DYNAMIC SUSTAINABILITY LAB™
AT SYRACUSE UNIVERSITY

THE UNITED STATES OFFSHORE WIND PERMITTING PROCESS

bulletin no. 20230301

CONTENTS

INTRODUCTION

With the introduction of new global Net Zero carbon commitments, renewable energy is on the rise to support carbon neutral manufacturing, transportation, and housing. President Biden's commitment to 30 gigawatts of offshore wind by 2030 as a part of Executive Order 14008 Tackling the Climate Crisis is equivalent to more than 2% of the U.S utility-scale electricity generating capacity. Its also approximately 25% of total U.S wind electricity generating capacity. As production in the United States takes off, we must consider the environmental impacts of offshore wind farms. Animals like birds, benthic and pelagic species can be affected by the turbines. There are also stakeholders that are impacted like the fishing industry and coastal and tribal communities. We must recognize roadblocks to the success of offshore wind and create solutions that enable us to achieve our low carbon energy and electricity future.

GLOSSARY OF TERMS.

FWS
Fish and Wildlife Service

NMFS
National Marine Fisheries Service

EMF
Electric and Magnetic Fields

GCIT
Gloucester County Institute of Technology

OCS
Outer Continental Shelf

WDA
Wind Development Area

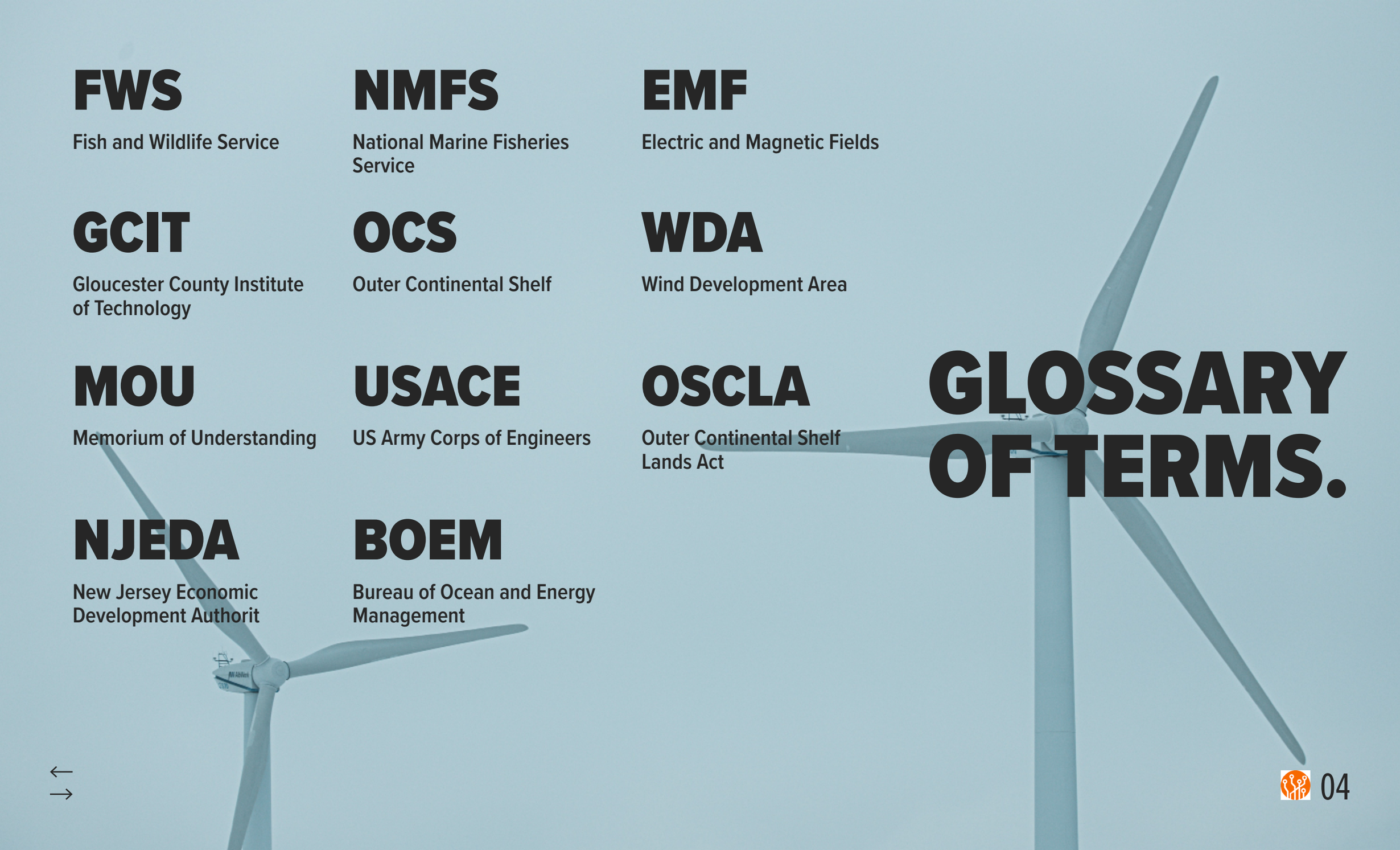
MOU
Memorium of Understanding

USACE
US Army Corps of Engineers

OSCLA
Outer Continental Shelf Lands Act

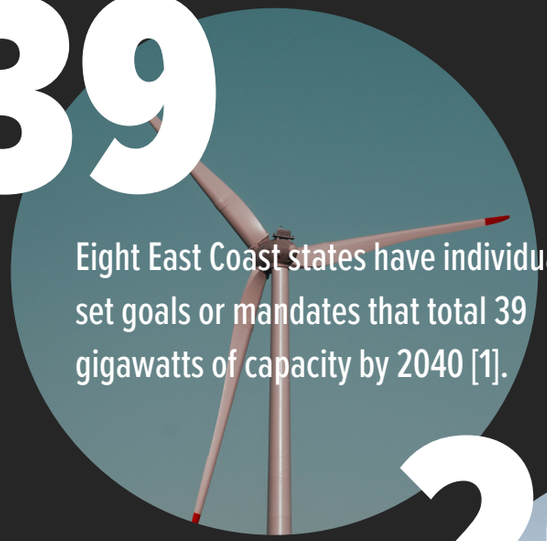
NJEDA
New Jersey Economic Development Authorit

BOEM
Bureau of Ocean and Energy Management



FIVE FAST FACTS

39



Eight East Coast states have individually set goals or mandates that total 39 gigawatts of capacity by 2040 [1].

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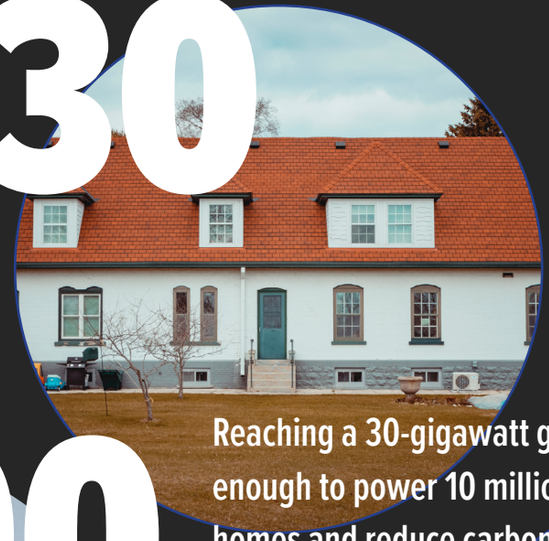
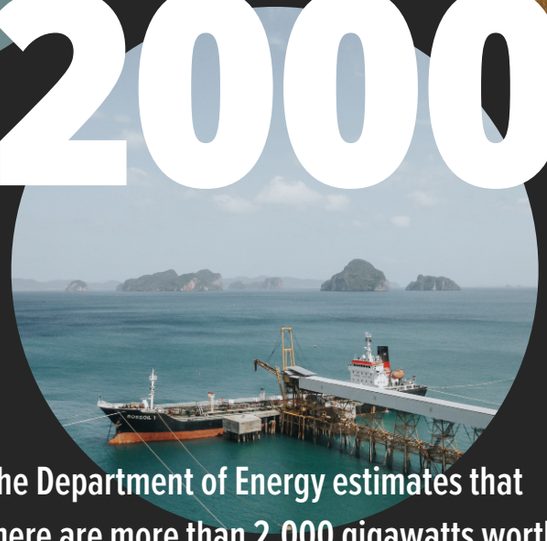


Reaching a 30-gigawatt goal is enough to power 10 million U.S. homes and reduce carbon emissions by 78 million metric tons a year [3].

