FLOATING OFFSHORE WIND: Benefits & Challenges for Oregon

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2022 FLOATING OFFSHORE WIND STUDY

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EXECUTIVE SUMMARY

Oregon and surrounding states have aggressive economy-wide decarbonization and clean electricity policies. A consensus has emerged in recent technical literature that identifies core pathways required to achieve these policies, including continued investments in energy efficiency, electrifying end-uses in the transportation and building sectors, and developing a tremendous amount of new renewable generation. To achieve the mid-century policy goals of many states, including Oregon, these new clean energy resources will be built across a diverse region, with Oregon likely seeing tens of gigawatts of renewable projects within state borders.

Offshore Wind: An Overview

Offshore wind is a renewable energy technology being deployed in shallow waters across the world and is advancing into deeper waters by affixing wind turbine technology to floating platforms. This floating technology is necessary to develop offshore wind in the deep ocean waters along the southern Oregon and northern California coast, which have some of the strongest wind resources in the world. Technical modeling shows the potential to develop dozens of gigawatts of offshore wind in these areas, which could play a critical role in helping Oregon and the region achieve mid-century clean energy and decarbonization policies.

Floating Offshore Wind in Oregon: Potential Benefits

Immense Resource*.* Offshore wind is a significant resource that could help many states in the region meet their mid-century climate and clean energy goals, including Oregon.

Generation Resource Diversity*.* Offshore wind could play a critical role in helping the state achieve its clean energy goals, particularly because of its ability to complement other renewables during certain times of the year, like the winter months when solar is less available.

Offsets Land Use Impacts*.* Offshore wind could help the state's utilities deliver 100 percent clean and reliable power while offsetting the cumulative amount of land developed for new solar and onshore wind projects.

Power System Reliability*.* The addition of commercial-scale electricity generation projects offshore could improve the reliability of the state and regional grid.

Local Energy Resilience*.* The deployment of offshore wind projects could expand opportunities for additional community energy resilience projects along Oregon's coast.

Economic Development*.* The need for a skilled workforce to build and maintain floating offshore wind projects, and to develop supporting infrastructure and supply-chains, could support direct, indirect, and induced job development, especially in coastal communities where construction and maintenance activities would be based.

Floating Offshore Wind in Oregon: Potential Challenges

Concern About Effects to Coastal Communities, Existing Industries, the Environment, and Cultural Resources. A wide range of stakeholders have expressed concerns about potential adverse effects from offshore wind development and operations on existing ocean and land users (e.g., fishing, seafood, recreation and tourism industries, and military activities), coastal communities, the environment, and cultural resources, among others. Concerns extend into the siting and permitting processes not being adequate or timely to meaningfully address all potential adverse effects.

Siting and Permitting Conflicts and Complexity. There are complex siting and permitting challenges associated with locating large-scale wind projects in Oregon's deep ocean waters that involve lengthy processes to address. A complex system of federal, state, and local rules and regulations are in place to evaluate and address potential adverse effects on current ocean and land users, the marine environment, and cultural resources. Conflicts and trade-offs are yet unquantified.

Technology Readiness. While large-scale commercial projects are being planned, floating offshore wind has yet to be deployed at gigawatt scales. To deploy offshore wind in the deep ocean waters adjacent to Oregon, mature wind turbine technology must be paired with new types of floating platforms based on concepts that have successfully been used in the offshore oil and gas industry.

Port Infrastructure. Investing in substantial upgrades to a coastal deep-water port in Oregon is a prerequisite to unlocking the full economic development potential associated with deploying wind projects off Oregon's coast. The required upgrades may take several years but would improve the port's capability to manufacture floating platforms, integrate turbines into the platforms, and tow out larger turbines to their ocean locations.

Transmission Grid. Substantial upgrades to the onshore coastal electric transmission grid would likely be required to develop offshore wind at-scale due to current grid limitations.

Power Offtake Agreements. Attracting the capital investment necessary to upgrade port and grid infrastructure – and developing the offshore wind projects themselves – likely requires commitments to develop projects at the gigawatt-scale. This scale outstrips the near-term energy need of a single utility in most cases, and likely requires a consortium of buyers to collaborate on cooperative power offtake agreements—potentially including out-of-state utilities or large industrial customers.

Study and Report Structure

As directed in HB 3375 (2021), this report provides a summary of important information, key findings, and recommendations for future study and engagement related to the benefits and challenges of integrating up to 3 GW of floating offshore wind into Oregon's electric grid by 2030. The report reflects a synthesis of information by Oregon Department of Energy staff from their review of the existing literature, their broader understanding of the power sector and its long-term needs, their consultation with other state, regional, and national entities with relevant expertise, and from the direct feedback received from stakeholders throughout 2022. As part of this study, ODOE convened a diverse group of stakeholders to discuss these issues. The materials shared and full recordings of those meetings are available online.

Need for Further Study, Engagement, and Collaboration

There was broad support for more information and studies across many topics to fully understand and add clarity on the potential value and trade-offs of developing offshore wind in Oregon. A common theme emerged around an interest in increased regional and local collaboration to balance the potential benefits and challenges.

The complete 2022 Floating Offshore Wind Study is available online:
https://www.oregon.gov/energy/energy-oregon/Pages/fosw.aspx

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Cover Image: Scottish Government | (CC BY 2.0)
A floating wind turbine off Goto Island visited by Culture Secretary Fiona Hyslop.

INTRODUCTION

Offshore wind is a renewable energy technology that generates electricity from wind turbines in an open water environment. Offshore wind has several advantages over other renewable resources, including higher capacity factors resulting from a more consistent wind resource and its unique location at the western edge of the power grid. Developing offshore wind projects off the coast of Oregon, however, faces significant challenges — including high initial capital costs, significant upgrades to onshore transmission lines to connect to the grid and deliver energy to customers, likely requirements for significant port upgrades and supply-chain development – particularly for floating platforms, and strong concerns around the potential effects on marine ecosystems and existing coastal industries, such as fisheries, recreation, and tourism. There are also potential benefits from developing offshore wind resources, including significant new economic development in coastal communities and strengthened community energy resilience, in addition to helping reduce Oregon's greenhouse gas emissions and achieve the state's clean electricity goals.

This report provides an overview of the potential for offshore wind development in Oregon, including information about energy-related benefits and challenges as well as economic, environmental, and conflicting use information that ODOE received from subject matter experts and other study participants, including Oregon state agencies, ocean fishing industry representatives, and coastal communities. To better understand the effects on reliability, state renewable energy goals, jobs, equity, and resilience from integrating offshore wind into Oregon's electric grid, ODOE conducted a literature review of studies and technical analyses to share this expertise and inform policy and stakeholder discussions. The agency also held four public meetings to gather information from other state, regional, and national entities,[i] energy experts, stakeholders from various industries (e.g., fishing, shipping, offshore wind), and local communities on the benefits, challenges, and concerns around the development of up to 3 gigawatts[ii] of offshore wind adjacent to Oregon's coast. While the agency's literature review found a great deal of information on the topic, it is important to note that because commercial-scale floating offshore wind projects have not yet been deployed along the west coast or elsewhere in the world,[iii] more analysis and assessment is needed across many topics to fully understand the potential value and trade-offs the development of offshore wind would have for Oregon communities and achieving state goals.

The key findings identified in this report characterize the primary benefits and challenges of integrating up to 3 GW of floating offshore wind into

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[i] See page 3 for a list of entities HB 3375 directed ODOE to consult with.

[ii] 1 gigawatt (GW) = 1,000 megawatts (MW). For example, the nameplate capacity of the Bonneville Hydropower Dam is 1.2 GW (1,200 MW). Nameplate capacity indicates the maximum amount of electricity a resource is technically capable of generating at a single point in time.

[iii] "*Globally, the development of a floating offshore wind energy market continues to emerge as experience and knowledge are gained from pilot projects in Europe, Asia, and North America. This pilot- and demonstration-focused phase, which should see most projects enter operation by 2023–2024, is expected to inform the development of cost-effective, commercial-scale projects that may be installed as early as 2025*." Offshore Wind Market Report: 2021 Edition, U.S. Department of Energy, pg. 48.

Oregon's electric grid by 2030. The report focuses on areas where there are actionable items that could be addressed. The agency acknowledges that there were questions and topics raised by stakeholders in some circumstances that ODOE cannot answer. Where possible, this report strives to share information on when and where these questions could be addressed, such as siting and permitting processes or utility energy planning processes.

This report is intended to provide a high-level overview to Oregon's Legislature of important information, key findings, and recommendations on future study and engagement related to the benefits and challenges of integrating up to 3 GW of floating offshore wind into Oregon's electric grid by 2030.

STUDY BACKGROUND

In 2021 the Legislature passed HB 3375, which recognized the tremendous opportunity for Oregon to participate in the growing global offshore wind industry, and the potential for the resource to help achieve the state's decarbonization objectives. The bill highlights the current opportunity for Oregon to participate in floating offshore wind (FOSW) planning activities that are advancing along the West Coast to ensure Oregon can make informed choices about its involvement and guidance on offshore wind development over the next decade, and position itself for any potential market expansion beyond 2030.

The Legislature also recognized, in legislative findings, that the development of offshore wind has the potential to affect Oregon's fishing communities, ocean and shore-side recreational users, Tribes, ports, coastal ecosystems, natural resources, the maritime sector, disaster recovery planning, workforce development, and electricity ratepayers. While some of these issues are beyond the scope of this study and ODOE's expertise, the agency acknowledges the importance of raising them and that further information may be necessary to ensure policymakers can make educated choices about energy development in Oregon.

HB 3375 includes a legislative finding and declaration of a state goal to plan for the development of up to 3 GW of FOSW within the federal waters off the Oregon coast by 2030 – and for planning to be conducted in a manner that will maximize benefits while minimizing conflicts between FOSW, the ocean ecosystem, and ocean users. It is important to note that the state goal to plan for FOSW development is not a deployment target and does not mandate or incentivize the procurement of FOSW by Oregon utilities. ODOE also does not consider this state goal to plan for up to 3 GW as a "floor" or "ceiling" to potential FOSW development off Oregon's coast over the near or long-term. Rather, ODOE considers this bill as legislative guidance for Oregon's state agencies to constructively participate in state and federal processes relating to planning for the development of floating offshore wind.

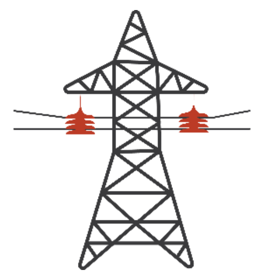
HB 3375 directed the Oregon Department of Energy to study the benefits and challenges of integrating up to 3 GW of FOSW into the Oregon power grid by 2030, and to provide the legislature with a report summarizing its key findings, including opportunities for future study and engagement. The bill expressly required ODOE to identify the effects of offshore wind on reliability, state renewable energy goals, jobs, equity, and resilience.

The bill directed ODOE to conduct a review of existing literature; to gather input and feedback from appropriate state, regional, and national entities, the public, and interested stakeholders; and to hold at least two public meetings. With respect to gathering input from appropriate state, regional, and national entities, the bill specifically listed, but did not limit this group to, the following organizations:

- Oregon Department of Land Conservation and Development
- Oregon Business Development Department
- Oregon Department of Fish and Wildlife
- Oregon Public Utility Commission
- Northwest Power and Conservation Council
- Bonneville Power Administration
- Bureau of Ocean Energy Management
- National Renewable Energy Laboratory
- Pacific Northwest National Laboratory
- United States Department of Defense

STUDY SCOPE AND PROCESS

Literature Review and Information Sharing



As required in the bill, ODOE conducted a literature review of existing studies and reports that could inform discussion around the benefits and challenges to developing up to 3 GW of offshore wind. The 3 GW specification in the bill guided ODOE to focus on the benefits and challenges of deploying gigawatt-scale FOSW projects off Oregon's coast and integrating this power into Oregon's grid. The agency focused on literature that was relevant to electricity system reliability, state renewable energy goals, jobs, energy resilience, and equity, which were expressly identified in HB 3375. ODOE also focused its scope on frequently cited and recent studies and reports related to the energy sector that reported relevant quantitative and/or qualitative findings.

ODOE provided a list of the literature used on its study webpage and provided a summary of example sources during the study's first public meeting in January 2022. The agency requested input on sources of literature and provided an online comment portal to receive feedback. Although the agency could not review every study that might have information relevant to offshore wind, the studies reviewed covered the required reporting elements and provided information that grounded discussions and served as helpful resources for stakeholders and ODOE to frame key questions that are explored in this study.

The agency used the literature review process to identify nine key topics that were used to focus information gathering and stakeholder discussions. ODOE staff developed a series of prompting questions around these key topics to help solicit targeted input and feedback, and to structure public meeting agendas.

The key topics used to develop the prompting questions and facilitate stakeholder discussions were:

- 100 Percent Clean Energy Targets
- Economic Development
- Equity
- Reliability and Resilience for Coastal, State, and Regional Power Systems
- Siting and Permitting (Focused on Potential Impacts to Ocean Users and Environment)
- Technologies and Costs
- Port Infrastructure and Sea Vessels
- Transmission Infrastructure
- Offtakers and Energy Markets

External Outreach and Engagement

Throughout the course of the study, ODOE aimed to conduct inclusive outreach and engagement with Tribes, state and federal agencies, local governments, environmental organizations, ocean and fishing organizations, labor organizations, Oregon utilities, elected officials, developers, and others. Initial engagement was conducted through discussions with known interested parties, including organizations and individuals:

- Listed in the HB 3375 study directive;
- That provided testimony during the HB 3375 legislative committee hearings; and
- Who engaged with the Bureau of Ocean Energy Management's Oregon Intergovernmental Task Force on offshore wind.

ODOE conducted extensive and inclusive public outreach and engagement throughout the course of this study.

The agency sent individual letters to each chair of the nine federally recognized Tribes in Oregon to find out if there was interest in providing separate input or meeting about this study. ODOE staff met with two Tribes about this study and generally about floating offshore wind, while keeping tribal staff apprised of the status of this study through Legislative Commission on Indian Services and Tribal/State staff cluster meetings.

The agency used its newsletter distribution list, blog, and social media channels to share information on the study and public meetings. Ongoing notifications and information were shared via email communications to the study distribution list, the agency's study webpage, an online portal for submitting comments and answers to the prompting questions, and through four public meetings. The study webpage included a sign-up feature that allowed anyone from the public to add their name or the entity they represented to the study distribution list.

ODOE held four public meetings. The first three meetings were held online with a focus on the key topics and feedback received from the prompting questions. The final meeting was held in person in North Bend (Coos Bay area) with an option to attend remotely, and focused on the initial findings of the report. On its study webpage, ODOE provided the draft of the literature review, prompting questions, online comment portal, agendas and materials for public meetings, recordings of public meetings, written comments received, and an overview of the study's key findings.

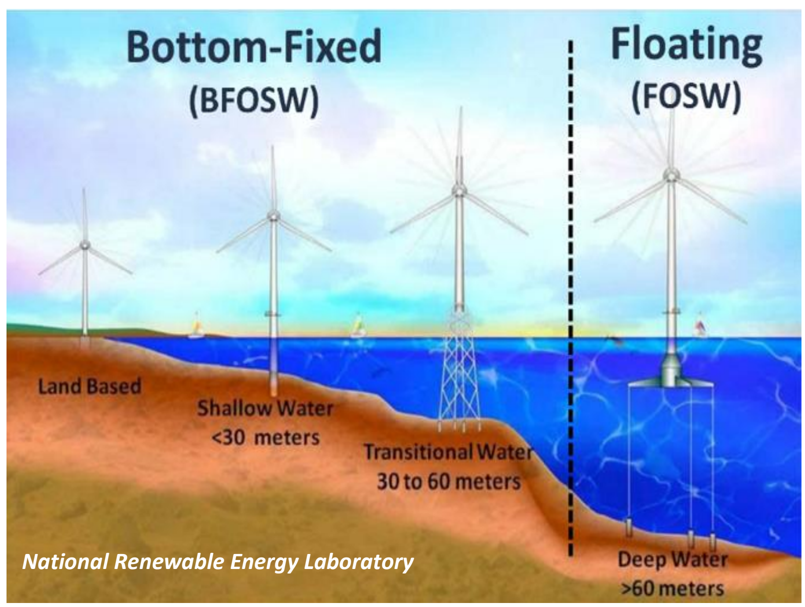
The development of large-scale projects like offshore wind farms—and the transmission and port infrastructure necessary to support them—could be transformational to Oregon and will have the greatest direct impact on those affected by their construction and operation. Further, projects may have implications for Oregon's environment and wildlife, which are a cherished part of the state's natural resources. The agency received input from a diverse group of stakeholders about their interests, questions, concerns, and recommended actions regarding offshore wind development. The Oregon Department of Energy thanks these interested parties for their time, expertise, and openness. For a tabular index of all written comments submitted, see ODOE's online comment portal for this study.

FLOATING OFFSHORE WIND OVERVIEW

The timing of Oregon HB 3375 and HB 2021 coincide with expanding efforts to increase clean energy across the world. As jurisdictions have increased commitments to reducing GHG emissions, and as certain jurisdictions have identified constraints to deploying vast scales of land-based wind and solar, markets for offshore wind have increased: total global installed capacity has gone from 3 GW in 2010 to 57 GW in 2021, which is nearly all bottom-fixed offshore wind with only 0.1 GW of floating offshore wind (see Table 1).[1]

Technology

The power components of offshore wind projects are effectively the same technology as onshore wind projects that are commonly seen in parts of Oregon, consisting of large turbines affixed to towers that are propelled by the wind. The marine environment creates additional structural challenges for offshore wind turbines, as they must withstand the effects of the saltwater environment, the stronger winds that blow offshore, and the effects of ocean waves and currents. Broadly, there are two types of designs for offshore wind projects: bottom-fixed offshore wind and floating offshore wind.



Bottom-Fixed Technology. Bottom-Fixed Offshore Wind projects anchor wind towers directly to the seafloor—similar to how onshore wind towers are fixed directly to land—and are capable of being deployed in shallow water depths less than 60 meters. Nearly all the world's operational offshore wind capacity consists of bottom-fixed projects in shallow waters. In the U.S., commercial-scale projects are under development, and while only two pilot-scale bottom-fixed offshore wind projects are currently operating, the Block Island Wind Farm (30 MW) and the Coastal Virginia Offshore Wind pilot project (12 MW), dozens of gigawatts are in the planning pipeline for domestic offshore wind.[2]

Floating Technology. Floating Offshore Wind is an emerging design that combines existing wind turbine technology with new floating platform technology that is conceptually based on floating platforms used for some offshore oil and gas extraction rigs. FOSW projects affix wind towers to floating platforms that are anchored to seafloors with mooring lines; they are capable of being deployed in waters deeper than 60 meters. The FOSW industry is currently exiting the pilot and demonstration phase and entering the pre-commercial phase globally. To date, there are fewer than a dozen pilot-scale FOSW projects in operation, with the largest sized at 50 MW and a total cumulative global deployment of approximately 125 MW, with another 125 MW under construction.[3]

The first pilot-scale FOSW project in the U.S. will be a single, 12 MW turbine off the coast of Maine that is expected to be operational by 2023. The second pilot-scale FOSW project in the U.S. will be another single turbine (10 MW) project off the coast of Massachusetts.[4] Demonstration projects can increase confidence in technologies and provide useful information that can lead to design improvements that help reduce the cost of offshore wind energy and the effects on ocean users and the environment.[5] Because of the significant water depths off the Oregon coast, offshore wind resources would require the floating design.

Table 1: Comparison of Global Installed Capacity of Land-Based, Bottom-Fixed, and Floating Offshore Wind[6]

Types of Wind	New Capacity Added in 2020	New Capacity Added in 2021	Cumulative Global Capacity as of 2021
Land-Based	~87 GW	~73 GW	~780 GW
Bottom-Fixed Offshore	~6 GW	~21 GW	~57 GW Most in N. Europe, 0.042 in U.S.
Floating Offshore	~0.025 GW	~0.057 GW	~0.123 GW Single Largest Project = 50 MW

Planning for FOSW project development is growing rapidly, though the development of planned projects remains uncertain. The cumulative capacity of FOSW in the global planning pipeline[iv] for potential development, as shown in Figure 1, has increased from 7 GW in 2019 to more than 26 GW of FOSW in 2020, and more than 60 GW in 2021.[7] As of 2022, as shown in Figure 2, the total global capacity of announced projects with commercial operation dates is currently roughly 8.4 GW, with 125 MW under construction and another 40 MW reaching financial close.[8] According to USDOE's Offshore Wind Market Report, there are expectations that the first commercial-scale FOSW projects in the U.S. will be deployed in Maine and California (not shown in snapshot below).[9]

[iv] The total pipeline numbers track early-stage planning through project operation and decommissioning, and include commercial-scale projects to meet global FOSW commitments. Notably, not all projects in the total pipeline will get built.

