SPINNING THE MID-ATLANTIC OFFSHORE WIND INDUSTRY INTO ECONOMIC OPPORTUNITY

C2ES CLIMATE INNOVATION 2050

by

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Virginia, Maryland, and North Carolina are on the cusp of entry into the U.S. offshore wind market. In Virginia, the first offshore wind turbines in federal waters symbolize the potential for a thriving clean-energy industry that could bring the region meaningful local economic benefits. With one of the deepest seaports on the East Coast, a large, skilled workforce, and proximity to major urban electricity demand centers, the Norfolk-Hampton Roads region is poised for a local offshore wind industry to take off. Nearby states North Carolina and Maryland similarly stand to reap significant economic benefits from a local offshore wind industry, and the three states have commitments to procure at least 6.8 gigawatts (GW) of offshore wind project capacity between them. However, the U.S. offshore wind industry remains nascent, and particularly so in the mid-Atlantic, with a long road remaining to building up the supply chain, workforce, and infrastructure necessary to sustain it. Locally, considerable work remains to ensure communities can experience the benefits, and state and federal policy and investment is needed to support the region's offshore wind ambitions. This brief summarizes key takeaways from a roundtable C2ES held in person in Virginia Beach, Virginia, in October 2022. It offers recommendations for policymakers to capitalize on the economic opportunity that decarbonization creates, in particular the growth of the mid-Atlantic offshore wind industry.

INTRODUCTION

ABOUT C2ES ROUNDTABLES

Achieving net-zero emissions will require large-scale change across all sectors of the economy, and efforts to accelerate this transition are intensifying. Yet these changes—and climate change itself—have already begun to profoundly alter social, economic, and political realities in communities across the country. To chart a pathway to sustainable, long-term prosperity, communities must be able to leverage their unique strengths and capitalize on emerging economic opportunities, while addressing barriers that are often poorly understood

outside of their communities. As companies make significant commitments and investments in low-carbon technologies and the facilities and workers who will produce them, policymakers have sought to identify approaches that can benefit communities and businesses alike. Doing this well requires engaging directly with communities to understand not only their unique challenges, but, perhaps more importantly, the future they want to chart for themselves.

An October 2022 roundtable, which C2ES held in Virginia Beach, Virginia, brought together more than 35 stakeholders representing business, policymakers, nongovernment organizations, and communities in the mid-Atlantic region to explore the economic opportunities associated with developing a thriving offshore wind industry in Virginia, Maryland, and North Carolina. The event included five discussion sessions spanning supply chain and workforce, environmental concerns, transmission and permitting, community engagement, and interstate cooperation. This brief includes key takeaways from the event and a series of C2ES recommendations meant to align climate and economic objectives in the region. These recommendations are based on the roundtable discussion itself, as well as consultations with stakeholders before and after the event.

WHY VIRGINIA BEACH?

The communities of Virginia Beach, Norfolk, Hampton Roads, and the surrounding area serve both as a test case and a demonstration of the opportunity an offshore wind project and related supply chain can bring to the region, but also exemplify the significant preparation necessary to support it.

Twenty-seven miles offshore from Virginia Beach, Dominion Energy is constructing the first offshore wind project in federal waters—and the only owned by a utility—the Coastal Virginia Offshore Wind (CVOW) project. In preparation for the coming demand for inputs, labor, and the coastal infrastructure and transportation equipment necessary to accommodate the huge components, the Hampton Roads region and the Port of Virginia have begun to develop local capacity. For example, in August 2022 just before the roundtable, the U.S. Economic Development Administration (EDA) awarded the Hampton Roads Workforce Council an $11 million grant.[1] Additionally, the Port of Virginia will lease 72 acres of formerly idle area in the Portsmouth Marine Terminal to Dominion Energy for staging and pre-assembly.[2] The CVOW project alone is expected to support 1,100 jobs in the construction phase and 900 thereafter. While many workers will bring experience and skills from previous jobs in adjacent industries, the community, utility, and the state are already preparing for the training needs of the offshore wind workforce.[3]

Virginia, Maryland, and North Carolina are signatories of the Southeast and Mid-Atlantic Regional Transformative Partnership for Offshore Wind Energy Resources memorandum of understanding (SMART-POWER MOU), a cooperation to "promote, develop, and expand offshore wind energy generation and the accompanying industry supply chain and workforce." As such, these states are aligned in their support for growing a mid-Atlantic offshore wind power industry, even while each is at a different stage of development.[4]

FRAMING THE DISCUSSION

Offshore Wind in the Mid-Atlantic Region

The mid-Atlantic region has an existing pipeline of offshore wind projects that could support at least 9 GW of power generation capacity by the end of the decade, with additional wind energy areas identified that could support even more power generation in the future (see Table 1).[5]

TABLE 1: the Mid-Atlantic Project Pipeline

TYPE	PROJECT/LEASE AREA	STATE	DEVELOPER	PLANNED GENERATION CAPACITY (MW)
Project	MarWin	MD	US Wind	300
Project	Skipjack Wind 1	MD	Ørsted	120
Project	Coastal Virginia Offshore Wind	VA	Dominion Energy	2,600
Project	Kitty Hawk North Wind Project	NC and VA	Avangrid Renewables	3,500
Project	Momentum Wind	MD	US Wind	808
Project	Skipjack Wind 2	MD	Ørsted	846
Lease Area	Carolina Long Bay	NC and SC	TotalEnergies and Duke Energy	1,300
			Total	9,474

Though each of the three states is a signatory of the SMART-POWER MOU, the progress of interstate collaboration in the industry since its signing has been relatively limited. In order to continue making progress, states need to demonstrate support for the industry throughout state government, including through designating offshore wind policy and technology needs and prioritizing offshore wind as an area of expertise among agency staff. Recent events illustrate that the SMART-POWER collaboration is not being leveraged at the executive level; for example, a convening on a new federal–state offshore wind partnership launched by the Biden administration in June 2022 did not feature all signatories to the MOU.[6]

