Offshore Wind: Challenges and Opportunities

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NAE-GRP

November 5, 2021

COP 26 Now Underway

Secure Net Zero by mid century to keep 1.5 degrees in reach– US cannot achieve this goal without developing Offshore Wind (OSW)

Accelerate action to tackle climate: government, business and civil society

Transform from fossil fuels to zero carbon generation by smart technology, information and data, sound policy and market instruments

OSW critical to successful energy transiton

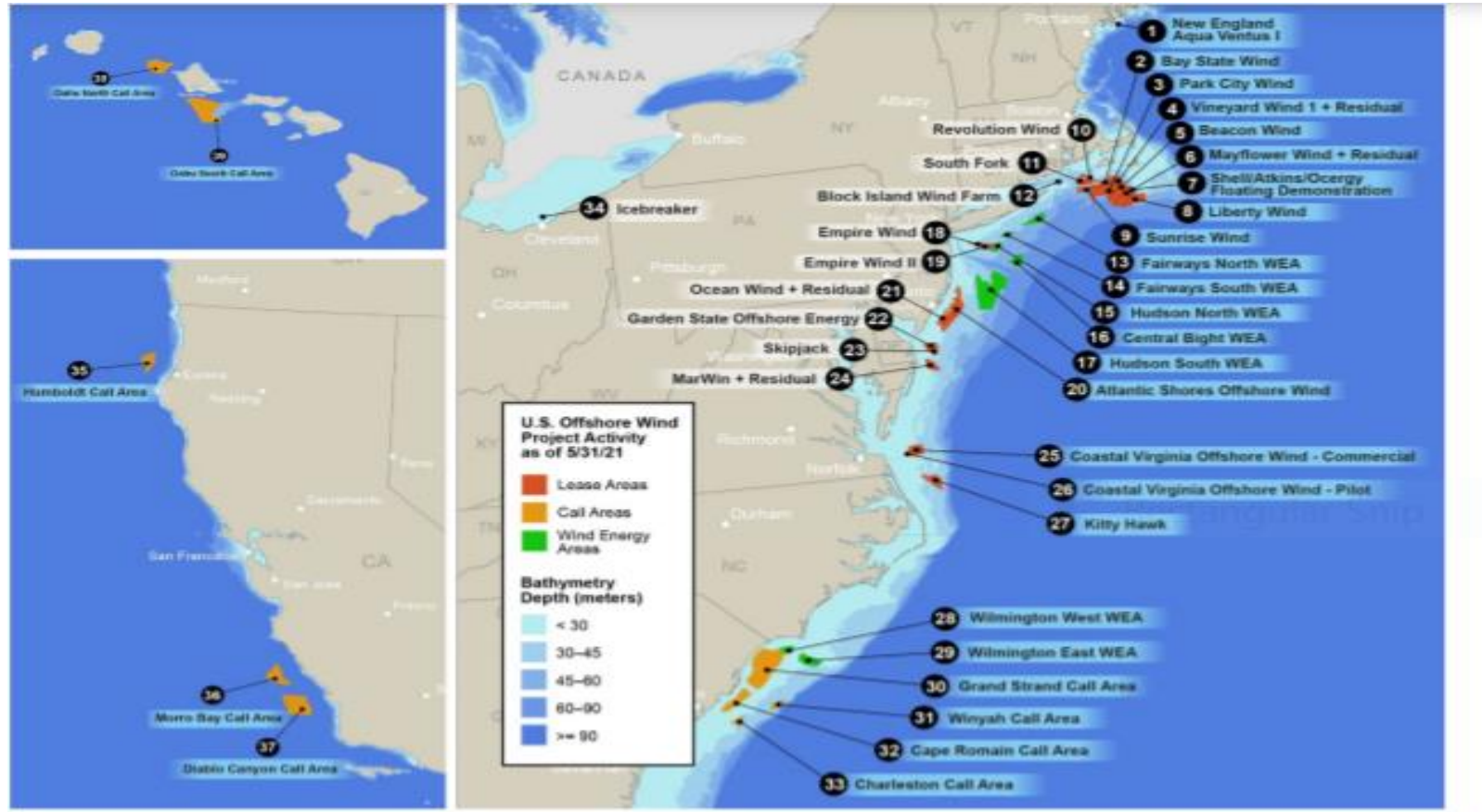


Figure ES-1. Locations of U.S. offshore wind pipeline activity and Call Areas as of May 31, 2021. ***Map created by NREL***