2000



The Department of Energy estimates that there are more than 2,000 gigawatts worth of wind power blowing off the coasts [4].

9

New York is currently committed to producing 9 gigawatts of offshore wind by 2035, about 30% of the state's electricity needs [1].

404.25

Projected GW of wind capacity by 2050 in the 48 states [2].

MAJOR PLAYERS IN UNITED STATES OFFSHORE WIND

REGULATORS

FEDERAL GOVERNMENT, ARMY CORPS, STATE AGENCIES, & UTILITIES

THE ENERGY POLICY ACT (EPA) • 2005

- Authorized BOEM to issue leases, easements and rights of way to allow for renewable energy development on the Outer Continental Shelf (OCS). This provides the general framework for BOEM to follow when authorizing renewable energy activities. It requires that BOEM must coordinate with relevant **federal agencies and affected state and local governments**. They must also obtain fair return for leases and grants issued, and ensure that renewable energy development takes place in a safe and environmentally responsible manner [5].

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)

- The principal US environmental law that dictates how environmental permitting and review works for offshore wind projects in United States waters [6].

US ARMY CORPS X BOEM

- BOEM and the U.S. Army Corps of Engineers have entered into an agreement in support of planning and reviewing renewable energy projects on the OCS.
- The agreement gives BOEM access to USACE technical expertise while planning new leasing in the Atlantic and reviewing National Environmental Policy Act documents, Construction and Operations Plans, Facility Design Reports, and Fabrication and Installation Report [7].

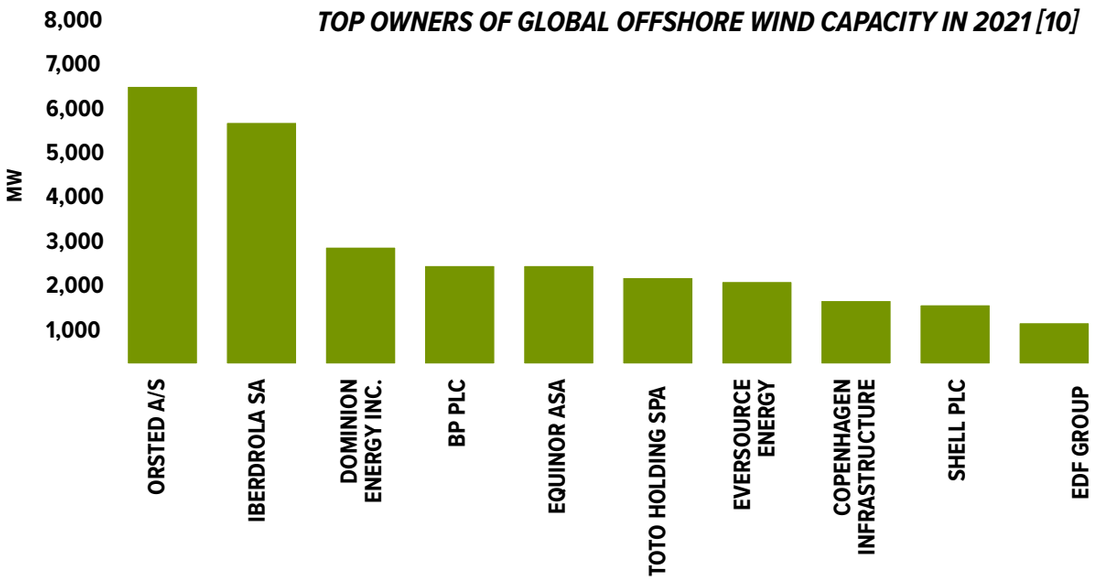
WHO IS BOEM AND WHY ARE THEY IMPORTANT? [8]

- BOEM is responsible for offshore renewable energy development in Federal waters.
- Responsible for managing the Nation’s energy and mineral resources on submerged lands between 3 and 200 miles (4.8–322 km) offshore, known as the Outer Continental Shelf (OCS).
- Works within federal waters which start approximately 4.8 km from the coasts, meaning that if states choose, they can manage their own developments within that distance [8].

FOREIGN INVESTORS

- Avangrid, Iberdrola and Copenhagen Infrastructure Partners co-own Vineyard Wind.
- Qatar Investment Authority and Iberdrola made $4 billion equity investment in Avangrid in 2021.
- Orsted and Eversource co-own Revolution Wind.
- Orsted owns or is a partner in seven BOEM leases—including block island.
- Apollo Global Management- investment in USWind made by their second infrastructure fund [9].

TOP OWNERS OF GLOBAL OFFSHORE WIND CAPACITY IN 2021 [10]



FOREIGN INVESTORS

US OIL & GAS MAJORS [11]

BP

- Empire Wind 1: owns a 50% share in Empire Wind 1, which will produce 816 megawatts of power for the US
- Beacon Wind 1: BP owns a 50% share in Beacon Wind 1, which will produce 1230 megawatts of power for the US
- Empire Wind 2: BP owns a 50% share in Empire Wind 2, which will produce 1260 megawatts of power for the US

EQUINOR

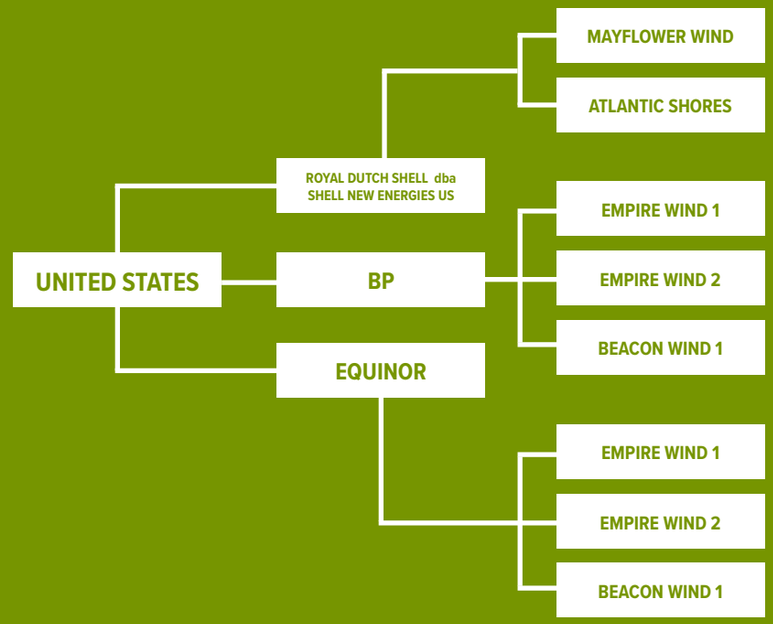
- Empire Wind 1: Equinor owns a 50% share in Empire Wind I, which will produce 816 megawatts of power for the US
- Empire Wind 2: Equinor owns a 50% share in Empire Wind 2, which will produce 1260 megawatts of power for the US
- Beacon Wind 1: Equinor owns a 50% share in Beacon Wind 1 with, which will produce 1230 megawatts of power for the US

ROYAL DUTCH SHELL DBA SHELL NEW ENERGIES

- Atlantic Shores: Royal Dutch Shell owns a 50% share in Atlantic Shores with EDF Renewables North America, which will produce 1510 megawatts of power for the US
- Mayflower Wind: Royal Dutch Shell owns a 50% share in Mayflower Wind with Ocean Winds, which will produce 804 megawatts of power for the US

FINANCERS

WHO IS PAYING?