Figure 1: Cumulative Capacity of Floating Offshore Wind in the Global Planning Pipeline[10]

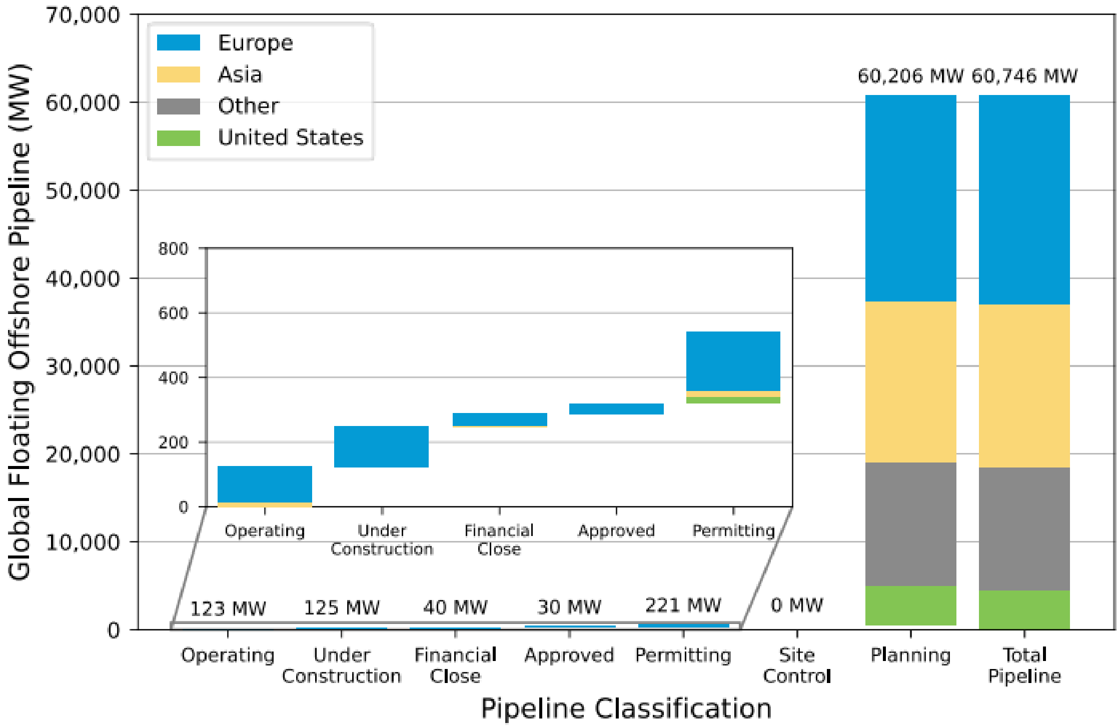
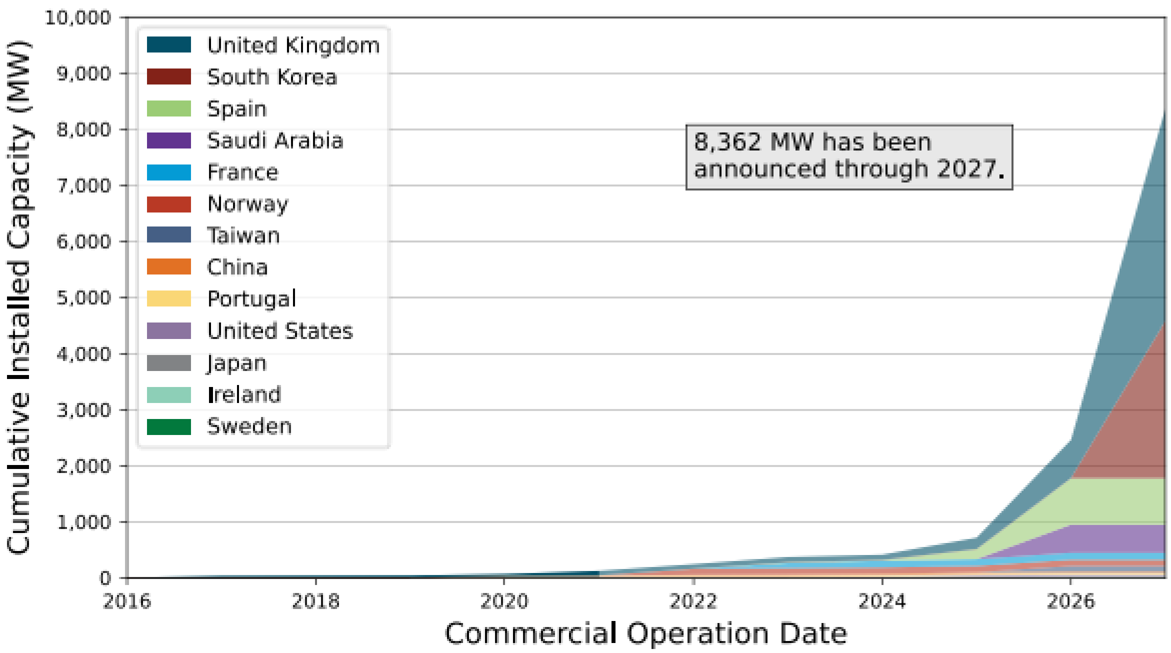


Figure 2: Total Global Capacity of Announced Floating Offshore Wind Projects and Operation Dates[11]



Oregon's Key Clean Energy Policies

While HB 3375 included legislative findings that set a state goal to plan for the development of up to 3 GW of floating offshore wind within federal waters off the Oregon coast by 2030, the state's GHG reduction goals and clean electricity policies are the most significant drivers affecting if and when FOSW projects could serve Oregon customers.

Oregon Clean Energy and Climate Policies

Executive Order 20-04 and HB 2021 are two key elements of Oregon's clean energy and climate policies. Both policies, particularly when combined, commit Oregon to deep decarbonization of the state's economy by mid-century:

> **Executive Order 20-04 (2020): Directing State Agencies to Take Actions to Reduce and Regulate Greenhouse Gas Emissions**
> One of the most consequential outcomes of EO 20-04 has been the establishment of the Climate Protection Program by the Oregon Department of Environmental Quality. The CPP is a regulatory program designed to dramatically reduce economy-wide greenhouse gas emissions through a cap on emissions from fossil fuels used in the state, with an interim target of a 50 percent reduction by 2035 and a 90 percent reduction by 2050.
>
> **House Bill 2021 (2021): 100 Percent Clean Electricity**
> The most relevant element of this law for purposes of this report is the 100 percent clean electricity standard. The law requires Oregon's largest retail electricity providers to eliminate greenhouse gas emissions associated with electricity serving Oregon consumers by 2040, with interim targets of an 80 percent reduction from baseline levels by 2030 and a 90 percent reduction by 2035.

There is a growing consensus in the technical literature that achieving deep GHG reductions by mid-century will require the deployment of new clean electricity generating technologies at an unprecedented scale, in addition to continued investments in energy efficiency, electrification of many end-uses that currently use fossil fuels (e.g., transportation), and the development of low-carbon fuels – like renewable hydrogen – for sectors that are harder to electrify. For example, a recent technical study[12] projected that 80 GW of new solar and wind capacity is needed to meet the Pacific Northwest's collective GHG reduction goals by 2050, which is roughly eight times the amount of solar and wind the region has added over the past 20 years.[13]

Achieving these aggressive policy targets will require Oregon and the region to develop energy resource portfolios that can deliver clean energy to meet customer demand during each of the 8,760 hours of every year. While solar resources are increasingly cost-effective, they face practical challenges to delivering energy at certain times, like in the overnight hours and through the winter months. As a result, a diverse portfolio of clean energy resources – including resources that complement solar, like offshore wind – will be required to cost-effectively achieve state and regional clean energy and climate policy objectives.

The health, economic, and environmental effects of climate change disproportionately affect Oregon's underserved communities, including low-income communities, rural communities, coastal communities, communities of color, children, and the elderly. Air pollutants emitted from fossil-based energy generation have similar disproportionate effects on underserved communities. The renewable energy generated by FOSW is another option to help replace fossil-fuel energy, thereby reducing regional air pollutants and addressing the inequitable burdens of air pollution. At the same time, this energy transition should not create additional burdens for these communities or create new inequities — it is inherent upon policymakers and regulators to ensure that choices and trade-offs made to achieve the goals are done so with the intention of balancing the social, environmental, and economic costs in an equitable manner, informed by sound data and the input of those most directly affected by particular choices.

The clean energy transition should not create additional burdens to underserved communities.

FOSW Development Process and Roles

Offshore Wind Projects in Federal Waters – Federal Authorities and Roles

Offshore wind projects can be located in federal or state waters. To date, Oregon has asked the offshore wind industry to focus on federal waters adjacent to Oregon's coast. Federal waters begin where Oregon's Territorial Sea ends (state waters end three nautical miles from the western most point of land) and extends out to 200 nautical miles. Oregon's policy preference to consider federal waters is in part based on perception of increased conflicts closer to shore, including viewsheds, fisheries/navigational conflicts, and other recreational uses. Additionally, because there is limited technical resource capacity potential for offshore wind at shallow ocean depths of 60 meters or less, the depth that significantly overlaps with the state waters of Oregon's territorial sea, it is unlikely an offshore wind project would be proposed within Oregon's state jurisdiction.

Federal Bureau of Ocean Energy Management (U.S. Department of Interior)

BOEM is responsible for the leasing of ocean areas in federal waters and is the lead agency for siting and permitting potential FOSW projects sited off Oregon's coast. BOEM's mission is to facilitate the responsible development of renewable energy resources on the Outer Continental Shelf through conscientious planning, stakeholder engagement, comprehensive environmental analysis, and sound technical review.

The Energy Policy Act of 2005 authorized the development of regulations for the Outer Continental Shelf Renewable Energy Program. This regulatory framework provides a process for issuing leases, easements, and rights-of-way for offshore wind projects, which require environmental review and significant site-specific research prior to the siting of offshore facilities. Each project is subject to a review under the National Environmental Policy Act as well as consultations with the National Marine Fisheries Service and the U. S. Fish and Wildlife Service under the Endangered Species Act and the Magnuson-Stevens Act. Tribal consultation is also conducted under Section 106 of the National Historic Preservation Act. In addition to multiple levels of review, BOEM develops, funds, and manages a rigorous scientific research program. See the Siting and Permitting section on page 35 under Key Challenges for more on BOEM's activities in Oregon.

At the highest-level, BOEM's leasing, siting, and permitting process for federal waters adjacent to Oregon consists of the following general steps:

1. BOEM-State Intergovernmental Task Force by state request (Preliminary planning & analysis)
    a. *Key BOEM Actions* - Collaborate with local/state/federal/tribal entities, while also engaging with the public, developers, and other interested affected parties to inform identification of Call Areas based on the best available data and information.
2. Identification of Call Areas (Large ocean areas)
    a. *Key BOEM Action* - Request for Information on Call Areas, including nominations of interest for leasing.
3. Identification of Wind Energy Areas (Smaller ocean areas with potential for multiple projects)
    a. *Key BOEM Action* - NEPA Environmental Assessments for Wind Energy Areas
    b. *Key State Action* - Federal consistency review of BOEM's NEPA EA for Wind Energy Areas and site assessment activities under authority of the Coastal Zone Management Act and Oregon's Coastal Management Program (*see next page for more information*).
4. BOEM Auction and Issuance of Leases to Developers for Lease Areas (Smaller portions of Wind Energy Areas for specific projects)
5. Site Assessment Plans and Site Characterization Activities by Developers
    a. *Key BOEM Action* – BOEM review of developer's Site Assessment Plans.
6. Construction and Operations Plans by FOSW Developers & BOEM Review
    a. *Key BOEM Action* – BOEM review of Construction and Operations Plans, including NEPA Environmental Impact Statements with assessment of potential cumulative impacts of past, present, and reasonably foreseeable future activities.
    b. *Key State Action* - Federal consistency review of Construction and Operations Plans under authority of the CZMA and OCMP (*see next page for more information*).

National Oceanic and Atmospheric Administration – National Marine Fisheries Service

BOEM consults with NMFS and other federal agencies to meet the requirements of the Endangered Species Act, the Magnuson-Stevens Act, Marine Mammal Protection Act, and Fish and Wildlife Coordination Act. NMFS is focused on minimizing the effects on ocean resources, critical habitats, and fishing opportunities throughout the planning, siting, and development stages – and helps supports responsible development by:

- Providing baseline data and analysis on ocean conditions and affected marine resources.
- Helping federal agencies that conduct wind development activities meet requirements. under the National Environmental Policy Act.
- Conducting research and monitoring to better understand the potential effects of offshore wind energy development on fish, shellfish, fisheries, protected resources, and their ecosystems.
- Providing BOEM, other federal agencies, states, tribes, and stakeholders with information on fisheries operations and the potential socioeconomic impacts of offshore wind projects on fishing communities.

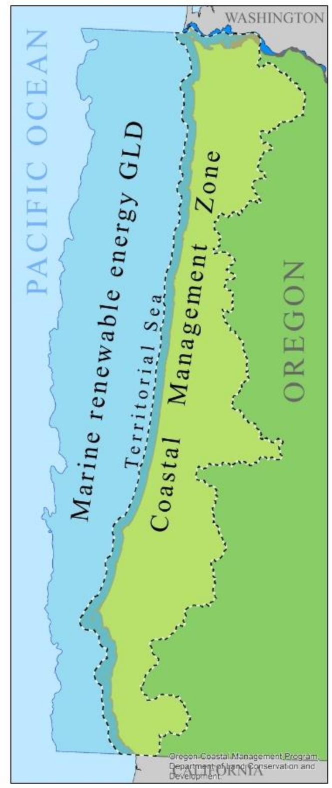
Pacific Fishery Management Council

The Pacific Fishery Management Council is one of eight regional fishery management councils established by Magnuson-Stevens Fishery Conservation and Management Act and recommends fishery management measures to the regulatory agency, NMFS, for the Federal waters off

Washington, Oregon, and California. Advisory bodies, comprised of stakeholders including representatives of environmental, commercial, and recreational fishing interests inform Council decision-making. Federal agencies that are taking actions that may affect fisheries or fisheries resources are encouraged to inform and or engage with PFMC on those issues; PFMC provides comment letters as appropriate during open public comments on a variety of those activities, including offshore wind development. Federally recognized west coast Tribes have a seat at the Council and contribute to decision-making; these Tribes retain strong spiritual and cultural ties to salmon, steelhead, halibut, whiting, sturgeon, lamprey, and many other aquatic species based on thousands of years of use for tribal religious/cultural ceremonies, subsistence, and commerce.

Oregon Coastal Management Program - Federal Consistency Review

Under the Coastal Zone Management Act, federally approved state coastal programs have the authority to review federal activities that may affect coastal Oregon resources and uses for consistency with state enforceable policies. The Oregon Department of Land Conservation and Development is the lead state agency for these reviews. The Oregon Coastal Management Program within DLCD would coordinate with other local, state, and federal agencies and consult with Tribal nations in the review of any BOEM-proposed actions within an area described as the Marine Renewable Energy Geographic Location Description, which covers the ocean areas of the Outer Continental Shelf between the western edge of the state's territorial sea and the 500-fathom depth contour – an area that generally overlaps with the ocean areas BOEM could lease for the potential development of FOSW projects.



At the conclusion of the review, the OCMP can concur that the activity is consistent, concur with conditions, or object on the grounds that the activity is inconsistent with the state's enforceable policies. If a review of a federally permitted project results in an objection, the federal agency will not issue the permit to the applicant. The applicant may appeal an objection to the U.S. Secretary of Commerce.

The OCMP consists of a network of 40 local and 11 state agency partners with authority in the coastal zone and enforceable policies to be used in federal consistency review. There are seven oceanfront counties and 33 cities in the Coastal Zone. They coordinate with each other to assist local governments, enforce state regulations, and carry out programs and state laws to protect coastal resources. The state agencies that make up the OCMP are listed below:[14]

- Oregon Department of Fish and Wildlife
- Oregon Department of State Lands
- Oregon Parks and Recreation Department
- Oregon Watershed Enhancement Board
- Oregon Department of Environmental Quality
- Oregon Water Resources Department
- Oregon Department of Geology and Mineral Industries
- Oregon Department of Agriculture

- Oregon Department of Forestry
- Oregon Department of Energy (as staff for the Energy Facility Siting Council)

Although tribal nations within Oregon's coastal zone are not networked partners with the OCMP, OCMP recognizes and respects that Oregon tribal nations are each separate and sovereign nations with deep cultural and historical connections to the Oregon Coast. OCMP currently uses the broader DLCD government-to-government consultation policy to consult with Tribal nations during federal consistency reviews. The Tribal nations within the coastal zone include: Confederated Tribes of Coos, Lower Umpqua and Siuslaw, Confederated Tribes of Grand Ronde, Confederated Tribes of Siletz Indians, Cow Creek Band of Umpqua Tribe of Indians, Coquille Indian Tribe.[15]

DLCD, through coordination with local, state, and federal agencies, and in consultation with Tribal nations within the Coastal Zone, leads analyses of the potential direct and indirect impacts—including consideration of cumulative and secondary impacts that have reasonably foreseeable effects on coastal resources or uses. Coastal effects cover five major categories: natural resources, cultural resources, coastal economies, aesthetics, and recreation/public access.

Development in State Waters and Onshore to Support Offshore Wind – Authorities and Roles

FOSW projects would also require the development of offshore transmission infrastructure that crosses state waters, the development of port infrastructure necessary to build and deploy FOSW projects, and onshore transmission infrastructure necessary to interconnect FOSW to Oregon's onshore grid. Each of these infrastructure projects are essential for FOSW development and would also require permitting reviews from a variety of tribal, local, state, and federal authorities.

Federal consistency review also applies to development activities within state waters, such as subsea transmission cable routing and onshore connection infrastructure. Any alterations to Oregon shoreline, estuaries, wetlands, or navigation channels to facilitate the deployment of FOSW projects would also be subject to Federal Consistency review (discussed above).

Statewide Planning Goals

Ocean and coastal planning by Oregon's state agencies follows the policies and objectives of the following statewide planning goals: Goal 19 - Ocean Resources, Goal 18 - Beaches and Dunes, Goal 17 - Coastal Shorelands, and Goal 16 - Estuarine Resources.

Oregon Territorial Sea Plan

The Oregon Territorial Sea Plan establishes the framework for state and federal agencies, as well as local governments and others, to manage ocean resources and activities through a comprehensive, coordinated, and balanced process. Part Five of the Plan describes the process Oregon uses for making decisions concerning the development of renewable energy facilities in the territorial sea (i.e., state waters within three nautical miles from shore), and includes the enforceable policies that will be applied to offshore wind energy development. Part Five also states Oregon's preference to develop marine renewable energy through a precautionary approach that supports the use of pilot projects and phased development in the initial states of commercial development. Part Four of the Plan guides the siting and review of subsea cables that cross the territorial sea and land on Oregon's shores. House Bill 2603, passed in the 2021 legislative session, initiated a review of Part Four, with recommended amendments being due in June of 2023.

Oregon's Department of State Lands has primary jurisdiction for leasing land within state waters, such as offshore transmission cables or other related infrastructure for FOSW. Oregon's Parks and Recreation Department OPRD has primary jurisdiction for cables or conduits crossing Oregon's shoreline, as well as any development in Oregon's numerous coastal State Parks.

Oregon's Precautionary Principle for Development in State Waters
Oregon prefers to develop renewable energy through a precautionary approach that supports the use of pilot projects and phased development in the initial stages of commercial development. – Territorial Sea Plan Part Five, pg. 1

Ocean Policy Advisory Council

The state legislature created the Ocean Policy Advisory Council, with members representing cities, counties, and ports, as well as recreation, fishing, and environmental and conservation interests. OPAC advises state agencies, the legislature, and the Governor's Office on ocean policy.

Oregon Energy Facility Siting Council

Oregon EFSC would not have jurisdiction over a FOSW project or offshore transmission lines but could have jurisdiction over onshore transmission infrastructure. Unless they qualify for an exclusion, lines over 10 miles in length with a capacity of 230 kilovolts or more, to be constructed in more than one city or county, require a site certificate from EFSC.