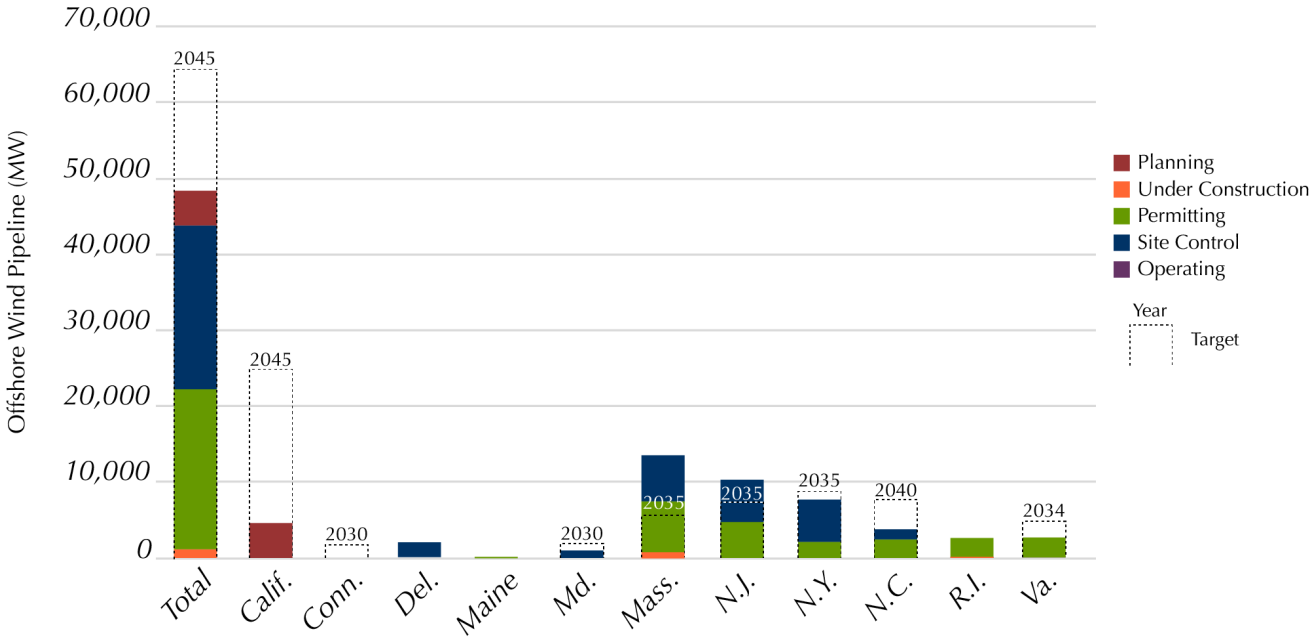
Momentum for Offshore Wind in the United States

Although development of the offshore wind industry in the United States remains nascent relative to its development in Europe and other parts of the world, the domestic industry is building momentum toward maturity within the next two decades. The Biden administration is providing strong federal support and has set a goal of reaching 30 GW of installed capacity by 2030. Across the United States, state procurement goals total more than 40 GW by 2040, demonstrating alignment of ambition at both the state and federal level. In the *2022 Offshore Wind Market Report*, the U.S. Department of Energy (DOE) identified more than 40 GW of capacity in various stages of development by the middle of 2022, an increase of more than 13 percent over the previous year.[7]

In December 2022, the Bureau of Ocean Energy Management (BOEM) held its first offshore wind energy lease sale for areas on the Outer Continental Shelf off the coast of California. This move not only adds considerable potential for additional development but also highlights the potential for deployment of floating offshore wind turbines. When deployed at scale, this new technology could revolutionize the geographic range of deployment for the industry.[8]

There have also been significant developments in offshore wind technology, even as projects are moving through the permitting process. Avangrid Renewables (and parent company Iberdrola) recently increased the projected capacity of its Kitty Hawk North Wind project off the coast of North Carolina from 2.5 GW to 3.5 GW due to the increased generation capacity of next-generation wind turbines it plans to install.[9] **Figure 1** shows the current U.S. offshore wind pipeline and targets by state.

FIGURE 1: U.S. Pipeline and Targets



Note that for states jointly developing projects, projects have been applied toward each state's total. These include New York and New Jersey (5620 MW in site control) and Massachusetts and Rhode Island (2528 in permitting and 132 under construction).

Source: U.S. Department of Energy Office of Energy Efficiency and Renewable Energy, *Offshore Wind Market Report: 2022 Edition*.

Offshore Wind and the Inflation Reduction Act

In addition to federal and state procurement goals, Congress has expanded support for offshore wind through the Inflation Reduction Act of 2022 (IRA). The energy investment tax credit (ITC) provides a credit of up to 30 percent for offshore wind projects that begin construction before January 1, 2026, if they meet prevailing wage and workforce requirements. Bonus credits are also available for projects that meet domestic content requirements.[10] Separately, the IRA also provides a new tax credit for manufacturers, covering the domestic production of components and related goods like offshore wind installation vessels.[11]

In addition to these tax provisions, the IRA provides $100 million for offshore wind electricity transmission planning, modeling, and analysis, including convening stakeholders.[12] It includes provisions authorizing the Secretary of the Interior to issue renewable energy leases in the mid- to south-Atlantic and the eastern Gulf of Mexico.[13] It also sets new limits that tie the Department of Interior's (DOI) ability to issue renewable energy leases to its lease offerings for oil and gas. Now, DOI is prohibited from issuing new offshore wind leases on the Outer Continental Shelf unless at least 60 million acres have been offered for lease for oil and gas development in the previous 12 months.[14]

Remaining Challenges Ahead

Challenges remain for the U.S. offshore wind industry to realize its full potential. While states and the Biden administration have set ambitious procurement goals, the time it takes from a goal being set to a project successfully beginning operation can take more than a decade. Project developers and manufacturers also regularly face uncertainty through the entire project pipeline. As stakeholders repeatedly highlighted during the roundtable, a reliable project pipeline is essential to building certainty among developers and companies throughout the supply chain, utility off-takers, and state and local planners.

Building out the transmission infrastructure necessary to carry electricity generated offshore to end users onshore is also a challenge, and utilities and developers must begin planning ahead to meet these needs even before projects are constructed. Under the current system, electricity is most often generated inland and carried out toward the coast. As the offshore wind industry develops, new lines and substations will need to be built to deliver the incoming power. Additionally, transmission considerations are often undertaken on a project-by-project basis, rather than with systemwide planning. This often creates inefficiencies or outright barriers to integration of projects built later down the line. DOE's National Renewable Energy Laboratory (NREL) is currently conducting an Atlantic Offshore Wind Transmission Study to evaluate multiple pathways to meeting state and federal offshore wind goals along the Atlantic Coast through coordinated transmission solutions, with results expected in late 2023.[15]

The huge scale and size of offshore wind components themselves also raises challenges relating to domestic—and more specifically, local—infrastructure. Offshore wind turbine components like blades, rotors, nacelles, and monopiles are simply too big and heavy for over-land transportation to accommodate, making coastal access essential for manufacturing and deployment. For example, turbine blades produced today are up to 350 feet long, and individual components can weigh up to 750 tons.[16] Ports from which components will be launched for installation need the acreage to accommodate lay-down areas for each of these components, wharves that can withstand their weight, and waterways deep enough to accommodate the vessels carrying them.[17]

Finally, to meet our offshore wind ambitions, the United States needs to develop a domestic supply chain and workforce that can fuel this growing industry. As many states, including Maryland, have strict local content and workforce requirements, and federal financial support hinges on domestic content, the build-out of domestic manufacturing capacity throughout the supply chain is crucial to staying on pace in meeting these requirements and procurement goals. Access to U.S.-flagged vessels—and trained workers to crew them—is also a necessity, both for Jones Act compliance (see **Box 1**) and to maintain U.S. competitiveness in the offshore wind industry.

KEY RECOMMENDATIONS

Supply Chain and Infrastructure

- BOEM should expedite the leasing process and offer additional leases for offshore wind energy development in order to build a project pipeline that can foster the development of a reliable domestic supply chain and justify comprehensive investments in transmission upgrades.
- Federal grants, loans, and other incentives to build domestic supply chain capacity and meet the needs of the growing offshore industry should include dedicated assistance to small businesses that may otherwise not have the capital necessary to perform the upgrades they need to demonstrate readiness for offshore wind investment.

