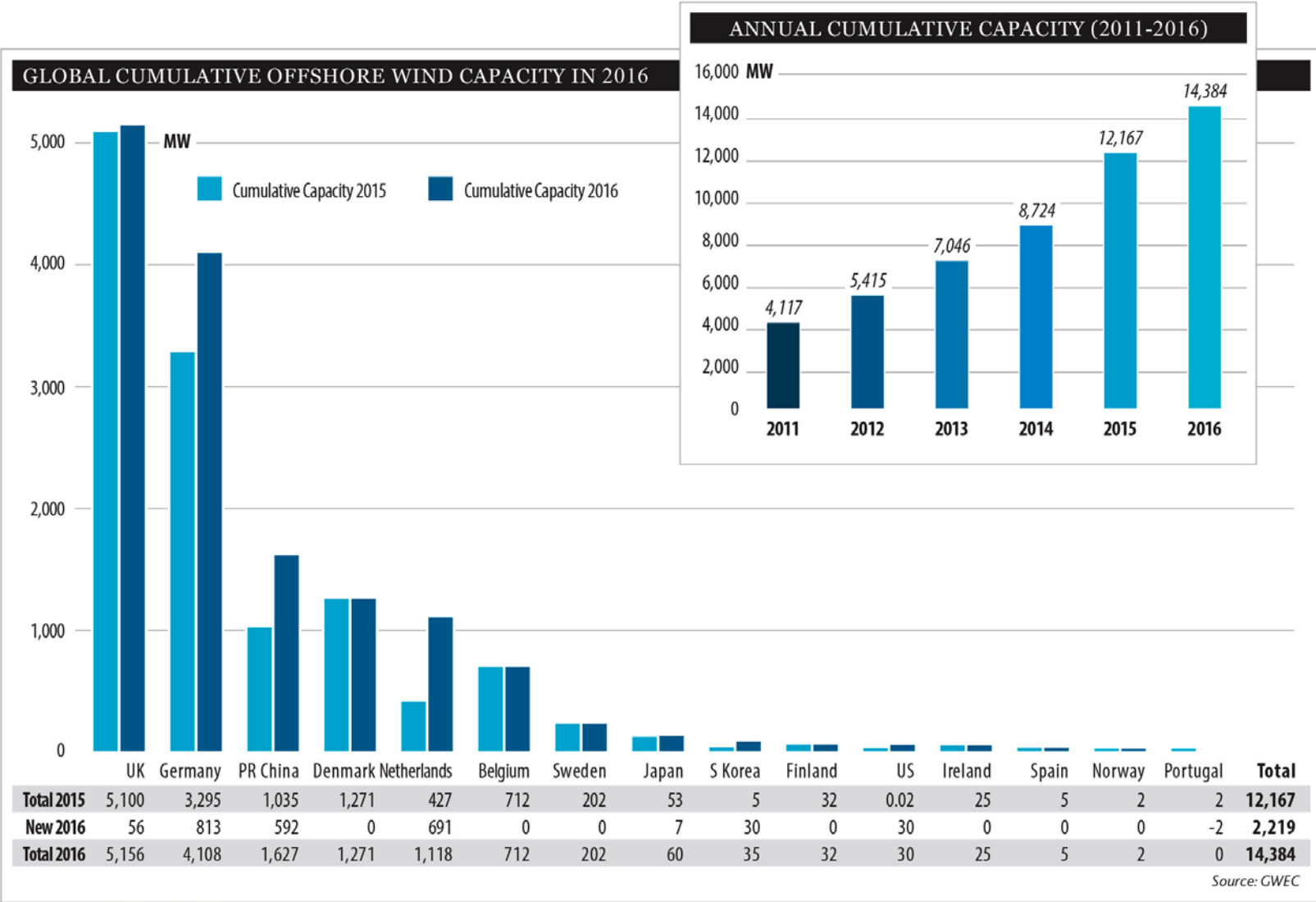