DEVELOPERS

WHO IS BUILDING?

These three developers represent over half of the total short-term planned offshore wind as of 2021.

1. **Ørsted** boasts the largest planned pipeline of offshore wind capacity, expecting to install about 14 GW in the near-term between Europe and North America.
2. **SSE Renewables** with 11 GW planned for development in the UK and Ireland.
3. **ENGIE** and **CGN** both with 7 GW of planned offshore wind capacity [12].

SIEMENS GAMESA

- Approximately 70% of market share in Europe as of 2021
- Siemens Energy has launched a voluntary cash tender offer to acquire all outstanding shares in Siemens Gamesa Renewable Energy, or approximately 32.9 per cent of Siemens Gamesa's share capital [13].

VESTAS

- 1,500 offshore turbines installed as of 2021
- 7 GW installed capacity across 45 projects
- World's first ever 15 MW turbine is the V236- 15.0 MWTM [14].

GENERAL ELECTRIC

- Manufacturing the Haliade-X, the most powerful offshore wind turbine in the world, with 220-meter rotor, 107-meter blade, leading capacity factor (63%), and digital capabilities [15].

EXAMPLE OF STATE SUPPLY CHAIN COOPERATION

NEW JERSEY PROGRESS

- NJEDA and the GCIT announced plans to enter a MOU to support the expansion of the GCIT's welding and painting programs in 2021.
- The NJEDA will provide up to $75,000 for programs that prepare students and workers for jobs in heavy steel offshore wind component manufacturing.

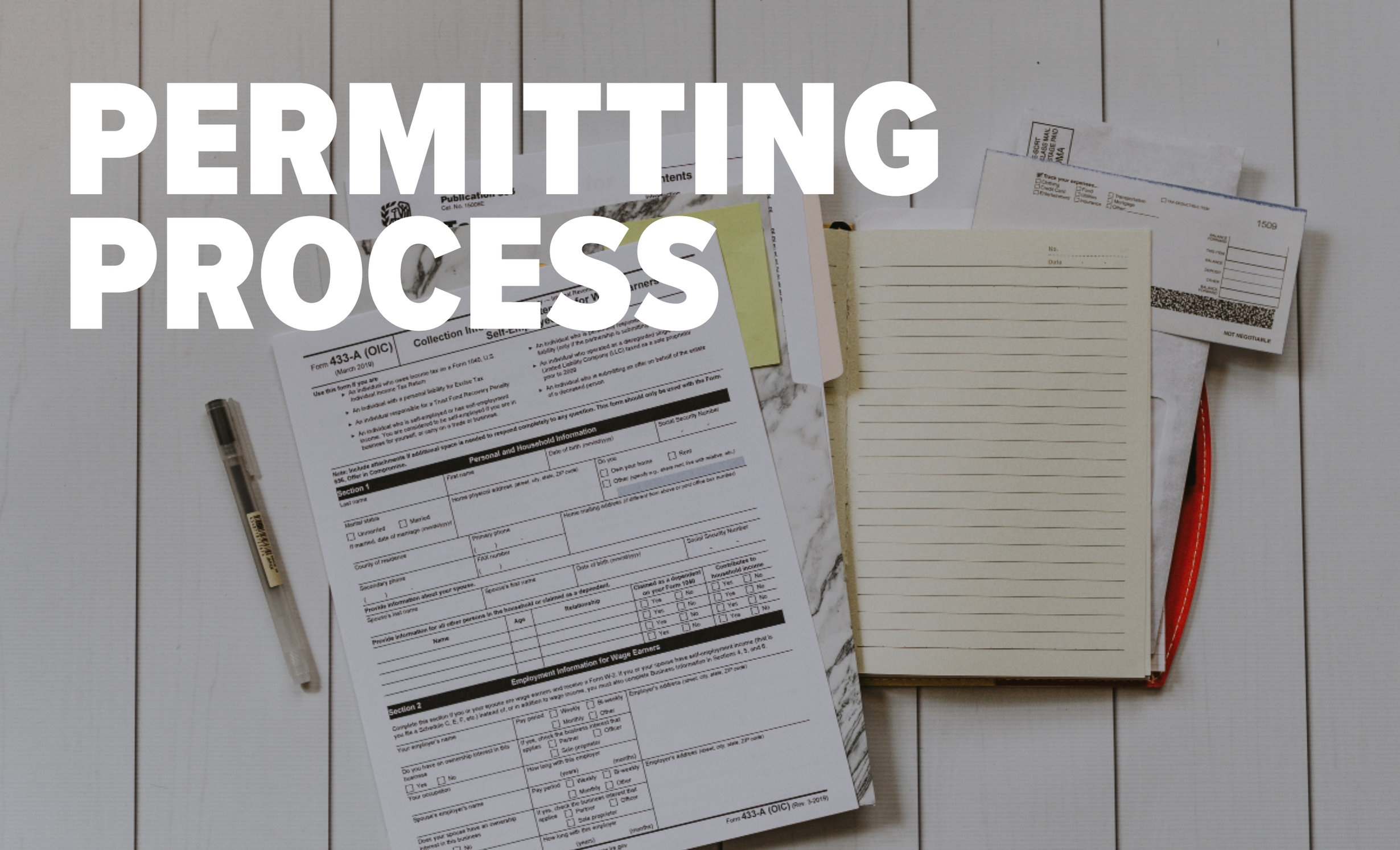
TASK 1
Background review on existing offshore wind research and innovation facilities, market analysis to evaluate potential gaps and needs not currently being fulfilled, and evaluation of New Jersey's competitive advantage to addressing one or more of these gaps.

TASK 2
Recommendations of at least three, to a maximum of five, strategies for New Jersey to pursue accompanied by feasibility analysis.

TASK 3
Creation of an implementation plan to pursue some or all recommendations identified in Task 2 above. Task 3 is optional and subject to additional Authority decisions [16].