Significance of Offshore Wind (OSW)

- OSW critical to meeting US Climate Goal of 50 percent reduction in GHG from 2005 in 2030 and net zero by 2050
- OSW development gaining momentum in the in terms of project scale and scope, contribution to state energy goals, economic development and equity opportunities
- Decisions related to OSW made today at the state and federal level will impact the future – thus, today is very important for success tomorrow

Underlying OSW: Attractive Long term National Market Opportunity

Abundant resource: 2058 GW of potential capacity

Significant offshore siting opportunities: BOEM leasing

Increase demand growth for electrification: tied to decarbonization of multiple sectors in the coastal states

Impact on existing generation: Zero commodity cost, projected fossil fuel plant retirements (In New England from 2013-2022, 5200 MW of fossil fuels to retire; up to 5000 MW more possible)

OSW Development Includes Multiple Components

- Development of the wind farms themselves: generators, suppliers, financiers, technologies
- Offshore and Onshore Grid: huge infrastructure projects; integration of OSW into can existing on shore grid (up to 54 MW), points of interconnection, potential of an offshore grid; governance, FERC, ISOs/RTOs engaged
- DATA to inform OSW siting, permitting, protection of wildlife and fisheries (DOE has made $13.5 million investment in dat (October 13, 2021)
- Pricing: Clarity and Transparency of wind development projects over 25-30 years

Today's Presentation: Overview of Policy Implications for OSW

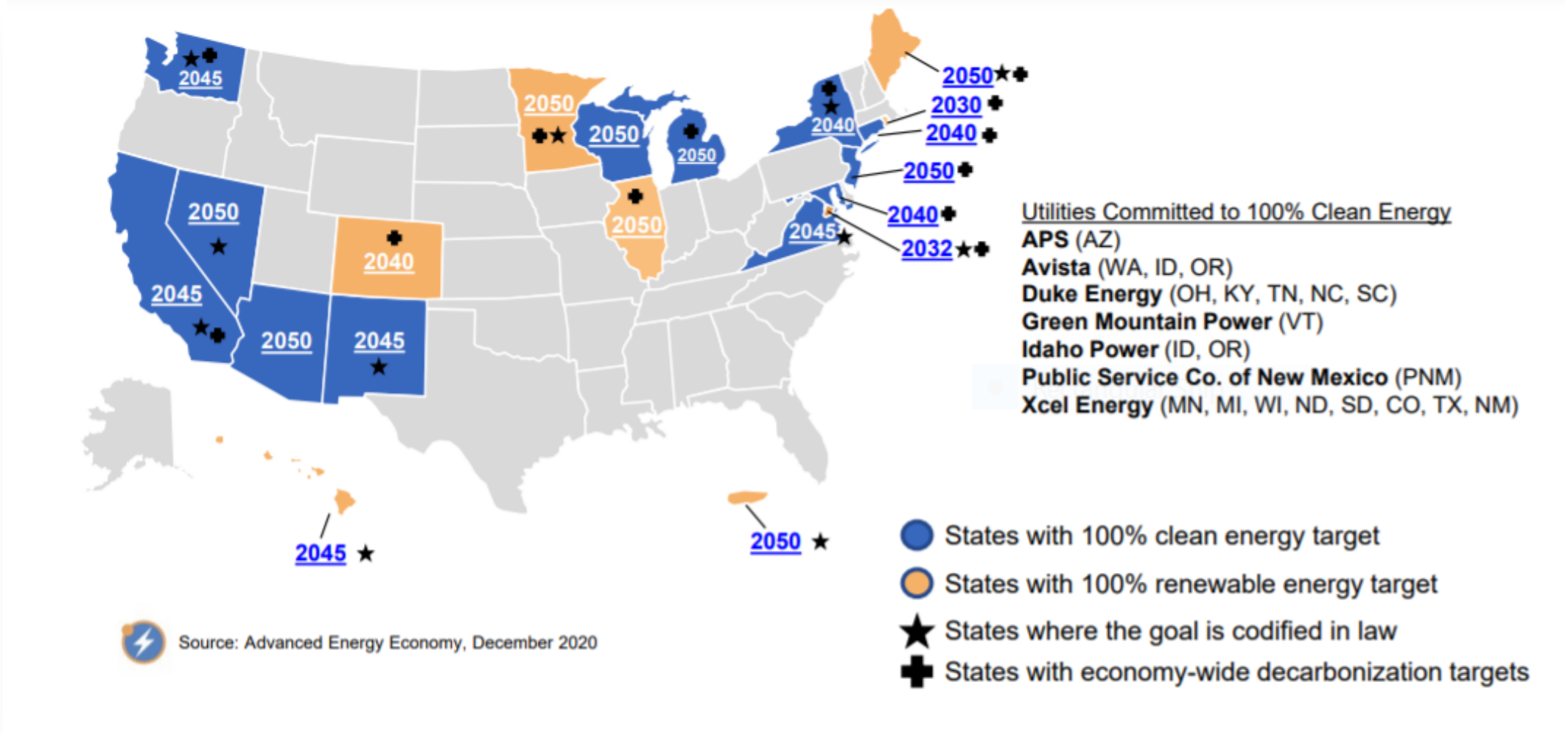
Consider OSW in terms of development of clean energy US Industry and Market