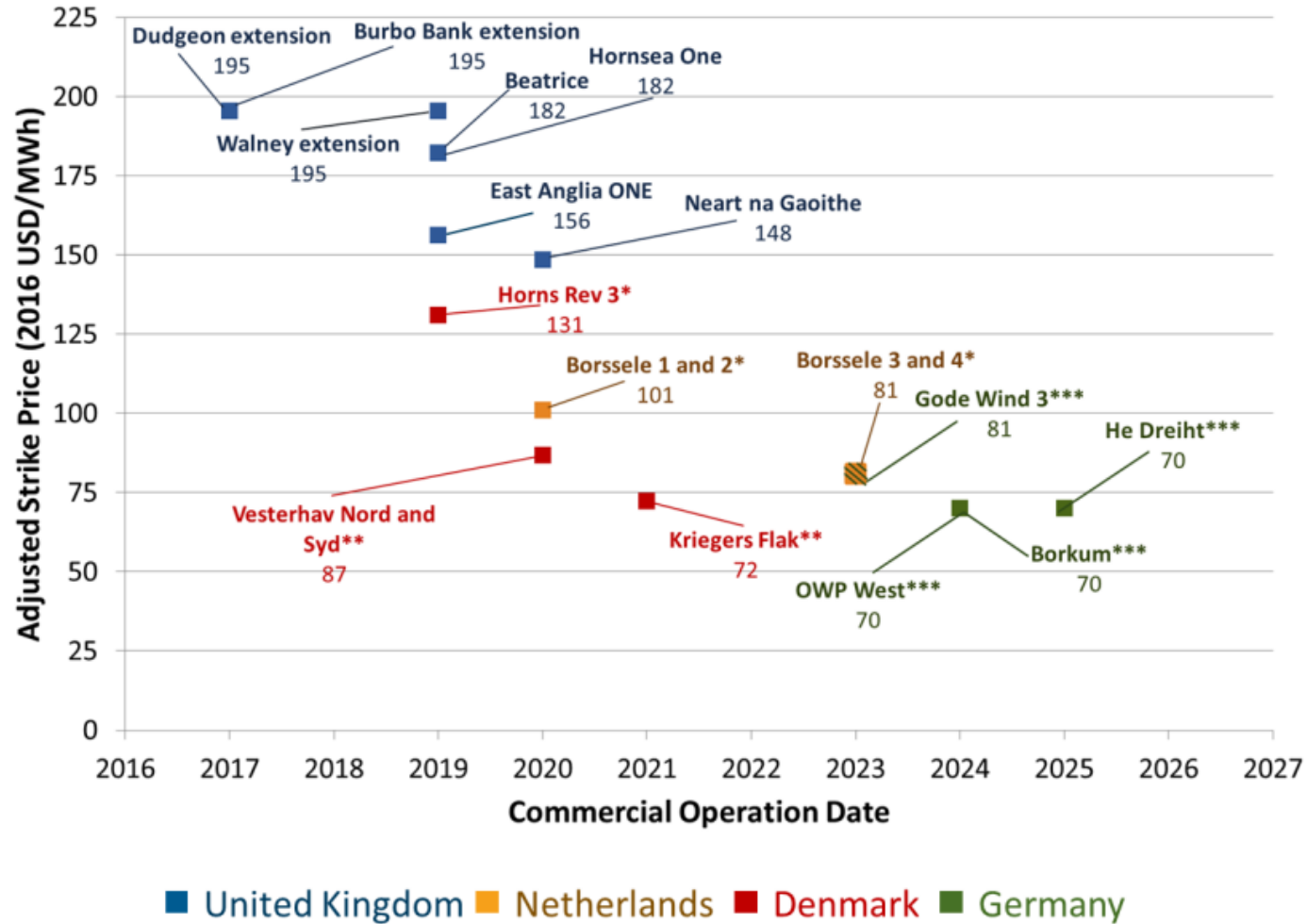


