



Grid and Transmission Working Group

Thinking Beyond 10 GW

ESIG 2019 Fall Technical Workshop

Charlotte, NC

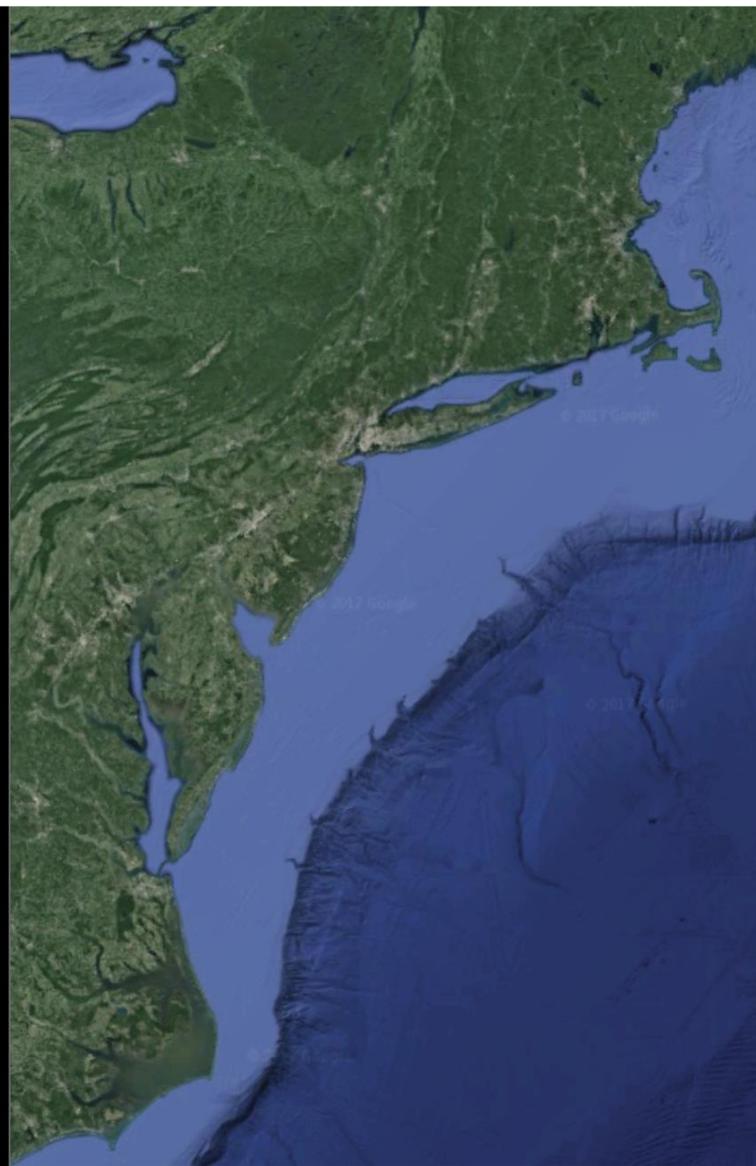
