Final Recommendations
Supply Chain, Workforce, Ports and Marine Transportation Working Group of the Maine Offshore Wind Roadmap

Contents

Introduction to the Supply Chain, Workforce, Ports, and Marine Transportation Working Group 2
Context for the Working Group's Recommendations 2
- Ports 3
- Supply Chain (including manufacturing and vessels) 4
- Workforce 6

Impact of the Recommendations on People 7
Vision Statement for Maine's Offshore Wind Supply Chain 9
Supply Chain Recommendations 10
- Summary of Supply Chain Recommendations 10
- Policy and Legislation Recommendations 10
- Market Development Recommendations 13
- Infrastructure Investment Recommendations 19
- Recommendations to Help Ocean Users, Wildlife, and the Environment Thrive 22
- Innovation Recommendations 24
- Regional Collaboration Recommendation 27

Vision Statement for Maine's OSW Workforce 29
Workforce Recommendations 29
Vision Statement for Maine's OSW Ports 39
Ports Recommendations 39
Appendices (TBD) 42

Introduction to the Supply Chain, Workforce, Ports, and Marine Transportation Working Group

The Offshore Wind Roadmap: Charting a Course for Maine is an 18-month, participatory initiative led by the Governor's Energy Office (GEO) to create an economic development plan for the offshore wind industry in Maine in harmony with ocean users, wildlife, and the environment. The Roadmap is supported by a $2.166M grant from the U.S. Economic Development Administration. GEO's overall objective for the Roadmap is to identify how to foster an offshore wind industry that works for Maine's people, economy, and heritage.
The Roadmap is being developed by a strategic Advisory Committee and expert working groups with broad public input, focusing on energy markets, ports and infrastructure, socioeconomic impacts, manufacturing and supply chains, workforce development, and compatibility with ocean users, wildlife, and the environment.

This document presents the recommendations of the Supply Chain, Workforce, Ports and Marine Transportation Working Group (the Working Group or WG). The WG consists of public and private sector representatives with diverse experience in offshore wind, maritime industries, workforce, labor, training, education, ports, construction, manufacturing, research & development, economic development, and international trade. The WG developed these recommendations through the course of 15 public meetings since August 2021.
Areas of interest for the working group include three sub-categories: 1) supply chain (including manufacturing); 2) workforce; and 3) ports and marine transportation. Working group discussions have been informed by multiple studies developed in consultation with the working group by globally experienced technical consultants to provide data and analysis supporting the working group's deliberations. Working group meetings have also featured presentations and discussions with offshore wind experts from around the world, government officials from Maine and beyond, and other groups and members of the public.

Context for the Working Group's Recommendations

The global offshore wind industry is growing rapidly, particularly in regions like China and Europe, and floating offshore wind is advancing the fastest. In the U.S., achieving the national offshore wind energy target of 30 GW by 2030 requires catalysts to spur domestic port, supply chain, and workforce development. Early U.S. offshore wind planning, development, operations, and maintenance will largely be conducted by international offshore wind developers, Original Equipment Manufacturers (OEMS), and supply chain companies using globally sourced materials, components, and vessels – and there will be heavy competition for these resources given the rapid growth of the offshore wind industry worldwide.

Climate, economic, and energy security goals are the primary factors driving this global growth of offshore wind. Maine has similarly aligned goals, including the need to sustain ocean users, wildlife, and the environment.

Ports

In terms of ports, the U.S. has few that are purpose built and ready to support the offshore wind industry. The domestic offshore wind industry requires a network of maritime port facilities working in unison to facilitate industry growth. The types of ports necessary include:

- Manufacturing: factory port where production of turbine components occurs
- Marshalling and Staging: consolidation point for components; potential assembly for floating OSW components
- Operations and Maintenance: port to support ongoing routine O&M services, including transporting personnel and smaller equipment
- Home Ports (for larger Service Operations Vessels): facilities to refuel and restock SOVs with larger components for maintenance

Currently, the East Coast of the U.S. has the NJ offshore wind port being purpose-built for offshore wind, and several others that are receiving public and private investments to support the offshore wind industry (Figure 1). Despite this list and the port developments on the West Coast (e.g., Humboldt, CA), the demand for U.S. OSW ports with sufficient water depth, air draft, and quayside capabilities remains high.

Figure 1. Offshore Wind Ports on the East Coast of the United States (Image Credit: Business Network for Offshore Wind)

Maine has ports that could be leveraged to support the U.S. offshore wind industry. In

2020, the Maine Department of Transportation conducted a feasibility study for the Port of Searsport to assess capabilities to support the offshore wind industry[1]. A second study is underway of Maine ports spanning the coast from South Portland to Eastport for their potential to support offshore wind in different roles (Figure 2).

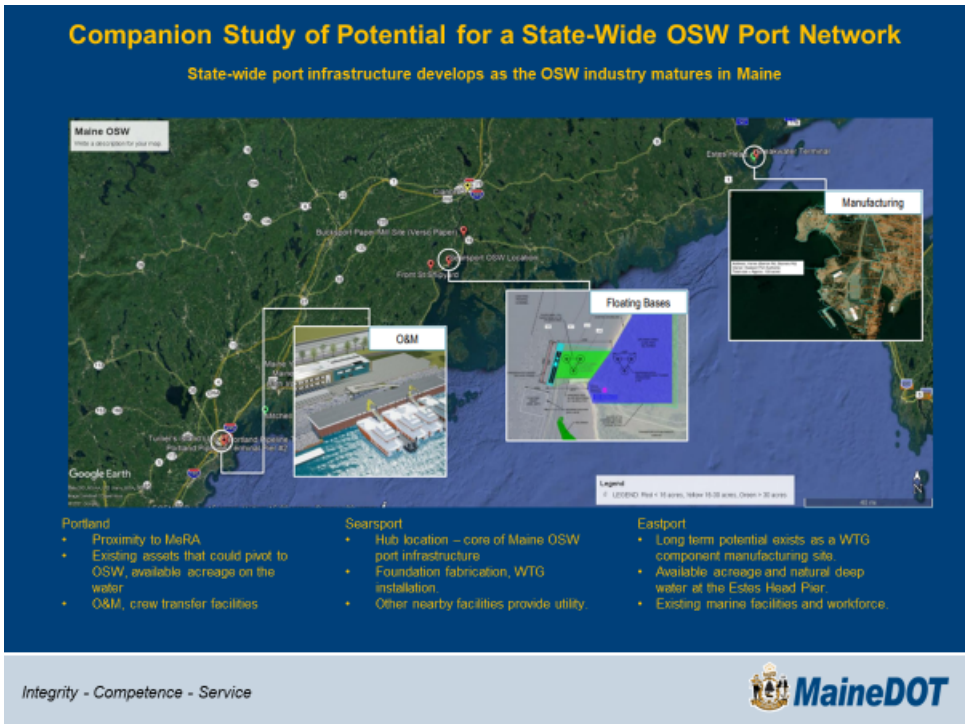


Figure 2. Examples from the study of statewide port infrastructure for offshore wind

Supply Chain (including manufacturing and vessels)

With respect to supply chain, the U.S. OSW supply chain requires many major elements, including wind turbines, foundations, cables, and vessels, all of which are in limited supply (Figure 3)[2]

[1] Maine Department of Transportation, 2021, Offshore Wind Port Infrastructure Feasibility Study, https://www.maine.gov/mdot/ofps/docs/port/MaineDOT%20OSW%20Port%20Infrastructure%20Feasibility%20Study-Concept%20Design%20Report%2011-17-2021.pdf

[2] National Renewable Energy Labs. 2022. 30 GW by 2030: A Supply Chain Roadmap for Offshore Wind in the United States, https://www.nrel.gov/wind/offshore-supply-chain-road-map.html#:~:text=NREL%20is%20leading%20the%2030,major%20components%20domestically%20by%202030

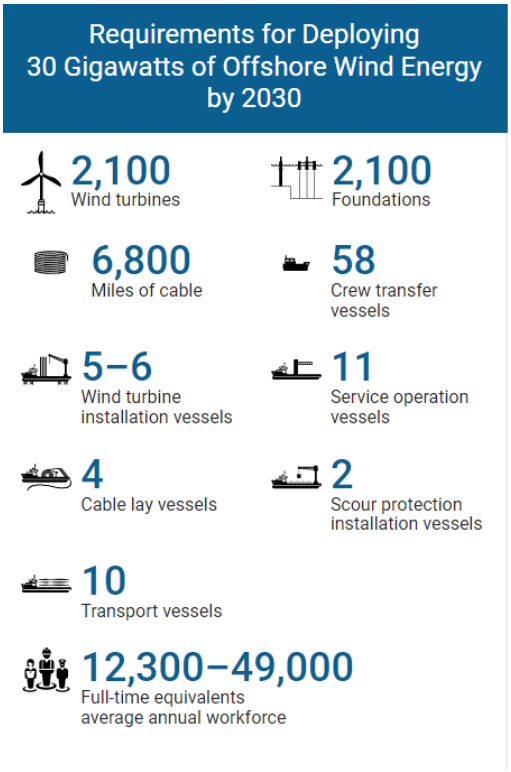


Figure 3. Major supply chain elements necessary to deploy 30 GW of offshore wind energy in the U.S. by 2030 (NREL, 2022, A Supply Chain Roadmap for Offshore Wind in the United States)

In addition to the major supply chain elements required, there are critical path subcomponents that pose a challenge to domestic manufacturing because of their size and specialty and require significant investment:

- Yaw and pitch bearings;
- Permanent magnets;
- Flanges and other large cast or forged components;
- Steel plates that are rolled into monopiles or towers;
- Electrical systems for offshore substations; and
- Mooring chains.