Figure 3: Federal, State, and Local Jurisdictional Authorities for Siting and Permitting

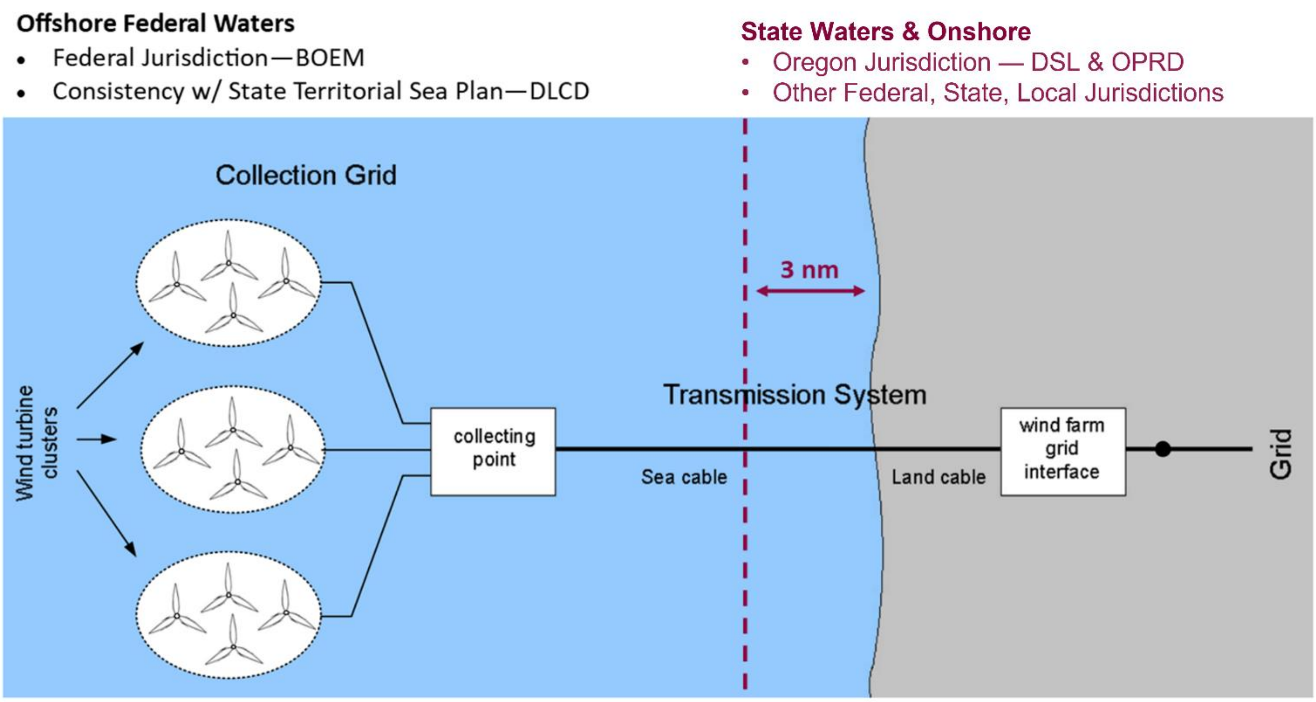


Figure modified from original: https://www.researchgate.net/publication/282779426

Utility Energy Planning in Oregon – Authorities and Roles

The development of new large-scale energy projects offshore or within Oregon is primarily driven by utility energy planning. Utilities across the region develop individualized plans to address their own energy needs. Utilities are either investor-owned or consumer-owned. Energy planning by utilities serving Oregon or non-Oregon customers can lead to new resources being built in Oregon and the federal waters adjacent to Oregon.

Oregon Public Utility Commission

Investor-owned utilities account for growth in customer demand and assess the ability of existing and new energy projects to meet demand in public planning processes that identify least-cost, least-risk solutions and actions (e.g., Integrated Resource Planning). The Oregon Public Utility Commission reviews the costs and risks of investor-owned utility plans and determines if any procurement plan, such as procuring FOSW energy, achieves the best balance of cost and risk for customers. See page 50, Long-Term Power Offtakers and Energy Markets Section, for more information about Oregon utilities.

The NW Power & Conservation Council: Regional Power Plan

Individual electric utilities engage in their own resource planning, identify their own needs, and develop their own action plans to acquire resources when necessary. Meanwhile, the Northwest Power and Conservation Council, pursuant to the 1980 Northwest Power Act, develops a regional power plan every five years "to ensure an adequate, efficient, economical, and reliable power supply for the region." [16]

The regional power plan includes several key provisions, including: [17]

- a regional electricity demand forecast;
- electricity and natural gas price forecasts;
- an assessment of cost-effective energy efficiency potential; and
- identification of a least-cost portfolio of generating resources.

While the regional power plan guides resource decision-making by the Bonneville Power Administration, it has no regulatory effect on the electric utilities that serve retail customers in Oregon. Instead, the regional power plan is relied upon by Oregon utilities mostly as an informational resource that helps them better understand the regional landscape when engaging in their own planning efforts.

The most recent five-year regional power plan, the 2021 Northwest Power Plan, was published in February 2022: https://www.nwcouncil.org/2021-northwest-power-plan/.

Consumer-Owned Utilities

COUs are self-governed by local boards and not subject to OPUC oversight when it comes to resource planning activities. Some of the state's larger COUs, such as the Eugene Water & Electric Board,[18] engage in integrated resource planning to consider potential future need for resources. Resource planning for most of the state's smaller COUs, however, looks quite a bit different for the reasons described below.

Role of BPA. In all cases, Oregon's COUs have a long history of contracting with the Bonneville Power Administration for significant amounts of the power supply necessary to serve their retail customers. COUs are currently engaged in 20-year Regional Dialogue Contracts with BPA that are due to expire in 2028.[19] BPA recently initiated a series of public workshops to address the development of the policies and contracts that it will offer to its customers to meet their evolving needs post-2028.[20]

Under the current contract, some of the state's COUs receive a fixed ***slice*** of BPA's power output, while that utility supplements the electricity delivery from BPA with output from its own generating resources or from other power contracts. The majority of the COUs that serve Oregonians, however, are ***full requirements*** customers of BPA, meaning that they "generate no power, relying instead on BPA for all of the power needed to meet their total load requirements."[21]

SUMMARY OF KEY FINDINGS

As directed by HB 3375, through the course of its study, ODOE identified key potential benefits and challenges from its literature review and engagement with stakeholders. ODOE acknowledges, however, that there remain uncertainties around FOSW technology and its potential effects. More thorough assessment and analysis of these benefits and challenges may be required. The key potential benefits and challenges are summarized in sections that follow.

KEY POTENTIAL BENEFITS

Based on review of the technical literature, understanding of the power sector, and extensive engagement with stakeholders, Department staff identified the following key potential benefits of developing FOSW off Oregon's coast:

Immense Scale of Offshore Wind Resource
The technical potential of Oregon's offshore wind resource is immense and could supply dozens of gigawatts of renewable electricity to help many states in the region meet their mid-century climate and clean energy goals, including Oregon.

Generation Diversity Value
Offshore wind could play a critical role in helping the state achieve its clean energy goals, particularly because of its ability to complement other renewables during certain times of the year, like the winter months when solar is less available.

Offsetting Land Use Impacts from Onshore Renewable Development
The development of offshore wind resources can help offset the significant amounts of onshore renewable resource development, and associated land use impacts, that will be required to achieve Oregon's clean energy and climate goals.

Power System Reliability
The addition of commercial-scale electricity generation projects offshore could improve the reliability of the state and regional grid, especially for Oregon's coastal communities.

Local Energy Resilience
The deployment of offshore wind projects could expand opportunities for additional community energy resilience projects along Oregon's coast.

Economic Development
The need for a skilled workforce to build and maintain floating offshore wind projects, and to develop supporting infrastructure and supply-chains, could support direct, indirect, and induced job development, especially in coastal communities where construction and maintenance activities would be based.

Key Potential Benefit: Immense Scale of Offshore Wind Resource

Clean Energy Need

The pace and scale of renewable energy development necessary to meet a 100 percent clean power grid is tremendous and cannot be overstated. As coal plants continue to retire across the west and states adopt increasing restrictions on building new or expanding existing natural gas plants, investments in renewable resources, such as solar and wind, will accelerate. Floating offshore wind could play an important role in achieving mid-century clean energy and greenhouse gas emissions reduction policies for Oregon and for states across the west. The scale of the offshore wind resource provides the potential to deploy dozens of gigawatts (or tens of thousands of megawatts) of clean energy generating capacity in the decades ahead.

The technical literature generally agrees that achieving economy-wide GHG reduction goals requires broad based electrification of the transportation sector and a significant conversion of other fossil-fuel end uses to electricity. This trend toward increased electrification is expected to drive growth in total electric demand at the same time the power sector is replacing fossil-fueled generation sources, like coal and natural gas, with solar and wind. This is expected to occur against the backdrop of continued population and economic growth in Oregon and in the region that will further contribute to higher electricity demand.

The literature review identified the need for a tremendous scale of new renewable energy development to decarbonize the state and regional grid. Studies differed in the precise timeframes and specific policies evaluated, but the general magnitude of the need was consistent across all studies. For example, a 2021 study by consultants Evolved Energy Research found that it would require adding approximately 35 GW of new renewable resources between 2020 and 2050 in order for Oregon to achieve 100 percent economy-wide decarbonization.[22] In particular, the study's modeling identified 20 GW of FOSW interconnected to the Oregon grid between 2035 and 2050 (Figure 4).

Key Process: Power Grid Planning

Investor-owned utilities account for growth in customer demand and assess the ability of existing and new resources to meet customer demand in a public planning process that identifies least-cost, least risk solutions and actions.

The Oregon Public Utility Commission reviews the costs and risks of investor-owned utility plans and determines if any procurement plan, such as procuring FOSW energy, achieves the best balance of cost and risk for customers. ***See the Long-Term Power Offtakers & Energy Markets Section for more information on Oregon Utilities.***

Renewable Northwest

"While the report is focused on getting to 3 GW by 2030, it is important to also consider getting beyond the 3 GW both in support of HB 2021 benchmarks and looking to meet increasing demands resulting from the electrification of other sectors."

Figure 4: Cumulative New Resource Build - Clean Energy Pathways for Oregon (2021)[23]

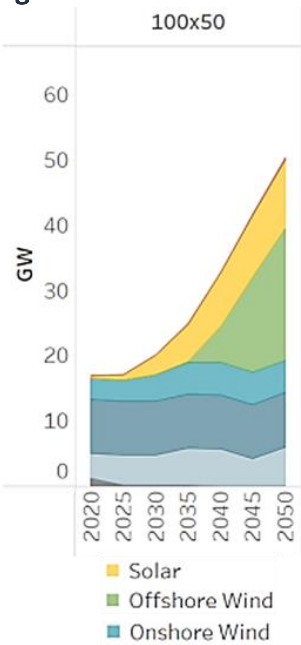
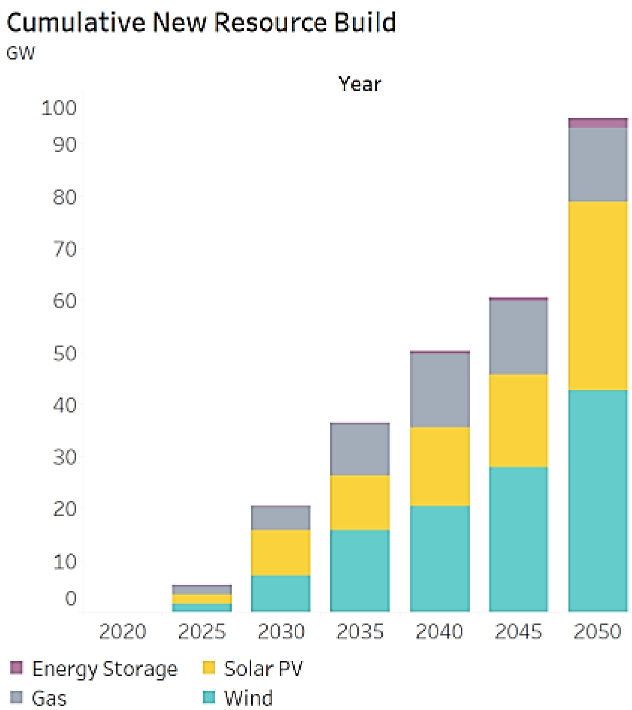


Figure 5: Cumulative New Resource Build - Northwest Deep Decarbonization (2019)[24]



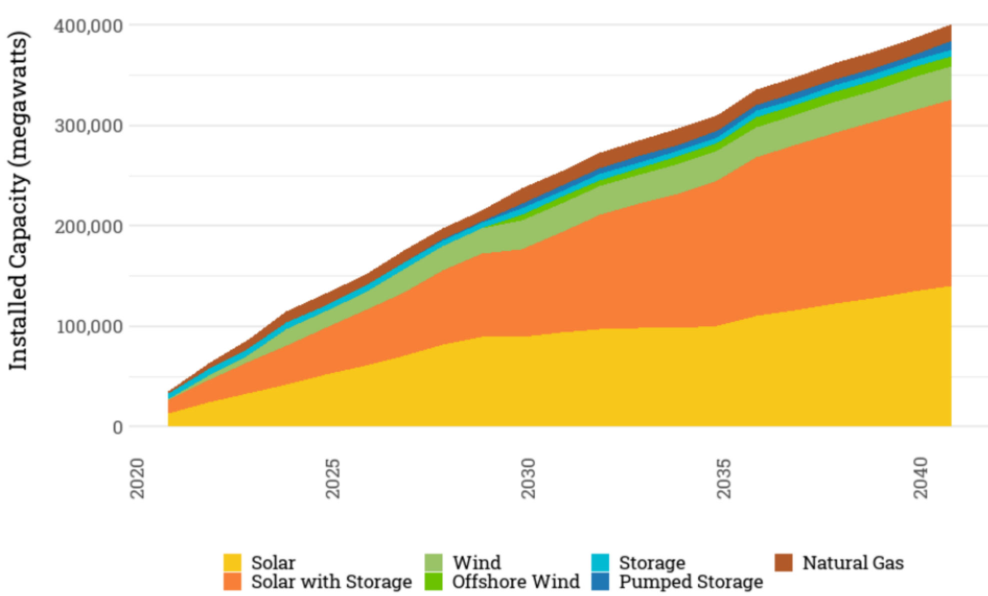
Another economy-wide decarbonization study from the same consultants found that the Pacific Northwest will require 80 GW of new solar and wind projects – after taking into account energy efficiency – by 2050 to achieve the region's collective clean energy commitments (Figure 5). For comparison, over the past two decades, the Pacific Northwest has added a total of about 10 GW of solar and wind[25] — and the total installed capacity of all resources (i.e., including all the large hydropower dams, fossil-fuel generators, and a nuclear facility – Columbia Generating Station – in Washington) in the region is about 60 GW as of 2022.[26]

Key Process: Regional Power Planning

For much of Oregon, Washington, Idaho, and Montana (the areas within the Columbia River Basin), the Northwest Power and Conservation Council conducts a public planning process that helps assess and ensure the region has an efficient and adequate power supply while respecting the renewable and clean energy targets of Western states.

The Northwest Power and Conservation Council (NWPCC) included modeling results in its 2021 Northwest Power Plan that projected an estimated need to add more than 350 GW of new renewables across the entire Western electric grid by 2041 to meet load growth expectations and all the various requirements of western electric utilities, including the clean energy targets of all western states.[27] This projection (Figure 6) included some amount of FOSW buildout in California, but this model run was not calibrated to allow for buildout in Oregon. This modeling was used to establish a forward-looking baseline electricity price forecast based on future regional resource buildout and, like all models, does not control what will actually be built in the future.

Figure 6: Projected Generation Additions, West-Wide[28]



Key Process: Federal Hydropower

The Bonneville Power Administration, the U.S. Army Corps of Engineers, and the Bureau of Reclamation comprise the River Management Joint Operating Committee (RMJOC). The agencies are continuously evaluating and anticipating vulnerabilities, risk, and resiliency of the Federal Columbia River Power System.

NOAA Fisheries Nexus: Federal Hydropower

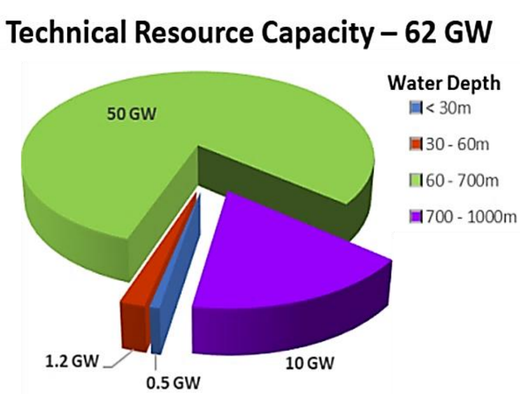
NOAA Fisheries has jurisdiction over threatened and endangered marine species, such as salmon, that migrate between the ocean and onshore river systems. The Federal Columbia River Power System is managed in accordance with NOAA biological opinions.

The effects of climate change may also limit the amount of hydropower available in the future, which could further increase the need for new renewable generation resources. For example, climate change is likely to reduce the amount of water supplying the dams during late summer and early fall when water levels are at seasonal lows but the need for electricity could be very high to meet the energy demands of air conditioning.

In addition, dams must spill water without generating power to help address negative impacts to fish and wildlife. These impacts are also driving current discussions between federal and state governments about breaching the Lower Snake River Dams (which currently provide about 1,000 MW of energy annually for the region) in an effort to recover threatened salmon and steelhead species.

Immense Floating Offshore Wind Resource Can Provide Significant Contribution to Achieving Oregon's Clean Energy Goals

Figure 7: Technical Potential for FOSW Off Oregon's Coast[29]



Winds off Oregon's coast are some of the strongest and most consistent in the world. The National Renewable Energy Laboratory estimates that Oregon has the technical potential for 62 GW of offshore wind electricity generation capacity.[30] The abundance of this high-quality wind resource provides an opportunity for gigawatt-scales of FOSW to contribute toward meeting the decarbonization and clean energy goals of Oregon and other Western states.

Key Potential Benefit: Generation Diversity Value

Grid Balancing Need

A reliably functioning grid requires adequate supplies of electricity to meet customer demand across all hours of the year (24 hours a day during all months and seasons). However, many renewable resources are not available to generate electricity at all times. These constraints impose practical and economic limits to the cumulative scale of solar and onshore wind that can be deployed to power a 100 percent clean grid. As Oregon's grid mix of variable resources grows to meet the state's clean electricity goals, it will become even more critical for utilities to procure a portfolio of resources that can complement each other to meet customer needs at all times with clean energy (more information about utility clean energy plans is on page 51).

Historically, abundant hydropower resources coupled with coal and natural gas generators – all considered dispatchable resources that are capable of generating electricity across most hours of the year – have met the bulk of Oregon's power needs. As a result, it has long been a practice for Oregon utilities, like those in most parts of the country, to evaluate new generation resources to meet increased demand on the basis of the resource's levelized cost of energy. LCOE measures the lifetime cost of a generating asset relative to the amount of energy production it will provide, irrespective of the particular times of the year when that energy is available.

Many renewable projects, most notably large-scale solar, can increasingly compete with these traditional generators based on LCOE. But unlike these traditional generators, most renewable resources are only available to send power to the grid for a fraction of the hours in a year. Solar projects in Oregon, for example, might have a capacity factor of 20 or 25 percent, meaning that on an hourly basis over the course of the entire year, the project, on average, can only deliver 20 to 25 percent of its total installed capacity to the grid. During some hours (such as a sunny spring afternoon) this might be 100 percent, while in others (such as in the overnight hours in winter) this will be zero percent. As a result, utilities often use additional metrics beyond LCOE to assess the full value of renewable energy projects, such as ones that consider the timing of when renewables actually generate electricity and the degree to which that output complements customer demand and the output of other generators already on the system.

Deep Blue Pacific Wind (formerly TotalEnergies SBE US)

"FOSW will be key to achieving the 100 percent clean energy goals in Oregon and Washington. Offshore wind's GW size scale potential, capacity factor, locational diversity, and winter peak contribution all make FOSW an excellent fit for a generation fleet in the state and region that will be increasingly dominated by variable energy resources."

There are multiple pathways available for achieving the type of clean energy portfolio that will be required to achieve 2050 policy objectives, for example:

- Overbuilding solar resources (to ensure sufficient energy is generated in the winter months) and deploying battery resources that can shift solar output to make it available through the nighttime hours.

- Developing more inter-regional transmission to facilitate importing clean energy from other areas of the west to complement in-region renewables.
- Developing onshore wind resources across diverse geographic areas (e.g., in the northwest, but also building transmission to access wind resources in the Rocky Mountain states) with varying output profiles that can complement a buildout of solar.
- Developing FOSW projects off Oregon's coast that can generate significant amounts of consistent power output, particularly at times that complement solar.

None of these pathways are mutually exclusive, and it is likely that some combination of elements from each of these pathways (and others not mentioned) will ultimately contribute to achieving mid-century policy objectives. Also, the maximum economic potential for renewable resources developed on rooftops and near cities will be insufficient to meet our targets.[31] Utilities working with their regulators will engage in near- and long-term planning to determine the most cost-effective options to meet load and maintain a reliable electricity system while achieving clean energy and climate policy objectives.