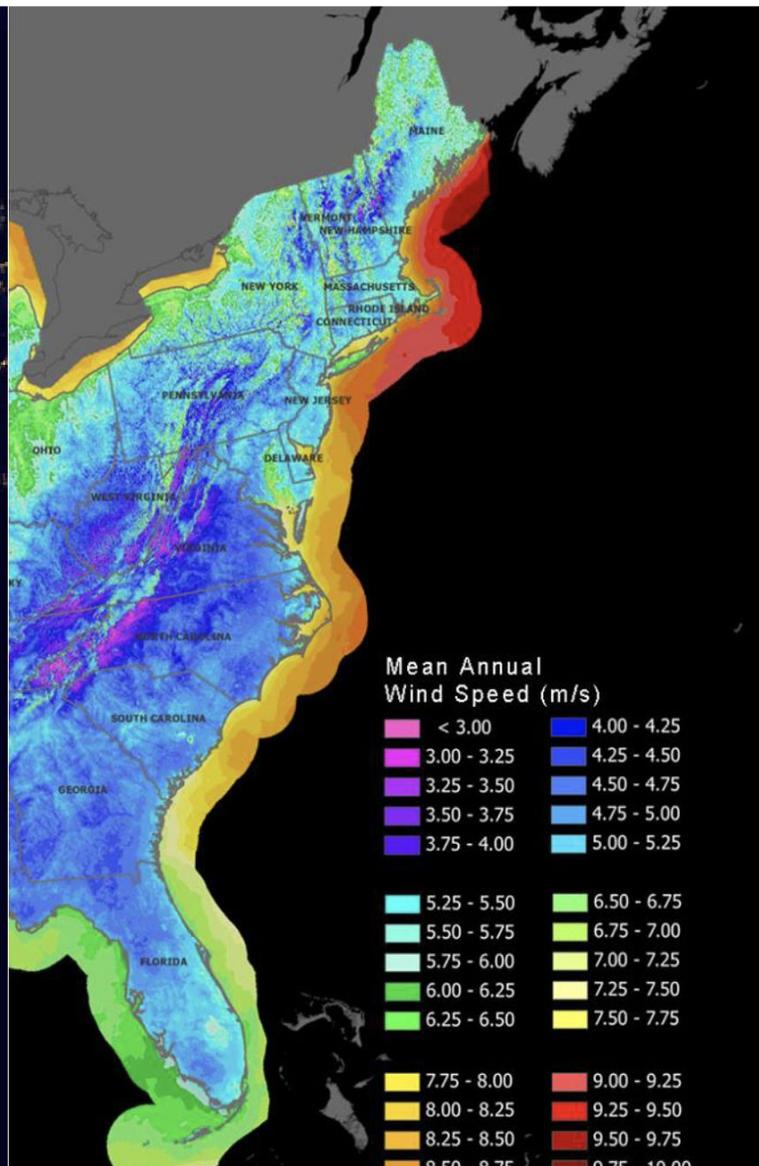
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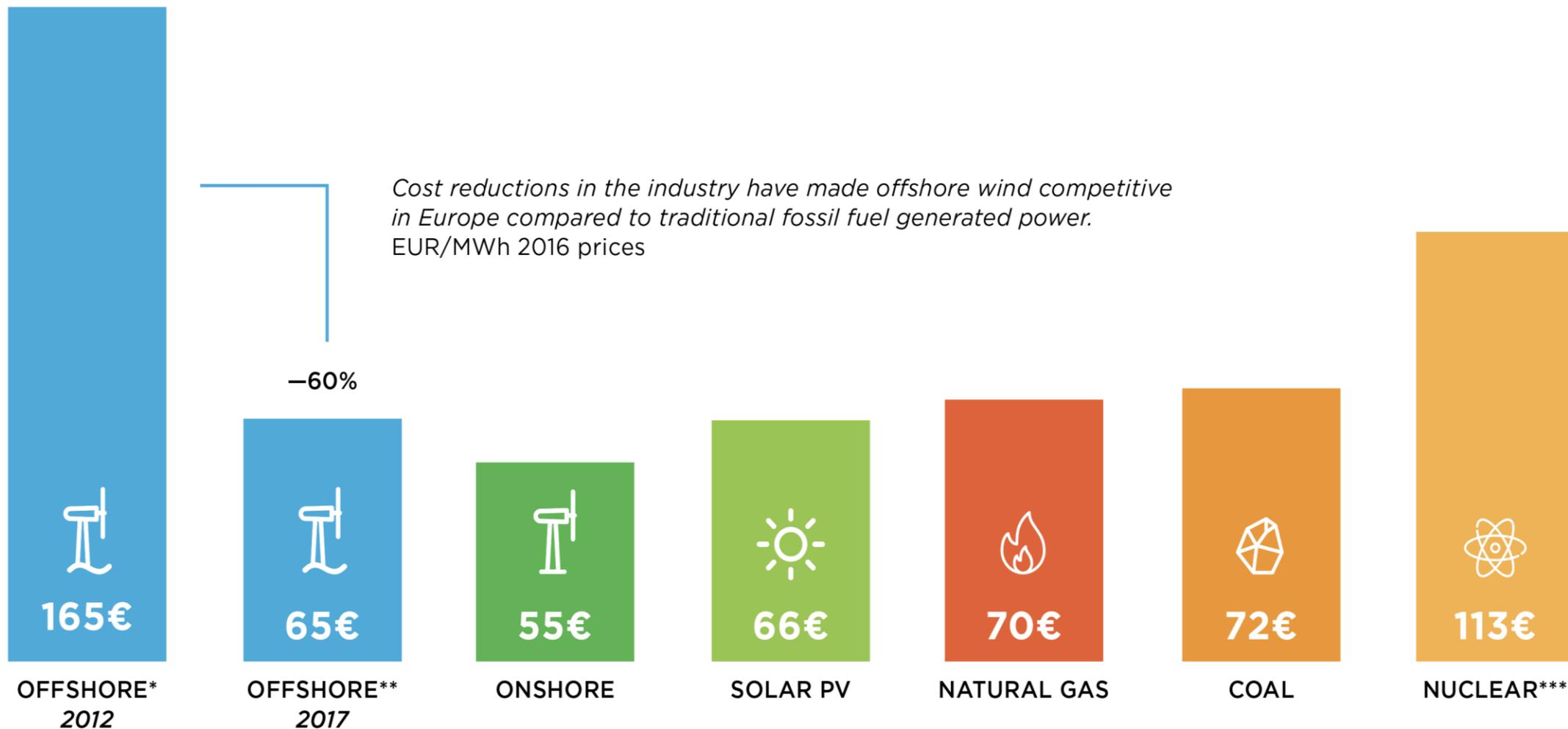
Business Network for Offshore Wind