The National Renewable Energy Laboratory will publish a second report later in 2022, characterizing the need for critical Tier 2 and 3 components and analyzing the existing U.S. OSW supply chain capacity to meet this demand.

The Maine Offshore Wind Supply Chain Assessment, conducted through the Roadmap, identified specific opportunities for Maine[3]. Key findings include:

[3] Maine OSW Supply Chain Assessment, 2022, XODUS Group, insert link here when posted

- *Maine has highly regarded expertise in floating offshore wind, which can be combined with experience in related industries such as civil infrastructure, onshore energy infrastructure, and onshore construction to provide key opportunities for Maine in the offshore wind sector.*
- *Maine has advantages through more than a decade of floating OSW R&D and the ongoing and proposed floating offshore wind demonstration projects (Single turbine AquaVentus in state waters off Monhegan Island and the proposed floating offshore wind research array in federal waters) to continue to advance the floating offshore wind supply chain. Through these projects, and other fixed offshore wind projects along the East Coast, companies based in Maine have opportunities to gain relevant experience and be well-positioned to support the commercial floating wind industry.*
- *Maine has physical assets, such as deepwater ports, that can be leveraged to support fixed offshore wind projects along the Atlantic coast and drive the development of the local supply chain.*
- *Maine has nationally and internationally active offshore wind supply chain companies and future supply chain opportunities in project development and management, environmental permitting, surveying, engineering & design, maritime industry, construction, secondary steel suppliers, turbine inspection and maintenance, and other supporting professional services.*
- *Maine has potential capacity to build Crew Transfer Vessels and other smaller vessels such as guard or survey boats for the industry, as well as operate and maintain larger offshore wind vessels, and provide additional port services like stevedoring, fueling, bunkering services, haulage, and more.*
- *Maine manufacturers have potential to produce secondary components for wind turbines.*
- *Maine has opportunities to help Disadvantaged Business Enterprises enter the OSW supply chain and support the development of Minority and Women Owned Business Enterprises for roles with offshore wind.*
- *Several colleges and universities in Maine have core competencies and tools in Artificial Intelligence, data science, and robotics that can be leveraged and applied to offshore wind projects to reduce costs and provide additional supply chain opportunities for the state.*
- *Regional and industry collaboration will be necessary to develop an efficient and effective offshore wind supply chain.*

Workforce

To achieve 30 GW of OSW by 2030, an annual workforce of 12,300 – 49,000 people will be necessary, with the variability a function of various OSW project timelines and the labor requirements of each. Through the Maine Offshore Wind Roadmap, consultants developed a model of 117 occupations that are essential to offshore wind projects, requiring different levels

of training or education[4]. These workers need to be educated, trained, and certified along the appropriate timeline, with transportation, housing, and other needs addressed.
Maine has significant talent and training assets with potential to support offshore wind. In particular, Maine is steeped in maritime heritage and has an existing maritime workforce that is currently recognized and deployed worldwide – providing connectivity and learnings from offshore projects around the world. According to the 2022 Maine Offshore Wind Talent Analysis, key findings include:

- *Maine's existing wind-related workforce is already strong, accounting for more than 1,300 jobs in 2020, or about 10% of Maine's clean energy workforce.*
- *The research team identified 117 occupations that will be crucial to the development and operation of OSW projects.*
- *The Maine workforce is largely prepared to build out the estimated 155 MW of OSW activity in the Gulf of Maine by 2030, though addressing the gaps in specialized skillsets will require strategic planning and deliberate efforts.*
- *There are several key occupations and industries in Maine that are well positioned to provide services in and outside of the state, for both floating and fixed-bottom OSW activities.*
- *Maine's training providers are well-positioned in many regards, though specialized training in OSW-specific skills will be needed.*
- *Community colleges around the state have historically produced dozens of graduates prepared for manufacturing trades, but registered apprenticeships and partnerships with organized labor will be necessary to fill training gaps.*
- *Maine has several industries that are well poised to grow and support the increasing number of OSW projects in New England. However, without strong regional collaboration or commitments to procure OSW generation, the opportunity for job creation in Maine is limited.*

Given this context of shortage in domestic ports, supply chain, and workforce to achieve 30 GW by 2030, and Maine's own goals and significant assets, Maine has opportunities to enhance these capacities to bring significant benefits to the state. These recommendations will prepare Maine to capture those opportunities.

Impact of the Recommendations on People

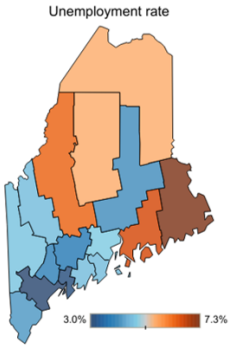
The recommendations developed by the working group are intended to broadly benefit all Maine people by leveraging the opportunity to establish a thriving offshore wind industry in Maine that supports renewable energy goals in Maine and beyond; reduces Maine's reliance on expensive, volatile, and polluting fossil fuels; helps meet the challenge of climate change; and delivers high-quality jobs, economic benefits, and necessary investments in Maine's infrastructure, economic fabric, and workforce.

Maine has communities who have seen fewer opportunities to date – in particular,

[4] The 2022 Maine Offshore Wind Talent Analysis, BW Research Partnership https://www.maine.gov/energy/sites/maine.gov.energy/files/inline-files/2022%20ME%20OSW%20Talent%20Analysis.pdf

communities that are rural or lower income or are comprised of people of color, women, or non-binary genders. These communities could benefit from Maine's thoughtful and responsible participation in the offshore wind industry. Early in the Roadmap process, Amanda Rector, Maine State Economist, provided a data-driven presentation demonstrating economic benefit opportunities from offshore wind to different regions throughout the state, including those with higher unemployment rates (Figure 4).

3. Opportunities for economic benefits in different regions of the state, including those with higher unemployment rates



	Percent of Population Age 25-64 (2019)	Labor Force (2021)	Unemployment rate (2021)	Percent of employment in Construction, Manufacturing, Transportation, and Utilities (2020)	Share of Total State GDP (2020)
Southern Coastal	54%	293,838	4.2%	19%	49%
Midcoast	50%	56,837	4.5%	19%	7%
Downeast	50%	41,828	5.5%	16%	6%
Northern	50%	36,496	5.5%	22%	5%
Central	52%	190,434	4.6%	16%	26%
Western	52%	62,455	5.8%	24%	7%

Sources: U.S. Census Bureau, Maine Department of Labor, U.S. Bureau of Economic Analysis

4

Figure 4. Opportunities for Economic Benefits from Offshore Wind by Maine Region

Maine also has new individuals and families moving to the state from all over the world – people with diverse skill sets seeking high-quality careers, such as the 117 different career occupations afforded by offshore wind development and operations.

Additionally, the Working Group considered that potential negative impacts of developing an offshore wind industry might be disproportionately experienced by some coastal communities. The Working Group includes a recommendation below to continue discussions with ocean users and other coastal community members when they are ready and learn what they need to help them thrive alongside this new industry.

Vision Statement for Maine's Offshore Wind Supply Chain

As noted in Maine's 10-year Economic Development Strategy, Maine is a state strongly rooted in natural resource heritage industries and powered by an entrepreneurial spirit. Maine is home to innovative companies who have built upon maritime heritage – off the centuries of working with the wind, the waves, and the tides – to successfully participate in the burgeoning offshore wind sector for the last two decades. Continued innovative growth of a Maine offshore wind supply chain requires there to be a visible, viable business opportunity, both for existing Maine companies and for those we wish to attract. Continued success also requires leadership, support, and advocacy from the State to capitalize on the intersection between a global trend (green energy solutions to address climate change) and existing strengths to unlock the potential of the offshore wind sector for Maine. Maine's assets include:

- World class offshore wind resource;
- Proximity to East Coast population centers and high-demand markets
- Significant expertise in engineering and design, permitting, maritime operations, and marine composites already engaged in the offshore wind industry for over a decade;
- World-leading R&D and educational institutions - a major asset for investment attraction, workforce development, and exportable expertise and technology;
- Gateway for international trade;
- Deepwater ports;
- Maritime and fisheries industry heritage and expertise;
- Workforce in key occupations;
- A strong manufacturing industry, including composites; and
- An enterprising and engaged citizenry

The recommendations in this document support the continued development of Maine's offshore wind supply chain to capitalize on an estimated $109B private investment opportunity in the U.S. by 2030 and are key to achieving the goals of Maine's Economic Development Strategy, Economic Recovery Plan, Climate Action Plan, and Clean Energy Economy Report. For all recommendations and supporting actions in this Roadmap to succeed, regular communication with industry is required to ensure the support is meeting the development needs of businesses in, entering, or considering, the OSW market.

The recommendations are categorized in several thematic areas as follows: Policy/Legislation; Market Development; Infrastructure Investment; Strategies to Help Ocean Users, Wildlife, and the Environment Thrive; Innovation; and Regional Coordination. The recommendations or supporting actions are also presented with a general timeline as follows: Immediate = within 2 years; Near Term = 2-5 years; and Long-Term+ = 5 years and beyond.

Supply Chain Recommendations

Summary of Supply Chain Recommendations

The working group's recommendations aim to identify the necessary steps Maine must make to support the continued development of the Maine offshore wind supply chain, to serve projects in the Gulf of Maine, other areas of the U.S., and globally, while optimizing benefits to Maine.

Policy and Legislation Recommendations

POLICY Recommendation 1: Maine should formally establish a clear state OSW policy, along with a sustained, sequenced effort to support and implement it.