Image from Global Wind Energy Council: http://www.gwec.net/wp-content/uploads/2017/02/27_Annual-and-Global-Cumulative-Offshore-wind-capacity-in-2016.jpg

Cost of Offshore Wind



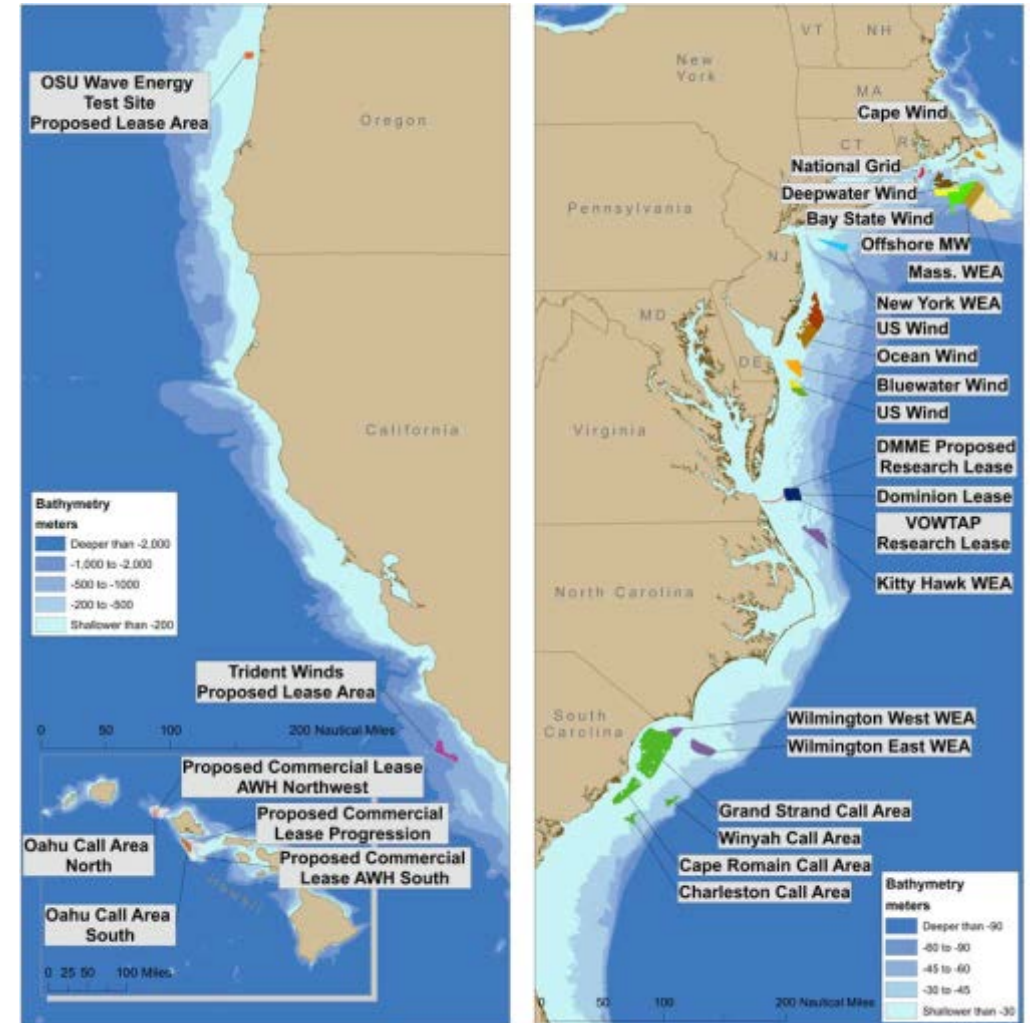
Adjusted strike prices from European offshore wind auctions