1. Not-for-Profit
2. Focus on developing US offshore wind and its supply chain
3. Provides: [Information, Education, Introductions](#)

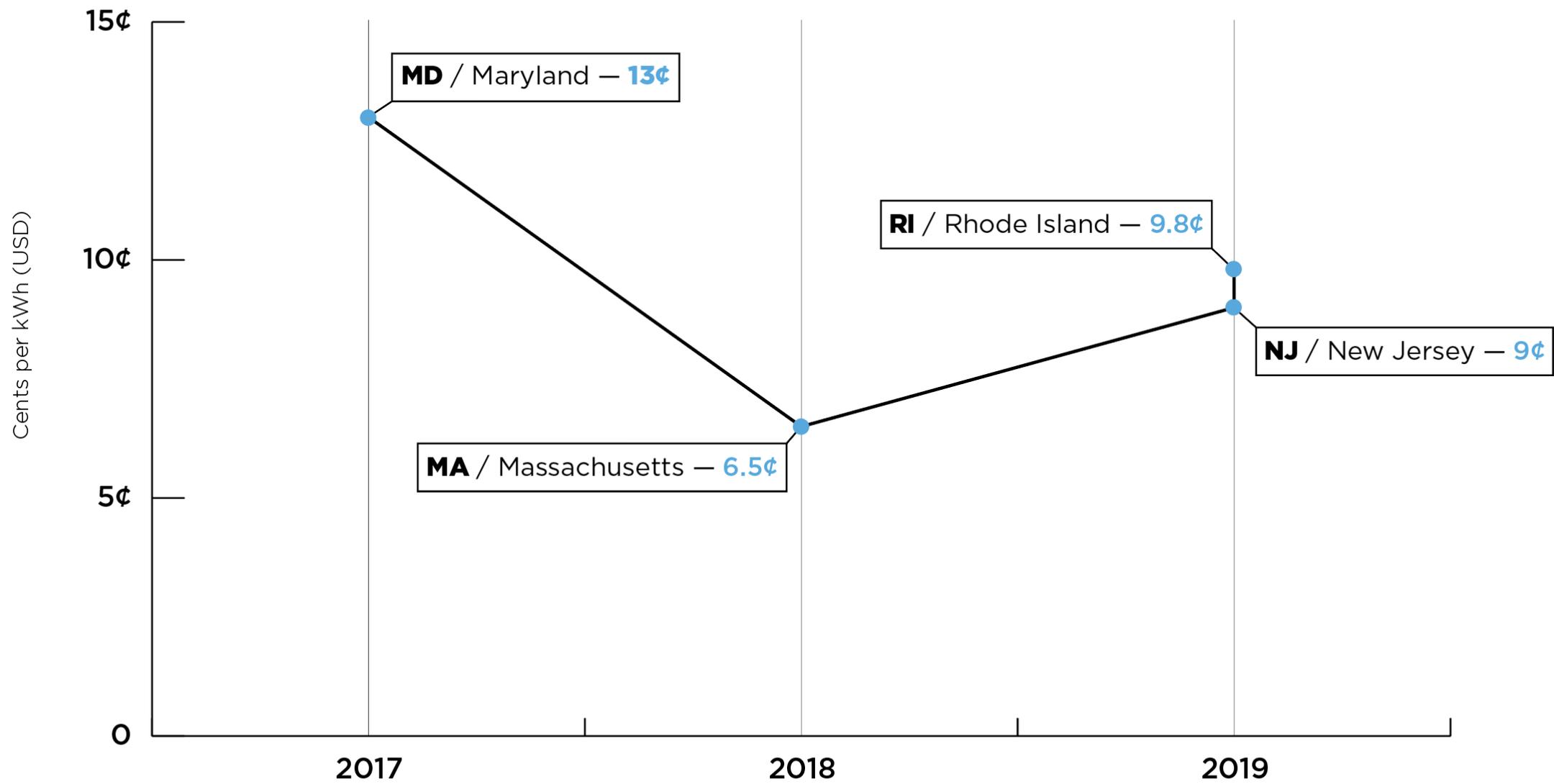
THE POTENTIAL

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





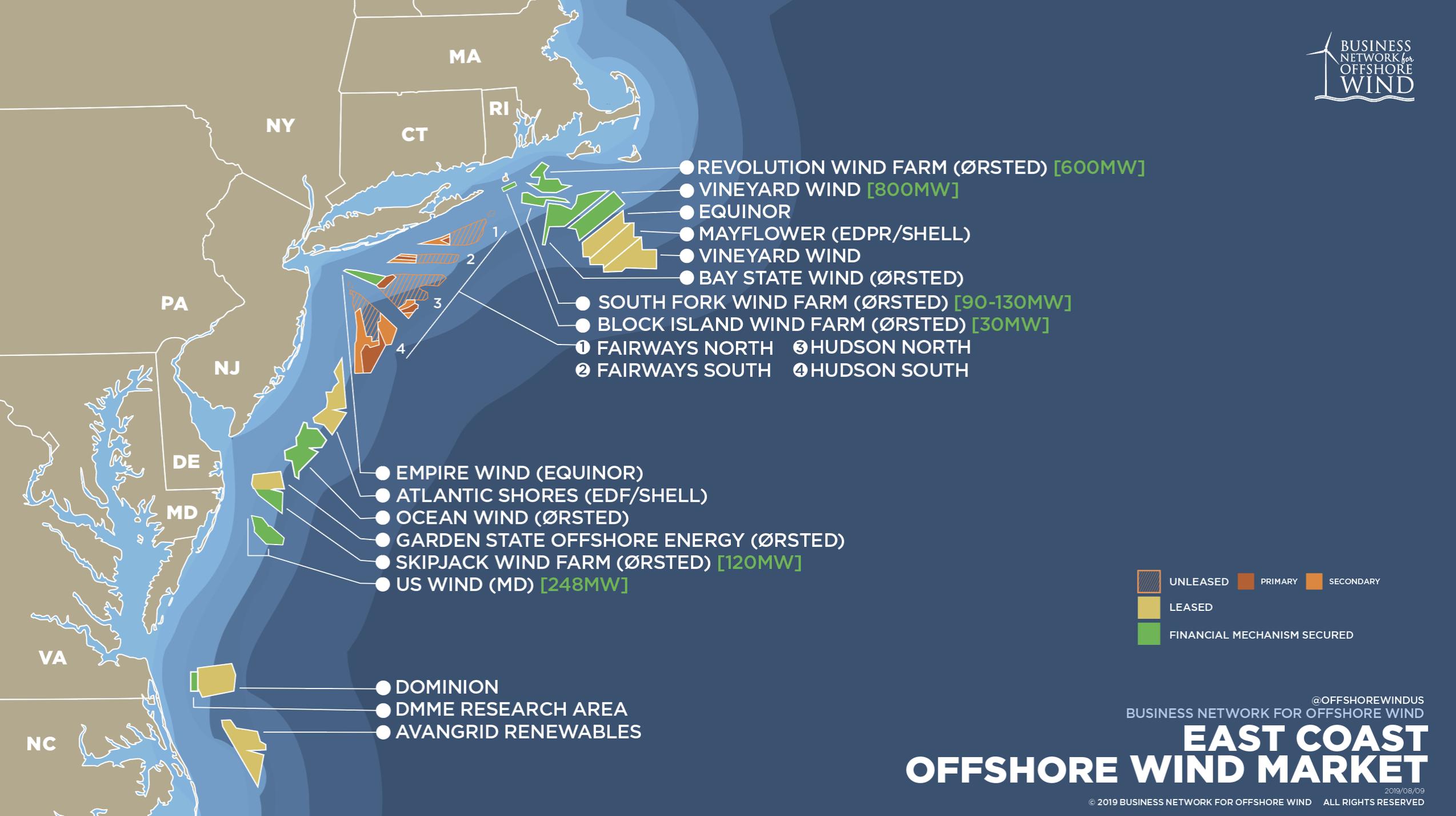
Source: Bloomberg New Energy Finance (BNEF) for CCGT and Coal plants for Northwest Europe, Danish Energy Agency and BNEF for Offshore Wind.
For offshore wind: Including cost of transmission - Calculated as Levelized revenue (subsidy and market price) of electricity over 25yrs lifetime as a proxy for the levelized cost of society. 3.5% real discount rate used. *Generic Offshore Wind, Northwest Europe, FID 2012. In 2012 our goal was to reduce offshore wind costs to 100 Euro/MWh in 2020, ** Hornsea 2, UK, *** Hinkley Point, UK. Same approach as for Offshore Wind. Strike price of 92.5 £/MWh in 2012 real prices. Lifetime of 60yrs, 91% capacity factor.