Supporting Actions

- Establish clear state policy supportive of offshore wind and informed by a broad spectrum of Maine stakeholders. Maine's policy should emphasize the state's economic opportunities to support fixed-bottom projects regionally, as well as consolidate a market-leading advantage in floating offshore wind. (Timing: Immediate)
- Announce a floating offshore wind goal or mandate soon with multiple procurement solicitations, realistic local or domestic content requirements that promote supply chain development and high-quality career paths, and best practice requirements to avoid and minimize impacts on ocean users, wildlife, and the environment. (Timing: Immediate)

Context and Rationale

- The commercial offshore wind leasing process has started for the Gulf of Maine with an anticipated auction in mid-late 2024; an early floating offshore wind procurement goal or mandate is key to ensure economic benefits from the development come to Maine.
    - o State-level offshore wind procurement policies are driving U.S. offshore wind developments and related investments.
    - o Each state is competing to maximize benefits to their state; There is limited coordination among states at present.
    - o Developments in the Gulf of Maine that make landfall in Maine will optimize benefits to Maine.
    - o Maine should engage stakeholders early and often to maximize opportunities for Maine stakeholders with relevant knowledge and expertise, as well as enhance co-existence of OSW with existing ocean users and the environment.
    - ○ The offshore wind industry doesn't know what Maine wants. Given the degree of investment risk present in this developing industry, investment attraction in Maine is unlikely to occur without a clearly expressed commitment of interest and long term certainty for developers.

- Transmission, workforce, and supply chain constraints may incentivize developments to land in southern New England.

POLICY Recommendation 2: Maine should work with our Congressional Delegation to support and advocate for a domestic supply chain content requirement, as well as Investment and Production Tax Credits for OSW (including Manufacturing Production Tax Credits for wind components and vessels). (Timing: Immediate)

Context and Rationale:

As noted above, achieving the U.S. offshore wind energy target of 30 GW by 2030 requires catalysts to spur domestic supply chain content for offshore wind. The U.S. supply chain needs additional support, such as a domestic supply chain content requirement, extending and modifying the existing investment and production tax credits for offshore wind, and production tax credits for manufacturing, to help scale and specialize domestic supply chains for advanced manufacturing technologies for offshore wind. The U.S. OSW supply chain requires many major elements, including wind turbines, foundations, cables, and vessels[5]. In addition to the major supply chain elements required, there are critical path subcomponents that pose a challenge to domestic manufacturing because of their size and specialty and require significant investment:

- Yaw and pitch bearings;
- Permanent magnets;
- Flanges and other large cast or forged components;
- Steel plates that are rolled into monopiles or towers;
- Electrical systems for offshore substations; and
- Mooring chains.

POLICY Recommendation 3: Maine should work with our Congressional Delegation to support the federal Reinvesting in Shoreline Economies and Ecosystems (RISEE) Act or legislation of similar intent to ensure funding from the federal commercial leasing process is shared with, and directed by, the states proximate to development. There should also be a mechanism to ensure funding is shared with tribes. (Timing: Immediate)

Context and Rationale:

The record-breaking $4.37 billion BOEM achieved through the recent NY Bight Offshore Wind Lease Auction captured the attention of many states interested in sharing some of the revenue currently directed to the U.S. Treasury. Members of the U.S. Congress are considering mechanisms to bring some of this revenue to the states where impacts may

[5] National Renewable Energy Labs. 2022. 30 GW by 2030: A Supply Chain Roadmap for Offshore Wind in the United States, https://www.nrel.gov/wind/offshore-supply-chain-road-map.html#:~:text=NREL%20is%20leading%20the%2030,major%20components%20domestically%20by%202030.

occur (based on a distance calculation). One mechanism is the current *Reinvesting in Shoreline Economies and Ecosystems Act* in the Senate, which adapts the Gulf of Mexico Energy and Securities Act to include renewable energy and expands to other coastal states. As currently drafted, this legislation does not include revenue sharing with tribes. Several states are also interested in identifying the priorities for which these funds can be used in their states.

POLICY Recommendation 4: Maine should collaborate with BOEM and other Gulf of Maine Intergovernmental Renewable Energy Task Force members to ensure responsible and timely commercial leasing. (Timing: Immediate)

Context and Rationale

This collaboration will enable visibility and certainty of a project pipeline in the Gulf of Maine, with potential to benefit Maine's existing and future supply chain.

Market Development Recommendations

MARKET Recommendation 1: In coordination with public and private sector partners, Maine should leverage its assets to support current economic opportunities in fixed and floating offshore wind projects in U.S. and international pipelines to develop experience and networks that prepare Maine's supply chain for future projects. (Timing: Immediate)

Supporting Actions

- Identify external market opportunities for market-ready or in-market Maine products and expertise (Timing: Immediate to Near-term)
    - Assist Maine companies and research institutions to identify external market opportunities in the national and international OSW supply chain.
    - Identify financial resources to support technical assistance and/or market access programs for Maine businesses wishing to pivot and/or access external market opportunities.
- Promote partnerships between Maine firms and international firms wishing to access US-based OSW projects (Timing: Immediate to Near-term)
    - Position Maine as a landing spot for international companies interested in entering the US OSW market.
    - Evaluate investment attraction assets as they might relate to OSW projects or supply chain partners, engaging municipalities early in this evaluation process, as appropriate:
        - Opportunity Zones (OZ);
        - Foreign Trade Zones (FTZ) as they might relate to import or distribution centers for Maine-based or regional projects;
        - In collaboration with Workforce and Port subgroups and in coordination with the Energy Markets and Strategies Working Group, create a strategy to promote Maine's workforce and training programs, current and future port developments, existing supply chain partners, and economic development incentives as investment attraction assets.
- Promote Maine and Maine companies in national and international industry
    - In coordination with Maine industry, help Maine companies foster relationships with developers, ports investors, and higher Tier supply chain companies (such as hosting "Meet the buyer" events) to learn more about opportunities and develop networks that can be leveraged in near-term and long-term OSW projects. (Timing: Immediate through Long-term)
    - Identify and facilitate speaking/promotional opportunities for Maine industry leaders to further develop/build relationships in OSW. (Timing: Immediate through Long-term)
- Continue supporting and developing the Maine Offshore Wind Supply Chain Registry[6] to

[6] The Maine Offshore Wind Supply Chain Registry is a component of the Business Network for Offshore Wind's Supply Chain Connect national registry.

highlight and connect Maine companies to offshore wind opportunities anywhere. (Immediate)

Context and Rationale

Maine has supply chain, manufacturing, and workforce assets that have been engaged in fixed offshore wind projects around the world for over a decade. Maine also has world-class R&D capabilities in floating OSW. Maine should continue to leverage and expand these assets to support fixed and floating offshore wind projects in the pipelines, especially the 35 GW of projects in the United States with 12 projects anticipated for concurrent installation in 2025 and 2026.

- In the U.S., a 2021 supply chain contracting forecast predicts $109B in private investment in the U.S. offshore wind by 2030 – suggesting ample supply chain opportunity in the U.S. offshore wind sector[7]
- Nearly all current (and likely near future) developers in the U.S. are European.
- In 2021, countries connected another 2.1 GW of OSW to the grid, triple the amount installed in 2020.
- Globally, OSW is on track to hit 504 GW in cumulative installations by 2035, a ten fold increase from 2021's record numbers (BloombergNEF).
- By 2050, 60% of offshore wind installations will be in Asia, 22% in Europe, and 16% in North America. (IRENA)

Applying Maine's assets to fixed foundation developments south of Maine and to fixed and floating projects worldwide will provide Maine firms with access to real opportunities today while strengthening our supply chain for the rapidly growing floating future market. Additionally, participation in current developments provides an opportunity to build relationships between Maine companies and European developers and suppliers.

MARKET Recommendation 2: Maine should work with private and public sector partners to leverage an early mover advantage in floating offshore wind. (Timing: Immediate)

Supporting Actions

- To advance Maine's floating OSW supply chain, encourage developers actively working in the state to help connect Maine OSW supply chain companies to their projects in the state and to their global offshore wind networks.
- Foster partnerships with higher education institutions in the State to encourage research and development in floating offshore wind technology and related supporting fields
- Identify opportunities to leverage existing specialties to provide ancillary services for floating projects in the Gulf of Maine and beyond, communicating findings to Maine's

[7] "Supply Chain Contracting Forecast for U.S. Offshore Wind Power: 2021", Special Initiative for Offshore Wind,2021, https://sites.udel.edu/ceoe-siow/

port management, marine trades, and construction sectors.

Context and Rationale

The State's Level 1 Research University, the University of Maine, has been a pioneer in floating offshore wind research, development, and testing for well over a decade. The University deployed a 1/8 scale floating offshore wind turbine for 18 months, which provided electricity to the grid. The University and partners from New England AquaVentus (a Joint Venture of RWE and Diamond Offshore) are currently planning a full-scale grid connected floating offshore wind turbine in state waters with anticipated construction date of 2024. With the University and New England AquaVentus, the State of Maine has submitted a research lease for a 144 MW floating offshore wind research array, the largest potential floating OSW demonstrator in the world, in federal waters of the Gulf of Maine. With these efforts as a catalyst, there is a unique but time-sensitive opportunity for Maine to solidify and commercialize a position as a leader in the floating offshore wind sector. Indeed, in June 2022, the UK launched a Floating Offshore Wind Task Force to lead the world in the innovative technology.