- Federal and state public commitments and support of to Clean Energy
- Procurement and pricing: Process (federal and state), RFPs/PPAS/OREC; pricing assumptions that last 30 years
- Risk: development, price and regulatory: borne by different stakeholders
- Equity and Economic Impact
- Infrastructure: onshore and offshore grid

OSW Requires a Federal and State Commitment

Underlying federal commitment: 100 percent carbon free electricity by 2035 and Net Zero emission economy by 2050

- 30 Gigawatts (GW) of OSW by 2030 is development challenge: Achievable within a decade?
- Projections (Benefits)
  - 77,000 jobs: industry and surrounding communities
  - Clean Power to 10 million + homes
  - Removal of 78 million metric tons of carbon emissions
  - $12 billion in capital investment annually: 10 new manufacturing plants, new vessels, $500 million in port upgrades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Utilities Committed to 100% Clean Energy
APS (AZ)
Avista (WA, ID, OR)
Duke Energy (OH, KY, TN, NC, SC)
Green Mountain Power (VT)
Idaho Power (ID, OR)
Public Service Co. of New Mexico (PNM)
Xcel Energy (MN, MI, WI, ND, SD, CO, TX, NM)
States with 100% clean energy target
States with 100% renewable energy target
States where the goal is codified in law
States with economy-wide decarbonization targets
Source: Advanced Energy Economy, December 2020

18 States with 100% Renewable Targets and Some with Strategies and Road Maps to Clean Energy

- **California**. 2021 SB 100 Joint Agency Report: Achieving 100 Percent Clean Electricity in California, An Initial Assessment
- **Maine**. Maine Won't Wait: A Four-Year Plan for Climate Action
- **Massachusetts**. Massachusetts 2050 Decarbonization Roadmap
- **Nevada**. Nevada's 2020 State Climate Strategy
- **New Jersey**. 2019 New Jersey Energy Master Plan: Pathway to 2050
- **North Carolina**. North Carolina Clean Energy Plan: Transitioning to a 21st Century Electricity System
- **Rhode Island**. The Road to 100% Renewable Electricity by 2030 in Rhode Island

Table 8. Current U.S. Offshore Wind State Procurement Policies and Activity as of May 31, 2021

State	Total Capacity Commitment (MW)	Target Year	Amount Procured (MW)	Contract Type	Year Enacted	Authority
Massachusetts	5,600	2035	1,604	PPA	2016 2018 2021	An Act to Promote Energy Diversity An Act to Advance Clean Energy An Act Creating a Next Generation Roadmap for Massachusetts Climate Policy
Rhode Island[24]	430	-	430	PPA	-	-
New Jersey	7,500	2035	1,100	OREC	2010 2018 2019	Offshore Wind Economic Development Act Executive Order 8/Assembly Bill 3723 Executive Order 92
Maryland	1,568	2030	368	OREC	2013 2019	Maryland Offshore Wind Energy Act Clean Energy Jobs Act
New York	9,000	2035	6,816	OREC	2018 2019	Case 18-E0071 Climate Leadership & Community Protection Act
Connecticut	2,000	2030	1,104	PPA	2017	Public Act 17-44 House Bill 7156
Virginia	5,200	2034	12	Utility-Owned	2020	Virginia Clean Energy Economy Act
North Carolina	8,000	2040	0	TBD	2021	Executive Order 218
Total	**39,298**		**11,434**			

