DNV

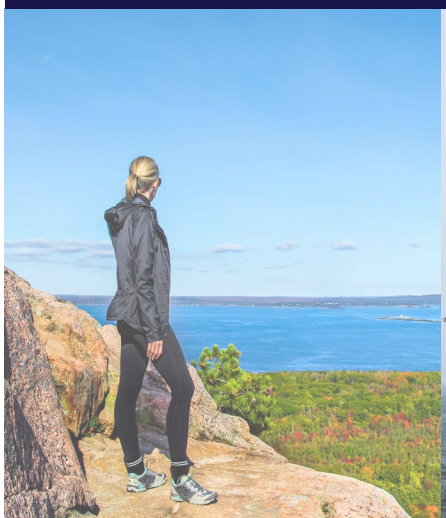
WHEN TRUST MATTERS

OFFSHORE WIND IN THE GULF OF MAINE

SOCIOECONOMIC ANALYSIS

Prepared for the Maine Governor's Energy Office and Maine Offshore Wind Roadmap

EXECUTIVE SUMMARY



The Offshore Wind Roadmap: charting a course for Maine

This executive summary provides an overview of the findings from the socioeconomic study DNV conducted for Maine's Offshore Wind Roadmap.

The Offshore Wind Roadmap 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. The Roadmap is supported by a $2.166 million grant from the U.S. Economic Development Administration.

With an abundant wind resource off Maine's shores, a growing demand for renewable energy sources to reduce fossil fuels and fight climate change, an enterprising citizenry with maritime experience, anticipated federal leases, and an innovative research environment with more than a decade of experience with floating offshore wind, the Governor's Energy Office is exploring how best to responsibly develop an offshore wind industry in Maine.

GEO's objective for the Roadmap is to identify how to foster an offshore wind industry that works for Maine's people, Maine's economy, and Maine's heritage.

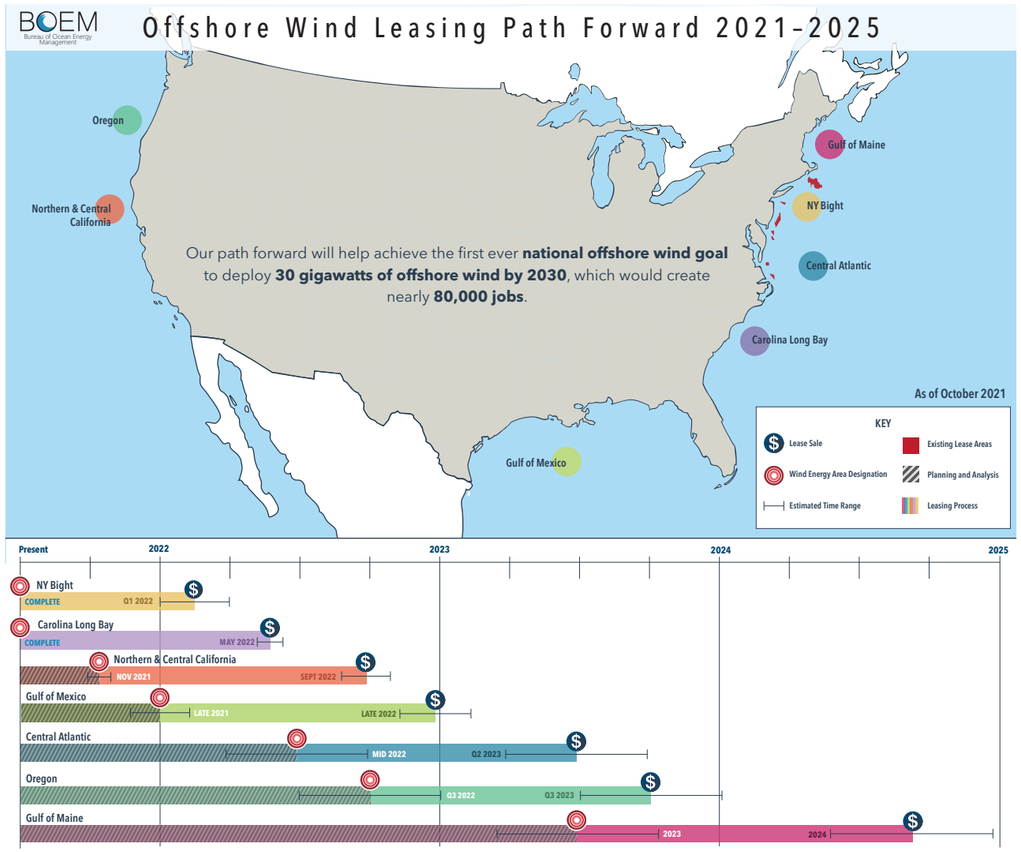
The Maine Offshore Wind Initiative launched in June 2019 by Governor Janet Mills with the goal of exploring how to thoughtfully develop floating offshore wind energy in the Gulf of Maine while ensuring balance with Maine's maritime industries and environment.