Source: NREL 2016 Offshore Wind Technologies Market Report



US Offshore Wind Leases

- Block Island 30 MW in operation
- Mass RFP award expected in April 2018
- New York and New Jersey developing compensation mechanisms
- Maryland OREC's awarded in 2017
- Dominion has contracted with Orsted to complete 2 WTG's off Virginia
- Additional lease awards expected off Mass & NY in 2018



Source: BOEM

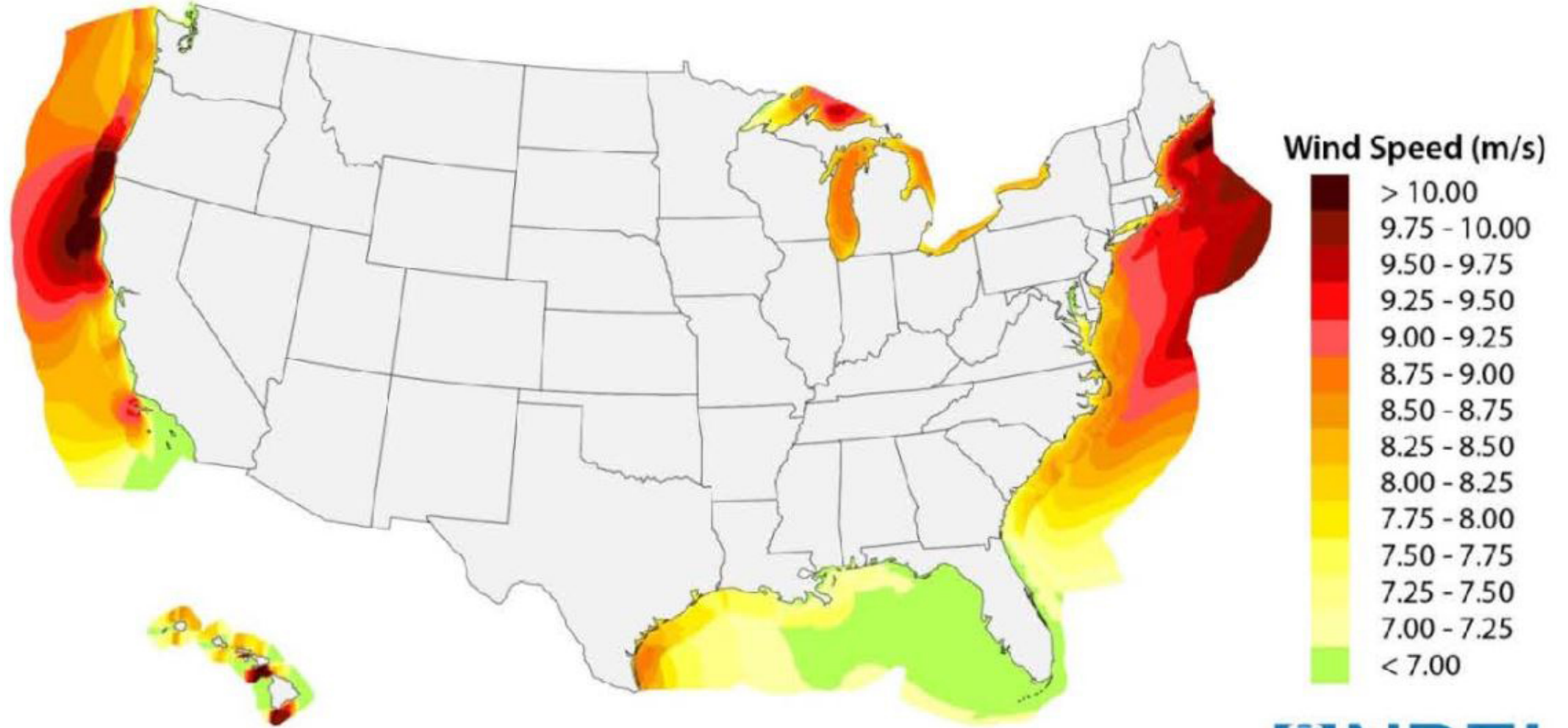
DOI/DOE National Offshore Wind Strategy



US Coastal Bathymetry



US Offshore Wind Resource

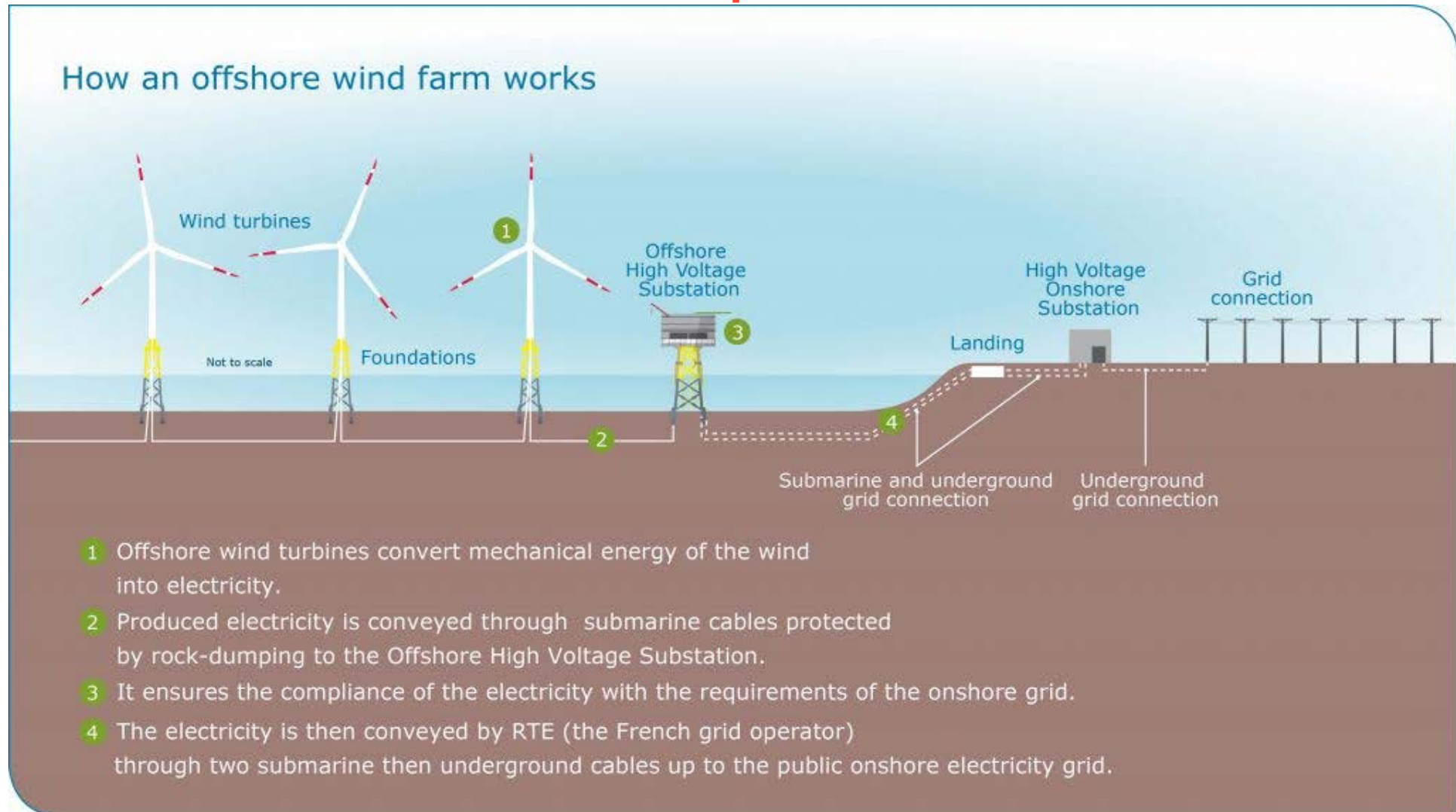


Data Source: AWS Truepower 0-50nm; NREL WIND Toolkit beyond 50nm.