Involvement in pilot/pre-commercial floating OSW projects in the Gulf of Maine will provide Maine's R&D, ports, companies, and workforce the opportunity to strengthen these assets, reduce deployment costs, assess local impacts, and address supply chain or technology related issues for future floating offshore wind projects. Global deployment projections for floating include 10.7 GW by 2030 and 70 GW by 2040.[8] In federal waters of the United States, much of the high-quality offshore wind resource, including in the Gulf of Maine, aligns with deeper waters that currently require floating technologies.[9] Anticipated BOEM offshore wind lease areas off Northern and Central California (late 2022), Oregon (late 2023), and in the Gulf of Maine (mid-late 2024) will likely be developed with floating technologies.[10]

MARKET Recommendation 3: In and beyond Maine, Maine should support, expand, and advocate for Maine's OSW supply chain companies, ports, workforce, and R&D.

Support, expansion, and advocacy for Maine's assets for the OSW industry can take many forms, including leveraging partnerships, adapting or developing supportive organizational structures, business intelligence gathering and marketing, and providing additional resources to Maine businesses.

Supporting Actions

[8] "Floating Offshore Wind Joint Industry Project Phase II Summary Report", Carbon Trust, 2020, https://prod-drupal-files.storage.googleapis.com/documents/resource/public/FWJIP_Phase_2_Summary_Report_0.pdf
[9] "Offshore Wind Market Report: 2021", NREL, 2021, https://www.energy.gov/sites/default/files/2021-08/Offshore%20Wind%20Market%20Report%202021%20Edition_Final.pdf
[10] "Secretary Haaland outlines ambitious offshore wind leasing strategy", BOEM, 10/13/21, https://www.doi.gov/pressreleases/secretary-haaland-outlines-ambitious-offshore-wind-leasing-strategy

Develop supportive organizational structures:

- Establish a commissioner-level industry advocate who can implement statewide economic development programs for offshore wind over the long-term and focus on supporting existing and new Maine companies and attracting new companies to Maine. The advocate should work on behalf of the State in conversations with offshore wind developers, OEMs, and supply chain companies, and actively promote Maine as a prospective destination for offshore wind development and related investments. (Timing: Immediate)
- Assess whether a person or separate Maine Offshore Wind Business Development Authority outside of state government is needed to support Maine businesses of all sizes and to facilitate and advance industry relationships. (Timing: Immediate)

Gather Business Intelligence and Market Maine:

- Conduct interviews with major developers, ports owners/operators, and key contractors in the region to understand their needs and identify existing or future constraints in the region and how Maine can be a viable resource. For example, what assets do the developers need for floating and fixed projects, what services and ports' criteria do they need, what limitations do developers see, what constraints are they concerned about, what sort of public-private partnerships facilitate sustainable investments? Based on this information and a plan, Maine should have strategic trade delegations heading south to clearly advertise. (Timing: Immediate)
- Establish and provide long-term (at least 10 years) support for a central state-driven OSW information hub website that provides clear, accessible, and high-quality business information that a developer or supply chain company needs to evaluate Maine as a potential landing site (whether for offices, ports or OSW developments). The hub should include, at a minimum:
    - Supportive policies
    - Ports, port investments, and related information
    - OSW resource assessments, environmental resource studies, etc.
    - Regulatory information
    - Constraints (transmission, etc.)
    - Supply chain, related sector support, and workforce training & education opportunities
    - Supportive business environment and incentives (Timing: Immediate to Near-Term)

Provide Additional Resources to Maine Businesses:

- Provide resources (such as training or funding for ISO 9001 certification) and financial incentives to Maine businesses in offshore wind or interested in pivoting to offshore wind, prioritizing those areas of greatest opportunity for Maine (e.g., land-based clean energy supply chain, environmental permitting and surveying companies, engineering and design firms, marine companies) and Minority and Women Owned Small Business Enterprises. (Timing: Immediate to Near-term)
- Organize Maine OSW supply chain participation in trade shows and conferences

- Foster cluster-based development – focus supply chain and workforce development funds on OSW businesses oriented to enhance Maine's position as an OSW leader (Timing: Immediate to Near-term)

Leverage Partnerships:

- Encourage global OSW developers working in Maine to connect Maine's OSW supply chain to projects in the state and around the world (Timing: Immediate to Near-Term)
- Engage with economic development professionals in Maine to help facilitate Maine's supply chain participation in the offshore wind sector and target economic development to areas of the state with the greatest needs and potential for the industry. (Timing: Immediate through Long-term)
- Partner with industry associations to offer OSW opportunities to Maine businesses (Timing: Immediate to Near-Term)

Context and Rationale

- Maine has significant assets and advantages to unlock the potential of the offshore wind sector for Maine.
- The U.S. OSW industry needs additional ports, supply chain companies, and workforce; preparations should start right away.
- Barriers to entry in the offshore wind industry may be mitigated for Maine entities with advanced planning and certification:
    - o Barriers include state-based local content requirements, industry specific certifications, stringent health and safety requirements, high throughput requirements for suppliers, lengthy (5-10 year) contracting timelines, heavy reliance on long-term relationships between suppliers and developers, and varying levels of profitability compared to other industries such as defense and aerospace.[11]
    - o Relationship building between European developers, suppliers, and ME entities is critical to overcoming the barriers
        - ▪ European companies are leading and will lead US offshore wind developments (BNOW)
        - ▪ The bulk of initial OSW supply chain will be met by European suppliers.[12]

MARKET Recommendation 4: Maine should explore opportunities to support local shipbuilding and marine logistics businesses suited to build or retrofit smaller offshore wind vessels (e.g., Crew Transfer Vessels, tugs, Service Operations Vessels), as well as operate and maintain all types of offshore wind vessels. Maine should explore opportunities to build, operate, and maintain electric, hybrid, or clean fueled vessels (Timing: Immediate – Near-term)

[11] "Foundation 2 Blade Training Manual, Business Network for Offshore Wind", 2021, at Page 246 to 259.
[12] "Report: Offshore wind supply chain worth $109B over 10 years," AP News, https://apnews.com/article/business new-jersey-atlantic-city-university-of-delaware-wind-power-19b67ff8bf285cf74e5fd19b39037c9b

Context and Rationale

There is a shortage of vessels, vessel services, and vessel operations that will be required along the U.S. Atlantic coast for offshore wind projects in the pipeline (12 projects installing in 2025-2026 with an anticipated need of 25-40 vessels). These services, products, and knowledge can be exported nationally and internationally. In particular, Maine can play a role in greening the maritime transportation industry that supports offshore wind, which can advance the state's and region's progress toward carbon neutrality.

MARKET Recommendation 5: Maine should consider supporting offshore wind projects that can produce green hydrogen and transport it to target markets (Timing: Near-term through Long-term)

Context and Rationale

As Maine and the world seeks to decarbonize, pursuit of offshore wind as a clean energy source unlocks future opportunities to generate, market, and transport additional clean energy sources, such as green hydrogen and other clean fuels, for hard-to-electrify sectors like aviation, shipping, long-haul transport, steel, and chemicals.

Infrastructure Investment Recommendations

All Maine infrastructure investments must be matched to the commercial opportunities in offshore wind and supported by a business case for the investment. Maine may be best served by collaborating with other states to develop offshore wind infrastructure the fits the needs of the region.

INVESTMENT Recommendation 1: Aligning with the regional context and business case, Maine should invest in a high visibility project in the state to attract additional investment from developers, OEMs, and higher tier supply chain companies. (Timing: Immediate to Near-term)

Context and Rationale

A key driver to growing the State's supply chain is to attract Original Equipment Manufacturers and higher Tier supply chain companies to the New England region, through data-driven, strategic investments in offshore wind infrastructure to attract businesses. This will drive growth to lower Tier suppliers. A high visibility transformation project attracts the industry's attention and gives developers confidence in making investments. Other states, such as New York, New Jersey, and Virginia, have pursued this path to great success – attracting significant additional investment in their state economies.

INVESTMENT Recommendation 2: Maine should work with partners to explore establishing a floating wind fund to encourage additional investment in manufacturing and ports (Timing: Immediate to Near-term)

Context and Rationale

To provide private investors with confidence to back the growing floating offshore wind sector, the UK Government instituted a 160M pound floating offshore wind manufacturing investment scheme. Maine can provide funding at a suitable scale to inspire investor confidence in homegrown floating offshore wind in the Gulf of Maine and region.

INVESTMENT Recommendation 3: Maine should leverage its deep maritime and defense background to provide major equipment used on installation vessels. (Immediate to Near-term)

Supporting Actions

- Maine should provide funding to help firms adapt their expertise with major equipment for vessels toward the offshore wind industry.
- Maine should make leading suppliers aware of this investment to support and attract additional private investment to the State.

Context and Rationale

Major equipment supply used on OSW installation vessels includes engines, cranes, navigation, heave compensation, jacking systems, and dynamic positioning systems. While it is unlikely that major equipment suppliers would establish a facility in Maine purely for this purpose, Maine's deep maritime and defense background presents a significant opportunity for the state to leverage. This opportunity could be further augmented by a linkage to an offshore wind project and state investment to attract additional resources.

INVESTMENT Recommendation 4: Maine should develop financial incentives and pursue federal and private funding to support Maine supply chain involvement in offshore wind and attract firms (Timing: Immediate to Near-Term)

Context and Rationale

Another key driver to growing a state's supply chain is offering financial incentives to attract offshore wind businesses. Maine can develop and implement financial incentives to support the offshore wind supply chain in the state. These financial incentives can be designed to complement federal or regional incentives and attract further investment to the state and/or region.