The Maine Offshore Wind Initiative is overseen by the GEO in close collaboration with the Governor's Office of Policy Innovation and the Future and the Department of Economic and Community Development. Other contributing agencies include the Department of Transportation, Department of Environmental Protection, the Department of Marine Resources, Maine Technology Institute, and Maine International Trade Center.

The offshore wind development process

The process of developing offshore wind in U.S. waters, including the Gulf of Maine, is led by the Bureau of Ocean Energy Management (BOEM), a federal agency. BOEM's process consists of three main phases: 1) planning and analysis, 2) wind energy area designation, and 3) lease sales. For the Gulf of Maine, BOEM is still in the first planning and analysis phase, and is not scheduled to designate wind energy areas until mid-2023. Lease sales are expected in late 2024. Below is a timeline for BOEM's lease process for offshore wind projects along the U.S. coasts. Construction activities will not begin until several years after BOEM's process ends.

What this means for estimating the socioeconomic effects of offshore wind development in the Gulf of Maine is that DNV cannot be very precise at this moment due to Maine's current stage in the process. The details of maximum wind energy capacity, the ocean surfaces affected, transmission landings, and the overlap with other ocean activities in the Gulf, such as commercial fishing, will all be speculative until BOEM announces specific lease areas.



Socioeconomic effects of offshore wind development in the Gulf of Maine

To calculate the potential socioeconomic effects of offshore wind development in the Gulf of Maine, DNV:

reviewed	conducted	calculated
176	64	36
secondary sources	in-depth interviews	economic impact estimates

For each key finding topic in this report, the above icons indicate which type of data was used to arrive at the findings for that topic.

Literature review

DNV read, reviewed, analyzed, and summarized 176 articles, reports, and presentations to learn about and better understand the socioeconomic effects from offshore wind development on five key areas: fisheries and other ocean users, ecology, tourism and recreation, communities, and equity. Sources included numerous federal and state studies, university research publications, and international evaluation studies. DNV received these sources directly from the stakeholders we worked with as well as government websites, research databases, and Google Scholar.

In-depth interviews

To supplement this existing research, DNV conducted 64 interviews—17 with representatives of coastal and non-coastal communities, 15 with tourism and recreational industry trade groups/representatives, and 31 with individuals in the fishing industry—to ensure we have the latest and most complete accounting of concerns and potential risks in this area. These interviews were completed between January 2022 and April 2022 and included a variety of perspectives from individuals spread out around the state.

Economic impacts

DNV used decarbonization scenarios developed in previous research to calculate the economic impacts of offshore wind development in the Gulf of Maine. We estimated impacts on different types of jobs, the social cost of avoided carbon emissions, and avoided health care costs due to non-carbon air pollution. DNV calculated estimates likely to occur in 2030, 2040, and 2050 depending on how much offshore wind is developed in the Gulf of Maine.

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Gulf of Maine offshore wind assumptions

Our research was based on the following assumptions and scenarios.

Policy assumptions

In the Gulf of Maine, all offshore wind will be developed in federal waters.