Three Essential Project Enablers

- Site control and authorization to construct = **Bureau of Ocean Energy Management**
- Offtake = **State** (policy + procurement)
- Interconnection = **RTO, State**

NOT Coordinated = Huge Project Risk



- REVOLUTION WIND FARM (ØRSTED) [600MW]
- VINEYARD WIND [800MW]
- EQUINOR
- MAYFLOWER (EDPR/SHELL)
- VINEYARD WIND
- BAY STATE WIND (ØRSTED)
- SOUTH FORK WIND FARM (ØRSTED) [90-130MW]
- BLOCK ISLAND WIND FARM (ØRSTED) [30MW]
- ① FAIRWAYS NORTH ③ HUDSON NORTH
- ② FAIRWAYS SOUTH ④ HUDSON SOUTH

- EMPIRE WIND (EQUINOR)
- ATLANTIC SHORES (EDF/SHELL)
- OCEAN WIND (ØRSTED)
- GARDEN STATE OFFSHORE ENERGY (ØRSTED)
- SKIPJACK WIND FARM (ØRSTED) [120MW]
- US WIND (MD) [248MW]

- DOMINION
- DMME RESEARCH AREA
- AVANGRID RENEWABLES

UNLEASED
 PRIMARY
 SECONDARY
 LEASED
 FINANCIAL MECHANISM SECURED

@OFFSHOREWINDUS
BUSINESS NETWORK FOR OFFSHORE WIND

EAST COAST OFFSHORE WIND MARKET

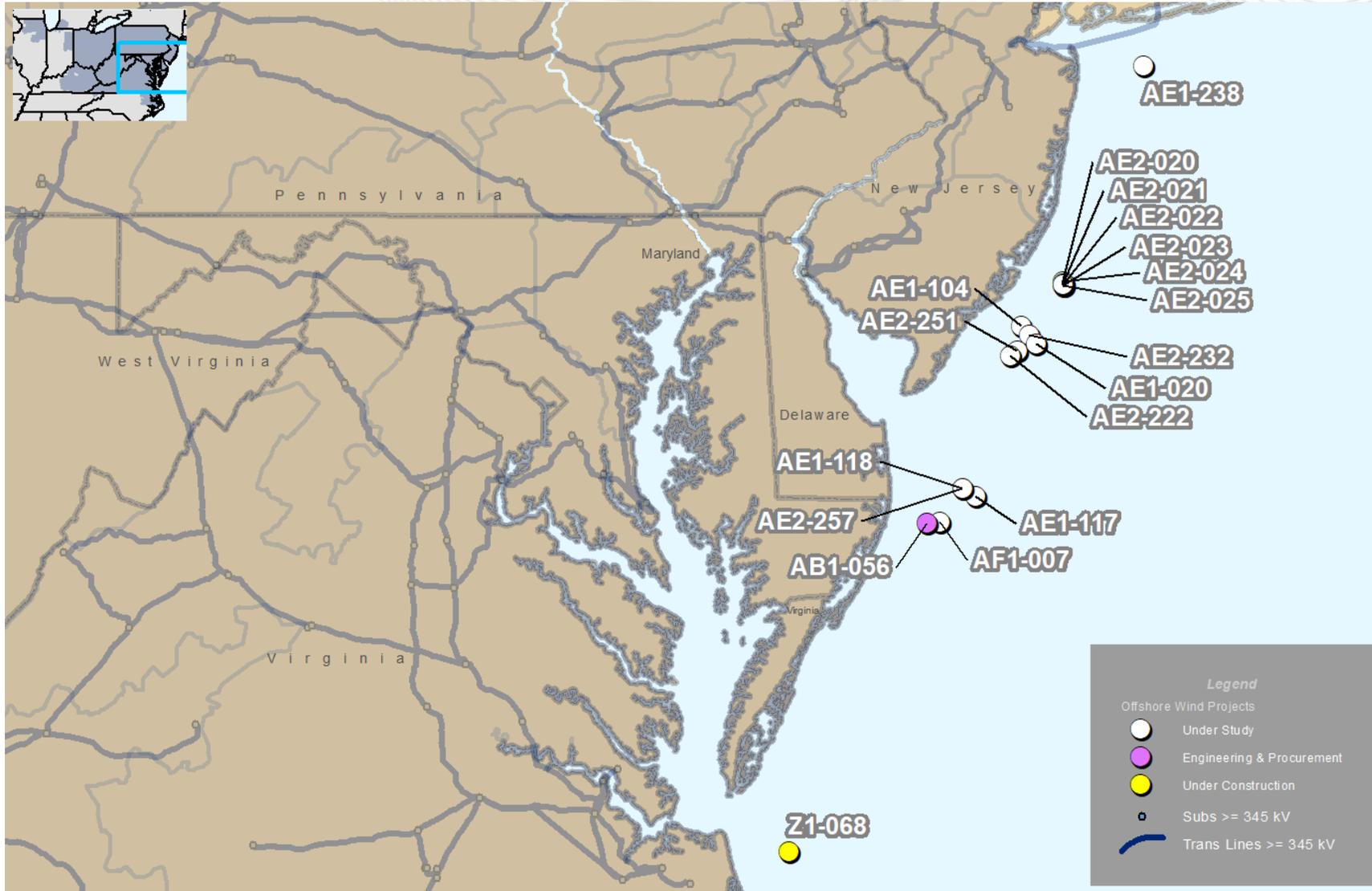




US Offshore Wind Market Basics

- 16 lease areas auctioned (2012-2018)
- 23.5 GW capacity
- Contracted pipeline = 4,834 MW (including demo. Projects in OH VA)
- 7 States with market mechanisms: MA, CT, RI, NY, NJ, MD (PPA, OREC)
- Sept. 19, 2019 VA / Dominion announce 2600 MW by 2026
- Nov. 2019, MA + CT will announce winning bids for up to 2800 MW combined