One example of a possible area for state financial incentives is the aviation industry necessary to support offshore wind development in the Gulf of Maine. Offshore wind development and operations involve substantial transport of crew on- and offshore. At present, the U.S. does not have any helicopter companies specifically licensed to support offshore wind. The first U.S. offshore wind aviation contract was awarded to a European company. Helicopters provide a faster and cleaner mode of personnel transport on- and offshore than traditional vessels. Given that Maine is pursuing offshore wind as a clean energy source and economic opportunity, reducing the carbon emissions from all facets of offshore wind development and operation is important to the state. Decarbonizing transportation to/from OSW farms could be one focus of

Maine's financial incentives to attract an important business to Maine. Three typical offshore wind projects require two helicopters for support, and possibly a third helicopter to augment Crew Transfer Vessels to transport additional workers during construction. Maine only has two helicopter companies operating, neither of which has helicopters appropriate for offshore work (e.g., EC 135s, EC145s, or Leonardo AW169), nor are prepared to pivot to offshore wind. This type of helicopter generally costs $8M and requires an 18-month wait from ordering with up-front payment. The helicopters require regional airport bases near the coast (e.g., Brunswick, Bar Harbor, Rockland, Portland). Airports listed under the National Plan of Integrated Airport Systems are eligible for Aviation Infrastructure Grants. (Maine has 35 airports listed under this plan). Pilots are in short supply and would require additional training for offshore wind and search and rescue offshore.

Another example for possible state financial incentives is the manufacturing industry in Maine. Manufacturers in Maine account for 9.46% of the total output of the state ($6.4B in 2019) and employ 8.35% of the workforce (49,000 people in 2020), with high quality careers in a variety of sectors, including aerospace, defense, and metal fabrication.[13] Maine could support the continued development of the manufacturing industry for offshore wind through financial incentives for training, ISO 9001 certifications, expanding from adjacent manufacturing sectors, and producing key smaller OSW components, such as secondary steel (e.g., railings, ladders, brackets, j-tubes), mooring and anchor components, cable protection systems, pull lines, commercial tow lines, rescue lines and heavy lift lines. The National Renewable Energy Laboratory will publish a second report later in 2022, characterizing the need for critical Tier 2 and 3 components and how effectively existing U.S. OSW supply chain capacity can be used to meet the component demand. This report will provide additional context to inform Maine manufacturing opportunities for offshore wind.

[13] National Association of Manufacturers, Maine Manufacturing Facts (2021), https://www.nam.org/state-manufacturing-data/2021-maine-manufacturing-facts/

Recommendations to Help Ocean Users, Wildlife, and the Environment Thrive

This working group recognizes the importance of supporting ocean users, wildlife, and the environment and presents the following recommendations to help them thrive. The Fisheries Working Group and the Environment & Wildlife Working group have each produced a more comprehensive, complementary set of recommendations on these topics for the Roadmap.

THRIVE Recommendation 1: Maine should continue to collaborate with the fisheries industries to avoid and minimize impacts to the industries, as well as identify and implement pathways to help the industries thrive. (Timing: Immediate through Long-term)

Context and Rationale

At the time of this Roadmap development, the critically important fisheries industries in Maine are under immense pressure on multiple fronts, including the new protective measures for the North Atlantic Right whale, climate change impacts on fisheries, and more. This working group has heard from the Fisheries Working Group that they are not in a position to discuss how investments in the offshore wind industry could help support fisheries priorities. Acknowledging this, the Supply Chain, Workforce, Ports and Marine Transportation Working Group believes it is essential for future continued discussion with Maine fisheries and includes this recommendation to highlight this need.

THRIVE Recommendation 2: The state should foster local government partnerships and engage in direct communications with affected communities through an ongoing consultation process to provide clarity, identify local concerns and needs, and co-create solutions (Timing: Immediate to Long-term)

Context and rationale:
Strong relationships and clear communication with local governments that may be affected by offshore wind development is necessary for a responsible offshore wind approach. Local government officials hear concerns from their residents, have decision-making authority, and are valuable sources of information and feedback.

The timeline to develop an offshore wind project is long – approximately 7-10 years. Throughout this process, it is important for the state to engage in direct communication with affected communities share information, hear their concerns and priorities, and co-create solutions.

THRIVE Recommendation 3: If avoiding and minimizing impacts are not possible, the state should explore using funds from offshore wind projects to support impacted ocean users and communities. (Timing: Near to Long-term)

Context and Rationale:

Responsible planning to avoid and minimize impacts is essential for the success of OSW. A state fund could be established via OSW projects (e.g., in a PPA or other mechanism) to mitigate any impacts incurred on ocean users and coastal communities and provide additional support. Affected ocean users and communities could determine how the funds are spent in their communities. The state fund could be designed to complement any additional developer or federal funding sources and be directed to the priorities that the affected parties identify.

Innovation Recommendations

INNOVATION Recommendation 1: Leverage public and private sector funding to help commercialize Maine's academic and R&D capabilities, especially with respect to floating offshore wind.

Supporting Actions

- To attract private investors to the State and nation, scope/conduct a feasibility study and implement a floating offshore wind innovation center in Maine with an aim to participate in a network of complementary centers in the U.S. and around the world (Timing: Immediate)
- Support and expand investment in technology transfer from Maine R&D projects to commercialization. (Timing: Immediate to near-term)
- Facilitate enhanced relationships and knowledge transfer partnerships with European innovation hubs to help keep Maine's academic R&D institutions at the forefront of the sector. (Timing: Immediate to near-term)

Context and Rationale

Maine has deep background in floating offshore wind R&D. To continue building on this legacy and realize implementation and broad commercialization benefits for Maine, the state can support the development of a floating offshore wind innovation center – with additional investments in technology transfer from R&D to commercialization, and continued leverage of existing relationships and partnerships with complementary U.S. and European innovation hubs.

INNOVATION Recommendation 2. Leverage and expand Maine's capabilities in Artificial Intelligence, data science, and robotics toward the offshore wind energy industry.

Supporting Actions

- Encourage more offshore wind focused applied research projects and research areas within universities specifically targeted to Artificial Intelligence, data science and robotics. (Immediate to Near-Term)
- Link Maine-based research projects in Artificial Intelligence, data science, and robotics to active offshore wind projects. (Near to Long-term)

- Support and expand entrepreneurship and incubator programs on Artificial Intelligence, data science, and robotics toward the offshore wind industry. (Near to Long-term)

Context and Rationale

Digitization and robotics applications of the offshore wind industry are becoming increasingly important with opportunities to reduce costs, improve safety, and enhance efficient operations. Digital solutions can improve decision making from project development through O&M phases of the OSW project lifecycle. The OSW industry is a data-rich environment and requires skillsets in data science, artificial intelligence (AI), machine learning and more. When combined with robotics and autonomous systems, these tools can revolutionize the offshore wind industry. The most significant opportunity for data science, AI, and robotics in OSW is in O&M activities, which account for 35-50% of the lifetime cost of an offshore wind farm. AI and robotic applications can reduce the LCOE of an offshore wind farm by 3.5%. It is likely that AI and robotics will continue to play a powerful role in the OSW industry as it continues to evolve.

Several universities in Maine have core competencies and tools to support the role of Artificial Intelligence, data science, and robotics in offshore wind. However, engagement with offshore wind projects needs to be encouraged. The existing entrepreneurship and incubator programs at the Roux Institute, and other organizations in Maine can be leveraged to attract entrepreneurs and start-ups in the fields of artificial intelligence, data science, and robotics and connect them to the offshore wind industry, academic and research institutions, and other technology development assets.

INNOVATION Recommendation 3: Maine should collaborate with federal agencies, such as the U.S. Department of Energy or its national laboratories, and other partners to pursue research into co-generation technologies, such as green hydrogen, and storage to further catalyze decarbonization.

Context and Rationale

Green hydrogen and other clean fuels are widely being recognized as pathways to realize state, national, and global decarbonization goals – particularly for hard-to-electrify sectors such as aviation, long-haul transport, steel, chemicals, and shipping. Excess offshore wind generation provides co-generation opportunities for these fuels and the ability to get the fuels to market quickly from offshore. Maine can explore collaborative opportunities to pursue additional research and innovation in this promising sector, including potential green hydrogen applications and technologies, safe green hydrogen transportation, policy development strategies, and more. Excess offshore wind generation also calls for innovations in energy

storage to ensure renewable energy supply is available to meet demand. Maine can explore collaborative R&D opportunities in this space, as well.

Regional Collaboration Recommendation

REGIONAL COLLABORATION: Maine should continue to advance beneficial regional collaboration in support of offshore wind supply chain development.

Supporting Actions

- Develop a clear policy and state objective(s) to bring to regional forums (Timing: Immediate to Near-Term), such as:
    - BOEM Gulf of Maine Renewable Energy Intergovernmental Task Force
    - ISO-New England/NESCOE on regional transmission planning

- Collaboratively develop a Memorandum of Understanding (MOU) or similar high-level agreement with other New England states, modeled after the SMART POWER MOU between Maryland, North Carolina, and Virginia, to establish a regional supply chain approach that allows states to capitalize on their strengths, share resources, and facilitate a strong domestic supply chain. (Timing: Immediate to Near Term)
- Pursue project-specific regional collaboration opportunities (Timing: Immediate to Long-term)
- Organize and coordinate trainings and education across New England states to foster additional regional collaboration on supply chain (Timing: Immediate to Near-term)

Context and Rationale

The focus of the *Supply Chain Road Map for Offshore Wind in the United States* (by the National Offshore Wind Research and Development Consortium, in partnership with the National Renewable Energy Labs, the Business Network for Offshore Wind, and DNV) is to determine how the U.S. can meet the supply chain needs for the national offshore wind energy target of 30 GW by 2030. Phase 1 of the report highlights the significant demand for components, ports, vessels and workforce. The report also notes that the U.S. supply chain and workforce is not yet sufficiently developed; As a result, in the early 2020s, much of this work will be done by European companies. To meet the 30 GW target and ensure national benefits, it is essential that the U.S. rapidly advance the supply chain and workforce – and do so in a coordinated approach. From a regional or national industry perspective, state-level supply chain efforts run the risk of leading to suboptimal or duplicative investments, which can add unnecessary costs and time to meeting the 30GW goal. Phase 2 of the report is anticipated late 2022 and will include realistic pathways to achieving the supply chain and bringing benefits to the states.