- Congress should create an incentive program to support the domestic construction and deployment of wind turbine installation vessels and training for workers to crew the vessels. This should include grants for domestic vessel construction and the development of workforce training programs, tax credits for domestic investments in infrastructure and facility construction, and financial assistance for workers enrolling in offshore wind-related workforce training programs.
- Congress should designate a portion of proceeds received from offshore area lease auctions to fund infrastructure upgrades at ports and other sites conducive to offshore wind component or input development, with particular emphasis on reclaiming brownfields.

Workforce

- In order to attract more diverse talent, businesses should partner with institutions that specialize in serving diverse populations, such as historically Black colleges and universities (HBCUs). Companies hoping to recruit from underserved communities should consider their unique needs and address them proactively.
- The Department of Labor should offer resources to workers in legacy fossil fuel communities, particularly communities formerly dependent on the oil and gas industry, to be able to take advantage of forthcoming opportunities in the offshore wind energy industry. These resources should include funding and financial support for retraining and placement on offshore wind projects, as well as direct outreach to energy communities to educate them on what the new opportunities are and how to take advantage of them.
- Congress and state governments should offer funding for workforce development relating to the offshore wind industry, to include retraining for skilled workers from other adjacent sectors, training and certification in the trades for new entrants to the field, and outreach to high school students and recent graduates on the opportunities in fields related to the offshore wind industry. This support should include financial assistance and access to benefits for workers in transition, such as healthcare, childcare, and transportation to onsite trainings. Once workers are employed, employers should offer these benefits to retain workers.

Integrating Environmental Protection and Community Engagement

- The White House should direct federal agencies to establish a coordinated, standardized process for submitting documentation for all environmental review processes for the development
- of offshore wind projects that can complement FAST-41 coverage to reduce the administrative barriers to project approval.
- States and federal agencies should set minimum standards for environmentally responsible development. State standards should reflect the local environmental context to expedite the permitting process while protecting vulnerable ecosystems and communities. States should also inform federal standards to ensure they reflect local environmental issues. Federal standards should account for population-wide impacts among migratory species and other ecosystems that transcend state boundaries.
- Regulators should set performance standards based on target environmental protections and encourage innovation by allowing project developers and other actors throughout the supply chain to meet them by using the most cost-effective technology.
- Environmental requirements for project approvals should include monitoring to collect baseline data on impacts on wildlife and meaningful engagement with local communities, including specific emphasis on underserved and Native American communities.
- In addition to environmental impact assessments, permitting processes for transmission interconnection sites and new transmission lines should require project developers to implement stakeholder engagement processes that demonstrate meaningful engagement with the community and accountability following input-based decision making.
- BOEM, DOI, and DOE should jointly offer training and technical assistance for state and local regulators on offshore wind technology development, construction, maintenance, regulatory approaches, and environmental impact.
- States should conduct project development and related transmission upgrades/installation simultaneously to ensure they can utilize all the power from the offshore wind project once it is completed.

BOX 1: The Jones Act

The Jones Act refers to the Merchant Marine Act of 1920, in combination with earlier laws covering U.S. domestic trade dating back to 1789, as well as subsequent refinements and expansions. The act limits U.S. domestic commerce, which is defined as the transport of merchandise or passengers between two points in the United States, to U.S.-registered vessels that are: U.S. citizen owned, U.S. citizen operated, and U.S. built; they must also have a U.S. citizen crew.

This has significant implications for the U.S. offshore wind industry, which is currently constrained by a limited number of Jones Act compliant vessels. It does not apply to surveying and research, as long as cargo is not transported on these trips, allowing foreign-built and/or crewed vessels to perform these functions. Additionally, tower installation can be performed by a foreign vessel as long as the crew and materials are transported by a U.S. feeder vessel; the same is true for cable lay as long as cables are delivered by a U.S. feeder vessel.

There are currently no U.S.-flagged wind turbine installation vessels (WTIVs). It is projected that between four and seven will be needed to meet the Biden administration's deployment target of 30 GW by 2030. The first Jones Act-compliant WTIV—Dominion Energy's *Charybdis*—is currently under construction in Texas, with a target completion date in late 2023.

A limited number of U.S.-flagged vessels that can support the industry do exist, with more under construction. A list of these vessels can be seen in Table 2 below.

TABLE 2: U.S.-Flagged Vessels

VESSEL CATEGORY (VESSEL NAME)	COMPANIES BACKING	PROJECT CONTRACTS	COMMISSIONING
Wind Turbine Installation Vessel (Charybdis)	Dominion Energy, GustoMSC, Keppel AmFELS	Coastal Virginia Offshore Wind, Revolution Wind, and Sunrise Wind	Expected 2023
Service Operations Vessel (ECO EDISON)	Edison Chouest Offshore, Ørsted, and Eversource	Revolution Wind, South Fork Wind, and Sunrise Wind	Expected 2024
Service Operations Vessel	Crowley Maritime Corporation, ESVAGT	(Empire Wind Possible)	Not Listed
Service Operations Vessel (Plug-in Hybrid)	Equinor, BP, Edison Chouest Offshore	Empire Wind	Mid-2020s
Crew Transfer Vessel x2 (Atlantic Pioneer, Atlantic Endeavor)	Atlantic Wind Transfers, Blount Boats Inc., Chartwell Marine Ltd.	Block Island Wind Farm and Coastal Virginia Offshore Wind	Vessels Delivered in 2016 and 2021
Crew Transfer Vessel x2 (WindServe Odyssey, Unnamed)	WindServe Marine, Senesco	Block Island Wind Farm, Coastal Virginia Offshore Wind, Revolution Wind	First Vessel Delivered 2020
Crew Transfer Vessel	Gladding-Hearn Shipbuilding, Duclos Corporation	Mayflower Wind	Expected Mid-2020s
Crew Transfer Vessel x4	American Offshore Services, Blount Boats	Four Wind Farms on U.S. East Coast	Expected 2023
Rock Installation (With Option To Contract a Second Vessel)	Great Lakes Dredge & Dock, Ulstein Group, Philly Shipyard, Inc.	Not Listed	Expected 2024 (Second Vessel Expected 2025, If Awarded)
Multipurpose Feeder (Eleanor)	Moran Iron Works Shipyard, Green Shipping Line, Keystone Shipping Company, DEKC Maritime	Not Listed	Expected Mid-2023
Walk-to-Work (Paul Candies)	Siemens Gamesa, U.S. Otto Candies, LLC	South Fork, Revolution Wind	2018
(2) Tugs and Barges	Maersk Supply Service, BP, Equinor, Kirby Offshore Wind	Empire 1 and 2	Not Listed

Table note: "Not Listed" indicates no commissioning date has been announced.