Offshore Wind Requests in the PJM Queue



500 kV Substations

25 miles

20 miles

40 miles

- Subs \geq 345 kV
- Trans Lines \geq 345 kV
- Planning Areas
- Lease Areas

230 kV Substations

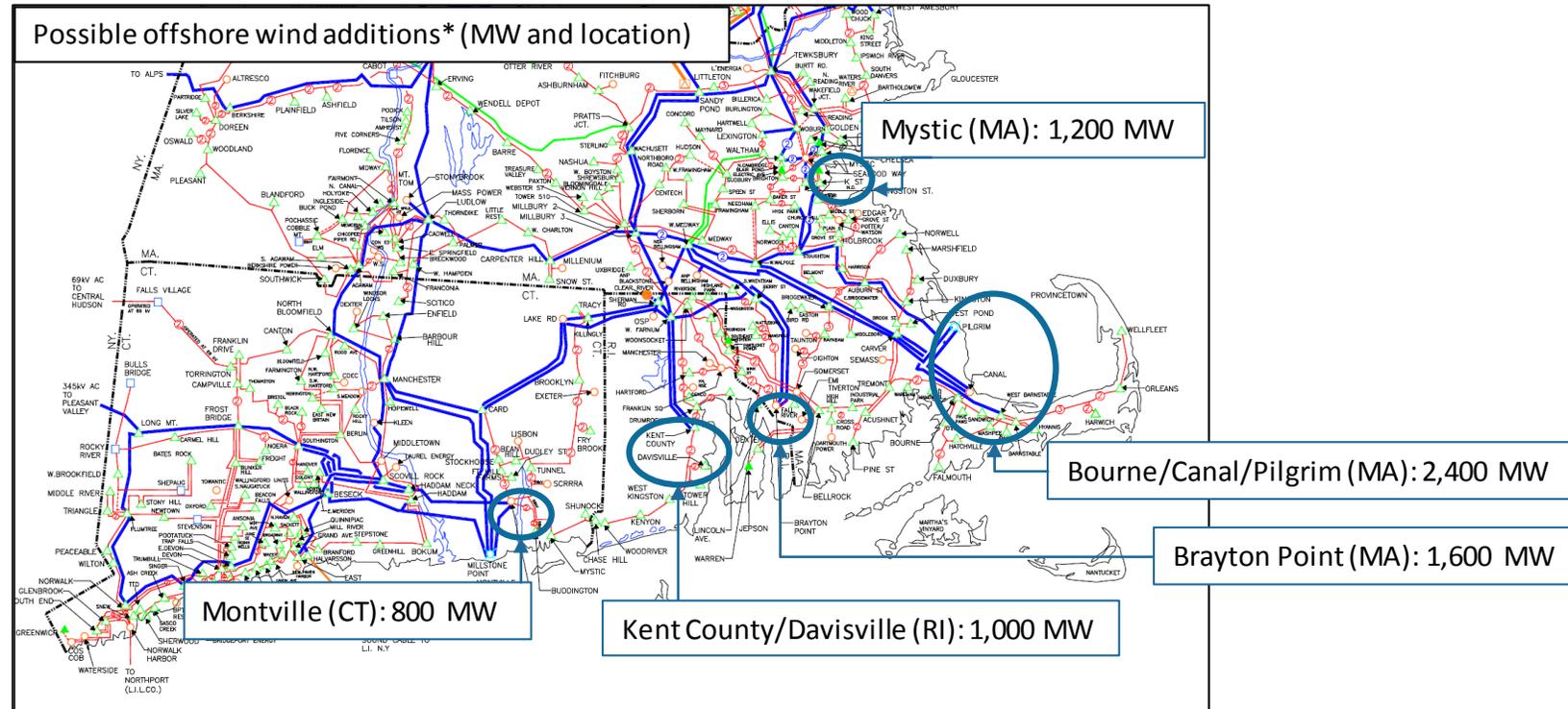
10 miles

15 miles

- Subs \geq 345 kV
- Trans Lines \geq 345 kV
- ◆ Subs = 230 kV
- Trans Lines = 230 kV
- Planning Areas
- Lease Areas

The NESCOE and Anbaric Scenarios Will Model Different Transmission Expansion Options

- The transmission system will be modeled using 2030 internal transmission-interface transfer capabilities
- Based on the currently expected transmission system for 2030, the ISO anticipates that the following levels of offshore wind additions (**approx. 7,000 MW**) have the potential to avoid major additional 345 kV reinforcements*