Diversity Value of Floating Offshore Wind

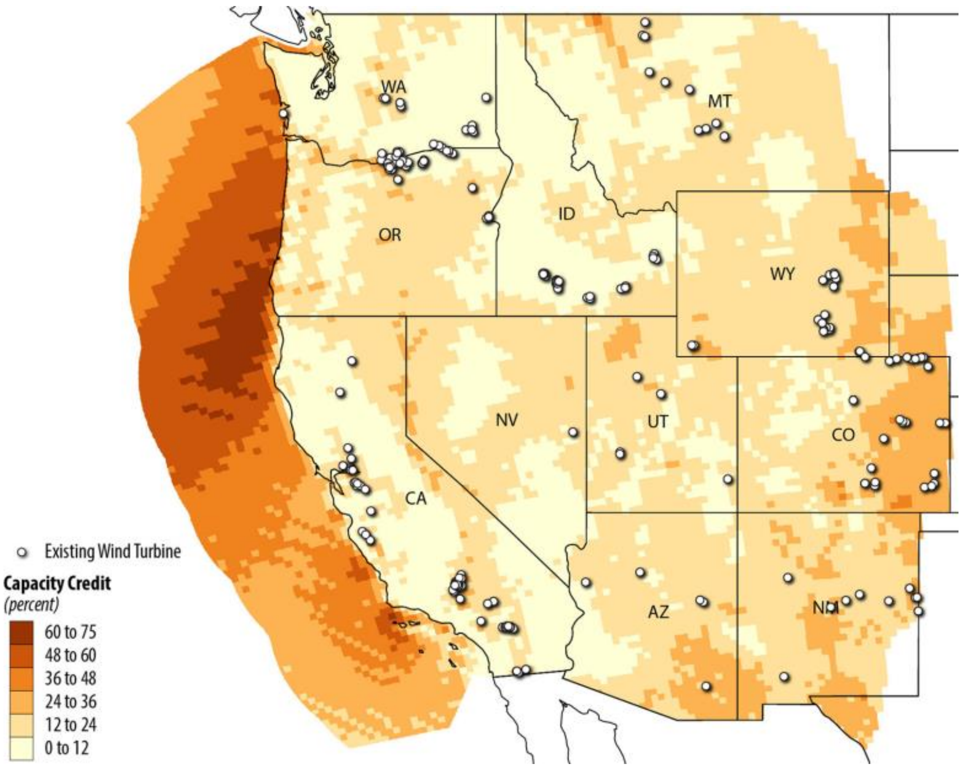
Floating Offshore Wind can complement customer demand patterns and the output of onshore clean energy resources across many hours of the year to help achieve a reliable, 100 percent clean power grid. Offshore winds generally, and those off the southern Oregon coast in particular, are stronger and more consistent throughout the year than onshore winds. Practically, this means FOSW could help provide clean generation in the nighttime hours and during the fall and winter months, and can help alleviate pressures on the hydropower system. FOSW can also offset the magnitude of new solar and wind projects that would otherwise need to be deployed on land.

FOSW can complement customer demand for power as well. A 2021 National Renewable Energy Lab study found that FOSW adjacent to Oregon's southern coast has between a 60 and 75 percent capacity credit for the Western Interconnection (Figure 8). Capacity credit is a metric that indicates the value an energy resource can provide to the grid when energy is most needed, such as when renewable energy generation is not otherwise available but when demand for energy is high. For comparison, the same study found the average capacity credit for the top performing land-based wind resources to be 20 percent. These findings demonstrate the significant diversity value that FOSW can deliver in Oregon and across the west to help ensure the reliability of a 100 percent clean power grid.

Pacific Northwest National Lab

"As indicated in the Douville et al. (2020), Jorgensen et al. (2021), and Novacheck & Schwarz (2021) studies, the capacity value of OSW differentiates it from other clean energy generators. Electricity generation and transmission system planners need to scrutinize these benefits as they consider reliability of decarbonized electricity sectors."

Figure 8: Capacity Credit for Land-Based and Offshore Wind[32]



Key Potential Benefit: Offsetting Land Use Needs to Support Clean Energy Development

As described above, achieving clean energy and climate policy objectives will require the development of dozens of gigawatts of renewable energy projects. The development of onshore wind and solar projects require large amounts of land to develop. For example, ODOE data finds that installed solar projects in the state, on average, utilize approximately 8 acres of land per 1 MW of installed capacity. Renewable energy development on land frequently intersects with other land uses including military activities, agriculture and ranching, forest lands, natural resources, and wildlife habitat. The central and southeastern parts of the state have the greatest solar technical potential but also the greatest concentration of special use airspace, military flight corridors, sage grouse habitat, and other sensitive areas. Generation assets can sometimes be collocated with other land uses, such as agriculture, but in many cases the land is restricted for the sole purpose of energy generation.

Concerns About Impacts of Solar Projects on Land

The development of commercial-scale solar projects on land has become a concern for some farmland protection advocates, commercial farmers, county governments and state agencies involved with natural resources. See the Oregon Land Conservation and Development Commission's 2018 Rulemaking addressing these concerns for more information.

Concerns over renewable energy development of all kinds was the focus of the Oregon Renewable Energy Siting Assessment project that created the ORESA Mapping and Reporting Tool, which can be used to investigate spatial data and generate reports related to potential locations of new energy projects.

Developing Oregon's FOSW resource would help to mitigate these impacts by reducing the cumulative need for onshore renewable development to meet the state's decarbonization and clean energy goals. Developing even a fraction of the large total offshore wind potential adjacent to Oregon could translate into an avoidance of developing tens of thousands of additional acres for onshore renewable energy. Additionally, FOSW projects would be located far from shore, at least 14 miles,[v] minimizing viewshed impacts from coastal communities. Developing resources off the coast could also potentially reduce the need for more transmission line development in other parts of the state.

Left to Right: Willamette Valley Solar, Central Oregon Solar, Eastern Oregon Onshore Wind

Key Potential Benefit: Power System Reliability and Resilience

Coastal Community Power Quality and Reliability Need

Coastal communities are located at the periphery of the regional electric grid, and there is no existing large-scale electricity generation west of Oregon's Coast Range. Coastal communities largely rely on electricity delivered to them via the relatively small number of transmission lines crossing the Coast Range, which can leave the coast with power supply challenges when one of these lines is disrupted. All transmission lines can be affected by winter storms or summer wildfires, but when a line serving the coast is disrupted, communities can face diminished power quality (i.e., brown-outs) or even power outages due to limited options for rerouting power around the disruption.

> A **reliable power system**, at any point in time, requires the amount of electricity generated and delivered to customers to be in balance with the amount of electricity consumed. Achieving this balance occurs through planning activities and system management protocols designed to meet established reliability standards. A reliable power system is designed to minimize power loss disruptions as a result of a sudden disturbance or unanticipated failures of system elements.

Generally, developing large-scale electricity generation capabilities can improve local power quality and grid reliability in communities near that generation (and resilience – see key potential benefit on Local Energy Resilience below). Locating large sources of generation across diverse locations on the grid helps maintain reliable, high-quality power delivery to customers. A small percentage of electricity is lost when it travels along transmission lines and voltage is reduced; locating generation close to loads can reduce the need for electricity to travel long distances, which can bolster and balance the flow of high-voltage power over transmission lines. Injecting electricity at multiple points of the grid helps support voltage and reduces cumulative line losses of electricity.

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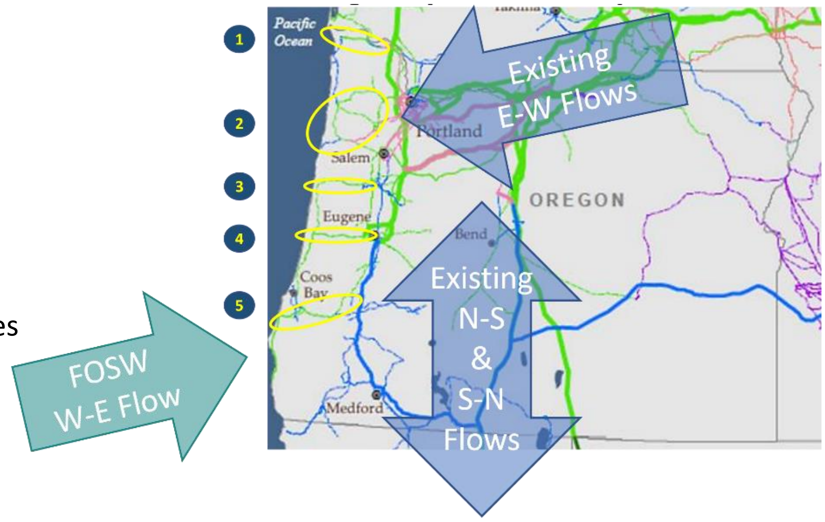
[v] BOEM and the State coordinated on development of an exclusion buffer where the Call Areas are located beyond 13.8 miles (12 nautical miles) from shore. See BOEM's Call for Information and page 36 for more details on BOEM Call Areas.

Floating Offshore Wind Can Improve Electricity Reliability and Resilience

Building generation along the western edge of the regional power grid can bolster power quality and reliability for coastal communities, while supporting reliability of state and regional power systems more broadly. For example, central and eastern Oregon have significant solar resources, but they have also seen intense wildfire seasons in recent years. Should those solar resources or transmission lines crossing the Cascade Range be taken offline due to a natural disaster, such as a wildfire, FOSW facilities could likely be isolated from those events and continue to produce power for the broader grid. Reliability benefits from FOSW could become more valuable in the future as a result of load growth from transportation and economy-wide electrification.

Figure 9: Oregon's Predominant Power Flows



The development of floating offshore wind and associated transmission upgrades may also mitigate existing transmission constraints. Oregon's electric grid is part of a larger, interconnected grid that ties in-state and out-of-state electric systems together. As a result, transmission constraints or failures in one area of the state can lead to transmission constraints and failures in other areas.

Meanwhile, developing more transmission to deliver FOSW to population centers could enhance the state's overall transmission system resilience by reducing reliance on existing east-west transmission pathways and providing for alternative north-south interregional lines. Figure 10 shows Oregon's active wildfires on September 11, 2020, including large areas of Southern Oregon under Red Flag Warning (magenta), which indicates high risk of new fire ignition from lightning and dry fuels. Figure 11 shows the 2021 Bootleg wildfire in Klamath County that shutdown the California-Oregon AC transmission line[33] [34] and restricted the Pacific DC line,[35] collectively reducing the capacity to transfer electricity by 5.5 GW.[36] In this circumstance an offshore north-south transmission line could have provided an alternate path for electricity to flow to communities in Oregon and other states.

Pacific Northwest National Lab

"FOSW may reduce reliance on cross-cascade and cross-coastal range transmission. It may also bolster power quality at the end of extended radial transmission lines into towns such as Brookings (Douville, et al., 2020). Given the annual wildfire threat, this alternative to reliance on East-West transmission infrastructure is beneficial to coastal communities. Other parts of Oregon (& California) may benefit from offshore grid infrastructure that provides alternative North-South power flow corridors to those which may be compromised by wildfire (e.g., see July 2021 Bootleg fire and the resulting partial de-energization of the California-Oregon Intertie and the Pacific DC Intertie)."

Figure 10: Wildfire Snapshot from Oregon RAPTOR at 7 a.m. Friday, Sept. 11, 2020

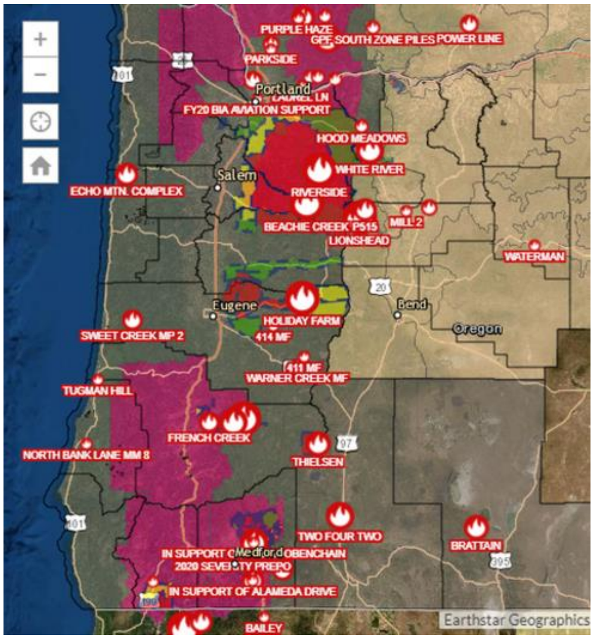


Figure 11: Map of 2021 Bootleg Fire and Transmission Lines

Key Potential Benefit: Local Energy Resilience

> **Power system resilience** is a concept separate and distinct from power system reliability. Resilience is the ability of power systems to withstand — and rapidly restore power delivery to customers following — non-routine disruptions of severe impact or duration. Resilience includes the ability to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents. For example, Oregon is at risk of severe impacts from a rupture of the Cascadia Subduction Zone, which could have an especially large effect on the power system in coastal Oregon communities.

Energy Resilience Need

Oregon's coastal communities have a greater need for alternative sources of energy because of their geographic distance from electricity generators, in addition to preparing for events that might cause significant power and fueling disruptions. Not only are coastal communities reliant on electricity transmitted over the Coast Range, but also transportation and heating fuels that are delivered into the area from the Willamette Valley, California, and elsewhere. Supplies of these fuels to the coast can be disrupted if roads are blocked due to an ice storm or wildfire. Supplies of electricity to the coast can be disrupted if transmission lines are out of service for similar reasons.

The coast is also particularly vulnerable to a Cascadia Subduction Zone earthquake (see page 38 under the *Key Potential Challenges Section, Technology Resilience*, for information on how this could affect FOSW). A CSZ event, likely followed by a catastrophic tsunami, is expected to devastate Oregon's coastal communities. In 2013, the Oregon Resilience Plan evaluated the potential impacts to different sectors of the state from a CSZ event.[37] That plan found that the regular delivery of electricity and liquid fuels to coastal communities could be severely disrupted for many months, or for as long as an entire year. In such a circumstance, the availability of local electric generating resources and fueling options could provide resilience value to these communities and help to maintain some level of delivery of essential community services.

Floating Offshore Wind Can Support Local Energy Production

FOSW generation could improve energy resilience for coastal communities. FOSW would provide a new supply of electricity that could help coastal communities withstand and recover from a non-routine, severe disruption for a long period of time (i.e., a resilience event). A resilience event (such as an extreme wildfire) could cause a failure of one of the major east-to-west transmission lines crossing the Coast Range, or one of the major coastal north-to-south transmission lines that are critical to keeping the lights on for coastal communities. In the absence of FOSW development, this could cut off these communities from power generation sources.

The deployment of significant amounts of FOSW could create opportunities for co-locating energy storage systems on the coast that don't currently exist today. And in the event of a severe disruption to the grid, these storage systems, paired with continued generation output from nearby FOSW, could provide resilience value to coastal communities. These types of storage systems could include grid-connected batteries, electrolyzers for the production and storage of renewable hydrogen, or other technologies that, when located in strategic locations, can help maintain the delivery of essential community services.

Key Potential Benefit: Economic Development

Floating Offshore Wind Could Support Broad Forms of Economic Development, Especially for Coastal Communities

The need for a skilled workforce to develop, build, and maintain floating offshore wind projects and peripheral infrastructure needs could support direct, indirect, and induced job development, especially in coastal communities where construction and maintenance activities would be based. At the same time, there is concern about the potential for FOSW to have adverse impacts on existing coastal economies, including fishing, recreation, and tourism.

The potential scale of this economic development is significant. A 2016 National Renewable Energy Laboratory study found that FOSW could contribute to near-term economic development in Oregon, especially if labor and supply-chain needs were sourced from within the state. The study concluded that 5,500 MW of FOSW developed by 2050 could support 65,000 to 97,000 job-years,[vi] and contribute $6.8 billion to $9.9 billion to the state gross domestic product. The long-term economic benefits of these developments are also substantial. The NREL study described above indicated that beyond 2050, 5,500 MW of FOSW would provide 2,300 – 3,400 operations and maintenance jobs in the local communities and add $240 million to $350 million in additional annual state GDP.

[vi] A job-year is one full time job for one year. For example, one person working full time for 10 years or two people working full time for five years each total 10 job-years.

Supply chain economies that support FOSW projects could provide indirect economic benefits, which could accrue more broadly across Oregon. However, because of their size, floating platforms and other FOSW components may need to be manufactured at or near the Oregon port where a FOSW project would be deployed from. These new industries would diversify coastal economies, offer opportunities to address underemployment and unemployment, and provide increased local tax revenues. A collaborative regional approach to developing FOSW supply chains could optimize distribution of economic development benefits across many communities in Oregon and other states.

Business Oregon
"Floating offshore wind has been identified as having future potential job creation and economic benefits for the South Coast region of Oregon. The South Coast region has been economically depressed since the decline of the wood products industry in the 1980s and must pursue economic diversification strategies beyond tourism." "Our agency is hopeful that in the future the floating offshore wind industry might co-exist in Oregon along with our fishing and tourism economies along with other maritime industries."

Policies can help ensure FOSW deployment supports equitable economic growth and economic sustainability for local coastal communities. Examples include requirements that:

- Support union jobs
- Provide funding mechanisms to support FOSW deployment and operations training programs at coastal community colleges
- Provide additional affordable housing to mitigate the potential for rising rents that would disproportionately affect underserved communities
- Provide compensatory funds to mitigate adverse impacts to other economies, such as those dependent on the fishing industry

Recognizing the vast potential job opportunities associated with FOSW development, labor organizations are working to collaborate with states and renewable energy developers on labor standards that will strengthen equitable access to living wage jobs, training opportunities, economic resilience, and local job development for Oregon communities.

Oregon law requires contractors for energy and storage projects that are 10 MW or larger to document and meet labor standards that support these concepts.[38] Contractors can also establish Project Labor Agreements, where specific requirements are agreed to through a collective bargaining agreement between developers and contractors.

There is uncertainty if Oregon's labor requirements of large energy projects would apply to the construction of FOSW projects at an Oregon port before they are moved to their ocean location in federal waters.

The Bureau of Ocean Energy Management has included leasing conditions that supported the development of PLAs for offshore wind projects in federal waters off the East Coast. Other BOEM leasing conditions have required lessee reporting on efforts to minimize potential impacts to other ocean users, and have led to developer investments in local supply chains for offshore wind components. Such conditions were included, for example, in the New York Bight leases executed in 2022.

FOSW could also bolster coastal energy supplies to support the development of new high-load industries located in and around coastal communities. Examples could be data centers, renewable hydrogen production, and other energy-intensive industries. Port upgrades necessary to accommodate FOSW deployment could benefit other industries, including fishing and marine transportation. New industry also induces economic benefits by increasing demand for housing, hospitality, and other local businesses, and increases tax revenues that can be reinvested in community infrastructure and programs.

The National Marine Fisheries Service conducts research to study the potential economic effects that offshore wind projects could have to communities that depend on ocean and coastal resources.

It is important to note that there is considerable concern about the potential for FOSW to have adverse impacts on existing coastal economies, including fishing, recreation, and tourism. There is little Oregon-specific data or analysis on the potential effects on these industries from offshore wind development, and a study currently underway on this data gap is highlighted on page 34. Existing coastal economies are important, for example, the fishing industry is one of the largest economies for the Oregon coast, generating an estimated $558 million in personal income to the statewide economy[vii] in 2019, which is equivalent to about 9,200 jobs, and an overall output estimated to be $1.2 billion.[39] A better understanding of any potential economic impact to these industries should be a critical consideration in any policy or regulatory decision-making concerning the deployment of FOSW projects.

Concerns over potential adverse effects from FOSW on coastal communities and industries are further described in the next section.

West Coast Seafood Processors Association

"The seafood industry is local and has historically been foundational economic drivers at Oregon ports, employing thousands of processing employees while also supporting hundreds of fishermen and their crews by buying their fish and shellfish. Offshore wind (OSW) farms could displace fishermen and, by extension, processors, if too much prime fishing grounds are lost to offshore wind energy devices."

[vii] About two-fifths of the income in 2019 is generated by distant water fisheries (such as the West Coast at-sea-fishery and Alaska fisheries).

Pacific Ocean Energy Trust

"FOSW could be developed in collaboration with our coastal fishing communities with up front investments in strengthening Oregon's sustainable fishery. Examples include - fleet and communications modernization, port infrastructure investments, atmospheric and biological monitoring and diversification of fleet employment during low fisheries seasons."

KEY POTENTIAL CHALLENGES:

To develop and integrate gigawatt-scales of FOSW into Oregon's electric grid, six key challenges (identified below) must be considered and addressed. Complicating matters further, many of these challenges involve processes with long lead times and multiple steps that interact with one another, which can lead to uncertainty for stakeholders. For example, some process steps can be completed concurrently, while other process steps may require the completion of one step before the initiation or completion of another. Developing FOSW resources by 2030 – or soon thereafter – will require successfully navigating the complex processes and addressing the substantive challenges within a sufficient timetable.

Concerns About Adverse Effects on Coastal Communities, Existing Industries, the Environment and Cultural Resources
Offshore wind projects could have adverse effects on existing ocean and land users (e.g., fishing, seafood, recreation, and tourism industries and military activities), coastal communities, the environment, and cultural resources, (among others). Concerns extend into the siting and permitting processes not being adequate or timely to meaningfully address all of the potential adverse effects.

Siting & Permitting
There is a complex system of rules and regulations governing the siting and permitting of energy resources and infrastructure offshore and on land, including consideration of potential effects on coastal communities, ocean and land users, the environment, natural resources, and cultural resources.

Technology Readiness and Costs
The floating offshore platforms necessary to support and anchor wind turbines in the deep waters off Oregon's coast have not yet been deployed at commercial-scale.