Source: U.S. Department of Energy Office of Energy Efficiency and Renewable Energy, *Offshore Wind Market Report: 2022 Edition*

Box Sources[18]

THEMES FROM THE DISCUSSION

OVERARCHING THEMES

Throughout the discussion, participants agreed and emphasized that a reliable project pipeline is essential to enabling the domestic supply chain, the necessary workforce recruitment and training initiatives, and the local infrastructure investments. As mentioned above, certainty that projects will be built—including future projects that can produce longer term demand for components, infrastructure, and workers—is a critical precondition for the large up-front investments of capital and time necessary to prepare companies, localities, and workers for the industry. Participants highlighted the need for expedient review timelines, lease auctions, and project permitting as central to the development of this pipeline, but also cautioned that this should not be at the expense of rigorous review for environmental and social impact. That said, there was broad agreement that reform to the current permitting process is key to the nation's ability to build out both offshore wind generation capacity and transmission at the pace and scale necessary to meet mid-century decarbonization goals.

Another key theme that emerged from the discussion was that to succeed, the U.S. offshore wind industry will have to compete globally. Developers and local economies will need to compete with global interests for access to foreign resources, vessels, and components until the United States can stand up its own supply chain. Success could offer significant benefits to domestic companies, communities, and workers in the offshore wind industry, justifying considerable investments to advance the industry.

In contrast to global competition, inter-state cooperation is also essential to accelerate the development of the industry and maximize states' comparative advantages. The needed up-front investment in infrastructure, manufacturing capacity, and workforce is such that interstate cooperation is necessary to avoid duplication and to allow states to play to their respective strengths. Roundtable participants stressed the importance of interstate cooperation and encouraged sharing of knowledge and capacity between states and regions, while acknowledging the limitations associated with local content requirements and the need to localize economic benefits of this investment.

Participants highlighted the influence of companies with clean power and net-zero emissions commitments at the state level. They noted that these companies can use their economic might to put pressure on states to raise their own clean power procurement ambition.

Our roundtable discussion delved deeper into issues surrounding the offshore wind supply chain and infrastructure, workforce, community and stakeholder engagement, and permitting and transmission.

SUPPLY CHAIN AND INFRASTRUCTURE

While the U.S. offshore wind industry remains nascent, project developers are currently able to use foreign installation vessels and imported components. However, as the industry grows at an accelerating pace, and global demand for installation vessels and components skyrockets, a robust domestic supply chain and highly trained workforce will be essential to building out the industry on pace and at scale.

Project Pipeline

A central topic of discussion was the federal siting and leasing process to identify and assign areas for lease in the Central Atlantic. Participants highlighted the urgency of an expedient leasing and permitting process as a key component of increasing certainty in the project pipeline. Thus, this process is central to the success of the offshore wind industry both as an economic driver and a means of reducing emissions at the pace and scale necessary to meet the climate challenge.

While there are currently three projects in development in the region, BOEM is in the process of releasing additional wind energy areas for lease. A variety of factors inform the agency's siting decisions, including first and foremost environmental considerations to protect the local ecosystem and migratory wildlife. Other factors include human uses like shipping, fishing, and military use. **Figure 2** shows the locations of planned projects and the additional call areas in the region.[19]

The BOEM process for siting, leasing, and permitting follows four phases:[20]

1. **Planning and Analysis**: BOEM identifies potential areas for development, considering wind strength, proximity to demand centers, and other uses for the ocean area (military, shipping, fishing); BOEM engages with stakeholders, including tribes, state, local, and federal governments and agencies).

2. **Leasing**: BOEM holds a competitive auction for the sale of the commercial wind energy lease (or otherwise issues the lease).
3. **Site Assessment**: Lessees submit site assessment plans (SAPs), which must be approved by BOEM before proceeding.
4. **Construction and Operations**: Lessees submit Construction and Operations Plans (COPs); BOEM conducts environmental and technical reviews before approving plans.

To develop the Central Atlantic draft wind energy areas (WEAs), BOEM worked closely with the Central Atlantic Intergovernmental Renewable Energy Task Force, comprised of key actors from Delaware to North Carolina. BOEM also incorporated input from state agencies in Delaware, Maryland, Virginia, and North Carolina, as well as federal agencies, stakeholders, other ocean users, offshore wind developers, and the commercial fishing industry. Additionally, the agency performed comprehensive analysis of the considerations relating to marine species and ecosystems, national security, commercial marine uses, wind speeds, and bathymetry (undersea topography).[21]

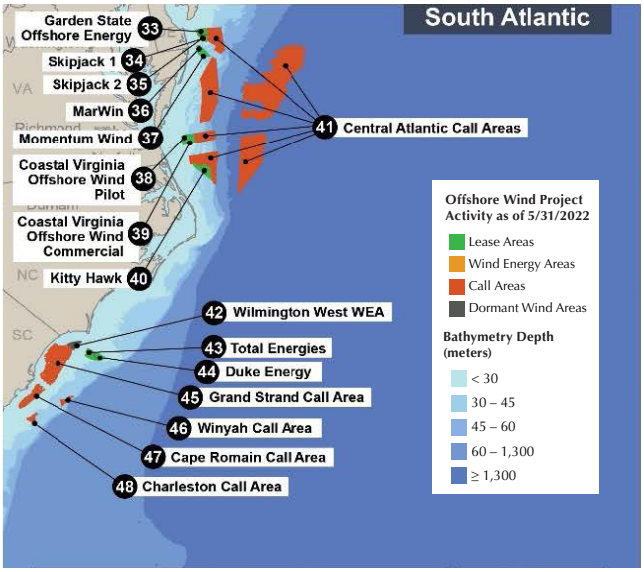
The marine areas surrounding the Norfolk/Hampton Roads region of Virginia have unique siting constraints due to competing uses by the U.S. Department of Defense (DoD) and National Aeronautics and Space Administration (NASA). In particular, NASA limits the locations of offshore wind turbines to minimize the risk of damage from falling launch debris.[22] The region also faces constraints due to local and migratory endangered species, including the fin whale, the north Atlantic right whale, sei whale, Atlantic sturgeon, Kemp's Ridley sea turtle, and leatherback sea turtle.[23] These species face heightened risk of harm throughout the construction and operations of the project; in addition to operational impacts, they also may experience significant adverse impacts from the noise made by the surveying and construction processes, and are at risk of injury or death due to boat strikes.

As participants highlighted, consistency in timelines of the siting, leasing, and process supports reliability for developers, especially as projects must schedule the use of limited foreign (and soon, domestic) vessels and crews. Even short delays in the permitting process can turn into significantly longer delays down the line, especially if the delay extends beyond the window of availability for these vessels and crews, and they move on to other jobs. A review of European projects in 2020 found "previous task" was the dominant reported cause of delay for offshore assembly locations, demonstrating the extent of this challenge and its ubiquity in other markets in addition to the U.S. market.[24] Participants also emphasized that seasonal change is another major factor limiting the window for installation, especially to protect endangered species like the right whale—for example, a delay in project permitting of even a few months could push the construction timeline to a season in which the right whale population density near the call area is highest, then causing further delay as the developer works to mitigate the increased risk of harm.[25]

In addition to project developers, suppliers also benefit from a reliable project pipeline. With multiple planned projects, the business case is clear for suppliers to invest the up-front capital and time in building up their operations and recruiting and training workers.