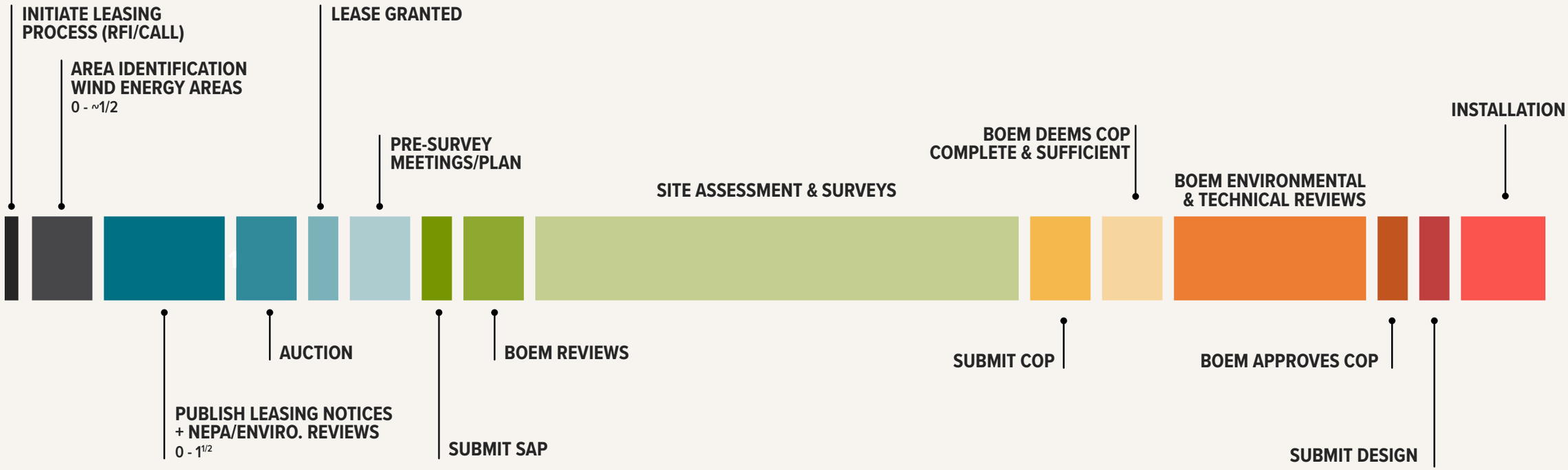
ORIGINAL EQUIPMENT MANUFACTURERS

PERMITTING PROCESS



PERMITTING BACKGROUND

- The U.S permitting process is founded on preventing the catastrophic failures associated with oil or gas extraction and maximizing short-term revenue that is deposited into the Federal Treasury through lease auctions.
- BOEM's permitting process is adapted from another offshore industry, oil and gas, which has different needs and priorities. Unlike oil and gas, wind projects are developed not based on prices set by global markets and regional refining but rather must contend with specific state level electricity markets and local marginal prices, and regional transmission organizations, which govern interconnection to the land-based grid.
- Part of the development timeline for BOEM includes opportunity for public input on lease sites so that social, cultural, environmental, and geophysical concerns related to certain projects are considered before the next stages of the permitting process.
- For oil and gas, the OCSLA requires BOEM to prepare and maintain forward-looking plans (referred to as five-year programs) that periodically evaluate all available lease areas and determine when and where lease sales will take place. There is no similar requirement for offshore wind leasing [17].



LEASING TO OPERATIONS

THE OFFSHORE WIND PROCESS

Source: [8]

GENERAL TIMELINE

Source: [18]

PLANNING & ANALYSIS | ≤ 2 YRS

- ***BOEM***
- **Intergovernmental Task Force**
- **Call for Information and Nominations**
- **Area Identification**
- **Environmental Reviews**

- BOEM identifies priority wind energy areas (WEAs) offshore. WEAs are locations that appear most suitable for wind energy development.

OR

- BOEM processes unsolicited application for lease
- BOEM may prepare an environmental assessment for lease issuance and site assessment activities
- BOEM has responsibility for leasing but its sister agency, the Bureau of Safety and Environmental Enforcement (BSEE), is primarily responsible for permits to develop projects on existing leases and for inspections and environmental enforcement.2
- The OCSLA and agency regulations allow BOEM to offer commercial wind leases and "limited leases" (e.g., leases for pilot or research projects that do not result in commercial production beyond a specified limit)
- Based partly on the feedback received, BOEM may identify, within the call area, targeted wind energy areas (WEAs) that appear "most suitable" for leasing.26 The WEA identification process includes public input and environmental evaluation under the National Environmental Policy Act (NEPA)

LEASING | 2 YRS

- ***BOEM + public comment***
- **Proposed Sale Notice**
- **Final Sale Notice**
- **Auction**
- **Issue Lease**

- BOEM determines whether competitive interest exists
- If competitive interest exists,
- BOEM notifies the public and developers of its intent to lease through sale notices before holding a lease sale
- If competitive interest doesn't exist, BOEM negotiates a lease
- Note: Issuance may be combined with plan approval
- BOEM determines if there is competitive interest in leases within the WEAs by publishing a request for interest in the Federal Register

SITE ASSESSMENT | 5 YRS

- ***LESSE***
- **Site Characterization (Geophysical and Geological Surveys, Biological Surveys etc.)**
- **Sight Assessment Plan (meteorological buoy or tower)**

- Lessee conducts site characterization studies
- Lessee submits site assessment plan (SAP)
- BOEM conducts environmental and technical reviews of SAP, eventually deciding to approve with modification or disapprove the SAP
- If approved, lessee assesses site (usually with meteorological towers(s) and/or buoys
- BOEM must approve the lessee's site assessment plan (SAP) through a process that includes environmental review under NEPA

CONSTRUCTION & OPERATION | 2 YRS

- **Construction and Operations Plan – LESSE reviews and submits reports**
- **Facility Design Report**
- **Fabrication and Installation Report**
- **Decommissioning**

- Lessee may conduct additional site characterization
- Lessee submits construction and operations plan (COP)
- BOEM conducts environmental and technical reviews of COP, eventually deciding to approve with modification, or disapprove the COP
- If approved, lessee builds wind facility

FINANCE & REVENUE

- Financing approval begins as a construction loan and is followed by a mini perm term loan. Most of these projects are owned by joint ventures. This requires a lot of going back and forth between big multi-party loans to get to a loan commitment. If this process takes too long, conditions in the financial market or state leadership can change so it is always encouraged that projects move as fast as possible [19].
- The “Build Back Better” bill restores federal tax incentives for renewable energy to the full level and extend deadlines. However, within the fine print, you must pay the same Davis-Bacon wages that the government pays on federal construction projects and use qualified apprentices for 10% to 15% of total labor hours, both during construction and for five to 10 years after the project is completed on later alterations and repairs the next 12 to 24 months to maintain momentum and political support [19].
- When BOEM holds a lease sale, developers bid on the offered leases and the winning company pays the bid amount (known as a bonus) to the federal government [19].
- A second type of revenue is rents, which developers pay annually on a lease prior to the stage when a project begins commercial operations.
- Under BOEM regulations, annual rents on commercial offshore wind leases are set at $3 per acre, unless otherwise specified in the lease or final sale notice [19].
- Developers pay an operating fee (similar to an oil and gas royalty) on electricity produced from an operating wind facility. The operating fee is calculated based on the nameplate capacity of the facility, a capacity factor representing the anticipated efficiency of facility operations (e.g., accounting for fluctuations in wind speeds), and the annual average wholesale electric power price in the state where the transmission cable makes landfall for each year that the operating fee applies [20].
- Under the OCSLA, revenues collected from offshore wind projects that lie within 3 nautical miles of the seaward boundary of state waters are shared with adjacent coastal states at a rate of 27% [20].

2010-14

Federal sitting review begins for the development of offshore wind energy on the outer continental shelf off the coast of Massachusetts and Rhode Island

2015

JANUARY The DOI holds a public auction for offshore wind development areas and Vineyard Wind obtains lease area OCS-A-0501

2016

AUGUST Massachusetts Governor Charles Baker signs An Act Relative to Energy Diversity requiring Massachusetts utilities to competitively solicit proposals for up to 1600 MW of offshore wind power by 2027

2017

DECEMBER Vineyard Wind submits state and federal project plans to build an offshore wind farm in lease area OCS-A-0501 including a Construction & Operations Plan to federal agency BOEM and transmission plans to Massachusetts's Energy Facilities Siting Board.

2018

MARCH BOEM holds public meetings in advance of preparing an Environmental Impact Statement for Vineyard Wind 1 ***APRIL*** Vineyard Wind submits plans for state review in Massachusetts kicking off environmental review of the offshore export cable corridor, and onshore transmission and interconnection. State agency EFSB opens a public comment period ***MAY*** In a competitive bid process, Massachusetts selects the Vineyard Wind 1 project to deliver 800 megawatts of offshore wind energy for Massachusetts ratepayers. ***DECEMBER*** Vineyard Wind submits a Final Environmental Impact Report (FEIR) to MEPA; Federal agency BOEM issues the Draft Environmental Impact Statement (DEIS); The Department of Interior holds a public auction for offshore wind development areas and Vineyard Wind obtains a second lease area, OCS-A-0522

2019

FEBRUARY Federal agency BOEM conducts public hearings on the DEIS; State agency MEPA issues certification of the Final Environmental Impact Report (DEIR). ***MAY*** State board EFSB approves Vineyard Wind 1 transmission. ***JULY*** Federal agency BOEM announces delay of Vineyard Wind 1 decision and requires additional review to analyze cumulative impacts of multiple offshore wind projects off the East Coast over the next decade.