Procurement Processes Occur at State Level

- Developers/Generators bear initial development costs which become evident in responses to state RFPs
- Method of Procurement: Purchase Power Agreements (PPAs) or Offshore Wind Renewable Energy Credits (ORECs)
- Long term contracts in PPAs in both ORECs and PPAs – long term contracts enable easier to finance;
- LCOE: Benchmark of the average revenue/unit of electricity generated to recover building and operating the wind farm: at 45% capacity factor with ITC = $115.04/MWh entering the market in 2026 (EIA)

MA and NY Procurements: Slightly Different Approaches

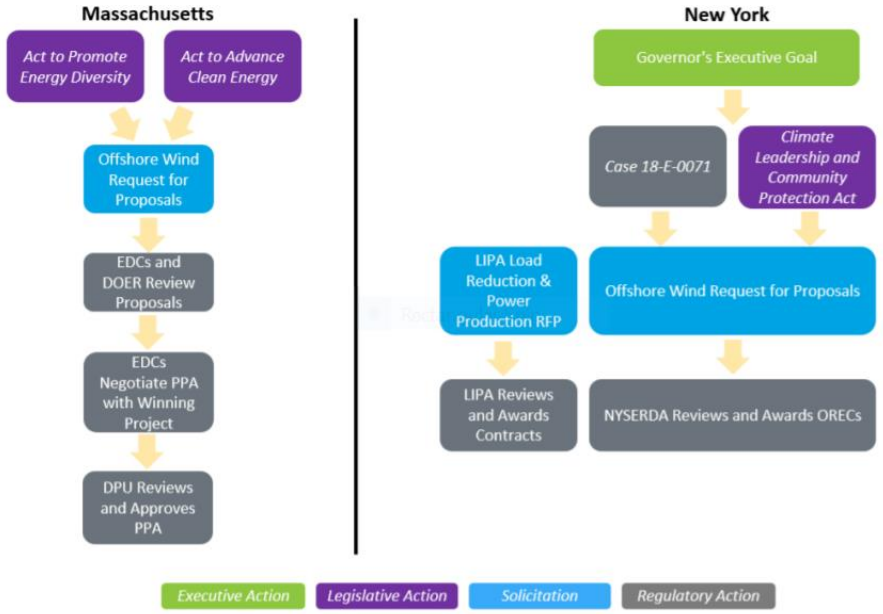

Figure 3. Statutory process for offshore wind procurement in Massachusetts and New York

Massachusetts Initial Model of OSW Procurement

- 15-20 Year PPAs for energy and RECs
- PUC approves RFP and Contract
- Price cap: each contract successively cheaper
- Proposed changes: review of price cap and limiting EDC and stronger energy office role in procurement