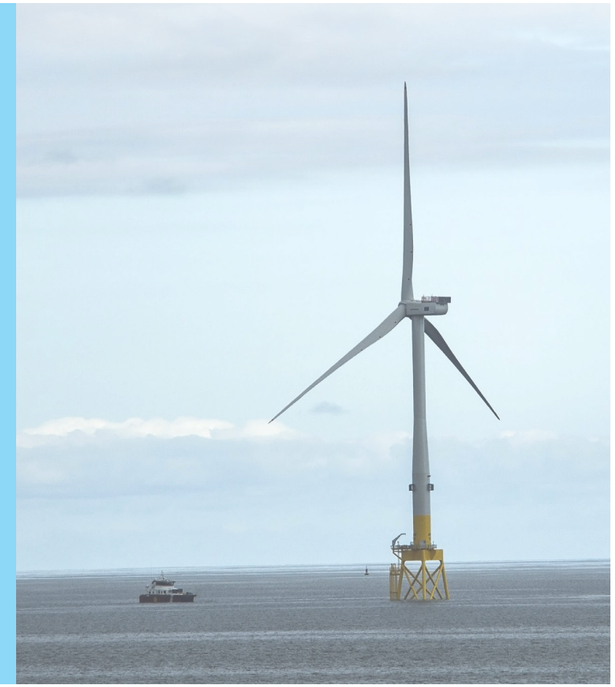
Technology assumptions

Due to water depths, 100% of the offshore wind turbines serving Maine will be floating technology. Floating offshore wind will be cost-competitive with fixed offshore wind by 2050.

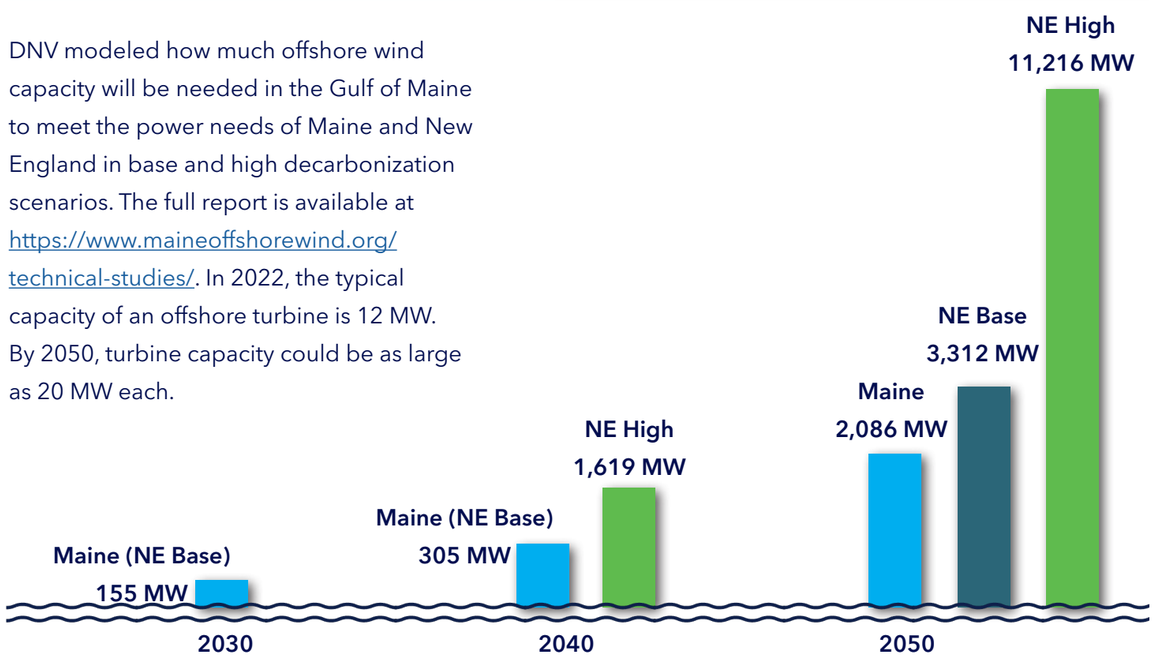
Timeline assumptions

A planned 144 megawatt (MW) research array and an 11 MW Aqua Ventus demonstration project will be completed by 2030.

In DNV's NE Base scenario, offshore wind in the Gulf of Maine will produce enough energy to power approximately 78,000 Maine homes in 2030, 114,000 in 2040, and 673,000 in 2050.



DNV modeled how much offshore wind capacity will be needed in the Gulf of Maine to meet the power needs of Maine and New England in base and high decarbonization scenarios. The full report is available at https://www.maineoffshorewind.org/technical-studies/. In 2022, the typical capacity of an offshore turbine is 12 MW. By 2050, turbine capacity could be as large as 20 MW each.



Key findings

Economic development

Offshore wind (OSW) development could result in over $2B in wages for one-time construction jobs and $778M in annual operations wages for each year over the 20 year project lifespans.