On the state level, it is important to support and pursue regional opportunities to fill gaps

and ready Maine's offshore wind supply chain.

- We have a mismatch between what Maine can offer for supply chain components and what industry needs; this may be true for NH and MA, too. There may be opportunities to collaborate.
- Commercial leases with floating OSW are starting on the west coast according to BOEM's schedule. This may affect the timing of our regional coordination and other supply chain opportunities.
- Companies who can or want to engage in the future OSW industry may be able to take advantage of existing opportunities domestically and internationally.
- Not all Maine companies that could serve the offshore wind industry necessarily want to or are prepared to.

Vision Statement for Maine's OSW Workforce

Maine people have a strong work ethic and an innovative spirit; qualities that will make our state a potential leader in the Offshore Wind Industry. Developing the state's OSW workforce will foster economic opportunities for Maine people and advance the goals of Maine's Ten-Year Economic Development Strategy (EDS), Climate Action Plan, and the Strengthening Maine's Clean Energy Economy report. The recommendations in this roadmap will further inclusivity and opportunity, offer new career paths, and ensure high quality, family-supporting jobs. With critical investments in the existing and new career training infrastructure in the state, Maine will continue to develop and attract the talent needed to cement Maine's global leadership role in the growing U.S. OSW industry – an industry expected to provide 80,000 direct jobs and tens of thousands of indirect jobs by 2030.

The recommendations or supporting actions are also presented with a general timeline as follows: Immediate = within 2 years; Near Term = 2-5 years; and Long-Term+ = 5 years and beyond.

Workforce Recommendations

Recommendation 1: Strengthen OSW Career Exploration Opportunities for K-12 and Career and Technical Education (CTE) Students

Action 1: Develop, publicize and implement opportunities for K-12 career exploration (curricula and awareness) relating to the offshore wind industry; and Science, Technology, Engineering, and Math (STEM) (Timing: Immediate to Long-term)

- Design professional development experiences for K-12/CTE educators to understand and teach OSW and related STEM content already existing in Maine's learning standards. Identify key education partners.
    - Create networks of educators (K-postsecondary) to support robust pathways into OSW careers.
- Develop and implement OSW career exploration opportunities that are available to students in formal and informal learning environments to ensure equitable access to STEM learning related to OSW. Career exploration should emphasize career mobility including career pathways and wages.
    - Engage education partners, communities, employers, organized labor and industry partners.
    - Look to existing programs and best practices, e.g. The Maine Ocean School (magnet school in Searsport) which does a semester on OSW and are willing to build out from there as the need develops.

- Develop community programs for youth to picture themselves in a clean energy career with Artificial Intelligence (AI) and data science at the core of such a program. Such programs lead to opportunities to incorporate OSW-specific projects, especially in the USM robotic and Oceans Wide Training program.

Action 2: Position Maine's 27 CTE Centers to generate a talent pipeline by offering OSW career exploration, OSW-related course work and work-based learning opportunities. (Timing: Immediate to Near-term)

- Recognize the importance of the CTE programs in preparing Maine's OSW workforce and:
    - Promote the value of CTEs to schools, students, and parents by highlighting career pathways, outcomes, and anticipated wages.
    - Strengthen and expand partnerships between post-secondary, industry, organized labor and CTEs.
    - Remove policy and regulatory barriers to CTE participation.
    - Formalize a pathway for CTE students to transition into Pre-Apprenticeship and Registered Apprenticeship programs.

  Example: The Massachusetts Clean Energy Center's Vocational Internship Program (VIP) enhances the talent pipeline for Massachusetts clean energy companies and places skilled labor from vocational high schools in paid clean energy internships during the academic year.[14]

Action 3: Expand OSW internship, work-based learning, and Pre-Apprenticeship offerings to all secondary students, charting a pathway to Registered Apprenticeship[15] programs in the trades. (Timing: Immediate to Near-term)

Maine Example: The University of Maine Advanced Structures & Composites center has successfully engaged high school interns in their wind energy-related research & development efforts. As other internship, Pre-Apprenticeship, and Registered Apprenticeship opportunities increase, ensure OSW employers and organized labor are included.
Other State Example: New Mexico collaborative with Los Alamos National Laboratory – A new partnership between the Laboratory, high schools in the region, and the NM Building and Construction Trades Council (NMBCTC) is creating a talent pipeline to fill in-demand positions at the Laboratory and in the wider community. The program prepares high school students for craft trades using a nationally recognized Multi Core Craft

[14] https://www.masscec.com/students
[15] A "registered apprenticeship" (RA) is administered by the Employment and Training Administration's Office of Apprenticeship (OA) within the U.S. Department of Labor (DOL), in conjunction with State Apprenticeship Agencies (SAAs). RAs are nationally-recognized, occupational training programs delivered by sponsors—employers, employer associations, and labor management organizations. Employers cover the costs of training, wages paid to apprentices, costs of managing the program, and costs associated with time spent by senior employees to mentor and train apprentices.

Curriculum (MC3) developed by North America's Building Trades Unions (NABTU).[16]

Action 4: Engage and support tribal educators and tribal economic development leaders in Maine's activities to develop, implement, and communicate opportunities for clean energy talent development, including offshore wind. (Timing: Immediate to Long-Term)

Rationale
Maine's 10-year Economic Development Strategy (EDS) and the Governor's Economic Recovery Committee prioritizes career exploration as a key workforce development initiative. The Maine Jobs and Recovery Plan includes a $25 million investment in career exploration across the K-12 system. Developing Maine's talent with early exposure to broader clean energy and offshore wind career opportunities will build a strong pipeline of dynamic workers who have a range of interests, skills and experiences.

Recommendation #2: Increase OSW Opportunities in Maine's Postsecondary Education Institutions

Action 1: Create Maine's Offshore Wind Foundation, potentially modeled after the UMaine Pulp & Paper Foundation, to support the creation of educational programs and experiential learning opportunities and provide direct scholarship support to students. (Timing: Near to Long-Term) Specifically:

- Partner with the Maine's higher education institutions to establish specific offshore wind tracks or certificate programs for undergraduate and graduate-level students in engineering, environmental and marine sciences, law, and other industry-related disciplines.
- Partner with the community college system to prepare and offer Global Wind Organization certification, or similarly established industry certifications.
- Encourage experiential learning and offshore experiences.
- Develop an international cooperative education/internship program to provide work experience at European and other global job sites.
- Provide scholarships to address equity concerns.
- Evaluate Vineyard Wind workforce investment program, including the offering of "Offshore Wind 101" in community colleges across the state.

Action 2: Support University-based R&D to benefit the industry in and beyond Maine. UMaine's Advanced Structures and Composites Center is positioned as the national leader in floating offshore wind research and development. The center has already spun off several successful private companies, including Aqua Ventus. Fostering innovation activity can also help attract top talent and capital to Maine. (Timing: Immediate to Long-term)

[16] New Program Offers High-schoolers Path to Trade Apprenticeships, DOE, https://www.energy.gov/articles/new-program-offers-high-schoolers-path-trade-apprenticeships

Action 3: Support and leverage Maine Maritime Academy's and Northern Maine Community College's Offshore training programs at the Offshore Training Center at Bucksport. This training center will be an important in-state provider of the necessary certifications and credentials for the maritime workers needed for the construction and operations and maintenance phases of offshore wind development. (Timing: Immediate to Long-term)

Action 4: Coordinate with Maine Quality Centers and other workforce training organizations, to increase training opportunities for the following high-demand occupations: Welding, CNC Machining (programs & operators), Quality Control Inspection, Electricians[17], Iron Workers, Concrete Laborers, Operating Engineers. Recognize and adapt to the quickly changing landscape of OSW workforce needs. (Timing: Immediate to Long-term)

Action 5: Declare the University of Maine a Center of National Excellence for Floating OSW. The University is already a national leader in floating OSW research and development, and a formal announcement will draw prospective talent and funding, further solidifying the University's leadership in the sector. (Timing: Immediate to Near-term)

Action 6: Attract and retain out-of-state students, educators, and researchers to Maine's higher education institutions. Promote Maine as "Education Land". Continuing to promote Maine as a Center of National Excellence for Floating OSW will draw potential talent, employers, and researchers. Once this "cluster" is fully formed, specialized talent will want to stay in Maine to be surrounded by other top talent, employers, and researchers. (Timing: Near-term)

Rationale

Maine's postsecondary institutions present an opportunity for Maine to further its leadership role in floating offshore wind. Supporting the activities of these institutions can help attract and retain highly educated and specialized talent in a sector that is poised to see substantial growth in the coming decades. As noted below, each college and university can play a unique role in developing Maine's floating OSW cluster.