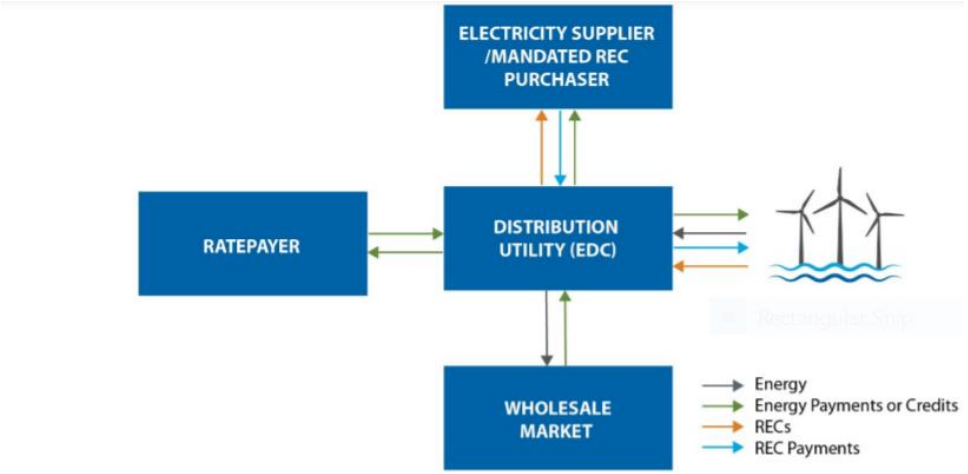

Figure 6. Generic PPA scheme

ORECs: Tied to Environmental Attributes

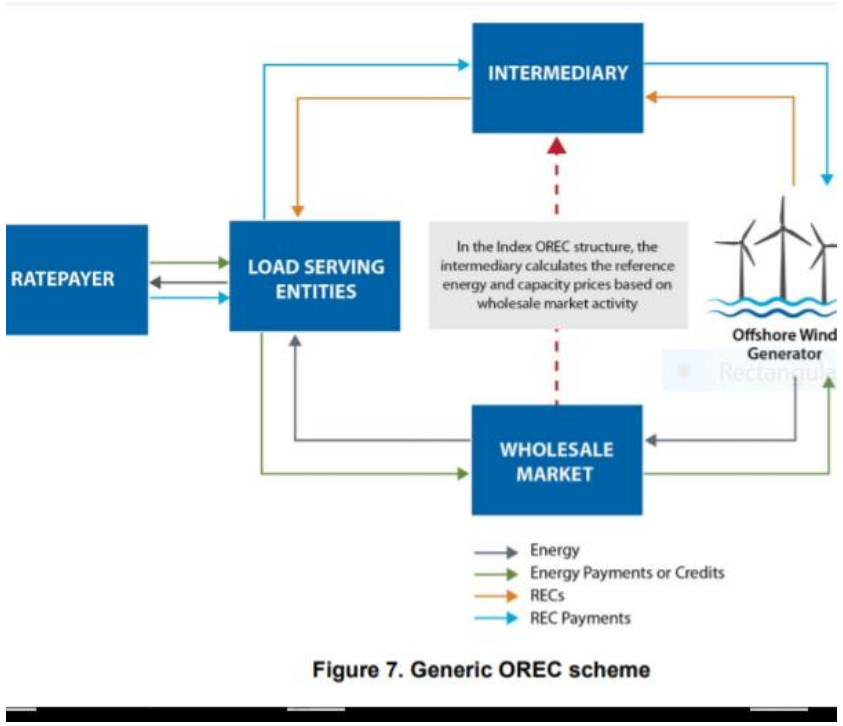

Figure 7. Generic OREC scheme

- Generator sells energy into wholesale market and ORECs go to intermediary like NYSERDA
- NYSERDA sells ORECs to suppliers (LSEs)
- Ratepayers pay ORECs on utility bill; prices impacted by what attributes included in the prices