2020

SPRING Vineyard Wind 1 state, regional, and local permitting completed. ***JUNE*** Federal agency BOEM completes the cumulative impact review and issues the Supplement to the Draft Environmental Impact Statement for Vineyard Wind 1. Over 29,000 people submit comments overwhelmingly in support of Vineyard Wind 1 and future offshore wind energy development.

2021

MARCH BOEM releases Final Environmental Impact Statement (FEIS). ***MAY*** BOEM releases Record of Decision (ROD). Onshore site preparation begins in the Town of Barnstable

2023

Offshore installation of turbines to begin.

VINEYARD WIND TIMELINE EXAMPLE

Source: [21]

FEDERAL PERMITTING

- BOEM
  - Notice of Intent to prepare an Environmental Impact Statement
  - Initial review in the Draft Environmental Impact Statement (DEIS)
  - The Supplement to the Draft Environmental Impact Statement (SEIS)
  - public comment periods after individual releases
- USCAOE 404 Permits
- USCG
- NEPA

STATE PERMITTING

- Massachusetts Environmental Policy Act (MEPA)
- Energy Facilities Siting Board (EFSB)
- Regional Permitting
- Martha's Vineyard Commission
  - Development of Regional Impact (DRI)
- Cape Cod Commission
  - Development of Regional Impact (DRI)

LOCAL PERMITTING

- Conservative Commissions: The Towns of Barnstable and Edgartown
- Vineyard Wind I subsea transmission cables were reviewed by Conservation Commissions
- Reviewed the onshore transmission and grid interconnection infrastructure [21].

STEPS FOR PERMITTING VINEYARD WIND

OPERATIONAL CONSIDERATIONS OF THE OSW TRANSITION

BIRDS & BATS

BIRDS AT RISK

- Passerines (songbirds) during their nocturnal, seasonal (fall, spring)migrations
- Threatened and endangered (piping plover, roseate tern, Bermuda petrel) plus declining species (red knot, other migrating shorebird species) during fall/spring migrations and summer/winter residence
- Large bodied, slow fliers (pelicans, gulls)
- True pelagic seabirds (albatross) – Gulf Stream risks
- Bats at risk – migrating insectivorous species on land
- Albatrosses that forage at night may have elevated risk
- Mortality risk from direct contact with blades
- Turbine avoidance can also reduce fitness by exclusion from key foraging habitat or by energetic costs of inducing longer flight paths (especially for migrating shorebirds and ducks)
- Risk of displacement from habitat due to pressure vortices
- Migratory patterns displaced from turbine location [22]

LOGISTICS

- Project proponents typically take these steps to avoid liability under the following federal wildlife laws related to avian species: the Migratory Bird Treaty Act (MBTA); the Bald and Golden Eagle Protection Act (BGEPA); and the Endangered Species Act (ESA), which protects species and habitats designated as endangered or threatened by the Fish and Wildlife Service (FWS)
- These laws generally prohibit the unauthorized “take” of listed bird or bat species. The term “take” means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct
- BOEM must prepare a Biological Assessment (BA) to evaluate the potential effects of any offshore wind farm that may affect any listed species or critical habitat listed (or proposed to be listed) under the ESA. If, based on the BA, the action is likely to adversely affect a listed species, formal consultation with FWS is required
- In May 2020, BOEM published its “Guidelines for Providing Avian Survey Information for Renewable Energy Development on the OCS [23].

MARINE

BENTHIC VS. PELAGIC SPECIES

SPECIFICS

- **BENTHIC** (i.e., bottom-dwelling organisms) soft-bottom and hard-bottom communities
  - The Block Island Wind Farm (offshore Rhode Island) observed an increased abundance in the existing soft-bottom community near some turbines, rather than a change in the composition of the species (HDR 2018).
- **PELAGIC** (i.e., residing in open water) community, including fishes, invertebrates, marine mammals, and sea turtles
  - Protected under Endangered Species Act and/or MMPA
    - Risk of noise during installation – resulting in displacement, hearing injury, and/or communication disruptions
    - Right and humpback whales and others – winter/spring in ocean
    - Loggerhead, Kemp's ridley, green, leatherback – year round in ocean and sound
    - Bottlenose dolphin – all year in ocean and sound
    - Manatee – summer/fall in sound
    - Risk during operation – electromagnetic fields around cable [22]

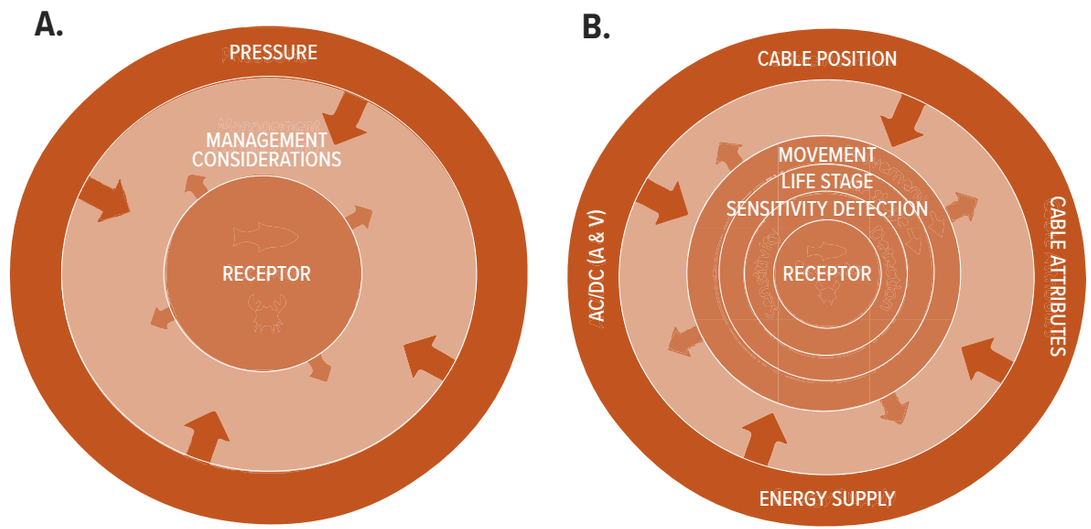
POLICY

- **THE MAGNUSON-STEVENS ACT (MSA)** governs marine fisheries management, fostering long-term biological and economic sustainability of federal fisheries. Among other things, the MSA protects marine and migratory fish species by establishing essential fish habitats
- **EFHS**: protected areas such as coral reefs, kelp forests, bays, wetlands and rivers necessary for fish reproduction, growth, feeding and shelter.
- **THE MARINE MAMMAL PROTECTION ACT (MMPA)** covers all marine mammals, including whales, dolphins and seals, by preventing their killing or harassment
- If a proposed wind farm may affect threatened or endangered marine species or a species protected by the MMPA that is within NMFS's jurisdiction, BOEM must submit a BA to NMFS assessing those potential impacts.
- If action may adversely affect an EFH (Essential Fish Habitat), BOEM must consult with NMFS and, if necessary, submit an EFH assessment [23].