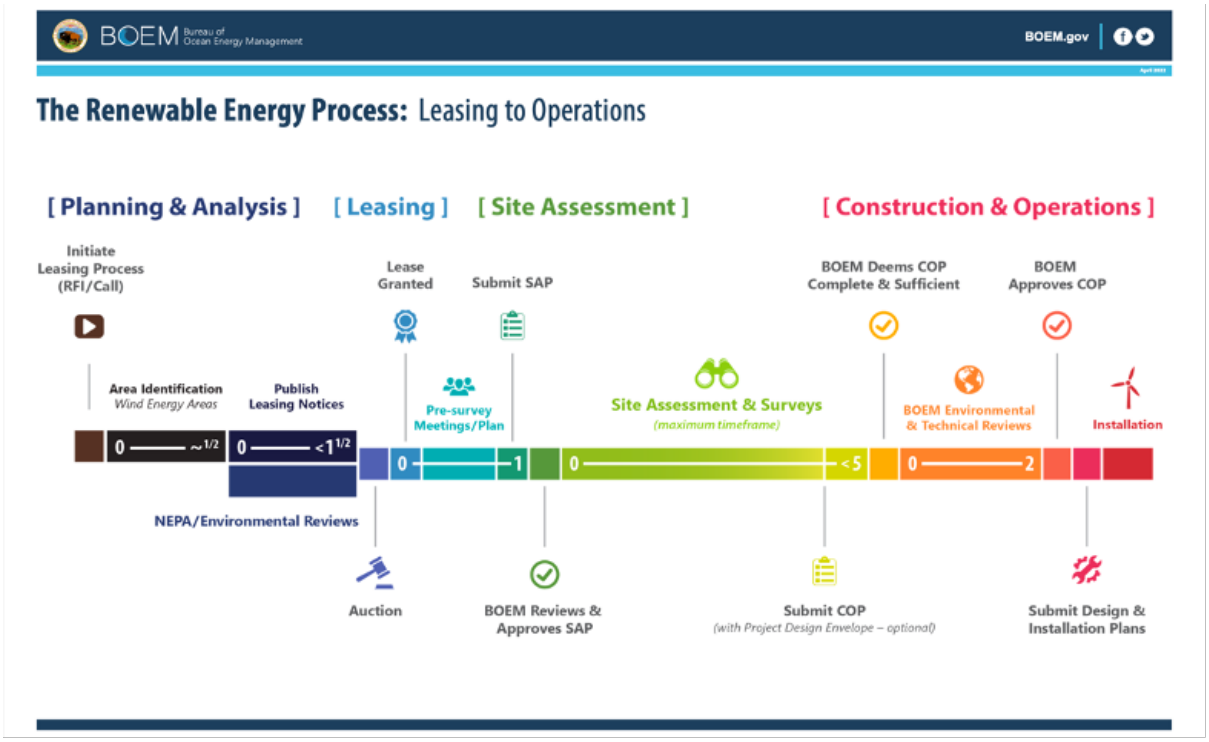
Reliability in the project pipeline is not only dependent on an expedited federal leasing and permitting process. Roundtable participants highlighted that states can send important, long-term demand signals to help expand the project pipeline by setting ambitious commitments to procure offshore wind energy. However, in order for these commitments to become capacity, it is

FIGURE 2: Map of Mid-Atlantic Wind Energy Areas, Leases, and Projects



Source: U.S. Department of Energy Office of Energy Efficiency and Renewable Energy, Offshore Wind Market Report: 2022 Edition; BOEM, "Central Atlantic".

FIGURE 3: The process of developing an offshore wind project



Source: BOEM, "The Renewable Energy Leasing Process: Leasing to Operations," accessed January 26, 2023, https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/BOEM-Poster-Renewable-Commercial-Leasing-Process_0.pdf.

crucial that states also back up their commitments and targets with policy support for and direct investment in the offshore wind industry supply chain, workforce, and infrastructure.

RECOMMENDATION:

- **BOEM should expedite the leasing process and offer additional leases for offshore wind energy development in order to build a project pipeline that can foster the development of a reliable domestic supply chain and justify comprehensive investments in transmission upgrades.**

The Domestic Coastal and Inland Supply Chain

The long-term needs of the offshore wind industry project pipeline will only be met through the development of a domestic supply chain. Yet the complexities of the offshore wind industry create significant, unique requirements for both coastal and inland supply chain development.

Growth in the domestic supply chain is already underway. The 2.6-GW CVOW project will be comprised of 176 turbines—each of which will stand more than 800 feet tall—three offshore substations, undersea cables, and new onshore transmission infrastructure. While this project alone cannot sustain an entire mid-Atlantic offshore wind supply chain, it will create significant demand that can jumpstart investments by facilities and ports to prepare for the industry.

As discussed above, the vast size of offshore wind turbine blades and towers, as well as the carousels for the up to 100 miles of cable needed to connect the projects to the grid, means they cannot be transported over land, but rather must be manufactured in marine-adjacent facilities with sufficient acreage to accommodate lay-down areas and sufficient port infrastructure to accommodate their marine transport.[26] This creates a significant need for regionally adjacent coastal manufacturing and assembly facilities with marine access to the project site and inland access to the supply of inputs to produce these components.

At the same time, many inputs like steel and copper, as well as high voltage (HV) electrical equipment, can be produced at existing facilities in other, inland states, creating an opportunity to develop a multistate supply chain that extends the economic benefit of the industry to locations beyond the coasts. Steel in particular is a major opportunity, with 120–180 tons of steel required for each new megawatt (MW) of installed offshore wind capacity.[27] Additional major mineral inputs include copper (eight metric tons per MW) and zinc (5.5 metric tons per MW), along with other rare earths and critical minerals.[28]

Roundtable participants highlighted that while it is possible to retool existing factories to build offshore wind inputs, doing so requires up-front capital investment. However, many of the specialized equipment manufacturers are smaller businesses that may be less equipped than their larger peers to make this up-front investment. For this reason, some suppliers may be passed over for contracts that would have included funding for retooling because they cannot demonstrate readiness. Once again, this underscores that project pipeline certainty and state and federal support are of the utmost importance to create certainty for companies to commit to up-front investments.

RECOMMENDATION:

- **Federal grants, loans, and other incentives to build domestic supply chain capacity and meet the needs of the growing offshore industry should include dedicated assistance to small businesses that may otherwise not have the capital necessary to perform the upgrades they need to demonstrate readiness for offshore wind investment.**

Installation and Maintenance Vessels

The first Jones Act-compliant offshore WTIV is currently in production in Brownsville, Texas, with an estimated completion date in the fourth quarter of 2023.[29] This vessel, the Charybdis, is already contracted to support the Sunrise and Revolution projects in the Northeast, as well as the CVOW project in the Mid-Atlantic.[30] The new construction marks an initial step toward U.S. independence in the offshore wind industry, but up to six additional WTIVs will be needed to support the industry through 2040.[31]

In addition to WTIVs, additional vessels are needed to support operations throughout the construction process, including heavy lift vessels and electric cable laying vessels. Such vessels are in short supply globally, and no U.S.-flagged vessel of this kind currently exists, requiring project developers to compete for access to the limited supply. These vessels are extremely expensive, must be purpose built, and require specialized training for workers, raising barriers to entry. Investments in vessel capacity simply will not happen in the face of significant market uncertainty.