The tables below show the annual economic impacts in 2021 USD (rounded to the nearest million) over the 20-year lifetime of the array. These totals include wages earned for short-term jobs created during construction and long-term jobs that span the entire 20-year operations phases for the OSW installations. Capacities listed in each row are what the scenarios predict will be installed by that year. Economic impacts in each row are calculated assuming that 100% of the listed capacity was installed in the listed year. Based on these calculations, Maine could experience up to 33,000 short-term and 13,000 long-term jobs. Workforce development programs that provide training to people living in disadvantaged communities will be important to ensuring equitable access to these economic impacts.

2030 scenarios - economic impacts by local content

Demand scenario	MW	Construction (one-time)		Operations (Annual for 20 years)	
		Low local content	High local content	Low local content	High local content
Base case	155	$24M	$55M	$5M	$12M
Decarbonization	155	$24M	$55M	$5M	$12M

2040 scenarios - economic impact by local content

Demand scenario	MW	Construction (one-time)		Operations (Annual for 20 years)	
		Low local content	High local content	Low local content	High local content
Base case	305	$25M	$73M	$7M	$21M
Decarbonization	1,619	$114M	$362M	$36M	$113M

2050 scenarios - economic impact by local content

Demand scenario	MW	Construction (one-time)		Operations (Annual for 20 years)	
		Low local content	High local content	Low local content	High local content
Base case	3,312	$209M	$678M	$74M	$231M
Decarbonization	11,216	$704M	$2,265M	$248M	$778M

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The calculation of meaningful, potential negative impacts on other ocean-using industries such as commercial fishing is not currently feasible.

However, DNV interviewed ocean users, coastal communities, and other stakeholders in Maine to begin capturing information that will help make these meaningful calculations possible in the near future. Once lease areas are announced, preliminary estimates of potential effects on other ocean users can be developed when the following information is also available:

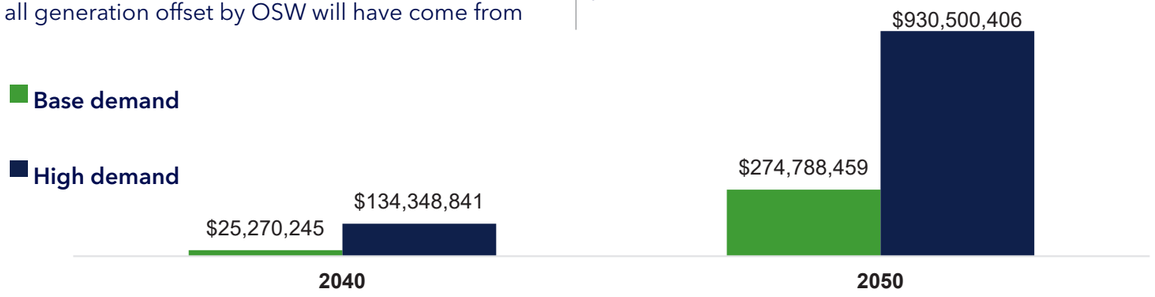
- The specific areas of the ocean where turbines will be installed, the configuration of the turbines, mooring technology, and inter-array cabling
- Corridors, technology, and depth of ocean-to-shore transmission cabling
- Levels and specific types of harvesting currently happening in areas where arrays and transmission are proposed
- The proximity of realistic alternative areas to harvest

After direct impacts to commercial fishing are quantified, economic multipliers can be applied to calculate indirect (supply-chain) and induced jobs that would also be affected. Permitting studies often include more precise commercial fishing impact estimates.

Social cost of carbon

OSW deployment helps avoid the social costs associated with releasing carbon into the atmosphere.
In the base and high demand scenarios, DNV assumed that the region will pursue decarbonization aggressively enough that it will look to renewables to fit capacity needs before developing additional fossil fuel generation. In 2030, both base and high demand scenarios do not predict that OSW will offset any fossil fuel generation. However, by 2040 (and beyond), both scenarios predict that all generation offset by OSW will have come from fossil fuels. Based on current fossil fuel generation mixes in Maine (96% natural gas) and the region (98% natural gas), DNV assumed the displaced fossil generation would be from natural gas-fired power plants.

The figure below shows the total avoided carbon costs in 2040 and 2050. These numbers are based on an estimate of carbon dioxide (CO2) emitted by natural gas-fired power plants and the federal government's social cost of carbon estimate of $51 per metric ton of CO2.