Port Infrastructure
Substantial port upgrades are necessary to support the construction, deployment, and maintenance of floating offshore wind projects, potentially including upgrades necessary to support the fabrication of floating platforms and the manufacturing of other project components.

Transmission Infrastructure
Significant investments to upgrade the onshore electric transmission grid are likely needed to accommodate gigawatt-scale floating offshore wind projects.

Power Offtake Commitment(s)
It is unlikely that a single Oregon utility would have the near-term need to procure a gigawatt-scale floating offshore wind project, likely necessitating a consortium of buyers committing to offtake arrangements.

Key Potential Challenge: Concerns About Adverse Effects on Coastal Communities, Existing Industries, the Environment, and Cultural Resources

Floating offshore wind projects, including necessary supporting projects – such as new onshore and offshore transmission infrastructure, and upgrades to port infrastructure – could have a multitude of potential effects to coastal communities, ocean users (e.g., fishing and seafood industries and the U.S. military), land users, the environment, natural resources, and cultural resources.

Potential Effects on the Environment, Ocean Industries, and Ocean and Land Uses

Many interested parties have expressed concerns over the effects of FOSW on ocean and land users, including: Tribes; the Oregon Department of Fish and Wildlife; the commercial fishing and shellfish industries; shipping interests; recreation and tourism interests; port, city, county and state officials; members of coastal communities; Oregon Department of Aviation; and the U.S. Department of Defense. Many of these same groups have concerns about the potential for disturbances to marine ecosystems, coastal habitats, and water quality. The following identifies many of the primary concerns raised in written feedback and during public meetings:

- **Fisheries** – FOSW projects have the potential to displace fishing grounds, which could cause economic and socio-cultural effects on the fishing industry and coastal communities. Existing data on current fishing areas may not reflect true fishing grounds, due to regulatory changes that open and/or close parts of the grounds over time. Careful and thorough economic analysis has not yet been done to assess negative impacts on this existing use.

- **Ecosystem** – FOSW projects could have impacts to the ocean ecosystem - the oceanography, ocean bottom habitat, and wildlife species (direct and indirect effects). Potential effects to the ocean ecosystem could result from project infrastructure (e.g., anchors, mooring cables, transmission lines) and project operations (e.g., turbines use of winds, noise, electromagnetic fields, use of oils and other fluids, supporting vessel traffic, etc.). For more information on ecosystem challenges, including fish and wildlife challenges, see ODFW's written comment letter submitted to BOEM in June 2022.

    - **Oceanography: California Current and Ocean Upwelling** – FOSW projects could cause changes in oceanography and atmospheric conditions – known as the California Current — and affect coastal upwelling. This coastal upwelling, the process by which deep, cold water rises to the surface, is the basis for the rich fishing and seafood resource that exists off the Oregon coast.

- **Fish and Wildlife** – There may be effects on wildlife and ecosystems, for example:
  - Fish - Behavioral changes due to introduced structures, electromagnetic fields, and acoustic effects. Potential life stage development changes resulting from altered ocean dynamics.
  - Seabirds - Interactions between seabirds and FOSW within the Pacific Flyway, dynamic soaring species (albatrosses, shearwaters, storm-petrels, fulmars, etc.), phototactic species, perch attraction, flight height, high-productivity ocean areas, onshore breeding colonies.
  - Marine Mammals - Noise during construction or operation, vessel collision, entanglement.
  - Habitat - Potential impacts of port construction and wind farm operations to ocean, estuarine, and onshore habitat that support the life and health of wildlife and ecosystems.

- **Military and Civilian Air Traffic** – The Oregon Department of Aviation and members of coastal communities indicated that heights of FOSW projects, new onshore transmission infrastructure, and tall equipment such as cranes used to assemble projects could affect civilian air traffic, especially if project activities occur near airports. The U.S. Department of Defense has similar concerns with respect to potential impacts to military air traffic and activities for operations, training, and testing that support national defense.

Concerns Relating to FOSW Infrastructure

- **Mooring and Anchoring Systems** – Inter-array and mooring cables, floats, anchors, and other system components could affect seafloor and open water habitat, contribute to secondary entanglement of marine life in debris, present conflicts with fishing practices and existing fishery management strategies, affect marine mammals and other marine life, and displace equipment or activities required for scientific research surveys (state, federal, academic).

- **Transmission Infrastructure** – There are potential impacts from offshore transmission cables and onshore transmission upgrades. Transmission infrastructure placement should be designed to avoid rocky habitats and other sensitive habitats, such as aquatic resources of special concern as defined in Oregon law and policy. Transmission planning should account for spatial limitations and the effects of climate change, such as sea level rise, increased risk of flooding, and landslides while still avoiding or minimizing adverse effects on coastal habitats.

- **Port Infrastructure and Activities** – There are potential effects on the environment and local community from port infrastructure development and FOSW construction and maintenance activities. For example, there is a potential to upset critical habitat areas and affect local shipping and fishing boat traffic at ports used to support FOSW activities.

Concerns About Cumulative Effects

Some interested parties indicated that potential cumulative effects to ocean users and the environment from FOSW projects across multiple ocean areas may be difficult to evaluate and address through siting and permitting processes. In particular, there was concern that cumulative effects could have adverse effects on the fishing industry, marine species, and ecosystems. BOEM conducts analyses of cumulative impacts of past, present, and reasonably foreseeable future activities in its preparation of a NEPA Environmental Impact Statement for FOSW projects after they are proposed, which could occur after its leasing process. However, stakeholders have requested analysis of cumulative impacts in *advance* of BOEM's identification and leasing of Wind Energy Areas (WEAs).

It's unclear whether BOEM's preparation of NEPA Environmental Assessments for WEAs could or would include an assessment of potential cumulative effects of FOSW projects. Because the greatest wind resource along the west coast is adjacent to southern Oregon and northern California, there is potential for many FOSW projects in this general area, and also potential for projects adjacent to the Washington coast. Recently, California established state planning goals for 5 GW of offshore wind development by 2030 and 25 GW by 2045 and has initiated strategic and comprehensive state planning efforts that are informed by these goals. Oregon has a goal to plan for up to 3 GW of offshore wind, however this is not a deployment target and the state has not initiated comprehensive state planning. Other than Oregon and California, no other western states have set offshore wind planning goals, and California is the only western state that has initiated comprehensive state planning efforts aligned with a state planning goal.

Any analysis of potential cumulative effects is complicated and is predicated on the accuracy of forecasts for reasonably foreseeable amounts of potential FOSW development in a generally common area, which would be informed and could be improved by both an Oregon comprehensive state plan, and a regional plan, for potential FOSW development. Without a state or regional plan that includes specific deployment targets, potential FOSW development is less foreseeable, which could lead to less accurate analysis of potential cumulative effects.

Oregon Department of Fish and Wildlife

"HB 3375 did not direct state agencies to develop a comprehensive state plan for the potential development of FOSW, but merely adopted a state goal to plan for 3 GW of FOSW by 2030. HB 3375 did not commit the state to developing FOSW, did not specify how 3 GW could be developed, did not specify whether 3 GW was a desired limit to FOSW development, and did not specify whether any potential development would occur all at once or in a precautionary stepwise fashion."

Oregon Coast Energy Alliance Network

"We recommend conducting a Preliminary Cumulative Effects Assessment. A PCEA would occur in three phases. Phase one would be organization of a working group that would determine the scope of the PCEA. Phase two would be compilation and evaluation of data, identification of key resources likely impacted cumulatively, development of measures to fill critical data gaps, and preparation of a draft report. Phase three would be stakeholder review of the draft and revisions for final publication."

Limitations on State Opportunities to Affect BOEM's Early Siting Processes

There is concern that State policies and authorities governing ocean resources do not provide a formal mechanism to influence the location of BOEM Call Areas and WEAs offered for lease. DCLD's first federal consistency review occurs for BOEM's leasing activities, concurrent with the NEPA Environmental Assessments for the Wind Energy Areas it initially identifies. This is the state's opportunity to assess whether the potential impacts of site characterization and assessment activities (e.g., installation of meteorological buoys and oceanographic devices, and not potential impacts of a proposed FOSW project) within these leasing areas would be consistent with state policies. There is concern that DLCD's consistency review will not affect the specific WEA locations that BOEM could offer for lease, and once a WEA is leased, the opportunity to locate any proposed FOSW project in other ocean areas to avoid and minimize potential impacts of FOSW project development is effectively precluded without restarting the WEA identification process.

Data Gaps

Comments from the Oregon Department of Fish & Wildlife and others indicated numerous data gaps remain related to key topics and criteria that decision-makers need to evaluate in siting and permitting processes, which present significant challenges. These information gaps are due to either data unavailability (not collected) or incomplete data analysis, or both. Data gathering and comprehensive analysis of the potential effects from FOSW development necessary to fill these data gaps will take a considerable amount of time and effort.
ODFW and several others recommend the state prioritize providing resources to conduct these analyses prior to any future state policy actions related to FOSW development or further steps in the BOEM process.

All written comments ODOE received are available on the agency's FOSW Comment Portal.

Stakeholders identified many topics with data gaps including, but not limited to:

- Spatial ocean modeling of human uses, including fishing activities, aircraft routes, and tourism and other recreational activities. Readily available spatial information related to the geographic footprint of fisheries is incomplete. There have been significant regulatory and climate change impacts that have resulted in shifting patterns of use in the outer continental shelf region.
- Mapping marine and estuarine ecosystems and habitat including more information on marine wildlife, including fish, seabirds, marine mammals, and others.

- Mapping subsea geology to understand potential effects on seafloor and coastal habitats and species should be understood and considered before finalizing the location and landing points of any offshore transmission infrastructure.
- Assessing potential impacts of wind farms on ocean dynamics (California current).
- Socioeconomic effects on coastal economies, including potential benefits and losses for the fishing and seafood industry, recreation, tourism, and others that can inform the net economic effect of FOSW development on existing economies.
- Assessing the potential for, and environmental effects from, FOSW project failures during extreme natural events such as ocean storms and earthquakes, including a Cascadia Subduction Zone quake.
- Evaluating the location, development, and maintenance of port infrastructure in estuaries and bays that provide important services for existing human activities and ecosystem resources.

Some of these data gaps are currently being studied. Integral Consulting is currently investigating the potential impacts of FOSW projects on west coast ocean circulation. The National Oceanic and Atmospheric Administration is conducting a study (Pacific Fishing Effort Model) on the spatial economic value of west coast fisheries specifically for the purpose of informing FOSW decision-making and development. Preliminary data is anticipated in 2023.

Best Practices

Stakeholders also provided input on best practices that should be used when developers, BOEM, and state agencies (such as DLCD and ODFW) are planning and reviewing proposals for potential FOSW projects, including:

- Community engagement
- Extensive cooperative data sharing
- Comprehensive state planning and a permitting roadmap
- Single state agency lead on siting and permitting
- Funding for data collection and analysis to fill information gaps
- Adaptative management approach to fill data gaps throughout the siting, permitting, construction, and operation phases
- Fisheries mitigation fund

Kalmiopsis Audubon Society

"We've recommended to BOEM and to the State of Oregon the idea of convening a special environmental and wildlife technical working group to provide independent review and expertise not only for siting of wind energy facilities but also to help with designing best management practices and to address adaptive management of these facilities in the coming years. This could be a separate group or perhaps a role assigned to the existing OPAC science and technical committee."

Key Potential Challenge: Siting & Permitting

Siting and permitting processes in general, and for energy projects specifically, are designed to evaluate and address a variety of potential effects from the construction, operation, and decommissioning of proposed projects through approaches that consider avoidance, minimization, mitigation, and monitoring of potential impacts. Much of this evaluation takes into consideration stakeholder input on the potential positive and negative effects a proposed project might have if developed. Developers that collaborate with stakeholders on planning for project locations and design can help address concerns and issues up front, potentially saving time and costs associated with siting and permitting processes. Avoiding or minimizing impacts from energy developments may be easier to accommodate in the early stages of planning.

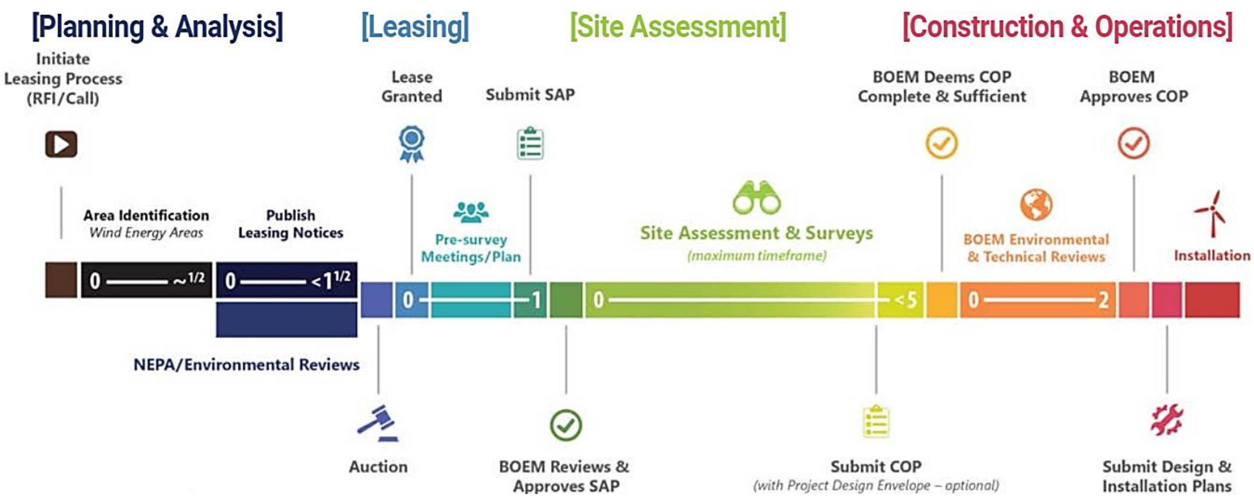
Federal Siting & Permitting Jurisdiction - Bureau of Ocean Energy Management (BOEM)

FOSW projects would be sited and permitted in federal waters adjacent to Oregon's coast, where BOEM has lead jurisdiction for leasing, siting, and permitting. Refer to page 10 for additional general information about BOEM and its key process steps.

A key distinction between siting and permitting processes for FOSW projects in federal ocean waters versus those for renewable energy projects on land is that BOEM's process includes and begins with leasing the ocean areas where projects could later be proposed. With renewable projects on land, developers can secure leases of areas for potential projects outside of siting and permitting processes. Securing a lease is the first step in developing any renewable energy project because it grants developers site access to collect and analyze data necessary to design and plan a project. With FOSW projects, securing a BOEM lease is the critical step necessary to perform a site assessment for an identified area, and this assessment is a prerequisite to a specific project design, including the specific design and planning for elements necessary to support FOSW, such as port and transmission infrastructure. Notably, a lease does not grant approval for construction and operations of a FOSW project, which is a step that occurs later in BOEM's process.

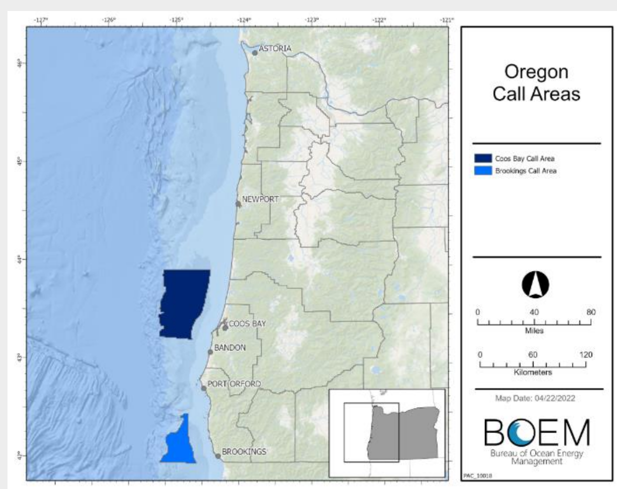
An illustration of BOEM's key process stages is below and includes steps for BOEM to: assess federal waters and identify potential leasing areas; publish potential leasing areas and receive comments from the public and developers; auction and lease areas to developers; conduct environmental assessments of developer plans for site characterization and surveys (site assessment plans); conduct environmental impact statements on developer plans for proposed projects (construction and operations plans); and decide whether to approve the construction and operation of a proposed project.

Figure 12: Bureau of Ocean Energy Management Siting Process



Bureau of Ocean Energy Management Siting and Permitting Process Begins in Oregon

On April 29, 2022 BOEM initiated its leasing process by requesting public input on two Call Areas located off Oregon's southern coast. This Request for Information and Nominations asked interested parties to provide comment on the Call Areas generally, and asked developers to provide comment and information on specific areas of leasing interest. BOEM received more than 270 comments from a wide variety of stakeholders regarding state policies, site conditions, natural resources, ecosystems, wildlife, and multiple uses in close proximity to or within the Call Areas (BOEM also received Wind Energy Area nomination information from potential developers). View the written comments BOEM received online, including comments from Oregon officials and local, state, and regional entities.



The Coos Bay area covers 1,363 square miles and the Brookings area about 448 square miles. Each area begins about 14 miles from the coast and extends to 46 and 65 miles offshore, respectively.[40]

As of the filing date of this report, BOEM's next step in the leasing process is to delineate a subset of smaller Wind Energy Areas within the larger Call Areas for further study and potential leasing. BOEM is considering up to 3 GW of near-team commercial development for the first leasing activities offshore Oregon.

It is important to note that BOEM's leasing process for specific ocean areas is a milestone that must be completed before robust environmental, cultural, and socioeconomic studies and assessments on potential impacts from a specific FOSW project can begin. This is because the design of FOSW projects, the design and location of transmission infrastructure options, and the identification of port(s) for deployment and services all depend on the specific location of a potential FOSW project, and are all critical, pre-requisite elements that must be known before conducting these types of in-depth analyses.

BOEM Guidelines for Avoiding, Minimizing, and Mitigating Impacts to Fisheries

To support efforts to help avoid and minimizes conflicts with other ocean users, BOEM is working with NOAA Fisheries and affected coastal states, including Oregon, to develop guidance for mitigating the effects of offshore renewable energy projects. As part of this effort, BOEM issued Draft Fisheries Mitigation Guidance and a Request for Information in June 2022 to obtain public review and input on avoiding, minimizing, and compensating for impacts from offshore wind energy projects to commercial and recreational fisheries. Focal topics of the draft guidance include a general approach to mitigation; project siting, design, navigation, and access; safety measures; environmental monitoring; and financial compensation for the fisheries industry.

State Siting & Permitting Jurisdiction

The Oregon Department of Land Conservation and Development has federal consistency authority to review federal activities that may affect coastal Oregon resources and uses, and would conduct consistency reviews of any BOEM proposed actions within a defined ocean area that generally overlaps with BOEM's area of jurisdiction. DLCD, through consultation with the Oregon Department of Fish & Wildfire, Department of State Lands, Parks & Recreation Department, other state agencies, and Tribes analyzes the potential direct and indirect impacts, including consideration of cumulative and secondary impacts that have reasonably foreseeable effects on coastal resources or uses. Coastal effects include five major categories: natural resources, cultural resources, coastal economies, aesthetics, and recreation/public access.

See pages 11-12 for more information about Oregon's role in BOEM's siting and permitting process for FOSW projects in federal waters, and for more on the roles of DLCD and other state agencies in the siting and permitting of projects necessary to support FOSW in state waters and on land.

Key Issues Relating to Siting and Permitting Challenges

Timeline to Meet 2030 Deployment is Very Challenging

Integrating gigawatt-scale FOSW projects into Oregon's power grid by or soon after 2030 requires imminent leasing of ocean Wind Energy Areas. A lease grants a developer with site control to conduct site assessment and characterization surveys that collect and analyze data necessary to design and plan a project, including elements necessary to support FOSW, such as port and transmission infrastructure needs. After site assessment and characterization, a developer would submit a construction and operations plan that outlines the development and operations activities for all onshore and offshore facilities associated with the specific FOSW project. The plan analyzes environmental, cultural, and socioeconomic effects of the project to inform BOEM's preparation of an Environmental Impact Statement (EIS) under the National Environmental Policy Act.

Completing the leasing step is a prerequisite for other critical planning, assessment, permitting, and development steps and is integral to the timeline for project development. Some of these steps, such as port upgrades, onshore transmission expansion, and development of supply-chains for project components have long lead times. Time and costs associated with overall project development can be tempered by developers engaging with stakeholders early in the project design process to address any potential negative impacts and to leverage opportunities that can benefit all parties.

Key Potential Challenge: Technology Readiness & Costs

There are no commercial-scale FOSW projects operating in the world, meaning there are only *modeled and projected data* on the costs to build a commercial-scale floating offshore wind project. Two of the most significant cost drivers are the wind turbines and the floating platforms. There are also port and transmission infrastructure development costs that would be necessary to deploy and integrate FOSW projects into the grid; these costs are discussed in subsequent sections.