- There are ten wind-specific training programs in seven different institutions in Maine. Three community colleges host wind-specific programs, along with three public universities. The other programs are not necessarily specific to OSW but the training is transferrable:
    - Four programs are geared towards electrical engineering and electrical technician roles
    - Three (all through Sky Climber Renewables) offer trainings for Wind Service Technician apprenticeships
    - Two are geared towards structural or materials engineering and,
    - One program will allow graduates to work in professional or support service roles related to OSW.[18]

[17] BW Research, 2022 Maine Offshore Wind Talent Analysis, https://www.maine.gov/energy/sites/maine.gov.energy/files/inline-files/2022%20ME%20OSW%20Talent%20Analysis.pdf

[18] Ibid BW Research 2022

- Northern Maine Community College's Wind Power Technology program offers broad fundamental training in the electrical, electronic, and mechanical aspects of the wind power industry, with a focus on wind turbine maintenance and electrical power production. The National Electrical Code and theory are taught throughout the program.
- The University of Maine is establishing itself as one of the leading national and international sources of offshore wind engineers and professionals. Additionally, UMS and Maine's other higher education institutions are successfully training students in adjacent occupations—mechanical engineering, marine sciences, for example, which can further Maine's OSW industry.
- Maine Maritime Academy (MMA) has already served as a key player in offshore wind development. When the University of Maine deployed the nation's first grid-connected offshore floating wind turbine prototype off the coast of Castine, MMA helped test and conduct analyses on the designs.

Cutting-edge technologies, including data science and artificial intelligence, as well as autonomous aerial and undersea drones, will play an increasingly important role in OSW. Maine can leverage several of its private four-year and graduate-level institutions such as the Roux Institute of Northeastern University, University of Maine, Colby College, University of New England, Bowdoin, and others to develop specializations in these fields. For example, the Roux Institute has several master's programs in data analytics, applied machine intelligence, and other data science-oriented programs, while Colby and Bowdoin Colleges can support the talent pipeline with computer science undergraduates. Diversifying Maine's OSW expertise into these technologies also presents substantial opportunity for exporting goods and services for future OSW locations around the world.

Recommendation #3: Enhance & Expand OSW Training & Registered Apprenticeship Opportunities

Action 1: Work with public and private sector partners to enhance and promote training and Registered Apprenticeship (RA) opportunities: (Timing: Immediate to Long-term)

- Prompt industry to create and expand Registered Apprenticeship opportunities and develop mutually beneficial partnerships that grow Maine's talent pool for offshore wind and other existing, adjacent Maine industries with similar requisite skillsets and expertise.
- Strengthen ties between work-based learning and classroom experience by supporting and providing technical assistance for high-quality pre-apprenticeship and Registered Apprenticeship programming.
- Engage Maine Quality Centers and other proven job-training organizations statewide for efficient, relevant, and cost accessible training, engage with stakeholders to promote RA opportunities, particularly to disadvantaged populations and non-traditional postsecondary students.

Action 2: Work with public and private partners to attract new workers into the developing OSW industry cluster without exacerbating existing workforce shortages in other industries. Attract

underemployed and unemployed residents, as well as dislocated workers who may be interested in expanding or adapting their skill sets to offshore wind. (Timing: Immediate to Long-term)

- Among others, consider initiatives that provide Maine's fishermen with supplementary income opportunities and remove barriers to those opportunities. Offer free training and support for relevant certifications.

Action 3: Advocate for a clear U.S. certification standard (or set of standards) for offshore wind workforce, such as the Global Wind Organization (GWO) certification, to provide clarity and certainty to training organizations, developers, and supply chain companies. (Timing: Immediate)

Action 4: Work with public and private partners to help ensure social infrastructure is in place for Maine people to engage in the workforce. Supporting entry and success into OSW-relevant occupations is essential in guaranteeing that Mainers of all backgrounds can benefit from the economic activity. (Timing: Immediate to Long-term)

- Publicize the career paths for offshore wind and adjacent industries, including information on trainings, benefits, flexible schedules to attract underemployed Maine residents to the industries.
- Bolster supports and awareness of programs that increase access to transportation, housing, childcare, and other basic needs to ensure Mainers can participate in the OSW economy.

  Example: The Building Pathways program in Massachusetts provides a gateway for low-income area residents, particularly in underserved communities, to access family-sustaining careers in the construction industry through apprenticeship preparedness training and advocacy.

Rationale
The EDS states that Maine needs to add 75K new workers to our workforce over the next 10 years. Part of that strategy includes welcoming disengaged adults, people with disabilities, new Mainers, and "at risk" young adults. Re-engaging disengaged workers will require significantly increased investment and a higher risk tolerance, as well as additional supports coupled with earn-to-learn frameworks. Previous OSW projects have shown that, due to supply chain dynamics and costs, the manufacturing of hulls and construction of turbines are activities most likely to be done in Maine. This presents a substantial opportunity for the state's workforce, particularly among occupations that require some training but less than a four-year degree. Registered apprenticeships provide great entrance ramps into these types of careers by allowing participants to earn money while they learn and prepare for a career.

Recommendation #4: Encourage High Quality Careers for Maine Workers

Action 1: When developing Offshore Wind projects and relevant policies, work with public and private sector partners to ensure opportunities for high quality, family-supporting jobs that

offer career advancement. (Timing: Immediate to long-term)

Action 2: Ensure safety and health protections—many OSW construction and operations and maintenance jobs will take place miles out at sea and in inclement weather. Given the considerable risk that workers will face in such an environment, proper training and certification, safety protocols, and risk mitigation strategies will be essential to ensuring OSW workers can safely complete their jobs. (Timing: Immediate to long-term)

Action 3: Build opportunities for Maine companies in data science, artificial intelligence, and robotics to expand their expertise into OSW. Jobs that require the development and deployment of cutting-edge technology often offer strong wage and career progression opportunities. These high-education, high-wage jobs also tend to have greater multiplier effects on the local economy. (Timing: Near to Long-term)

Action 4: Support Maine's engineering and professional services clusters/hubs of excellence related to OSW. Maine not only has a relatively high concentration of these workers, but these jobs tend to offer family-supporting wages and career progression opportunities. (Timing: Near to Long-term)

Rationale

Maine's current and future talent pools deserve high quality career opportunities that can support families. Developing Maine's offshore wind workforce is an opportunity to put shared goals into action - goals such as safety, wellness, career advancement opportunities for all, continuing education, competitive pay and benefits. Maine should support innovative companies to expand into offshore wind, to develop clusters of businesses to support offshore wind and offer sustainable, well-paying careers. In the U.S. offshore wind sector, government, industry, and unions are working together to provide these pathways. Some mechanisms used in other states include ongoing training, prevailing wage or prevailing wage & benefits requirements, bidding credits to developers in exchange for substantive commitments to domestic workforce development and safety, and Project Labor Agreements (PLAs) (Note: these apply only to the construction phase of projects). Members of the Working Group agreed on the shared goals for Maine's workforce, but had differing opinions on PLAs as a mechanism to meet the shared workforce goals; they did not reach consensus on the appropriateness of PLAs for Maine offshore wind. Some Working Group members viewed Project Labor Agreements as important tools to establish the terms of bidding for construction phase projects. These members noted that PLAs are being encouraged for offshore wind construction by the federal administration and are being used effectively in other states. Other Working Group members noted that PLAs are not a good fit for Maine's open-shop companies and Maine's construction workforce, which is roughly 90% open-shop/non-union, higher than most of the other Eastern seaboard states. These Working Group members noted that workforce goals can be realized with open market conditions and encouraged using other ways to achieve the goals of this recommendation. All members supported developing a strong Maine workforce with high quality career paths to support the burgeoning offshore wind industry.

Recommendation #5: Promote Equity in Workforce Development

Action 1: Address equity and barriers to participation in OSW jobs, Registered Apprenticeships, and other training opportunities to ensure Maine can attract and develop high-skilled workers, protect public health and safety, and support an expanding clean energy economy. (Timing: Immediate to Long-term)

- Consider creating an Office of Just Transition within state government to help ensure that disadvantaged populations and Maine workers in the fossil fuel industry have family-supporting career paths in renewable energy.
- Document the current diversity of the clean energy sector workforce, and opportunities to increase access to these jobs for underserved communities.
- Work with existing training providers to ensure disadvantaged populations have priority access to training opportunities.
- Create targeted, earn-to-learn programs that provide work experience and classroom learning to prepare individuals for apprenticeship entry examinations and other certifications and licenses.
    - These training opportunities should provide resources to increase recruitment of women, people of color, vulnerable Mainers and other underrepresented groups. Opportunities should be promoted and accessible to Mainers from across the state.
- Explore barriers to entry into clean energy careers related to credentialing pathways—including license and work experience reciprocity for new and returning Mainers and requirements for individuals entering the clean energy workforce.
- Encourage developers to create workforce equity committees to prioritize recruiting and retraining disadvantaged populations.
- Support training programs to decrease barriers to entry through the provision of wrap-around services, financial incentives for learners to decrease identified barriers and other opportunities.
- Expedite systems to recognize foreign-trained professional credentials and connect immigrants, refugees, and asylum-seekers to OSW training and job opportunities.
- Advance policy and investments that support immigrant workers with English as a Second Language and associated job training, and other supports for new Mainers.

Action 2: Support programs such as the New Mainers Resource Center (NMRC) in offering OSW training opportunities to disadvantaged populations. The NMRC is a Portland Adult Education program serving immigrants, refugees, and employers in the Greater Portland area that provides skilled professionals programs, employment and case management, intensive classes focused on job readiness skills, networking opportunities, workshops and other services designed to help New Mainers of all professions overcome barriers to entering the workforce. (Timing: Near to Long-term)

Other State Example (New York): Nontraditional Employment for Women (NEW) prepares, trains, and places women in careers in the skilled construction, utility, and maintenance trades, helping women achieve economic independence and a secure future for themselves and their families. At the same time, NEW provides a pipeline of

qualified workers to the industries that build, move, power, green, and maintain New York.