CABLE EMF

ELECTRIC AND MAGNETIC FIELDS [24]

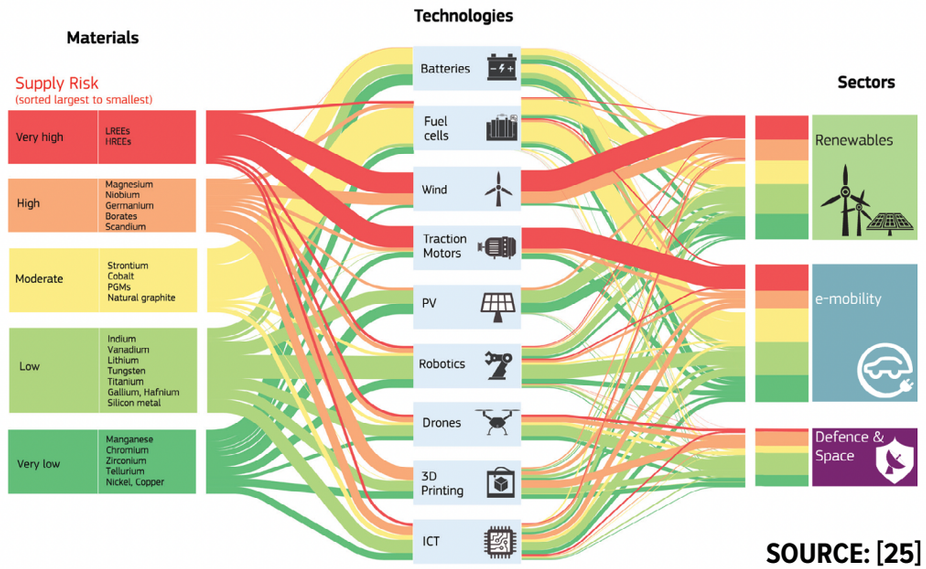
- The voltage applied to the cable produces an electric field that is contained within the cable shielding if perfectly grounded.
- Due to the rotational nature of the magnetic field associated with AC cables, they also induce electric fields.
- Regardless of cable capacity, the power transmitted varies temporally and influences the EMF.
- A magnetic map sense and/or a magnetic compass sense facilitates navigation, allowing an animal to determine its position and direction in relation to a goal. Electroreceptive bentho-pelagic species also use navigational cues from geomagnetic fields.
- Detection thresholds of EMF components likely vary among species.
- US Mid-Atlantic OSW development will expose important seasonally migrating (north–south, inshore–offshore) finfish and elasmobranchs to EMFs, as their movements will periodically cross cables.



ARROWS INDICATE INFORMATION FLOW

A. Vantage point of receptor species. Management must be informed by characteristics defining the pressure (here, EMF) and receptor response.

B. Sensory capabilities and detection thresholds are at the core of receptor species attributes and must be considered through the integration of life history ecology. Simultaneously, EMF characteristics must be known so that exposure levels can be determined and management can consider the likely encounter rate and potential consequences of exposure. A = current (amps.), V = voltage (volts.)

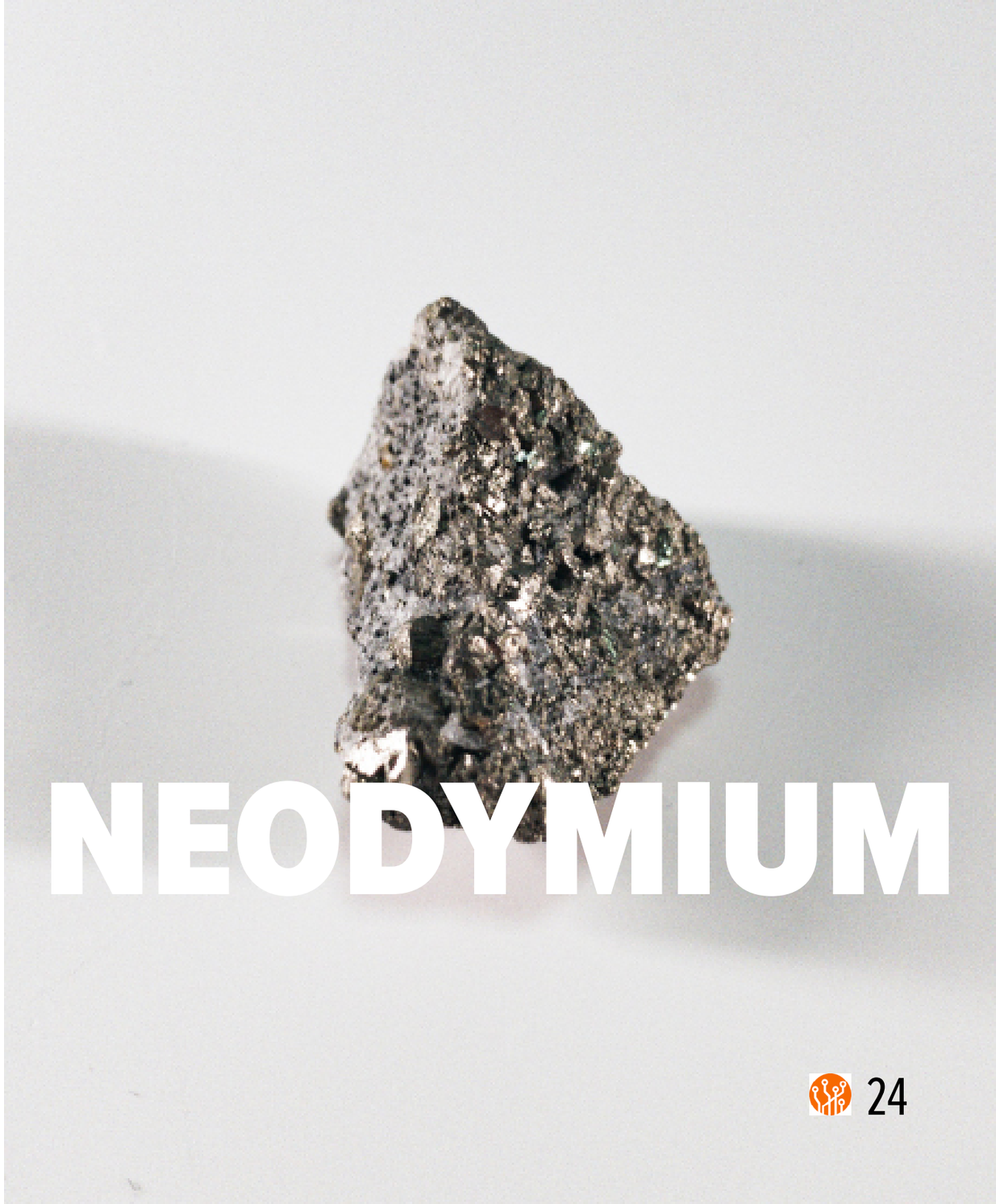


SOURCE: [25]

CRITICAL EARTH ELEMENT MINING

- According to a report from the National Renewable Energy Laboratory, depending on make and model wind turbines are predominantly made of steel (66-79% of total turbine mass); fiberglass, resin or plastic (11-16%); iron or cast iron (5-17%); copper (1%); and aluminum (0-2%).
- According to the Land-Based Wind Market Report by the Office of Energy Efficiency & Renewable Energy, wind turbine towers are 60-75% domestically sourced, blade and hub components are 30-50% domestic, and nacelle assemblies are over 85% domestically sourced. However, many internal parts such as pitch and yaw systems, bearings, bolts, and controllers are typically imported.
- Aluminum plays a role in most parts of a wind turbine, particularly in the nacelle, where the transfer of wind power to electricity occurs. The United States was 50% reliant on foreign sources for aluminum in 2018.
- Rare Earth Minerals: enable wind turbines to have smaller, lighter generators. In 2018, the United States relied on imports to meet its domestic demands for rare-earth compounds, metals, and manufactured products [26].

- Essential for offshore wind production
- Mined as part of a conglomerate with other rare earth elements in the monazite (top) and bastnaesite mineral deposits.
- Neodymium combined with iron and boron make a strong permanent magnet used in the nacelle of the turbine.
- This same elemental combination is in demand for motors of electric and hybrid vehicles.
- It is considered a Critical Earth Element due to the high recovery costs and lack of recycling development.
- Today China supplies 70% of the world's RRE
- Reference ***Nelson Falkenburg's Critical Minerals and the Electric Vehicle Transition bulletin*** [**27**].