Floating Offshore Wind Technologies Readiness

FOSW projects are more costly in terms of upfront capital investment and their levelized cost of energy than land-based wind and bottom-fixed offshore wind projects. The primary technology components for FOSW projects are the turbines themselves and the floating platforms that turbines are fixed to. Wind turbines are a proven, mature technology, even if the size and scale of turbines needed to be cost-effective for FOSW deployment are still in the development phase. Floating, deep-water platforms for offshore oil and gas extraction are also proven technologies, but platforms designed to support wind turbines, specifically, are still in the emerging stage of technology development. Some leading FOSW platform concepts have emerged, however, and are being used for the first FOSW turbine deployments in other countries. Increased deployment of FOSW and continued technology advancements over the next decade are essential to reducing costs.

The ocean depth and seafloor conditions, including slope, at the point of installation also play a role in project feasibility and costs. The National Renewable Energy Laboratory and FOSW developers indicate 1,300 meters is the current cost-effective depth limit for deploying projects. Advancements in anchoring technology may eventually enable cost-effective wind turbines at greater ocean depths, but these advancements are not expected to materialize in the near-term.

The Bureau of Ocean Energy Management's identification of Oregon Call Areas was informed by NREL's analysis. Oregon's two Call Areas span depths of 120 meters to roughly 1,300 meters and distances of 14 to 65 miles from shore. While there is interest from industry in developing projects in depths beyond 1,300 meters, the likely timeline for technology advancements to accommodate these greater depths would almost certainly preclude Oregon from achieving 3 GW of offshore wind by 2030.

Technology Resilience

Research on the resilience of FOSW to natural hazards, especially their resilience to Pacific Ocean storms, swells, tsunamis, and earthquakes is incomplete and inconclusive. Without real world data on how FOSW projects will fare in significant tsunamis or earthquakes, for example, there are concerns about the effects of a high-magnitude earthquake, such as a Cascadia Subduction Zone earthquake, on floating offshore wind projects off Oregon's coast.

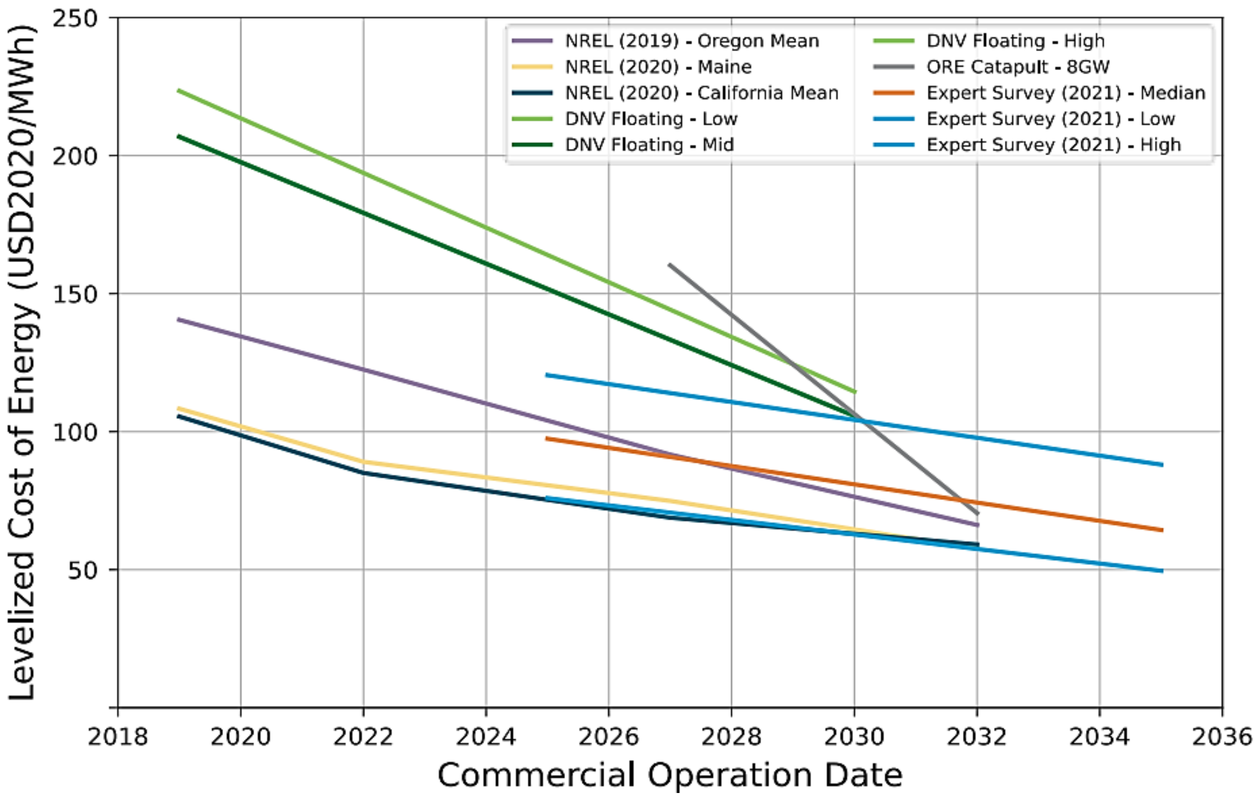
Technology Costs

The Levelized Cost of Energy, or LCOE, for floating offshore wind is currently higher than for other renewable technologies, including for fixed-bottom offshore wind. Like many energy technologies, as global FOSW deployment increases over time, its LCOE is expected to decrease. The chart below from USDOE projects the LCOE for FOSW will decrease significantly through the late 2030s. The major drivers of this reduction in cost are expected to be larger turbines, increased production volumes of floating platforms, and other design and technology improvements driven by increasing numbers of global FOSW projects.[41]

Levelized Cost of Energy is the total cost of developing an energy project divided by the amount of energy it produces. It is usually measured in dollars per megawatt-hour ($/MWh), on the basis of the energy produced, as-available.

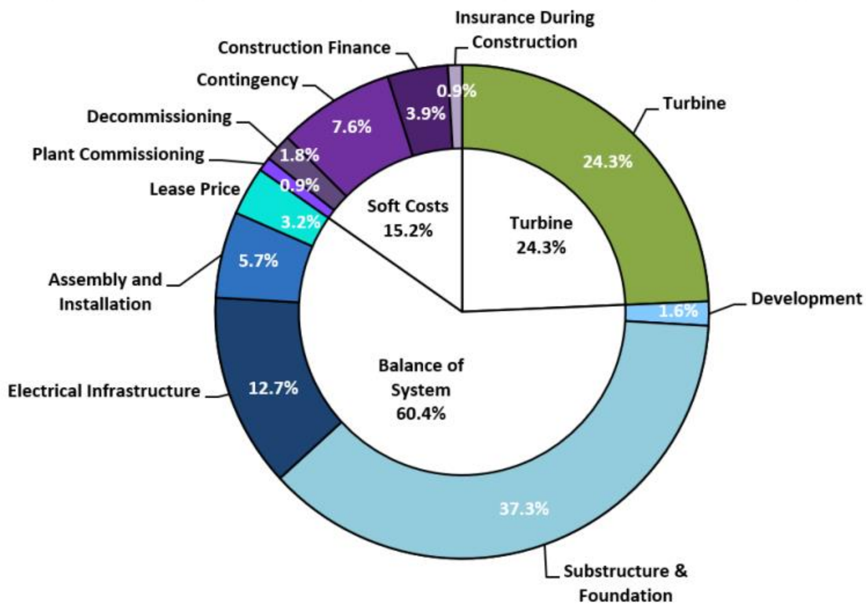
LCOE does not take into account when a project can or cannot produce that energy.

Figure 13: Levelized Cost of Energy for Floating Offshore Wind Deployment Over Time



There are no commercial-scale FOSW projects in operation today, which means the waters off California and Oregon could ultimately host one of the first such facilities in the world. Because of the high costs associated with building the first commercial-scale FOSW projects, permitting and deploying larger overall projects with more turbines is likely the most cost-effective approach for developers. Deploying more turbines would spread fixed costs – such as transmission infrastructure – over a larger amount of generating capacity. This would reduce the overall cost per megawatt of installed capacity, and ultimately the overall cost per megawatt-hour of energy generated (the levelized cost of energy). Additional turbines also increase the quantity of FOSW components necessary to support them. This can enable "industrialization" of supply-chains for mass production, thereby further lowering component manufacturing expenses and reducing a project's LCOE. While larger projects could have economic benefits, they could also have larger effects on ocean users and ecosystems.

Figure 14: Capital Cost Breakdown for a FOSW Reference Project[42]
Does not include capital costs for onshore upgrades to ports or the existing transmission grid.



Floating platforms are massive, heavy structures that are costly to transport. To reduce transportation costs, platforms could be manufactured at, or near, the local assembly and deployment port where turbines would be fixed to platforms before being towed to the project's open water location for mooring to the seafloor. Platforms could also be manufactured at a port further away and towed to the local port for integration with turbines, but this would increase transportation costs.

Business Oregon

"The supply chain can be located in several different communities. Most likely the larger items that are logistically challenging to transport will be located close to the terminal facilities. The small items can [be] transported from farther distances."

Reductions in the LCOE for FOSW are expected to occur as FOSW technologies mature and commercial projects are brought online. The construction of commercial projects will support supply chain efficiencies that optimize manufacturing economies of scale and minimize transportation costs, which will also lower project LCOEs. Technological advancements anticipated in the next decades will also likely drive costs lower. For example, NREL has estimated LCOEs for FOSW projects in 2022 with 8 MW turbines off Oregon's coast, sited at different locations from south-to-north, to range from $74/MWh to $107/MWh; but has estimated that these LCOEs could drop to a range of $51/MWh to $74/MWh by 2032 with 15 MW turbines and advancements in other FOSW component technologies, particularly floating platforms.[43]

As it stands today, deploying FOSW projects off Oregon's coast by or near 2030 would require developers to be early adopters of floating offshore wind technology, and utility procurement before many of these actions will have had much effect on reducing overall project costs.

Concerns About Risks Associated with Technology Readiness

There are inherent risks to being an early adopter. As discussed above, costs tend to be higher. The technology investments may fail or become obsolete quickly, requiring reinvestments to ensure the project continues to operate efficiently. Many stakeholders indicated interest in developing a smaller, pilot-scale project, which could provide valuable information about costs, operations, maintenance, and efficacy of FOSW before committing to a larger-scale project.

There was also interest in studies that would assess the technical viability of commercial-scale FOSW projects in the ocean conditions in the areas of the Pacific Ocean where projects are being considered. Stakeholders expressed concern that because FOSW technology is unproven in Pacific Northwest ocean conditions, there could be increased risk of project failures and the potential harmful economic and environmental effects this might have on Oregon's communities and natural resources.

Technology constraints currently limit siting FOSW resources at ocean depths beyond 1,300 meters. The fishing industry, shipping industries, and Tribes indicated that the specific areas BOEM is considering for lease are also ocean waters that they use for their work and communities. There's interest from many in understanding if, and when, deeper water FOSW projects might be economically viable. Because ocean areas beyond the 1,300-meter depth do not overlap as much with current activities and provide more room for ocean vessels to maneuver around, locating FOSW projects at these depths would alleviate many of the concerns over potential adverse impacts to fishing and shipping communities.

Key Potential Challenge: Port Infrastructure & Sea Vessels

The most cost-effective way to construct, deploy, and maintain an offshore wind project is from a nearby port. No single port in Oregon, however, is currently capable of supporting the deployment of FOSW projects without significant upgrades. Any Oregon port would need to be upgraded to accommodate construction, deployment, and maintenance activities.

Oregon ports are not deep enough or large enough to accommodate these activities. The necessary upgrades to Oregon's port infrastructure would likely require several years of planning and development activities, and possibly longer depending on the magnitude of potential impacts to existing uses and the environment and the complexity of siting and permitting processes. These upgrades could include dredging, expanding lay down areas, increasing weight capacity, erecting cranes, and upgrading rail and roads to accommodate supply lines.

Coos Bay is the largest deep-water port between San Francisco and Puget Sound and may offer the best opportunity in Oregon for the type of expansion necessary to support FOSW development. However, both San Francisco and Puget Sound are home to larger ports that would require fewer upgrades to accommodate FOSW activities. FOSW deployment at these ports would add expense for transporting projects to the strongest offshore wind resource areas, near the Oregon-California border.

Port activities could also be split so that different ports specialize in different activities. Use of multiple ports would support increased scaling, diversify risk, optimize costs, and distribute economic development benefits. As an example, mass production of floating platforms could occur by co-locating a platform fabrication facility at a FOSW deployment port, or through multiple port fabrication facilities that provide modular platform components to a FOSW deployment port for final assembly. Regional collaboration could help optimize the number and locations of ports to minimize costs involved with port upgrades and costs of transporting FOSW components to a deployment port.

Pacific Seafood

"To build efficiencies developers and construction companies will consolidate in several ports and they may not be on the OR coast, Seattle/Tacoma and LA may prove to be better locations as they have deep water ports already and supplies of skilled labor."

In 2016, the Bureau of Ocean Energy Management conducted a study of west coast ports that classified them into three categories as they relate to FOSW support: ports suitable for assembly, ports suitable for fabrication and construction, and ports suitable to support maintenance, troubleshooting, and repair after project installation. The study identified Coos Bay and Astoria Ports as the only Oregon ports with the potential to serve all three categorical needs for FOSW. Ports along the Columbia River region, including Portland, could potentially support the fabrication and construction of FOSW components. However, the height of the assembled towers and bridge restrictions along the Columbia precludes assembly at these ports, and the ports are too far inland to provide operational and maintenance support.

Coos Bay Study

A 2022 port study funded by TotalEnergies SBE US and the Oregon Business Development Department (Business Oregon) found that the Port of Coos Bay has physical characteristics that could be upgraded to support the manufacturing, deployment, and maintenance and operations activities necessary for FOSW projects. The depth and width of the existing navigation channel and availability of waterfront acreage seaward of bridges for yard and wharf development are key elements of ports critical to supporting FOSW.

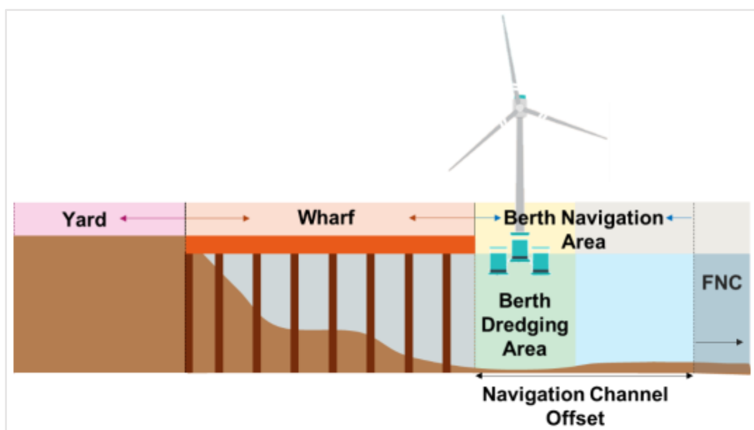
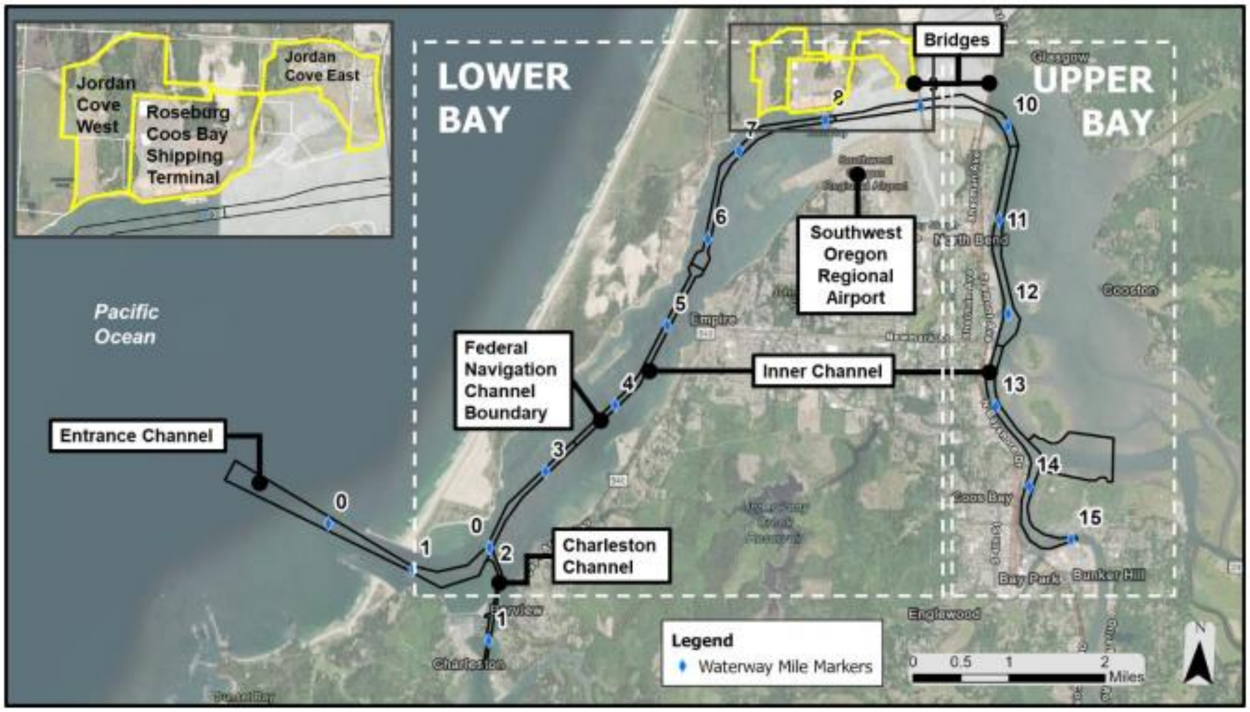


Figure 15 shows an aerial view of the Port of Coos Bay and Jordan Cove West site that the study identified as a location for where upgrades could occur – outlined in yellow.

Figure 15: Coos Bay Area Overview



Sites for a potential FOSW facility shown in yellow outline.

At a minimum, a new shoreside FOSW facility and a channel expansion are necessary to deploy the largest turbines currently available (15 MW). The study estimated the cost to provide the facility upgrades alone at the Jordan Cove West location was $0.5 to 1.0 billion and did not include channel expansion costs.[44]

Coos Bay has existing plans to expand the navigation channel and to develop a central rail terminal at the port, both of which align with the upgrades necessary to support FOSW. The Coos Bay Channel Modification Project would accommodate larger shipping vessels by widening the existing channel from 300 feet to 450 feet, and deepening it from 37 feet to 45 feet. The proposed Coos Bay Multimodal Terminal would be the first ship-to-rail facility on the West Coast and would reduce the dependence on imports and exports moving in and out of Oregon by truck via the ports of Seattle/Tacoma and Oakland. Together these projects would expand the port's capacity for importing and exporting goods of all kinds, which would benefit both the delivery of FOSW components and the deployment of integrated FOSW turbines and floating platforms.

South Coast Development Council
"Immediate project development will impact the Oregon International Port of Coos Bay channel deepening project, while also spurring major marine terminal upgrades and new construction to meet the immediate quayside needs for integration and deployment of turbines. In addition, these projects will generate significant job creation numbers, through the maritime sector, however, it is also anticipated that a large number of supply chain entities will follow suit and site in the general vicinity or greater region of the port location."

Sea Vessel Needs

Because turbines and platforms can be assembled in port and towed to sea, FOSW will be less dependent on specialized sea vessels than bottom-fixed offshore wind projects, although specialized sea vessels are likely necessary to support tow-out and the installation of mooring lines and power cables. The following are additional specially designed sea vessels that may be necessary:

- **Component Delivery Vessels.** Consist of breakbulk carriers, cargo ships, and barges that transport wind turbine components.
- **Heavy Lift Vessels.** Designed to transport very large loads and may be used to deliver wind turbine components or FOSW platforms.
- **Semisubmersible Heavy Lift Vessels & Barges.** Designed to transport very large floating loads with semisubmersible capabilities for loading/unloading and may be used to deliver FOSW platforms**.**
- **Semisubmersible Dockside Barges.** Designed to lower floating platforms into the water and can be used to transport floating platforms.
- **Crane Vessels.** Designed for heavy lifts required for dockside float-off and for lifts required for ocean installation.

Investments in U.S.-built vessels to support the offshore wind industry are being made because specialized sea vessels to support FOSW are in relatively limited supply, and most of those available are foreign-flagged vessels. The Jones Act requires U.S.-flagged vessels be used for the transport of merchandise between two U.S. points, which includes ports and ocean sites of FOSW projects. This means all aspects of FOSW component delivery must use vessels built and registered in the U.S. and primarily crewed by Americans. There is uncertainty about whether the Jones Act would cover construction activities at sea. If construction activities occurred at sea, they could require the use of U.S.-flagged vessels for heavy lift installation activities — and there are currently no U.S. flagged heavy-lift vessels.