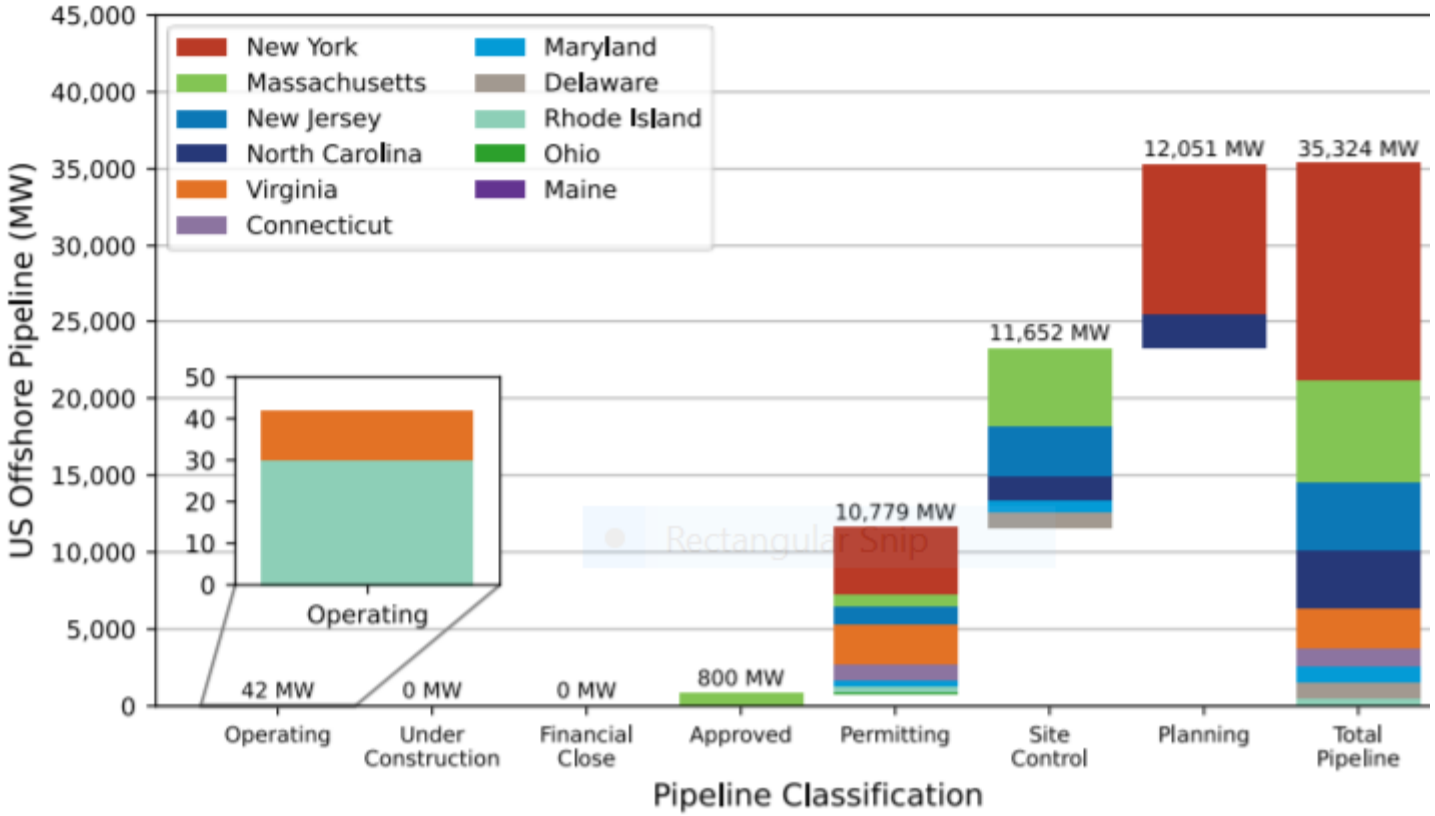

Figure 2. U.S. project pipeline classification by state[18]