NEODYMIUM

FISHING

PROBLEMS

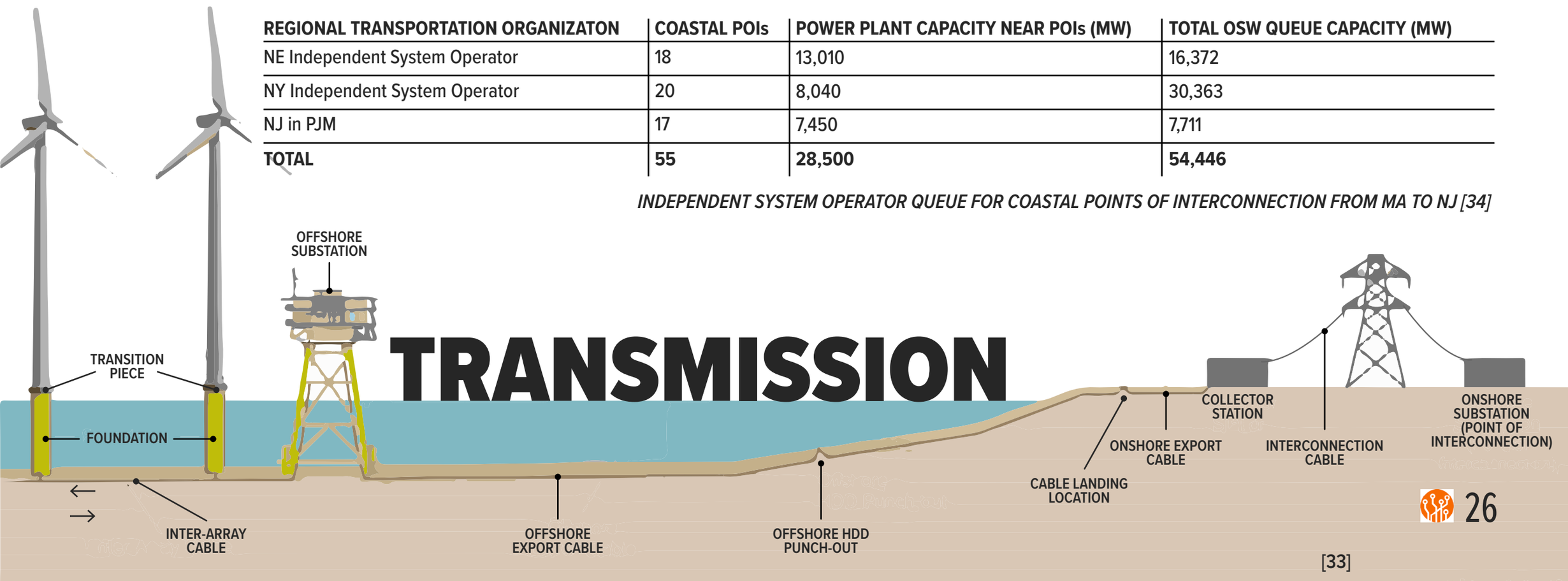
1. Navigational obstructions during construction and operation
2. Increased vessel traffic near the WDA
3. Increased traffic between various ports providing services to the project and the WDA
4. Increased possibility of fishing gear conflicts with the wind turbines
5. Increased risk of collision occurring between project vessels and other vessels during transmission cable laying
6. Increased risk of collision with structures placed as part of the overall wind energy project

- The commercial seafood sector provides over $46 billion in annual sales, income, and value added to the New England and the Mid-Atlantic economy [28].
- Offshore wind directly interferes with the National Marine Fisheries Service's statutory mandate to assess and manage fish stocks and marine mammals [29].
- Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) [30]
- Reasons for conflict and resistance are fear and uncertainty about the loss of income and livelihoods due to competition for important marine space and resources.
- Vineyard Wind established fisher compensation funds to address losses, a trust fund to support fisher navigational and safety equipment and to deflect any increases in insurance costs, and an innovation fund with program and research project grants.

- Offshore wind developers in the U.S. committed to the generator lead line approach where they build individual transmission lines, linking up wind farms one by one to the onshore high-voltage network. That approach is driven by state solicitations [32].
- Building a Better Grid initiative to accelerate the deployment of new transmission lines—as enabled by the Bipartisan Infrastructure Law. This enables a more reliable and resilient grid in the face of intensifying extreme weather and is critical to achieving the President Biden's goal of 100% carbon pollution-free electricity by 2035 [31].
- DOT announced in March 2021 that this discretionary port funding would be available to support offshore wind activities [31].
- Germany and the Netherlands, national transmission operators proactively plan the rollout of the network and build lines out to sea. The U.K. developed its own approach, which sees generators build transmission lines to connect their wind farms but then sell the grid assets to independent operators who bid for them in auctions [32].

REGIONAL TRANSPORTATION ORGANIZATON	COASTAL POIs	POWER PLANT CAPACITY NEAR POIs (MW)	TOTAL OSW QUEUE CAPACITY (MW)
NE Independent System Operator	18	13,010	16,372
NY Independent System Operator	20	8,040	30,363
NJ in PJM	17	7,450	7,711
TOTAL	**55**	**28,500**	**54,446**

INDEPENDENT SYSTEM OPERATOR QUEUE FOR COASTAL POINTS OF INTERCONNECTION FROM MA TO NJ [34]



TRANSMISSION

[33]

- The deployment for 30 GW by 2030 is estimated to require an average of over 260 wind turbines to be installed per year [34].
- Reliance on global supply chains will help accelerate U.S. offshore wind near term deployments it also demonstrates a significant need to expedite the development of a domestic supply chain [34].
- Developers must either commission the construction of new U.S.-flagged WTIVs or develop a Jones-Act-compliant installation strategy that integrates foreign-flagged WTIVs and U.S.-flagged feeder vessels. A potential strategy for combining foreign WTIVs with domestically flagged feeder barges is explained in this section [34].

DEVELOPMENTS

- The EEW monopile facility in the Port of Paulsboro is the largest industrial offshore wind manufacturing facility in the United States to date, and construction broke ground in April 2021 [35].
- In January 2021, Welcon and Marmen announced investing in a tower and transitionpiece manufacturing facility in the Port of Albany, in conjunction with Equinor and NYSERDA [36].
- In May 2020, Siemens Gamesa announced that it is considering establishing a factory to assemble its new 14-MW offshore wind turbine in the United States, although no formal commitment to a specific site has been made [37].
- in June 2020, Nexans was contracted to design, manufacture, and install three 65-kilometer (km)-long export cables for the Seagreen 1 wind farm in Scotland, which will be built in its manufacturing facility in Charleston, South Carolina [38].