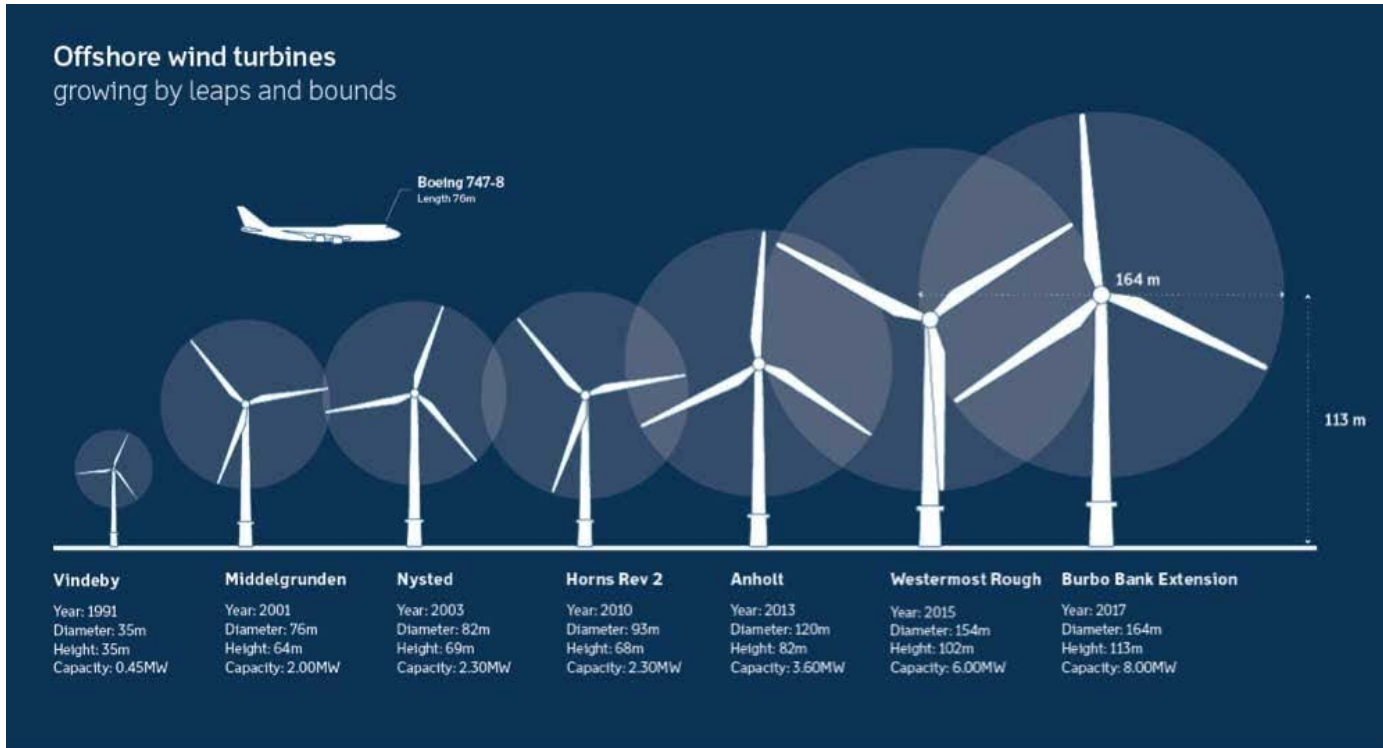
Design Conditions



Offshore Wind Farm Components



Wind Turbine Generators



Source: Orsted



Source: National Renewable Energy Laboratory

Image from US Department of Energy Wind Vision Report