South Coast Development Council
"We anticipate the immediate investment in FOSW will positively impact current marine and shipbuilding companies on the southern Oregon coast such as Fred Wahl Marine Construction, Giddings Boatworks and Tarheel Aluminum, Sause Bros, and Advantec, among others."

Concerns About Port Infrastructure and Specialized Sea Vessels

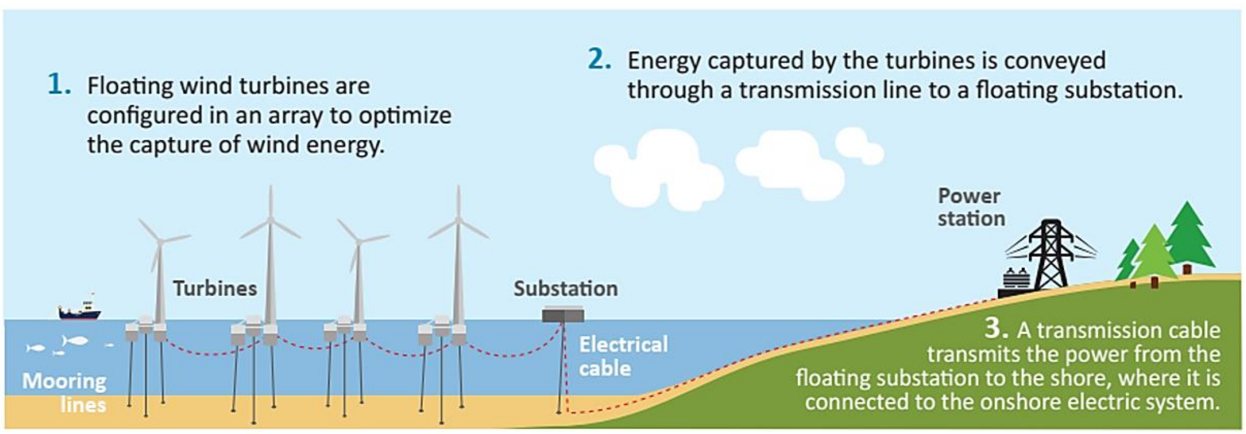
Port upgrades and building specialized sea vessels could take several years, and may be difficult to finance without assurances of planned FOSW projects. Fabrication and assembly of components could occur at ports outside of Oregon, but would still require some degree of port facility upgrades no matter where these activities occur. Because of the limited supply and uncertainty around the implications of the U.S. Jones Act, the construction of additional U.S. vessels would need to begin several years before they are needed to support FOSW deployment.

Key Potential Challenge: Transmission Infrastructure

Transmission infrastructure is necessary to interconnect FOSW to the grid and transfer power to load. Projects require subsea transmission lines and likely ocean-based substations that are complex and costly to install. In addition to the offshore transmission infrastructure, upgrades to existing onshore substations and lines – potentially new lines – would also be required to interconnect FOSW projects to the grid. Transmission infrastructure is expensive (at least $1 million per mile—and often substantially more—for new lines)[45] and its planning, permitting, and construction can take 10 to 15 years for new lines.

Portland General Electric
"In PGE's experience, new significant transmission line/s will require a long lead time, including right of way acquisition and permitting which can take 10-15 years before construction can begin. Developing 500 kV transmission lines can cost anywhere from $3-5 million dollars a mile. To overcome these existing challenges, delivering supportive policy will be essential."

Figure 16: Offshore and Onshore Transmission Infrastructure Necessary for FOSW[46]



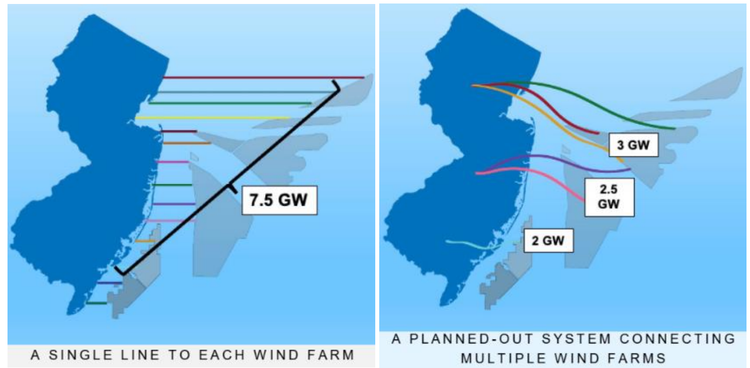
Offshore Transmission Design and Costs

There are two different types of transmission line configurations that could deliver electricity generated from floating offshore wind projects to the grid onshore: high-voltage alternating current or high-voltage direct current lines. The decision to develop an HVAC or HVDC transmission line, or a hybrid configuration using both, is largely dependent on the scale, quantity, configuration, and distribution of FOSW project(s). In general, larger FOSW projects located longer distances from shore are more conducive for using HVDC lines to interconnect to the onshore grid and smaller projects closer to shore are more conducive to for using HVAC lines for grid connection.[47]

The most common configuration used for offshore wind projects to date is an HVAC configuration. These have been used to link individual projects to the onshore grid, and if multiple projects are developed can result in the need many lines.

HVDC lines can transmit higher capacities of electricity more efficiently, which can support multiple offshore wind projects. Multiple projects would each tie into an HVDC line offshore, and then the HVDC line would carry all the generated electricity onshore.

Figure 17: HVAC Radial Export Cable Configuration (left) and HVDC Backbone Transmission Configuration (right)



An HVDC configuration could optimize transmission costs for multiple projects because it would reduce the need for each project to construct and maintain an independent HVAC line. The line could also be designed to allow for additional projects to be added at a future date. However, this type of line would likely require a comprehensive plan that identifies a reasonable cumulative buildout of FOSW over decades, a mechanism to pay for the up-front capital expenditures, and robust collaboration between developers, utilities, regulators, and local stakeholders.

The HVDC design requires floating HVDC converter stations to convert the generated AC power to DC. To date, there are no existing *floating* HVDC converter stations. Some bottom-fixed offshore wind projects use an HVDC configuration, but in these instances the converter stations are also bottom-fixed. While studies have explored the concept of a floating HVDC design, and while the industry is planning for this type of configuration to be available in the future, this technology has not been tested and additional technological advancements are needed for this design to be a viable configuration for FOSW.

The cost for building an HVDC line is also a significant hurdle. A conceptual assessment for a nearshore, approximately 250-mile, 500-kV HVDC subsea cable project from Humboldt Bay to San Francisco had a very rough cost estimate of at least $2 billion.[48] For comparison, a land-based transmission project of similar scale, the approximately 300-mile, 500-kV AC Boardman to Hemingway project, is estimated to cost about $1 billion.[49]

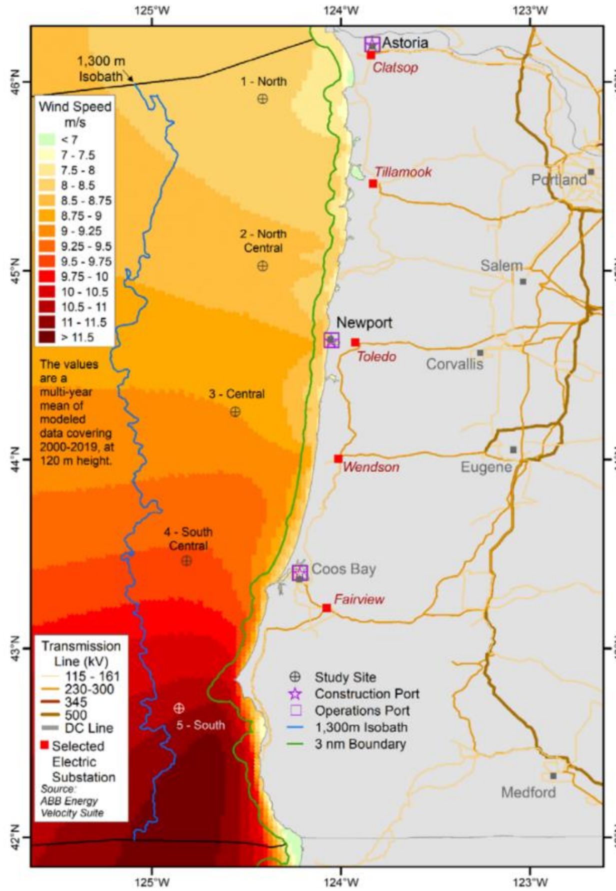
Onshore Transmission Capacity

As shown in Figure 18, Oregon's coastal grid has been designed to supply the relatively small loads of coastal communities with electricity delivered via transmission lines from large inland generating resources located east of the Coast Range. Without significant upgrades, Oregon's coastal onshore transmission infrastructure can support only a limited amount of FOSW generation.

Completed Onshore Transmission Capacity Studies

Without significant transmission upgrades, interconnecting more than 2.6 GW to Oregon's existing onshore transmission system would risk curtailment of those resources under some circumstances. Two recent studies by Pacific Northwest National Laboratories (2020)[50] and the National Renewable Energy Laboratory (2021)[51] identified existing transmission capacity across the Coast Range as the most significant challenge to integrating more than about 2.6 GW of FOSW nameplate capacity, which equates to about 2 GW of electrical power into Oregon's grid (some electricity is lost at the point of generation and through transmission lines). Without significant upgrades to existing transmission, additional gigawatt-scales of FOSW generation would be at risk of curtailment – the need to shut down some amount of FOSW generation due to a lack of transmission capacity.

Figure 18: Trans-Coastal Transmission Lines



Plugging into the Grid – What is Interconnection?

Modifications, additions, and upgrades necessary to physically and electrically connect a generation resource to the transmission system while maintaining reliability. Requirements can be affected by:

- Type and size of generation
- Location
- Existing generation and load
- Existing transmission infrastructure and in-process upgrades

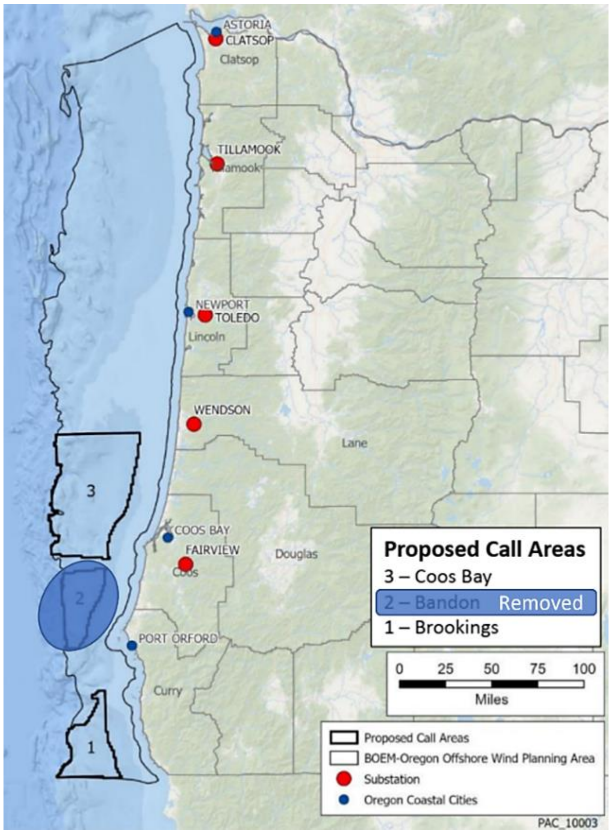
No single interconnection point on Oregon's coastal grid can accommodate the full 2 GW. In both studies, the power was split across multiple interconnection points – four coastal substations in the Pacific Northwest National Laboratory study and five in the NREL study. In the NREL study, the five substations shown in Table 2 were necessary to

Table 2: Existing Substation Capacity Limits for The Injection of FOSW Power (NREL)

Offshore Wind Injection Point	Max Capacity (MW)	Max Injected Offshore Wind Power (MW)
Clatsop	361	301
Tillamook	553	461
Toledo	156	130
Wendson	613	512
Fairview	941	785
Total	2,625	2,189

integrate the 2 GW of FOSW power injection without significant and costly transmission system upgrades. The studies did not explore the specific costs of those potential upgrades.

Figure 19: Existing Onshore Transmission Network (NREL)



The NREL study shows that the existing onshore transmission network can accommodate about 1.5 GW of FOSW in the two Call Areas identified by BOEM through the Wendson and Fairview substations. Practically, the onshore transmission capacity may be even less. Additional studies are needed that assess additional constraints, such as transmission reliability and availability of transmission service rights, which may further reduce the amount of available transmission capacity at the coast.

Other transmission studies are being conducted,[52] and each will contribute new information to further develop and refine a common understanding of the existing limits of the onshore transmission system's ability to interconnect FOSW at various scales and the potential scale and costs of onshore upgrades that could be necessary to support this interconnection.

Bonneville Power Administration

"Coastal transmission was designed primarily for local load service. About 1 GW total of off-shore wind can be integrated in Southern Oregon with upgrades to the existing system. Large-scale integration will require new transmission lines, and may take over a decade to permit, engineer and construct."

Transmission Planning

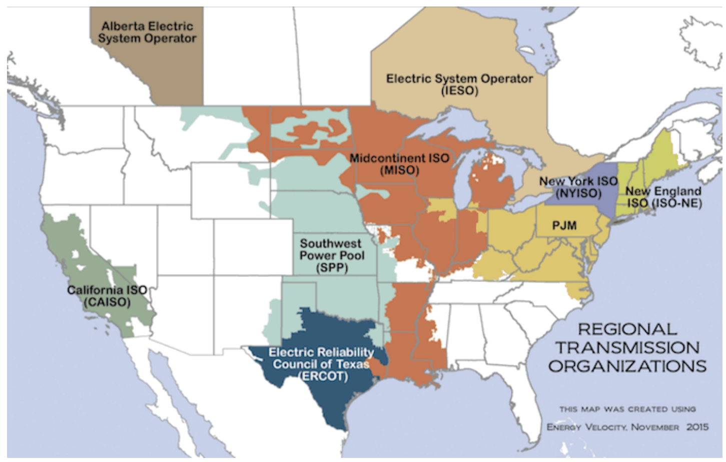
Transmission planning in Oregon – and much of the West – is largely driven by the procurement of generation assets. When planning for new generation, offtakers – the entities that buy the electricity – must plan for transmission needs. The most cost-effective method is to locate generation near existing transmission lines that have capacity to bring the power to the offtaker. If transmission capacity is unavailable, upgrades to existing transmission pathways or new transmission pathways would likely need to be developed, or committed to, before a

Power offtaker is a general business and financing term that describes the purchaser of a product or service sold. Offtakers in the energy sector are those that purchase the power generated by a specific energy project.

procurement contract can be executed. See next section on Long-Term Power Offtakers and Energy Markets for more details on resource planning and procurement.

The Pacific Northwest does not have a single regional transmission provider and uses a decentralized approach to regional transmission planning. The region is composed of many providers, each conducting their own local transmission planning for their individual systems. Planning is primarily based on utility resource plans that identify expectations for load growth and resource additions that will affect the transmission provider's system. Transmission providers in Oregon and the region submit their local transmission plans to NorthernGrid – the regional transmission planning entity. NorthernGrid develops a Regional Transmission Plan that evaluates and identifies the combination of transmission projects that will most efficiently and cost-effectively meet the region's reliability needs.

In much of California and other parts of the country, transmission planning is centralized. Regional Transmission Organizations and Independent System Operators provide a formal structure for regional transmission cooperation.[viii] RTOs and ISOs streamline efforts to optimize power planning and procurement to serve the loads of the entire region, and this includes coordinated regional transmission planning.



Pacific Northwest utilities would likely need to cooperate with each other or with utilities outside the region to plan for the procurement of FOSW which would then prompt local transmission planning. To be cost-effective, FOSW would likely need to be deployed at gigawatt-scales, but this amount of generation is likely too large to serve the needs of any single moderately sized utility in the Pacific Northwest. As a result, it is unlikely any single utility will plan for the procurement of FOSW on its own. Because procurement drives local transmission planning, it will be challenging to plan for the transmission upgrades necessary to interconnect a FOSW project without a collaborative effort.

Cooperating utilities could be located in the Pacific Northwest region or include utilities outside the region. It is possible that a single large utility outside the region might identify Oregon FOSW as a resource to meet its needs. In any of these instances, if the identified FOSW project would interconnect to, or affect the power flows across a Pacific Northwest transmission provider's system, then transmission projects necessary to accommodate the project would be identified in a local transmission plan.

[viii] For more information on RTOs, see the ODOE RTO Study (2021) - https://www.oregon.gov/energy/energy-oregon/Pages/RTO.aspx

Key Potential Challenge: Long-Term Power Offtakers and Energy Markets

Long-term offtake commitments for gigawatt-scales of FOSW are likely necessary to attract investment from developers and for them to secure financing — while gigawatt-scale FOSW projects are likely too large for the needs of any one of the moderately sized utilities that serve Oregon and the Pacific Northwest. Either fractional commitments from multiple offtakers in and/or outside Oregon, or a gigawatt-scale commitment from a single offtaker – likely outside Oregon – will likely be needed to facilitate procurement. The bi-lateral market structure of the Pacific Northwest, where utilities procure resources and wholesale energy to meet their individual needs, complicates collaboration amongst Oregon utilities for cooperative procurement.

Portland General Electric

"Given the potential cost of FOSW, a significant deployment is likely too large and too risky for a single moderate sized utility to absorb. Large projects like that being proposed through FOSW generally would require more than a single equity partner/offtaker. However, substantial investments from the federal government, as well as tax credits, could improve the economic viability of the projects and mitigate customer cost impacts."

Offtaker Options

There are a variety of ways to offtake electricity from a FOSW project. FOSW generation could be used by a project owner to meets its own demand, sold via a long-term Power Purchase Agreement, or sold in shorter timeframes via wholesale energy markets. Some examples include:

- A utility or a combination of utilities making direct investments to own a project and use its output to serve customer loads;
- An independent power producer investing in and owning a project to sell its output to utilities or other consumers via a Power Purchase Agreement or through wholesale energy markets;
- A private business investing in and owning a FOSW project to use its output for meeting its own, typically industrial-scale, electricity needs (e.g., potentially for the production of hydrogen); or
- A combination of the entities above could share the output of a FOSW project to serve their individual needs.

Oregon or Pacific Northwest Utilities as Potential Offtakers

There are currently no binding mechanisms for centralized planning that would identify optimal resources for the state or region to procure.[ix] There are, instead, dozens of entities that conduct planning activities designed to serve Oregon customers, with the state's three investor-owned utilities' planning subject to the regulation of the PUC and the state's 38 consumer-owned utilities' planning subject to oversight from their individual governing boards. This multitude of processes, entities, regulations, and requirements would complicate any effort to develop a cooperative offtake agreement among multiple utilities operating in Oregon.

[ix] Note that while the Northwest Power and Conservation Council does produce a regional power plan every five years, that plan is used for informational purposes by the several dozen electric distribution utilities serving Oregonians and has no binding regulatory effect on them.

Despite the complexities, cooperative direct investment in or procurement of large-scale resources like gigawatt-scales of FOSW is possible and has occurred in the region's past.[x] To date, Oregon utilities have not identified FOSW as a cost-effective and least-risk procurement option to meet the energy needs of Oregon customers. However, Portland General Electric and PacifiCorp are both modeling FOSW as part of their current planning cycles, with results expected to be reported in 2023.

Oregon Consumer-Owned Utilities

Most Oregon consumer-owned utilities meet the vast majority (and in many cases, 100 percent) of their power needs with wholesale electricity provided by the Bonneville Power Administration. As a result, most COUs do not typically enter into power purchase agreements with other entities, the type of agreement that would support cooperative investment in a resource like FOSW. Recently, however, a handful of COUs have entered into new agreements with third parties other than BPA to develop power projects to meet increasing customer demand. BPA, meanwhile, conducts its own planning activities but, due to the structure of its current long-term contracts, has not had to make significant investments to acquire new generating resources to meet customer demand in several decades. BPA is currently in the process of discussing with the region what the next long-term power sales contracts will look like. Those future contracts will shape the demand for and types of new resources that BPA would be looking at in the future.

Oregon Investor-Owned Utilities

Investor-owned utilities are required by the Oregon Public Utility Commission to engage in long-term resource planning – through integrated resource plans – to determine what resources they will use to meet current and future load. IRPs use sophisticated modeling and vetting of assumptions in a public process to forecast energy needs over a 20-year period. The IRP process identifies the least-cost, least-risk combination of energy resources to meet demand at all times. Utilities use the information and conclusions developed in IRPs to identify near-term procurement actions.

To comply with HB 2021, Portland General Electric and PacifiCorp are required to submit Clean Energy Plans with their IRPs. OPUC Order 22-206 requires PGE and PAC to submit these plans to achieve Oregon's clean electricity targets with their next IRPs in 2023.

Portland General Electric

"As we continue to explore emerging technologies, customer affordability and reliability will be at the forefront. We believe FOSW could be part of the solution in helping Oregon and surrounding states to meet their 2040 climate and clean energy goals."