Air quality and health effects

OSW development will improve air quality by displacing more polluting generation sources.
As discussed above, OSW will primarily offset natural gas-fired electricity generation. This produces the non-carbon air pollutants of nitrous oxide (NOx) and associated fine particulate matter (PM2.5), which are the primary contributors to negative air quality and health effects such as asthma, heart disease, lung diseases, and cancer. Electricity generation in Maine releases approximately 0.073 metric tons of NOx per GWh.

DNV used the EPA COBRA model to estimate the health cost effects of NOx emission reductions resulting from OSW deployment. The table below shows these estimates.

Avoided NOx emissions and avoided healthcare costs

Demand	Avoided NOx			Benefits low (2021 dollars)			Benefits high (2021 dollars)		
	2030	2040	2050	2030	2040	2050	2030	2040	2050
Base	0	100	1,084	0	54,152	588,847	0	122,651	1,333,701
High	0	530	3,669	0	287,897	1,993,966	0	652,070	4,516,165

Public perception & community involvement

Onshore and OSW developers have seen success with meaningful community engagement that includes deliberative, multidirectional communication. This type of engagement seeks to reconcile technical needs and community values and gives communities the power to collaboratively negotiate for community benefits. Proactive communication can mitigate concern and uncertainty. Local communities want to know how wind energy projects can affect them and want to know about a project early in the process. Our interviews with communities and ocean users found that education, direct communication, and local community engagement with developers and other community groups are essential to informing the community about OSW development. The literature review of best practices found that developers often assign a community liaison to ensure the earliest possible involvement and engagement of local communities.

Messages must come from trusted sources. Our interviews indicated that some information sources were more likely to be trusted than others. The community interviews underscored the importance of engaging local information sources to educate the public such as libraries, churches, and town managers. Interviews with fishermen mentioned the Department of Marine Resources as a trusted information source. Interviews with tourism representatives reiterated the importance of engaging with "trusted flag-bearers." As mentioned above, a developer's community liaison can help facilitate this process as well.

Without proactive communication, misinformation can spread. State agencies are key sources of accurate information about OSW. In our interviews, many stakeholders shared that they receive news about OSW from other sources such as social media platforms, suggesting the potential for misinformation. Interestingly, numerous stakeholders expressed certainty that any proposed OSW projects would send all of their power only to Massachusetts and not to Maine, although this is not necessarily the case.

Proactive, multidirectional public engagement is a necessary—but not sufficient—component of procedural equity. Procedural equity also requires additional attention to ensure that historically marginalized groups have decision-making power and a seat the table.

Mindful policy is required to address historic inequities suffered by Indigenous people and avoid additional harm. People living on Indigenous tribal lands can realize ecological, economic, and health benefits from decarbonizing the energy system. However, without policy approaches that deliberately recognize and seek to increase tribal sovereignty, there is a risk of continuing a history of exploitative resource development and energy inequities on tribal lands.

Fisheries

Members of the fishing industry are worried about losing harvesting areas.

A majority of the interviewed Maine fishermen expressed concern about the possible loss of harvesting areas due to OSW and submarine transmission corridors. Many studies on the economic risks to fishermen from specific arrays in specific areas of the ocean assume that fishermen can easily shift to harvesting a different part of the ocean. The interview results suggest this assumption may be overly optimistic. The interviewed fishermen stressed that there is a strong social convention among Maine fishermen and lobstermen to harvest only within specific areas that have often been negotiated over generations. Maine state lobster licenses also restrict fishing to within one of seven zones, the boundaries of which extend into federal waters of their permitted zones. Displacement could create further conflict, accelerate arguments over space, and necessitate moving to less productive locations. Additionally, even if fishermen could shift their harvesting areas, interviewees shared that their work is highly dependent on a detailed knowledge of fish behavior built up over years or decades that might not apply in unfamiliar waters.

Multidirectional communication that occurs early in the planing process is a best practice to avoid conflict and minimize negative impacts to commercial fisheries.

The Roadmap process includes a working group dedicated to fisheries. However, close to half (42%) of the fisheries and one-fourth of the community interviews (24%) suggested that more could be done to fully engage the fishing community in the dialog.

Navigational routes might increase in length.

Several interviewees expressed concern that the location of arrays might require changes to the routes they take to get to harvesting areas. This could increase steaming times and fuel costs, which would be harder on smaller fisheries. In at least one case in Europe, a wind farm was sited in a way that restricted a transit area that was previously freely accessible. There are ongoing conversations on the East Coast related to this risk.

Any lost maritime jobs will have multiplier effects.