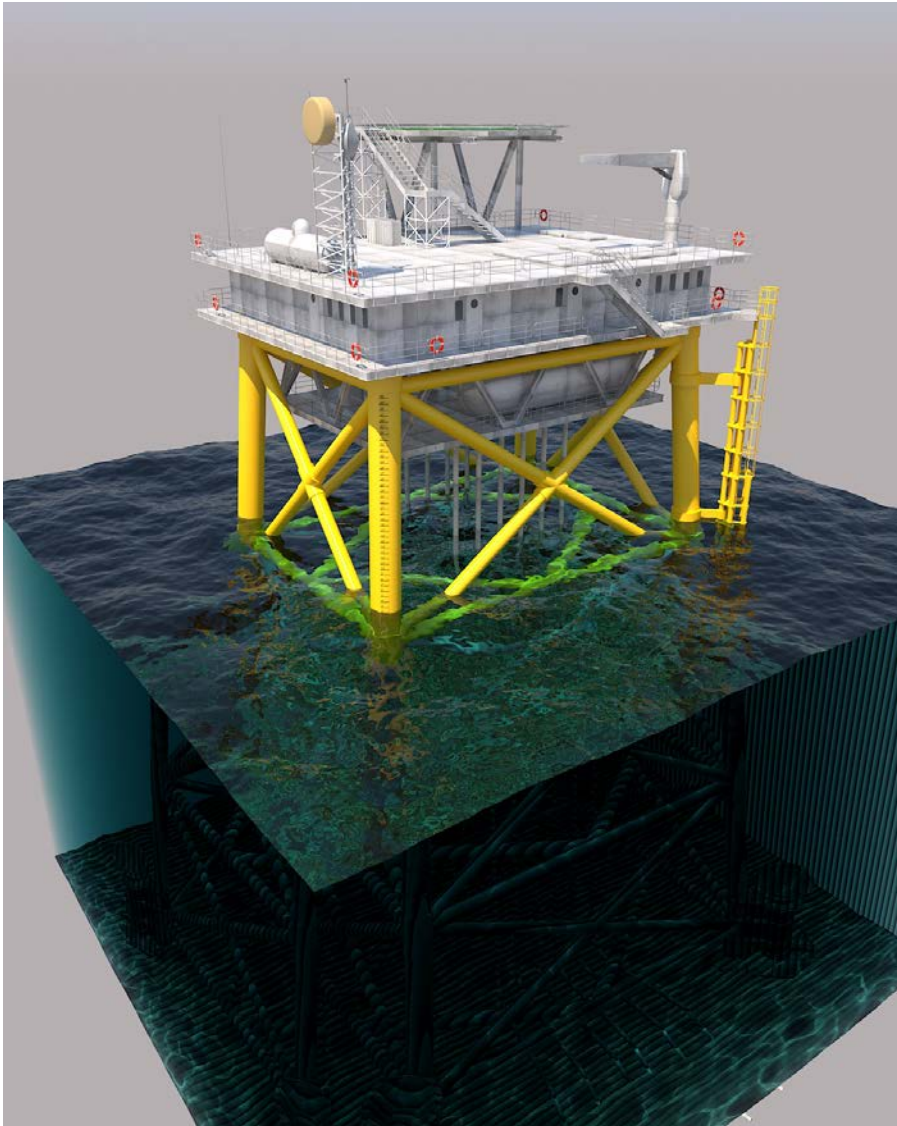
Foundation Types

- Monopile
- Jacket
- Gravity Base
- Suction Bucket
- Floating
 - *Tension Leg Platform*
 - *Spar bouy*
 - *Sem i-submersible*