Rationale

A recent report by the Maine Center for Economic Policy shows that systemic racism prevents many Mainers of color from reaching their full potential through barriers to hiring, lower wages, lack of protection from the law, and being made to feel unwelcome in the workplace.
For example, in Maine, a woman who is a representative of the racial, Indigenous, or tribal population with a college degree earns only slightly more than a White man with a high school diploma. While three-quarters of White Mainers own their own home, the same is true for fewer than one in four Black Mainers. Mainers who are representatives of the racial, Indigenous, or tribal populations typically experience unemployment and poverty at twice the rate of White Mainers.[19]
Offshore wind can offer high wage careers in 117 different occupations for more people, including women, people of color, and disadvantaged populations.

Recommendation #6: Coordinate & Collaborate Regionally to Attract Skilled Workers

Action 1: Attract skilled workers to Maine by promoting Maine's advantages and jobs that are family-supporting and offer upward mobility: (Timing: Immediate to Long-term)

- Expand the Opportunity Maine Tax Credit: This program reimburses student loan payments for college graduates who live and work in Maine through the form of an income tax credit. Eligibility requirements include living, working, and paying taxes in Maine and having an accredited associate, bachelors, or graduate degree, with additional benefits for STEM degrees.
- Promote adjacent and overlapping industry opportunities in tandem with OSW to attract workers to Maine

Action 2: Continue to work with public and private sector partners to address the housing shortage in Maine. The Maine housing shortage is not unique to offshore wind; It impacts the current and potential workforce in all industry sectors and Maine's overall economy. The state and other public and private partners should continue to expand affordable housing initiatives to ensure economic development opportunities, such as offshore wind, are realized. (Timing: Immediate to Long-term)
Action 3: Develop regional workforce strategies: (Timing: Immediate to Long-term)

- Consider the convening of a regional OSW workforce development task force.
- Draw upon a skilled regional workforce and talent pool in partnership with organized labor and others, including open shop companies, using mechanisms such as PLAs.
- Explore the establishment of a joint Maine Building, Engineering and Trades

[19] Myall, James. Data on racial inequality shows need for solutions to advance racial justice. (June 2019). Maine Center for Economic Policy. Retrieved June 15, 2020 from: https://www.mecep.org/wp-content/uploads/2019/06/MECEP-racial-inequality-fact-sheet-FINAL.pdf

Training Facility to attract and retain in-state and regional worker talent.

Rationale

Building on Maine's existing strengths in the floating OSW industry can help the state solidify its status as a hub for floating OSW activities. The development of an industry "cluster" or a "hub of excellence" within Maine can generate far-reaching positive feedback effects. This type of convergence of research, postsecondary institutions, skilled workforce and businesses have positive feedback effects as workers and employers alike are drawn to them because of greater access to the other. Alongside promoting self-perpetuating growth, industry clusters can help drive innovation as workers are able to cross-pollinate skills and ideas that can revolutionize an industry. [20]

Regional strategies can help facilitate cooperation and coordination. Collaboration between states can allow each state to capitalize on its strengths while leveraging the strengths of its neighbors, increasing project efficiency, and decreasing costs.

[20] Maine's Economic Development Strategy, DECD, 2019

Vision Statement for Maine's OSW Ports

Maine's has a versatile deep-water port system that handles a wide variety of marine cargo. Throughout the years, infrastructure investments have been made to ensure that Maine's ports are well equipped and able to compete with marine facilities located to the North and South. The emerging offshore wind industry is an opportunity to include Maine's ports in the current trend of significant port development projects for OSW throughout the US East Coast. The Ports, Supply Chain and Workforce Development working group has created this list of recommendations to provide state leadership with a basis of understanding of why Maine's ports are so important for OSW, and how Maine can best position itself to develop its ports to benefit from the potential economic impact of OSW. While further study and stakeholder outreach is necessary, this working group recognizes the importance of port facilities to OSW and strongly believes that the development of a purpose-built OSW port facility is necessary to realize the full economic benefit of the industry to the State of Maine.

Ports Recommendations

Recommendation #1: Move forward with port development plans with urgency.

Supporting Actions

- Maine should develop a timewise ports development plan with a dedicated investment strategy.
- The market will drive the port requirements for OSW. Investments will occur in phases as the east coast offshore wind pipeline matures with the OSW industry, and the value of a deep water, heavy lift quay side, and unlimited air draft in a protected port increases.
- Maine should continue the ongoing work of evaluating multiple port facilities (Portland, Eastport, etc) that could be developed to support OSW projects in the Gulf of Maine and/or Northeast region.
- Maine can help developers reduce risk by conducting early permitting, environmental impact investigation and robust stakeholder outreach[21] on potentially developable sites along the Maine coast. Stakeholder groups should also include local port operators to ensure consistent communications with OSW developers.
- A business case for the development must be made before significant investment in engineering / construction planning is initiated.

[21]The role of the OSW Port Advisory Group (OSWPAG) is to advise the State of Maine on the potential impacts and benefits of offshore wind port development throughout the planning process to select a location for a wind port in Maine.

- Maine should consider pursuing federal funding for OSW port development. This includes communicating port development plans with federal delegation staff and keeping aware of federal funding opportunities.

Context and Rationale

Maine's deep-water ports provide a unique opportunity for the state to establish the nation's first purpose built floating offshore wind port. Marshalling floating turbines requires significant water depth, upland storage capabilities, quay side heavy lift area, and proximity to project sites to allow for towing of completed units. There may potentially be several locations along Maine's coast that have the capability of meeting these criteria. With the right investment, stakeholder engagement, and aggressive timelines, Maine has the opportunity to establish a floating offshore wind hub to support the development of floating projects along the east coast. The Moffatt & Nichol feasibility study for the port of Searsport provides a good foundation to consider potential floating OSW port infrastructure in Maine.

Recommendation #2: Discuss OSW goals with neighboring states and jurisdictions in the region as well as OSW developers.

Supporting Actions

- Maine should pursue efforts to support the development of floating offshore wind, through marshalling services, with the potential for handling, assembly, and transport services longer term, serving projects along the North Atlantic coast for multiple states and jurisdictions.
- Maine needs better data around the needs of developers, and how the state could support those needs. Maine should solicit a Request for Information to collect appropriate data from east coast developers interested in Maine as a staging port.
- Since the infrastructure requirements for floating and fixed have commonalities, considering port infrastructure projects in both modes would likely benefit the state, even as Maine moves to develop a competitive advantage with floating.

Context and Rationale

Floating offshore wind should be the future focus for Maine moving forward. The long-term OSW energy goals on the US East Coast relies on floating OSW, and Maine could position to facilitate that build out to be a leader in supporting multiple states' and jurisdictions' goals. Maine has an existing network of ports that can coordinate to support offshore wind activities.

In order for Maine to position itself to take on a role of providing infrastructure to facilitate the floating OSW market on the US East Coast, a significant amount of time to achieve this goal makes it essential to start the planning and permitting process now.

Recommendation #3: Consider and study potential negative and positive impacts to both land side and coastal communities in ports that could support OSW, starting in Searsport.

Supporting Actions

- Develop an Overland Plan to minimize disruptions to communities, businesses, and tourism in near-coast areas, and to support the operations of the OSW ports. Strategies could include transportation infrastructure investments (road capacity, bypass routes, etc.) in combination with traffic management schemes. Providing options to transport components, raw materials, equipment, and personnel by water is an ideal way to minimize congestion inland.
- Maine should consider port improvements that simultaneously meet multiple user needs and avoid excluding other sectors that could benefit from multiple forms of ocean users (fishing, other marine cargoes, recreation, etc.).
    - The state should focus on investments that strategically benefit communities and avoid or minimize impacts to the environment and existing ocean users.
    - This could be achieved through an industry funded grant program that targets ocean users impacted by OSW development in Maine, specifically targeting working waterfront facilities.

Context and Rationale

OSW port activity is significant and may create negative and positive impacts on ocean users and communities. Currently and in the short term, the OSW supply chain is primarily supplied internationally. Through policy and proximity, a US-based supply chain will come to dominate US offshore wind projects. As shipments of components come in from the West Coast, Gulf Coast Midwest and Atlantic, the number and density of shipments including oversize shipments (subassemblies and parts) will become concentrated as they approach the OSW ports. Added to this will be commuter traffic associated with the ports and their ecosystems. Current potential offshore wind ports are not equipped to deal with this and could become congested. Prediction and mitigation of these impacts should be studied.

Recommendation #4: Expose Maine's ports-related supply chain to various stages of offshore wind projects – first with fixed, and then transitioning that experience and relationship building into floating.

Supporting Actions

- Pursue existing fixed-bottom OSW related services opportunities as the pipeline for floating projects matures
    - This could include: security, utilities, fuel bunkering, stevedoring, cranes, handling, forklifts, self-propelled modular transporters (SPMTs), trailers, vessel maintenance, ships agent, towage, and waste removal.

Context and Rationale

Offshore wind projects in the extensive U.S. pipeline require not only large port facilities, but also smaller port facilities with associated port and logistics services. Provision of these services spans all phases of an offshore wind project. Smaller ports in Maine may aid in these logistical services to support development surveys and wind farm O&M stages for projects along the U.S. Atlantic coast.

Appendices (TBD)

- Stakeholder input: A summary of feedback received and how the WG responded to it
- Technical reports reviewed by the WG
- List of external speakers brought in to share information/perspective with the WG