RECOMMENDATION:

- **Congress should create an incentive program to support the domestic construction and deployment of wind turbine installation vessels and training for workers to crew the vessels.** This should include grants for domestic vessel construction and the development of workforce training programs, tax credits for domestic investments in infrastructure and facility construction, and financial assistance for workers enrolling in offshore wind-related workforce training programs.

Coastal Infrastructure

Another capital-intensive stage of the offshore wind industry is the preparation of ports and coastal manufacturing sites. Few sites across the East Coast have both deepwater port infrastructure and sufficient acreage to support the offshore wind construction process. In the mid-Atlantic, both the Port of Virginia and the Port of Baltimore have the advantage of meeting these requirements already—due in part to recent investments in port improvements and dredging—making them strong prospects to support projects all along the Atlantic Coast. In Virginia, the Hampton Roads region is well-positioned for mid-Atlantic project development, with access to commercial lease sites off the coasts of New Jersey, Delaware, Maryland, Virginia, and North Carolina within less than 24 hours at a speed of 10 knots, the limit required by the National Oceanic and Atmospheric Administration (NOAA) to protect the right whale.[32]

Roundtable participants expressed excitement about the opportunity to redevelop brownfields for new manufacturing and support facilities to serve the offshore wind industry. The port areas in Baltimore, MD, Norfolk, VA, and Wilmington, NC, all have sites already identified by their respective state agencies for remediation eligibility.[33]

The Infrastructure Investment and Jobs Act of 2021 (IIJA) invests more than $17 billion in port infrastruc-

ture and waterways through the U.S. Maritime Administration (MARAD). A similar program, or sub-designation within the program, could target specific improvements for offshore wind and leverage federal funding to support these port upgrades.[34]

RECOMMENDATION:

- **Congress should designate a portion of proceeds received from offshore area lease auctions to fund infrastructure upgrades at ports and other sites conducive to offshore wind component or input development, with particular emphasis on reclaiming brownfields.**

Demand Management

One area in which roundtable participants expressed concern was the alignment of supply and demand, and the ability of states and individual suppliers to manage the load over time. Currently, the MarWin, Kitty Hawk, and CVOW projects all expect to be completed within a few years of one another. Demand for construction and production of inputs and for workers will spike to match the projects' timelines, then fall to a period of relatively low demand once these projects are completed and before the next set of projects is approved. This cyclical volatility will create challenges throughout the offshore wind industry and the industries that support it as resources are invested up front to build up manufacturing and workforce capacity to meet demand, but could result in a surplus of unused capacity after only a few years. This cycle is different from other kinds of industries that are not as dependent on individual large projects, in which consistent demand over time can guarantee longer-term employment and return on investment.

Rather than waiting for additional local projects to be approved, participants suggested companies throughout the offshore wind supply chain should capitalize on the current opportunity to plan ahead and sequence the scaling of their operations to continue production and support projects elsewhere in the country or internationally when local demand is low.

WORKFORCE

The Current State of the U.S. And Mid-Atlantic Offshore Wind Workforce

Major skills needed throughout the industry include: manufacturing skills to fabricate and assemble components and materials; maritime construction, crew, and engineering skills; operations and maintenance; and project management.[35]

Many workers already possess key skills needed to succeed in these roles, either from other industries or within industries already serving end uses like offshore wind. For example, trades like steelworkers, elevator constructors, and offshore oil and gas workers all bring transferrable skills to the construction, maintenance, and interconnection of offshore wind turbines. At the same time, additional training needs remain, including special certifications for offshore wind installers and technicians. Workers may need to complete trainings through community colleges and/or union-led trainings and apprenticeships, or even (though generally to a lesser extent) university coursework to be fully prepared for work in the offshore wind industry.[36]

The Global Wind Energy Council projects more than 25,000 workers will require new training to support the U.S. offshore wind industry between 2021–25.[37] Separately, NREL estimates that a domestic offshore wind supply chain could create between 10,000–45,000 supplier jobs in addition to 10,000 direct manufacturing jobs by 2035.[38] Currently, 44 offshore-wind-energy focused programs exist in the United States, with various skills and certifications covered by each; to date, no comprehensive program exists yet to meet the full workforce demand of a project or the industry demand as a whole.[39]

In the Virginia Beach area, prospects abound for the offshore wind industry to recruit from an existing large, skilled pool of U.S. military veterans. At more than 16 percent of the local adult population, the Virginia Beach-Norfolk-Newport News area is home a higher percentage of veterans than any other metropolitan statistical area.[40] Veterans are often equipped with skills like safety awareness from working around dangerous equipment, decision-making and project or team management, and problem-solving skills. They may also have specialized technical, software, or equipment skills that can be applied to work in the offshore wind industry.[41]

Roundtable participants highlighted the importance of integrating workforce diversity and inclusivity as central to attracting and retaining talent. This could be in the form of specific outreach to workers in communities of color, as well as communities that have formerly been dependent on recently closed coastal manufacturing facilities. Participants also highlighted programs and paths to hiring for non-traditional workers, for example workers with General Educational Development (GED)

certificates, single parents, and formerly incarcerated workers.[42] Local labor and nonprofit organizations also highlighted the value of local hiring agreements, particularly those giving under-resourced applicants the opportunity to apply to open positions before they are posted publicly and offering existing workers the right of first refusal for jobs in transition.[43]

RECOMMENDATION:

- **In order to attract more diverse talent, businesses should partner with institutions that specialize in serving diverse populations, such as historically Black colleges and universities (HBCUs).** Companies hoping to recruit from underserved communities should consider their unique needs and address them proactively.

Energy Communities: Workforce in Transition

The growing U.S. offshore wind industry presents an opportunity for workers in the oil and gas industry to leverage applicable skills and expertise to new opportunities in offshore wind. Local workers, as well as workers from other regions traveling in to temporarily support projects, can seize on these opportunities—as seen in the construction of the Block Island Wind Farm, where offshore oil and gas workers from Louisiana supported construction in Rhode Island.[44] That said, it is important for state policymakers, developers, and other key actors to balance specific opportunities for local workers with the prospective need to play to local strengths and maximize the comparative advantage between states.

For example, the Siemens Gamesa blade finishing facility under construction in Virginia will have the capacity to serve the 2.6-GW CVOW project's needs, and following project completion will then have the capacity to serve other comparable projects along the Atlantic Coast. Given the need for this manufacturing to be located near facilities, near-term policy support should encourage geographic diversity among comparable facilities. In the mid-Atlantic, rather than incentivizing the construction of another blade finishing facility that would duplicate the capabilities of the Siemens Gamesa facility, regional policymakers should support the construction of facilities that can meet other supply chain needs like cable or rotor production.

RECOMMENDATION:

- **The Department of Labor should offer resources to workers in legacy fossil fuel communities, particularly communities formerly dependent on the oil and gas industry, to be able to take advantage of forthcoming opportunities in the offshore wind energy industry.** These resources should include funding and financial support for retraining and placement on offshore wind projects, as well as direct outreach to energy communities to educate them on what the new opportunities are and how to take advantage of them.