SUPPLY CHAIN

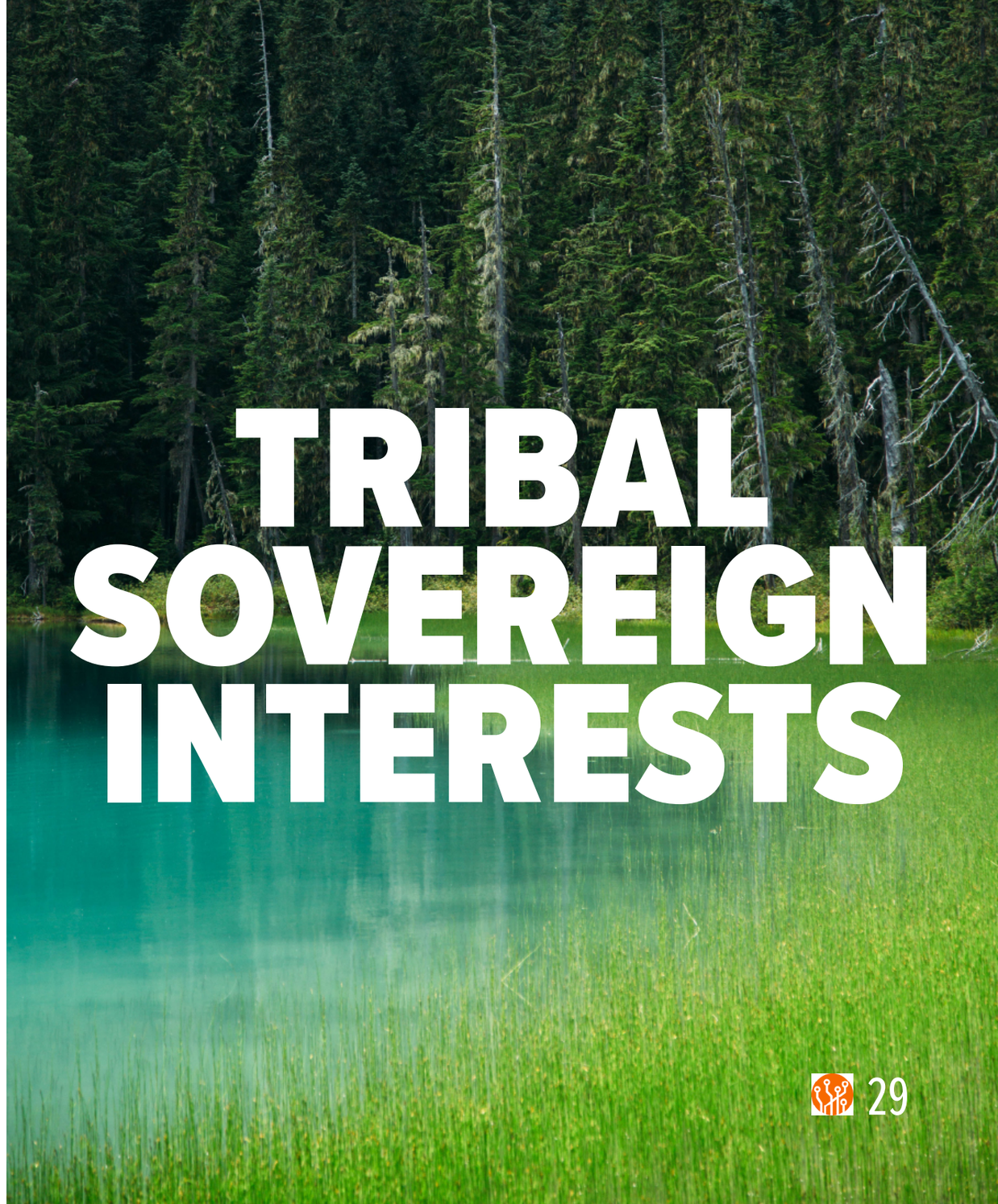
PROJECTED SUPPLY CHAIN DEMANDS TO MEET THE OFFSHORE WIND TARGET OF 30 GW BY 2030 [39]

CUMULATIVE DEPLOYMENT	30 GW AT END OF YEAR (YR)
DEPLOYMENT AVERAGE	3.7 GW/YR
OFFSHORE WIND ENERGY GENERATION	117 TERRAWATTS-HOUR/YR AT END OF YR
CUMULATIVE CAPITAL EXPENDITURE	$97 BILLION AT END YEAR
AVERAGE CAPITAL EXPENDITURE	$12.2 BILLION/YR
CUMULATIVE WIND TURBINE DEMAND	2110 UNITS
AVERAGE WIND TURBINE DEMAND	263 UNITS/YR
CUMULATIVE STEEL DEMAND	7093 THOUSAND TONS
AVERAGE STEEL DEMAND	886 THOUSAND TONS/YR
CUMULATIVE PERMANENT MAGNETS	81 THOUSAND TONS
AVERAGE PERMANENT MAGNET DEMAND	10.1 THOUSAND TONS/YR
CUMULATIVE ELECTRIC CABLING	9240 MILES
AVERAGE ELECTRIC CABLING	979 MILES/YR
WIND TURBINE INSTALLATION VESSELS	4-6 MINIMUM REQUIRED PER YEAR
CUMULATIVE PORT INFRASTRUCTURE UPGRADES	$365-500 MILLION
[CONSTRUCTION PERIOD] INSTALLATION, MANUFACTURING, AND SUPPLY CHAIN JOBS	31.3 THOUSAND FULL TIME EQUIVALENT JOBS/YR
[OPERATING PERIOD] O&M TECHNICIANS, MANAGEMENT, AND SUPPLY CHAIN JOBS	13.4 THOUSAND FULL TIME EQUIVALENT JOBS/YR

NOISE

- Unwanted Sound sources, such as those from offshore development are referred to as “noise”.
- During OSW farm construction, the driving of foundation piles into the sediment generates a significant amount of noise for certain foundation types. As a result, a number of mitigation measures have been developed to reduce noise and minimize impacts to wildlife.
- Noise levels that can cause auditory injury. At greater distances, the intensity of noise is reduced (due to spreading) and is less injurious but may still affect the behavior of marine species
- The risk from noise during other phases of wind farm development (e.g., site surveys, operations, and maintenance) is considered to be lower, but further monitoring is still needed to help fill existing research needs and gaps in understanding [40].

- Executive Order 13175 is one directive that guides federal agencies like BOEM in proper tribal consultation practices
  - BOEM's 3 Goals [41]
    1. Improving BOEM's understanding of their connections to physical and biological resources and society
    2. Being mindful of the historically long-time horizon of Tribal communities -- encompassing past, present, and future generations
    3. Reaffirming BOEM's commitment to understand, foresee and minimize the impact of BOEM decisions on Tribal communities
- Given the history of human migration patterns, Native American Tribes that are not located directly near a development site may still have attachment to ancestral lands, so the geographic scope of projects may reach wider than the specific coastal area being developed [42].
- Much of what is now considered the OCS was exposed and inhabited by indigenous peoples that have been present in the area for 10,000 years or longer, as coastal habitation was possible sometime after the Last Glacial Maximum (Brown, 2015). As a result of this cultural history, the role of place-based attachment in these areas is underscored in the wake of potential impact of renewable energy projects [42].



TRIBAL SOVEREIGN INTERESTS

VISUAL OBSTRUCTION IN THE COASTAL US

- Further distances from the shore are associated with increased water depths, costs can increase significantly in an attempt to locate wind farms further offshore [43].
- Offshore wind often leads to public opposition to the visual nature of the farms on the horizons of their coasts [43].
- For example: The Block Island wind farm is functioning as an attractant, either as a novel sight or as a recreational fishing destination [43].
- Participants felt the wind farm should be promoted for tourism but cautioned that interest may be short-lived and there may be less support for larger offshore developments [43].
- Findings support tourism and recreation sector engagement throughout offshore wind project planning and operation [43].
- No laws or regulations specifically govern visual impacts in the US, but the National Historic Preservation Act (NHPA) requires that federal agencies like BOEM consider the adverse impacts of their actions on properties that may be eligible for or listed in the National Register of Historic Properties (NRHP) [44].
- BOEM must provide the Advisory Council on Historic Preservation (ACHP) with an opportunity to comment, and it must consult with state historic preservation offices and representatives of federally recognized Native American tribes [44].
- A project proponent generally prepares a Visual Impact Assessment (VIA). The VIA uses techniques such as distance modeling, visual simulations and professional rating panels to quantify the potential impact on stakeholders [44].

- Fixed foundation technologies are currently most feasible in waters ≤60 m deep, yet more than 58% of the offshore wind energy in the United States occurs beyond this depth
- Floating turbines could produce more energy than the largest onshore or offshore technologies. Not only are winds in deeper waters more powerful than those closer to shore, he says, but the physics of the flexible, suspended rigs enables them to carry larger turbines
- Deep-sea wind arrays, where the density of the turbines and the communities of birds are more thinly distributed, have less of an impact on seabirds than near-shore wind arrays
- The noise associated with pile driving would be eliminated, and floating wind systems could also allow for greater flexibility in siting because of their broader depth allowances [45].

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