Source: NREL 2014-2015 Offshore Wind Technologies Market Report

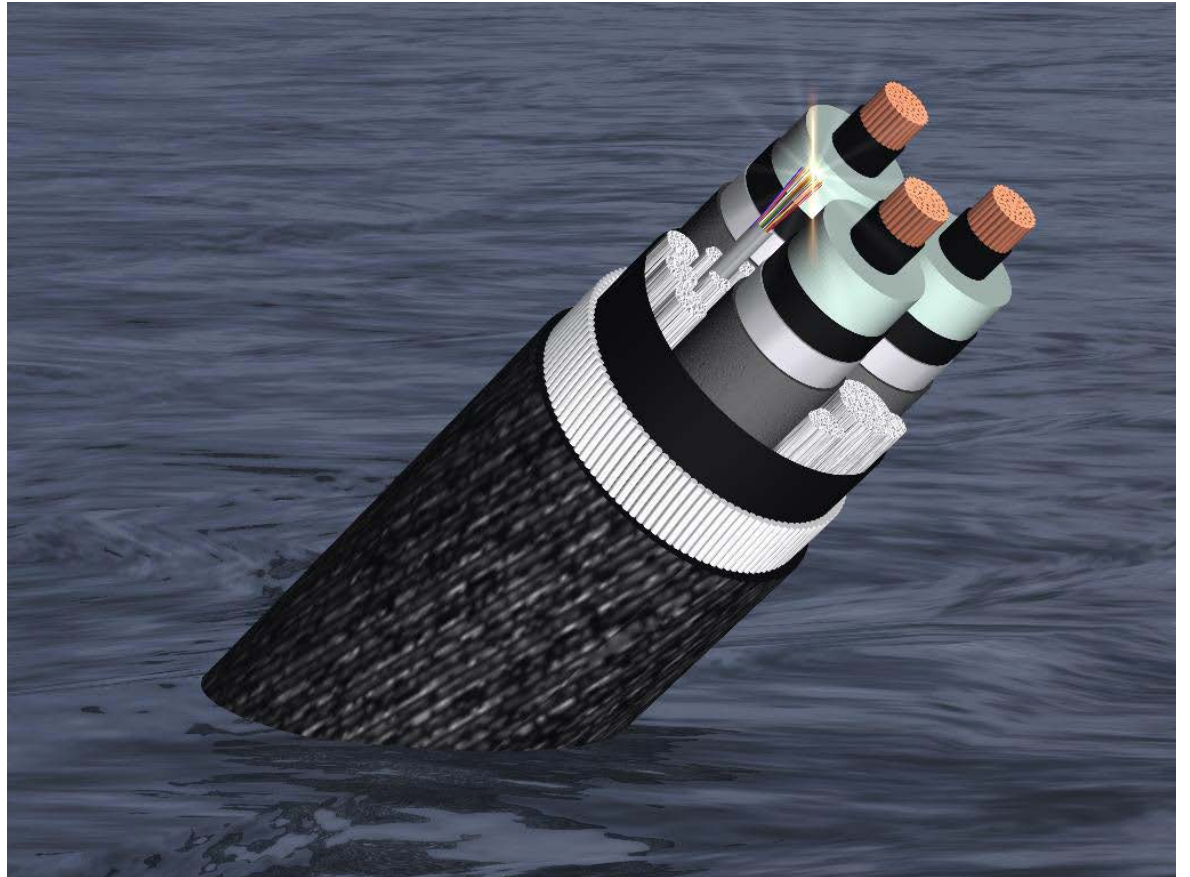
Offshore Substations



- Receive Intra Array cables
- House substation equipment
 - *CB's XFMR's, typically GIS*
- Export at higher voltage
- Multiple potential arrangements

Cables

- Intra Array:
 - *Connect WTG's to offshore substation*
 - *Typically 33 – 66kV*
- Export:
 - *Connect offshore substation to interconnection*
- Installation:
 - *Buried several meters below sea floor*
 - *Jet plowing com m only used m method*



Source: Subsea World News

Thank you

A photograph of an offshore wind farm at sunset. The sun is low on the horizon, creating a bright orange and yellow glow that reflects on the water. Several wind turbines are silhouetted against the sky, with their three blades clearly visible. The sky is filled with soft, wispy clouds, and the overall atmosphere is serene and peaceful.

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