Making Offshore Wind Jobs "Good Jobs"

Many jobs to support the offshore wind industry offer workers opportunities for upward economic mobility. These jobs pay higher wages and have lower barriers to entry in comparison to many other industries.[45] Representatives from both companies and labor unions in the roundtable highlighted the benefits of building strong relationships between the two. They emphasized that companies with strong relationships with unions can leverage those union resources for recruiting and training workers; conversely, this presents a disadvantage for companies whose workers are not unionized.

Project developers and other companies, as well as communities, benefit when most of the workforce for a project is local. Companies can benefit from communities' local knowledge, while building good will and buy-in among communities as they staff projects. In turn, communities receive both direct and indirect economic benefits from working to build up the local industry.

Operations and maintenance can comprise around 25–35 percent of a project's lifetime costs, and provides long-term job opportunities, making it a powerful opportunity for local workers to realize the benefits of a local offshore wind industry.[46]

Role of Companies and Policy in Recruiting and Training Workers

Companies can attract and retain workers by supporting access to training and certifications, as well as providing services that support employees' ability to work, like onsite childcare and healthcare benefits. Participants in the roundtable—especially those working directly with workers in the community—highlighted that this kind

of wraparound support can wholly determine a worker's ability to participate fully in the workforce.

The state of Maryland offers grants of up to $400,000 (with funding for fiscal year 2023 totaling $800,000) to support new or existing workforce training centers for workers entering the offshore wind industry.[47] This kind of state-level funding can be transformative to getting new training initiatives off the ground.

RECOMMENDATION:

- **Congress and state governments should offer funding for workforce development relating to the offshore wind industry, to include retraining for skilled workers from other adjacent sectors, training and certification in the trades for new entrants to the field, and outreach to high school students and recent graduates on the opportunities in fields related to the offshore wind industry.** This support should include financial assistance and access to benefits for workers in transition, such as healthcare, childcare, and transportation to onsite trainings. Once workers are employed, employers should offer these benefits to retain workers.

INTEGRATING ENVIRONMENTAL PROTECTION AND COMMUNITY ENGAGEMENT

Offshore wind energy can have significant impacts on local ecosystems and communities, making early, proactive, comprehensive review and redress of potential impacts key to the responsible development of offshore wind. Responsible project design and early engagement with the local community are also crucial to creating buy-in among community members and can prevent significant opposition from both community and environmental groups down the line that could entirely obstruct a project.

Environmental Protection

The mid-Atlantic region has unique coastal and marine environmental features (e.g., coastal estuaries, migratory birds, and whale populations) that must be protected in the development of offshore wind. Migratory birds may be at particular risk based on the altitude of their flight, but additional research is needed to map these flight patterns. Endangered whale populations including the North Atlantic right whale and the sperm whale face risks not only from the habitat disturbance caused by installed projects, but also from the noise of construction and potential collisions with vessels.[48]

Participants from across sectors were aligned in support for environmental protections in the offshore wind development process. However, there was tension among viewpoints between the need to avoid the direct impacts from project construction and operation and the need for accelerated development to avoid the longer-term and catastrophic impacts of climate change on wildlife and local ecosystems.

Several groups and coalitions are working with developers to identify guidelines for responsible development of offshore wind, including the Audubon Society and the Responsible Offshore Development Alliance.[49] Additionally, NOAA Fisheries and BOEM are developing a draft joint strategy to "protect and promote the recovery of North Atlantic right whales while responsibly developing offshore wind energy," which includes: mitigation and decision support tools; research and monitoring; and strategies for collaboration, communication, and outreach.[50]

Currently, developers make voluntary commitments to the responsible development of offshore wind energy that are more stringent than federal standards. Each of these voluntary commitments is done on an individual basis, requiring individual review of each project proposal. However, state agencies could make these commitments mandatory to standardize the definition of responsible development and provide a path for individual developers to formalize their voluntary commitments. Doing so would level the playing field in the competitive bid process and create locally informed environmental standards for development. Additionally, it could reduce the administrative burden by shifting the emphasis from standard development to compliance.

Another barrier to comprehensive environmental protections is the necessity for constant data collection and monitoring, information sharing and transparency, and the development of baseline data for comparison and utilization in the permitting and development process. Impacts across geographically dispersed wildlife populations are difficult to judge at the project level, particularly for migratory species. This elevates the need for state and federal collaboration in designing these protections. Doing so can provide a more complete picture of impacts and to ensure their success in protecting wildlife populations.

Technology to monitor and protect wildlife is continuously improving, making it necessary for state and federal agencies to periodically review data collection and monitoring processes.

RECOMMENDATIONS:

- **The White House should direct federal agencies to establish a coordinated, standardized process for submitting documentation for all environmental review processes for the development of offshore wind projects that can complement FAST-41 coverage to reduce the administrative barriers to project approval.**
- **States and federal agencies should set minimum standards for environmentally responsible development.** State standards should reflect the local environmental context to expedite the permitting process while protecting vulnerable ecosystems and communities. States should also inform federal standards to ensure they reflect local environmental issues. Federal standards should account for population-wide impacts among migratory species and other ecosystems that transcend state boundaries.
- **Regulators should set performance standards based on target environmental protections and encourage innovation by allowing project developers and other actors throughout the supply chain to meet them by using the most cost-effective technology.**
- **Environmental requirements for project approvals should include monitoring to collect baseline data on impacts on wildlife and meaningful engagement with local communities, including specific emphasis on underserved and Native American communities.**

Community Engagement

In addition to robust environmental protections, early and active engagement with local communities about the potential impacts and opportunities from project development is essential to ensuring the responsible development of offshore wind projects.

Different phases of the project development process can produce different conditions for opposition or support among different communities; for example, some communities supportive of the project itself may be activated in opposition when they are chosen as the sites for onshore transmission lines. Outreach to communities and coalition building should cover all aspects of the project so communities can be informed throughout the process and prepared for all elements of the project.

Roundtable participants shared learnings from past, ongoing, and upcoming community engagement efforts. They agreed that a successful community engagement strategy should include a variety of approaches to engage different segments of the population, whether through digital means, in-person convenings and conversations, or direct mail; non-traditional communication channels like social gatherings can also help produce more meaningful, authentic, accessible engagement than written communications.

Demonstrable, good-faith collaboration between companies and grassroots organizations advocating for community interests can help build trust between them and the community, while ensuring community concerns are elevated and heard.

That said, to be truly effective and community-focused, any stakeholder engagement process must demonstrate that community concerns are heard. Developers must show communities how they have incorporated concerns raised throughout the process alongside their ultimate decisions.