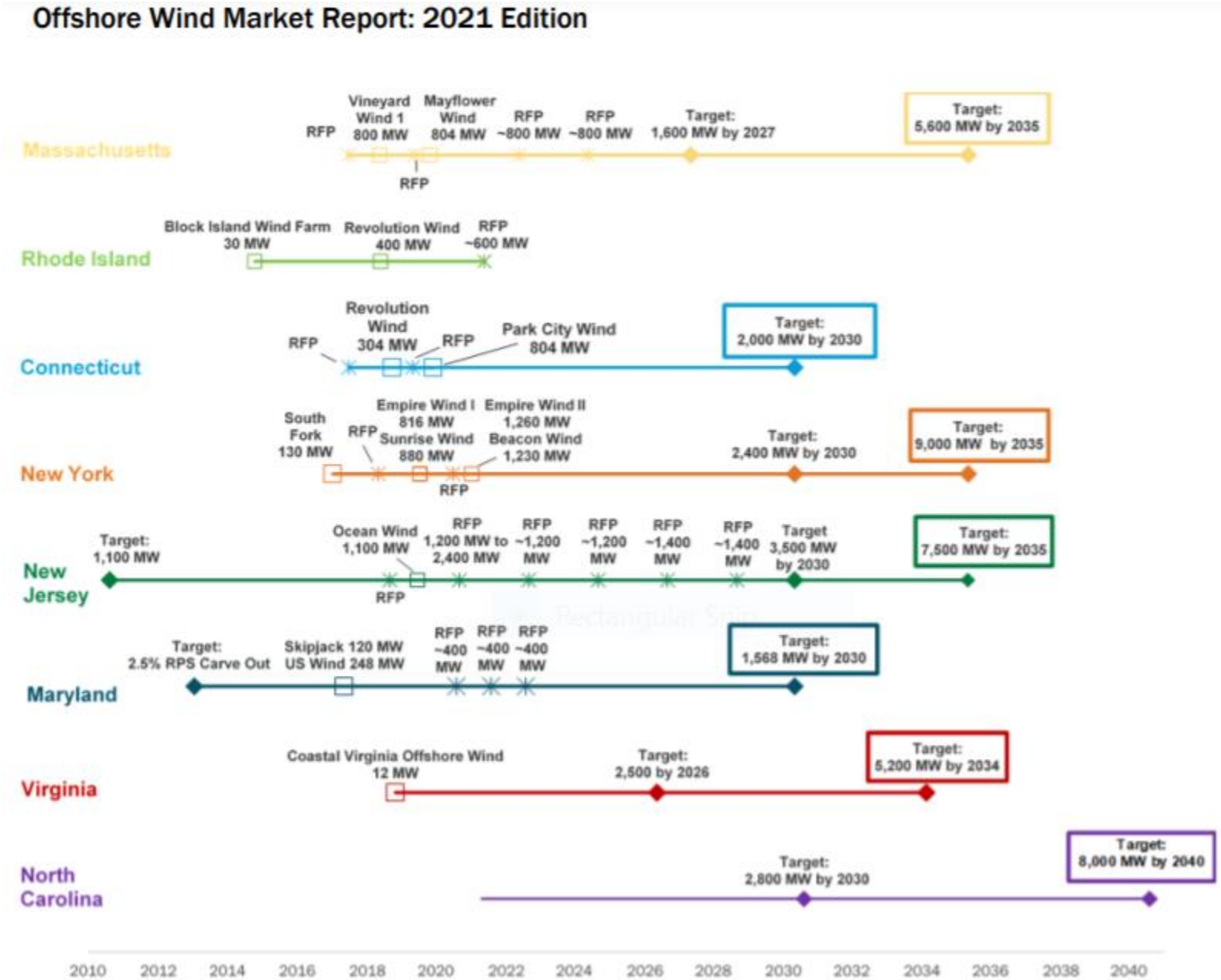

Figure 9. U.S. state procurement goal and award timelines[23]; *renewable portfolio standard (RPS)*

OSW Transmission and Grid Integration Key

- Transmission cost integration varies to date (see NREL)
- Currently interconnection by generators
- Could change – independent transmission operators
- FERC ANOPR
- Configuration of the Offshore Grid

Table 13. Offshore Wind Procurement Transmission Cost Considerations

State	Project	Transmission Costs	Cost Details	Source
New Jersey	OREC RFP	Unknown	Redacted in RFP response	[a]
Maryland	Skipjack	Included in OREC bid	Ratepayers compensate seller for interconnection costs via the OREC price; seller covers required transmission upgrades, but no upgrades anticipated	[b]
Maryland	US Wind	Included in OREC bid	Ratepayers compensate seller for interconnection costs via OREC pricing; seller covers required transmission upgrades, but no upgrades anticipated	[b]
New York	South Fork	Included in PPA terms	EDCs compensate seller for interconnection and transmission costs covered by the PPA, this compensation is assumed by ratepayers	[c]
Connecticut	Revolution Wind	Included in PPA bid	Seller covers all interconnection and necessary or elective transmission improvement costs	[d]
Massachusetts	Vineyard Wind Mayflower	Included in PPA bid	Transmission construction costs covered by PPA, assumed by ratepayers; construction cost overruns not borne by ratepayer	[e]
Rhode Island	Revolution Wind	Included in PPA terms	Seller covers transmission costs to delivery point; buyer covers transmission costs after	[g]

OSW: Next Steps- Much Unsettled to Achieve the Promise

Development Challenges: foundation types, supply chain, ports, installation vessels

Environmental Challenges: fishing, birds, right whales

Infrastructure Challenges: on shore grid integration and siting; offshore grid: its future form and governance; state federal interaction- states, FERC , the ISOs

Pricing Challenges: Lower Costs (LCOE), transparency among true project costs for customers;

Public Engagement and Support Challenges: based on realization of jobs, price, GHG reduction

References:

Phillip Beiler et al, Comparing Offshore Wind Energy Procurement and Project Revenue Sources, Technical Report, NREL, TP-5000-76079, June 2020, https://www.nrel.gov/docs/fy20osti/76079.pdf, slides 13, 14, 15,17, 18

Walter Musial et al, 2019 Offshore Wind Technology Data Update, NREL/TP 5000-77411, October 2020, https://www.nrel.gov/docs/fy21osti/77411.pdf,

Advanced Energy Economy (ACEE), Map, Slide 9

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