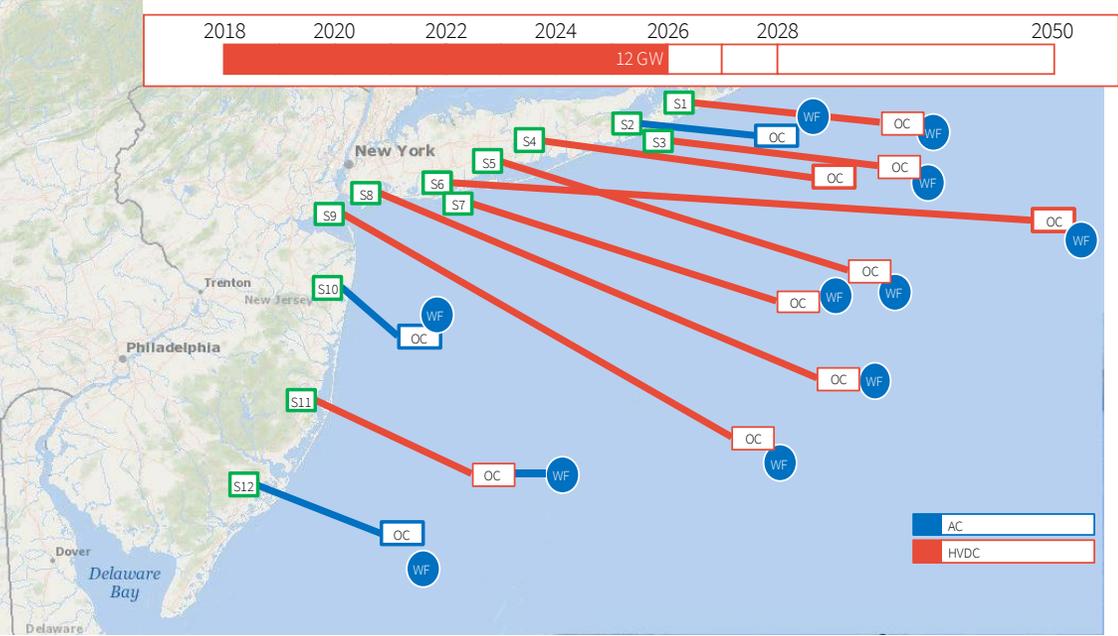


- This assumes FCA 13 retirements have occurred, including the retirement of Mystic 8 & 9

*Some 345 kV reinforcement/expansion may still be needed for this scenario. This anticipation is preliminary (system impact studies have not been completed for all of these MW). This anticipates minimal interconnection at nameplate levels and capacity interconnection at intermittent capacity values – does not anticipate all of the MW being able to run simultaneously at nameplate levels at all times on the system.

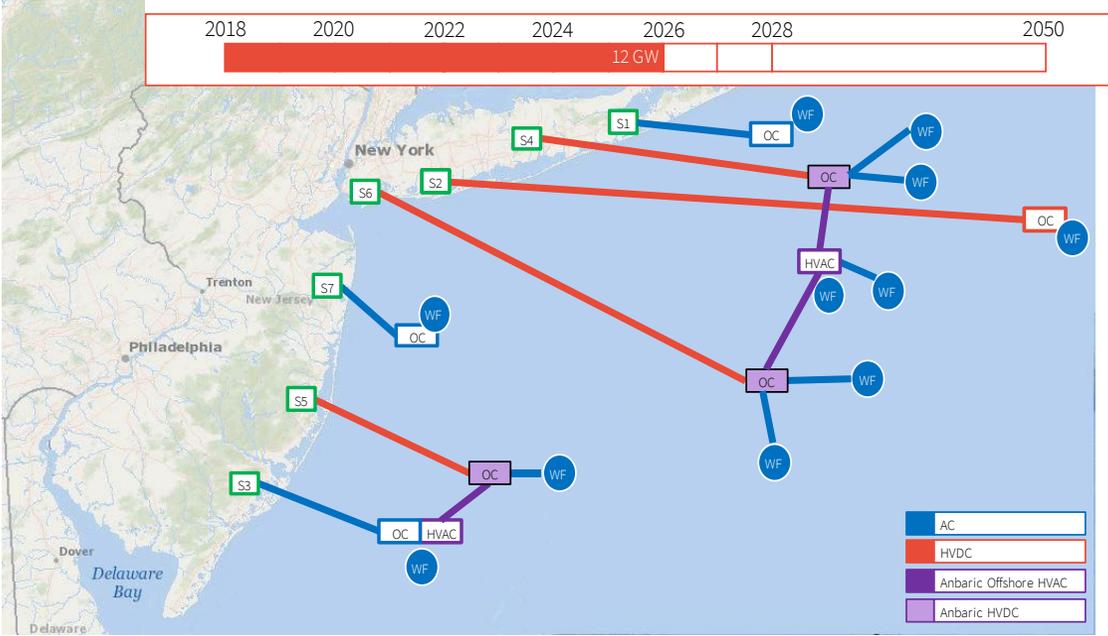
Offshore Interconnection Comparison: Circa 2026 example

Conventional (gen lead lines)



- 12 POIs = 12 cable systems to shore
- No redundancy / resilience
- Point to point links for each new project

Planned offshore grid



*Note: Point locations are for conceptual discussion and are not exact.
OC: offshore connector | WF: wind farms |*

- 7 POIs = 7 cable systems to shore
- HVAC offshore connector; flexibility/low cost/redundancy
- Best connection setup for each new project: existing link, via offshore collector or new link to shore



In Summary...

- The offshore environment brings new challenges to wind energy integration
- Grid integration has been almost an after thought in the public discussion until recently
- Transmission and cable laying is a high-risk feature in offshore wind development: from stakeholder issues in planning to insurance claims during operation
- As the market grows, we need to translate European experience into the US context, and consider big new ideas
- The Business Network for Offshore Wind is working with its membership to bring focus to grid and transmission issues, frame the questions, engage the right stakeholders and encourage the analysis needed to support policy advances.



offshorewindus.org

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