RECOMMENDATION:

- **In addition to environmental impact assessments, permitting processes for transmission interconnection sites and new transmission lines should require project developers to implement stakeholder engagement processes that demonstrate meaningful engagement with the community and accountability following input-based decision making.**

Permitting and Transmission

The federal permitting process for offshore wind energy development is managed by DOI (via BOEM), which is responsible for ensuring coordination among other federal agencies and compliance with the National Environmental Policy Act (NEPA), as designated by the Energy Policy Act of 2005.[51] The full process can take as many as ten years (or even longer) from project conception to approval. While led by BOEM, other federal agencies like NOAA, as well as state-level agencies, require additional submissions and may operate on incongruous timelines. **Figure 4** shows the FAST-41 permitting dashboard for the CVOW Project, demonstrating the varying federal permitting processes and associated timelines and delays. At the state level, while some states consolidate all authority for offshore energy and transmission permitting into one agency, most operate through networks of state and local agencies that spread the permitting authority across agencies.[52] This decentralized decision-making

BOX 2: Dominion Energy's Stakeholder Engagement Process

As part of the process of building new transmission lines to connect the CVOW project to shore, Dominion Energy conducted a robust stakeholder engagement process with the communities of Hampton Roads. Over a period of two years, the company engaged more than 11,500 individuals through individual and small group meetings, topic-specific workshops and roundtables, and a digital platform. Project leaders actively sought input from business, chamber, and labor organizations; educational institutions; and community or cultural organizations. In the face of challenges to in-person communication posed by the COVID-19 pandemic, digital tools helped the company to collect precise information from community members and build trust by demonstrating good-faith engagement. In addition to surveying the community on siting decisions, the company worked to engage businesses and workers in the supply chain to create opportunities for productive partnerships.

Ultimately, the company identified a transmission route that would respect historically and culturally significant sites, while incorporating concerns from local communities and businesses. Additionally, the company identified and elevated local partners throughout the supply chain.

process can draw out the timeline for project approvals at both the state and federal level as developers work to comply with varying requirements.

Roundtable participants pointed to these processes as a major source of project delay, which in some cases can be prohibitive when compounded. They stressed the importance of agencies streamlining and/or coordinating the project approval process to prevent unnecessary and unproductive administrative delays. Some suggestions for achieving this included consolidating the submission requirements or bundling permitting processes to better coordinate timelines.

Transmission build-out is a necessary precursor to bringing offshore wind projects online and must be accomplished parallel to project design to prevent projects from becoming stranded. Yet permitting for transmission is undertaken separately from project permitting and involves additional actors that may cross state lines. As mentioned above, NREL's Atlantic Offshore Wind Transmission Study is exploring options to better coordinate transmission solutions along the entire Atlantic Coast, which will be central to supporting coordinated, long-term transmission planning that integrates future Mid-Atlantic projects and other projects along the East Coast.

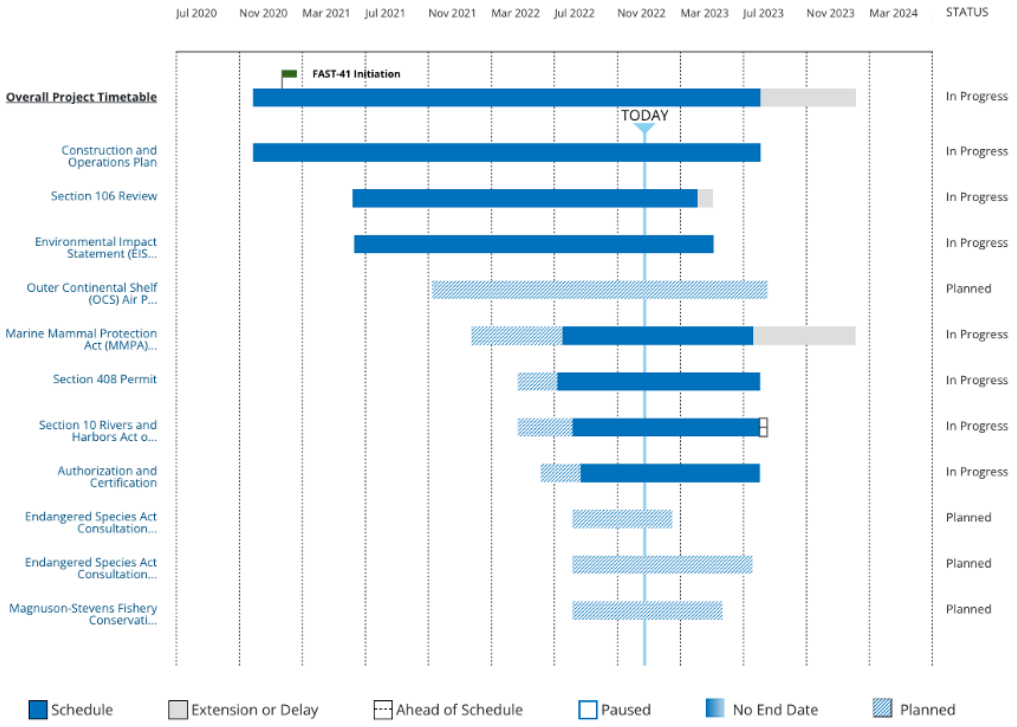
In the Virginia Beach region, myriad other marine uses for the surrounding ocean area—including military, commercial fishing, and shipping—provide challenges to building out transmission lines. Developers plan to integrate subsea power cables on top of existing telecommunications lines, which may help address some of the problem. However, there are additional challenges around the existence of shallow areas in port and potential conflicts with other marine rights of way.

Roundtable participants raised concerns that the nascent nature of the offshore wind industry in the United States makes it less likely that local administrators will have the necessary expertise to consider all of the relevant factors and solutions, without additional training. They called for increased local- and state-level administrative capacity and direct initiatives to boost local technical knowledge.

RECOMMENDATIONS:

- **BOEM, DOI, and DOE should jointly offer training and technical assistance for state and local regulators on offshore wind technology development, construction, maintenance, regulatory approaches, and environmental impact.**
- **States should conduct project development and related transmission upgrades/installation simultaneously to ensure they can utilize all the power from the offshore wind project once it is completed.**

FIGURE 4: CVOW Permitting Timetable



The project timetable for the CVOW project demonstrating progress through each of the major permitting and approval processes, current as of November 2022.

Source: Permitting Dashboard, "Coastal Virginia Offshore Wind Commercial Project," posted February 12, 2021, https://www.permits.performance.gov/permitting-project/coastal-virginia-offshore-wind-commercial-project.

CONCLUSION

The burgeoning American offshore wind industry holds tremendous promise for American companies and workers throughout the supply chain. Yet proactive, coordinated planning among states, as well as between states and the federal government, is necessary to ensure the regulatory system is prepared to evolve with the growing industry. A robust domestic supply chain and skilled workforce will be necessary to meet the needs of the existing and future project pipeline, and reliability in this project pipeline is key to underpinning the preparatory investments.

Virginia Beach, and broadly the mid-Atlantic region, has much to offer the domestic offshore wind industry: deepwater port space and a history of industrial manufacturing, a skilled workforce, and proximity to densely populated coastal communities who can use the electricity. With policy and targeted investment support, and cooperative interstate engagement, the region can help scale—and benefit—from the economic opportunity the offshore wind industry will create.

Additional Resources

Business Network for Offshore Wind: SupplyChain Connect Database
https://www.offshorewindus.org/supplychain/

FAST-41 Permitting Dashboard
https://www.permits.performance.gov/

C2ES Resources

Regional Roundtables
https://www.c2es.org/content/regional-roundtables/

Power Infrastructure Needs for Economywide Decarbonization
https://www.c2es.org/document/power-infrastructure-needs-for-economywide-decarbonization/

Getting to Zero: A U.S. Climate Agenda
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