It is uncertain if Oregon IOUs will identify FOSW for near-term procurement in their next IRP cycle. Currently, the low costs of other clean energy resources, such as land-based wind, solar, and hydropower, may result in FOSW projects not being identified as cost-effective in the near-term. In the longer-term, however, the value of FOSW is likely to increase due to its complementary output

[x] Energy Northwest owns the Columbia Generating Station, the regions 1.2 GW nuclear plant. Energy Northwest is a joint action agency of the state of Washington, currently made up of 27 consumer-owned utilities.

profile with load, solar, onshore wind, and seasonal hydropower constraints. See the Key Benefit: Grid Generation Diversity Value section for more on complementary benefits of FOSW generation. Because of its long lead time, if an IOU identified FOSW as a preferred resource option in its IRP and the OPUC concurred with its determination, procurement activities would need to begin quickly for deployment by 2030.

Collaboration with Potential Offtakers from California and Other States

California's electricity market offers several advantages to help overcome the challenges facing floating offshore wind development in the near-term compared to Oregon's. California has a commitment to 100 percent clean electricity by 2045, has already deployed more than 15 GW of solar capacity and is confronting the need for greater resource diversity, and it has more centralized state-wide energy resource and transmission planning processes. California also has larger load requirements and higher overall energy prices. In addition, in 2021 the California Legislative Assembly passed AB 525, which directed the California Energy Commission to evaluate the maximum feasible deployment of FOSW to achieve reliability, ratepayer, employment, and decarbonization benefits for the state. As part of that effort the CEC established a goal of 2 to 5 GW of offshore wind by 2030 and 25 GW by 2045.

AB 525 also requires the CEC, in collaboration with other state agencies, to develop a strategic and comprehensive plan for FOSW by June 30, 2023. California state agencies involved with resource planning and procurement and with transmission planning are coordinating with each other to assess the potential for FOSW offtake. California's planning efforts for FOSW are closely linked to the State of California's engagement with BOEM's siting, leasing, and permitting process for FOSW in waters adjacent to California's coast. It is also possible that a California entity could develop a FOSW project located in BOEM-identified areas adjacent to the Oregon coast.

The potential for entities outside of Oregon to develop FOSW projects off Oregon's coast highlights an important opportunity for collaboration between Oregon and other western states, particularly California. Collaboration can help optimize planning and procurement efforts across multiple-dimensions, and can help:

- Identify optimal scales of FOSW to contribute to least-cost, least-risk comprehensive plan for meeting the 100 percent clean energy needs of western states;
- Identify entities for long-term power offtake arrangements who have both near-term and long-term need for the resource;
- Identify optimal port and transmission infrastructure solutions to accommodate cumulative deployments of FOSW over the next several decades;
- Identify optimal locations to site cumulative deployments of FOSW to best avoid or minimize potential impacts to ocean/land users and the environment.

See Appendix A for more information on California's policies and planning efforts related to FOSW.

Renewable Hydrogen

Electricity generated by floating offshore wind could help support a renewable hydrogen industry. Renewable hydrogen is produced by using renewable electricity to power an electrolyzer, which splits water into hydrogen and oxygen. The largest single cost factor associated with producing renewable hydrogen is the cost of renewable electricity, accounting for between 30-75 percent of production costs depending on the size and type of the installation. This makes low-cost renewable electricity attractive to developers of renewable hydrogen.

ODOE Renewable Hydrogen Study

SB 333 (2021) directed ODOE to conduct a study on the potential benefits of, and barriers to, production and use of renewable hydrogen in Oregon. The study is due to the Legislature in Fall 2022. See ODOE's Renewable Hydrogen Study webpage for more information.

Across the world there is growing interest in the production of renewable hydrogen as a clean alternative fuel source and for backup power, and ODOE heard interest in developing hydrogen projects in tandem with FOSW projects from stakeholders in this study. Renewable hydrogen could be used as an alternative, zero-carbon fuel to help reduce greenhouse gas emissions from a number of sectors, including transportation, industrial, and energy storage. It can be converted through a fuel-cell or combusted through a turbine to generate electricity. Modular fuel cells and renewable hydrogen have the potential to provide back-up power and resilience benefits to grid customers and communities during power outages. Combustion turbines fueled by renewable hydrogen could deliver power to the grid.

Renewable hydrogen could also play a role in reducing onshore transmission capacity needs by providing a flexible demand for any electricity that might otherwise be curtailed due to capacity constraints. As previously discussed, a challenge facing FOSW projects off the coast of Oregon is the limited capacity of existing transmission infrastructure. A renewable hydrogen production facility located close to a FOSW project could reduce curtailment – and improve the economic viability of the project – by providing an option for using the electricity when transmission is not available or transmission expansion is not economically viable.

Studies focused on the European offshore wind market note that the renewable hydrogen industry could potentially be a viable offtaker of FOSW generation.[53] Ultimately, the viability of a renewable hydrogen producer purchasing FOSW generation depends on several economic considerations:

- The power grid's need for FOSW generation and whether upgrades to transmission infrastructure would accommodate the flow of electricity to the grid with minimal curtailment;
- Whether the amount of any curtailed electricity would be enough to support a renewable hydrogen project;
- Whether there are any local competitors for the otherwise curtailed electricity;
- Whether electricity to support renewable hydrogen production can be procured from renewable resources other than FOSW at lower costs (e.g., hydropower, solar, onshore wind); and
- The value of the cost of renewable hydrogen to potential customers – for example, customers in need of alternative transportation fuels or customers in need of back-up power for resilience events, such as Oregon's coastal communities that are at risk of energy supply disruptions caused by winter storms, wildfires, or earthquakes.

STATE-LEVEL POLICIES AND SUPPORT FOR OFFSHORE WIND

A major factor driving offshore wind development in the U.S. is state policies specifically supporting offshore wind. While bottom-fixed offshore wind has seen the most growth in response to these policies due to its lower development costs relative to floating offshore wind, the policies in place are applicable to both bottom-fixed and floating offshore wind. State policies are employing two primary mechanisms to support specific offshore wind procurement goals.

- **Power Purchase Agreement Policies** – State policies that mandate utilities to enter PPAs with offshore wind generators for a specified nameplate capacity.
- **Offshore Wind Renewable Energy Certificate Policies** – State policies that require utilities to procure offshore wind renewable energy certificates.

As of 2021, eight states have set offshore wind energy procurement goals calling for the aggregate deployment of 39,298 MW by 2040. States with offshore wind procurement policies are listed in Table 3. Note that California, Oregon, and Louisiana have adopted policies that support studying and planning for offshore wind energy development but have not quantified procurement targets or created procurement requirements.[54]

Table 3: Current U.S. East Coast Offshore Wind State Procurement Policies and Activity as of May 31, 2021[55]

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

[23]Former Rhode Island Governor Gina Raimondo called for a roughly 600-MW offshore wind energy solicitation to be developed in 2021. Although that request is not codified, this table includes the possible solicitation to illustrate a comprehensive picture across the United States.

Federal Support for FOSW

Federal policies and programs are providing support for offshore wind development, including FOSW. Primary examples include: federal tax credits for offshore wind; support for new energy infrastructure investments, including $100 million dollars for interregional transmission and offshore wind planning, modeling, analysis, and stakeholder engagement; the President's 2021 executive order establishing targets to reduce the country's GHGs; a national target to deploy 30 GW of offshore wind by 2030; a variety of federal agency funding programs specific to FOSW development, including a $2 million dollar grant in 2021 to Oregon State University for research to support analysis of potential effects from FOSW projects; and a new federal-state partnership with East Coast states to support FOSW supply-chain development.

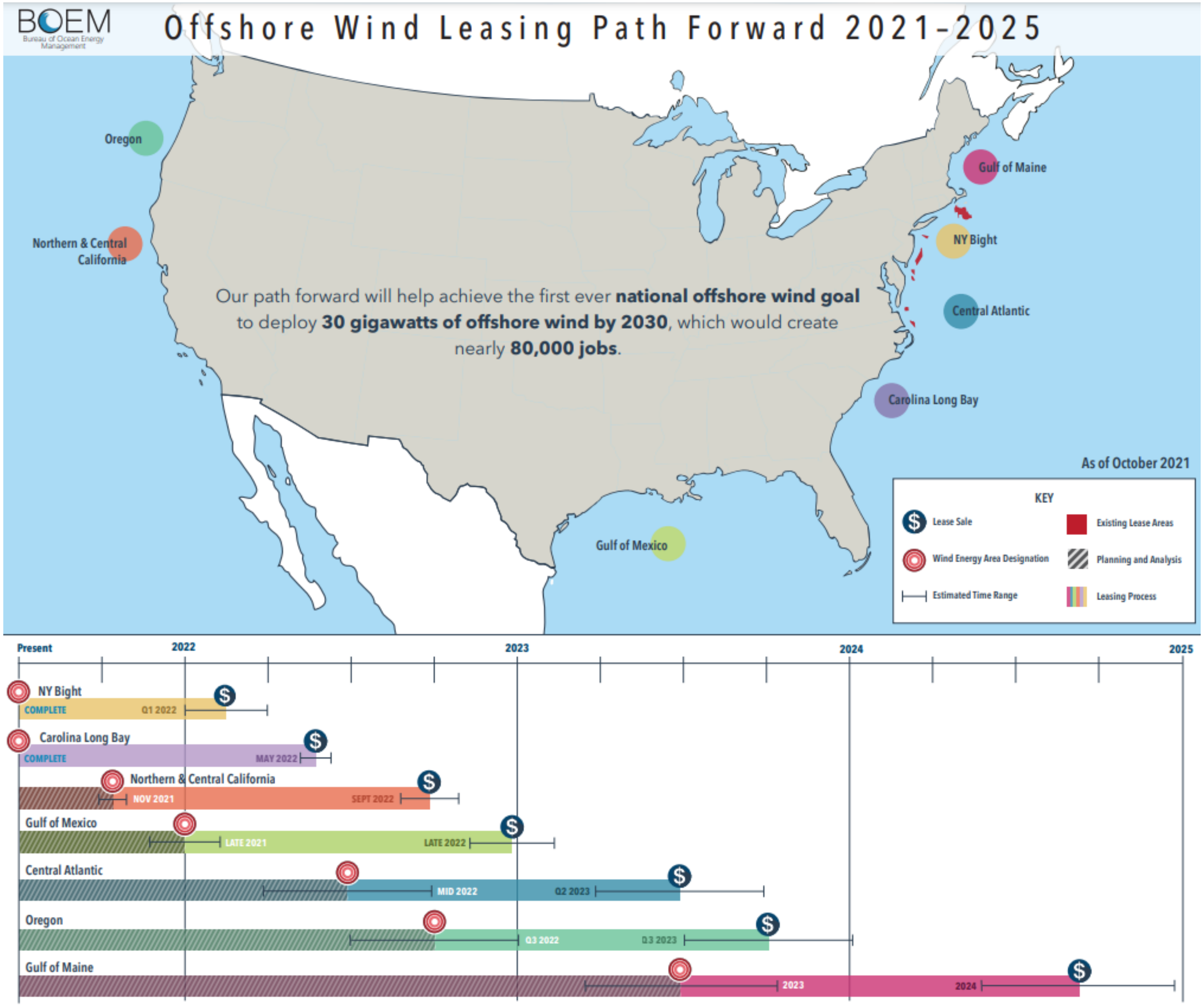
BOEM Activity

The U.S. Department of the Interior has outlined a path forward for leasing ocean areas in federal waters to meet the national goal to deploy 30 GW of offshore wind by 2030. In October 2021, the DOI Secretary announced plans for the Bureau of Ocean Energy Management to potentially hold up to seven new offshore lease sales by 2025 in the Gulf of Maine, New York Bight, Central Atlantic, and Gulf of Mexico, as well as offshore the Carolinas, California, and Oregon.

BOEM is refining its process for identifying Wind Energy Areas (areas that may be suitable for offshore wind energy leasing) and working with Oregon to delineate potential WEAs from the larger Call Areas that are currently mapped. BOEM is working to develop clear goals, objectives, and guidelines to share with government agencies, Tribes, industry, ocean users, and others prior to identifying such areas. BOEM is making efforts to use the best available science as well as knowledge from ocean users and other stakeholders to minimize potential impacts to existing ocean users and the environment from potential FOSW development that could occur in WEAs identified for leasing.

BOEM is also considering innovative lease conditions, such as lessee reporting requirements on efforts to minimize potential impacts to other ocean users; mechanisms for project labor agreements; and supply chain investments for offshore wind components. Such conditions were included in the New York Bight leases executed in 2022. In May 2022, BOEM modified its rules for the Carolina Long Bay auction using multifactor bidding criteria that allow bidding credits to be allocated for local supply chain commitments. A similar multifactor approach is also planned for the upcoming lease auction in California scheduled for late 2022 that will allow bidding credits for local benefits.[56]

Figure 20: BOEM Offshore Wind Leasing Path Forward, 2021-2025[57]



CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE STUDY & ENGAGEMENT

Achieving Oregon's economy-wide decarbonization and clean electricity policies will require developing a tremendous scale of new renewable generation projects. Federal waters off Oregon's coast hold the potential to develop dozens of gigawatts of floating offshore wind that could make a meaningful contribution to an all-of-the-above solution to achieving the state's clean energy goals. However, as described in this report, developing and integrating gigawatt-scales of floating offshore wind into Oregon's electric grid will be challenging.

While HB 3375 has resulted in this initial, high-level assessment of potential opportunities, challenges, and benefits of developing FOSW, a more comprehensive state planning effort will be necessary to address the many challenges associated with FOSW development. Any state planning strategy should be centered around collaborative engagement with the public; local communities; Tribes; stakeholder interest groups; utilities; and state, regional, and federal entities, along with an allocation of resources to fund additional technical studies to address data gaps. This type of effort could also help to identify the optimal contribution that the FOSW resource can contribute to the state's overall strategy for developing a portfolio of diverse resources to achieve mid-century policy goals. Many other states already have or are currently developing comprehensive state plans specifically targeted to offshore wind development. Two examples of states planning for FOSW are California and Maine; see Appendix A for a summary of these efforts and more details.

Regional collaboration may be necessary to develop sufficient scales of power purchasing and infrastructure investments needed to initiate FOSW project development. There are many regional forums that are contemplating and discussing relevant regional issues – including decarbonization, regional energy markets, and sustainable fisheries – that could be leveraged as the platform for this regional collaboration. Some of these forums include the West Coast Ocean Alliance, Western Governors Association, Northwest Power and Conservation Council, Western Power Pool, Pacific Fishery Management Council, and the Pacific Coast Collaborative.

If the challenges can be overcome, floating offshore wind could make significant contributions to achieving Oregon's GHG and clean energy policies, while strengthening the reliability and resilience of the power system for coastal communities. Development of this industry along Oregon's coast could initiate a new energy-based economy in coastal communities, supporting large numbers of jobs and economic investments. While these benefits are compelling, it is critical that the potential effects on existing economies, cultures, communities, and the environment are assessed, avoided to the maximum extent practicable, and mitigated where necessary. This is best accomplished through intentional and robust engagement with affected communities to develop successful outcomes.

Recommendations for Future Study & Engagement

The next logical steps toward planning for floating offshore wind development include more rigorous analysis of the energy, economic, and environmental effects of development to support planning activities. The Oregon Department of Energy has identified four broad recommendations for future study and engagement on the potential for FOSW development:

- **Additional resources and technical studies**: State agencies have limited budgets to accomplish existing duties. The allocation of additional resources to Oregon state agencies with a nexus to FOSW development is essential to comprehensively plan for FOSW. Additional resources would fund technical studies and support more extensive state engagement with the public, local communities, Tribes, stakeholder interest groups, utilities, and state, regional, and federal entities to inform the studies.

- **State strategy**: Develop a comprehensive state strategy for FOSW development with a potential outcome being an identification of optimal deployment goals that contribute to achieving 2050 clean energy and climate policies. While the state currently has no comprehensive energy strategy, a state strategy for FOSW would align with utility and regional planning activities while balancing consideration of effects and challenges important to Oregon.

- **Broad and robust stakeholder engagement and input**: Study and planning activities should be conducted through extensive and broad engagement with all interested parties, and especially local communities, including Tribes. These entities hold critical expertise in identifying the potential cumulative and local effects on ocean and land users, the environment, and cultural resources, and are key to developing options to avoid or minimize these effects.

- **Expand regional collaboration**: Identify pathways to expand regional collaboration to advance and optimize opportunities for FOSW development in a manner that best avoids and minimizes the potential cumulative and local effects along the Pacific Coast.

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APPENDIX A: EXAMPLES OF COMPREHENSIVE STATE PLANNING FOR FOSW

Comprehensive state planning efforts for potential FOSW development are underway in California and Maine, two states similar to Oregon in that they both have deep ocean waters adjacent to their coasts that would require floating offshore wind.

California

In 2021, the California State Legislature passed AB 525, which directs the California Energy Commission to coordinate with local, state, and federal agencies and a wide variety of stakeholders to develop a strategic and comprehensive state plan for offshore wind deployment in federal waters off the California coast.

To inform the state plan, the law required CEC to evaluate and quantify the maximum feasible capacity of offshore wind energy to achieve reliability, ratepayer, employment, and decarbonization benefits, and to establish offshore wind energy planning goals for 2030 and 2045. In August 2022, after convening public workshops and receiving comments from the offshore wind industry, environmental organizations, labor organizations, environmental justice, fishing, tribal, and the shipping industry, among others, the CEC issued a detailed report that established a 2 to 5 GW planning goal for 2030 and a 25 GW planning goal for 2045.

- **Critical Note:** Planning goals are not procurement targets – which many East Coast states have enacted alongside specific policy mechanisms that mandate or incentivize utilities to procure offshore wind projects – and any future procurement authorization for offshore wind must go through all necessary resource planning, procurement, and permitting requirements.

The law further requires the CEC to continue collaborating and coordinating with other state agencies (e.g., the California Coastal Commission, the Department of Fish and Wildlife, the Ocean Protection Council, the State Lands Commission, etc.), and a wide variety of stakeholders through a public process that creates a state plan for offshore wind that:

- Identifies ocean areas suitable to accommodate the planning goals;
- Plans for improving coastal port facilities and transmission infrastructure necessary to support the planning goals, including an analysis of economic benefits and workforce development needs;
- Develops a permitting roadmap describing the timeframes for the permitting processes necessary for implementing the planning goals; and
- Includes an assessment of the potential impacts on coastal resources, fisheries, Native American and Indigenous peoples, and national defense, and strategies for addressing those potential impacts.

California state agencies are also involved with resource planning and procurement and transmission planning. They are coordinating with each other to assess the potential for FOSW offtake by California utilities. California's planning efforts for FOSW are closely linked to the State of California's engagement with BOEM's siting, leasing, and permitting process for FOSW in waters adjacent to California's coast.

Maine

In June 2019, Maine's Governor launched the Maine Offshore Wind Initiative to identify opportunities for offshore wind development in the Gulf of Maine and to determine how Maine can best position itself to benefit from future offshore wind projects, including opportunities for job creation, supply chain and port development, and contribution to Maine's clean energy future.[1] The Initiative is charged with promoting compatibility between potential future uses and existing uses in the Gulf of Maine to inform offshore wind siting considerations and minimize impact on Maine's commercial fishing and maritime industries.[2]

To further its Initiative, in October 2020, Maine received a $2.16 million dollar grant from the U.S. Economic Development Agency to support long-term planning for offshore wind with fishery, business, environmental, and science representatives.[3] This grant to the Governor's Energy Office is helping to advance the development of a comprehensive state plan – an "Offshore Wind Roadmap" - which could help grow Maine's economy and improve Maine's economic resilience.[4] Maine's Offshore Wind Roadmap is being developed through a collaborative stakeholder and public engagement process, with an expert advisory committee and several working groups focusing on energy markets, ports and infrastructure, socioeconomic impacts, equity, manufacturing and supply chains, workforce development, and ocean and environmental compatibility. Importantly, the effort is focusing on planning and data-gathering to support future siting decisions, with the goal of minimizing potential effects on the environment and fisheries.[5] The Roadmap is expected to the completed in December 2022.[6]

Concurrent with its Roadmap development activities, and as result of Maine's 2019 law LD 994, Maine is moving forward with the country's first FOSW demonstration project in state waters – the New England Aqua Ventus project consisting of a single 11-MW turbine.[7] Additionally, in 2021, Maine passed LD 366 declaring a FOSW research project in federal waters as in the public interest and authorized the Maine PUC to approve a contract with New England Aqua Ventus for a small-scale FOSW project of 12 or fewer turbines totaling up to 144 MW.[8] The project will foster leading research into how FOSW interacts with Maine's marine environment, fishing industry, shipping and navigation routes, and advance the development of commercial-scale FOSW projects in the U.S. and beyond.[9] On August 19, 2022, BOEM initiated concurrent processes for determining if there is competitive interest in leasing federal ocean waters in the Gulf of Maine for FOSW projects of any size (i.e., research-scale or commercial-scale), which could affect the costs of the location of where Maine's FOSW research project would ultimately be sited.[10]

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