Reduced harvesting areas and increased transit costs could harm profits and possibly lead to a loss of maritime jobs. Economic multiplier effects due to indirect (supply-chain) and induced effects would operate in a negative feedback loop. The loss of one fishing vessel creates economic ripples in ancillary industries including reduced demand for fuel, bait, ice, dockage, and maintenance, and reduced supply for downstream industries such as seafood dealers. Lost fishing and supply chain jobs would have negative induced effects on overall economic activity in the community as families have reduced disposable income. Many fishing communities exist in rural areas where alternative employment is not readily available. These losses would affect crews, their families, and parts of the unique rural Maine coastal economy that are heavily dependent on commercial fisheries. Fishermen expressed concern about the potential loss of their heritage and also a lack of alternative employment options.

Co-location might be feasible if safety concerns are addressed.

Maine fishermen are concerned about the safety of operating near OSW turbines. There remain substantial unknowns around the implications of inter-array cabling, mooring, and ocean-to-shore transmission corridor that will become clearer as the development process matures. Co-location or multi-use areas have been considered in some areas of Europe.

Previous experiences with regulations around the protection of North Atlantic right whales are affecting fishery response to OSW.

As of May 1, 2022, new federal regulations require lobstermen to alter their gear to prevent whales from becoming entangled. These regulations are contentious and commercial fisheries have taken legal action to attempt to change them. The State of Maine has been attempting to engage the fishing industry about OSW at the same time. During interviews, 61% of the fishermen voiced frustration about the timing of OSW development. They expressed concerns over cumulative effects, and that OSW development would impose additional restrictions on their industry which is already affected by climate change, the development of other industries, and regulatory oversight and enforcement.

Fishermen found it difficult to offer ideas for mitigation measures that adequately addressed their concerns.

For many fishermen, fishing isn't just a job, it is a way of life, part of their heritage, and a source of cultural identity. Within such a context, simple economic compensation would be an insufficient way to mitigate lost jobs. The current context of uncertainties about the overlaps of lease areas with harvesting areas, the technical details of floating arrays and co-location possibilities, and the lack of research on ecological effects made it difficult for interviewees to suggest mitigation strategies or understand how they would adapt. Continuing to engage in a supportive dialogue with the fishing community around these issues will be essential to mutually optimal outcomes.

A secondary goal of the interviews was to better understand where fishermen are currently harvesting. A limited number of interviewees who were willing to disclose their fishing locations stated that they operate an average of 3 to 30 miles from the coast. They reported that harvesting in federal waters (past 3 miles) has increased in recent years, and few boats are large enough to safely operate past 30 miles. They named five harvesting "hot spots": Platts Bank, prime groundfish habitat; Jeffreys Ledge, about 30 miles offshore, a "hot spot" for cod and pollock; Tibbet's Ledge near Boothbay, a favorite for ground fishing; any "ledge" in the Gulf with rocky shoals and muddy, gravelly bottoms as a potential hot spot; and the area where the Research Array is being proposed, a winter habitat for lobster.

It should be noted that these are only the areas that were mentioned by interviewees. It is not meant to be an exhaustive list, and these reports have not been verified against objective data sources.

Coastal and non-coastal communities

The primary issue facing most towns is the availability of affordable housing.

Most (71%) of the community interview respondents cited housing availability as a primary concern. Increased population via migration from other states with higher costs of living is driving up housing prices, putting strain on local infrastructure, and creating skilled labor (plumbers, electricians, etc.) shortages. Town managers are concerned that this problem will worsen if OSW development brings more people to Maine.

Community officials are concerned about their communities' resiliency to the impacts of climate change.

In interviews, 41% of the respondents cited concerns about climate change impacts. Drought, rising sea levels, coastal erosion, and a higher volume of runoff are straining existing infrastructure. Town managers reported regularly encountering resistance from community members when changes are proposed. In one anecdote, a town manager stated that even though a primary section of downtown now experiences regular flooding due to higher tides and storm surges, she has been unable to make the necessary improvements because residents do not want to change the visual aesthetic of that area. While OSW seeks to alleviate the larger issue of climate change, there is an immediate need for investment in existing infrastructure, and town managers suggested that a portion of the revenue from OSW be allocated for these improvements. This would allow local leaders to deliver the message that OSW is creating additional benefits in the community and improving everyday life for the residents.

The third-most commonly mentioned issue from interviewees (35%) is concerns regarding social and financial equity.

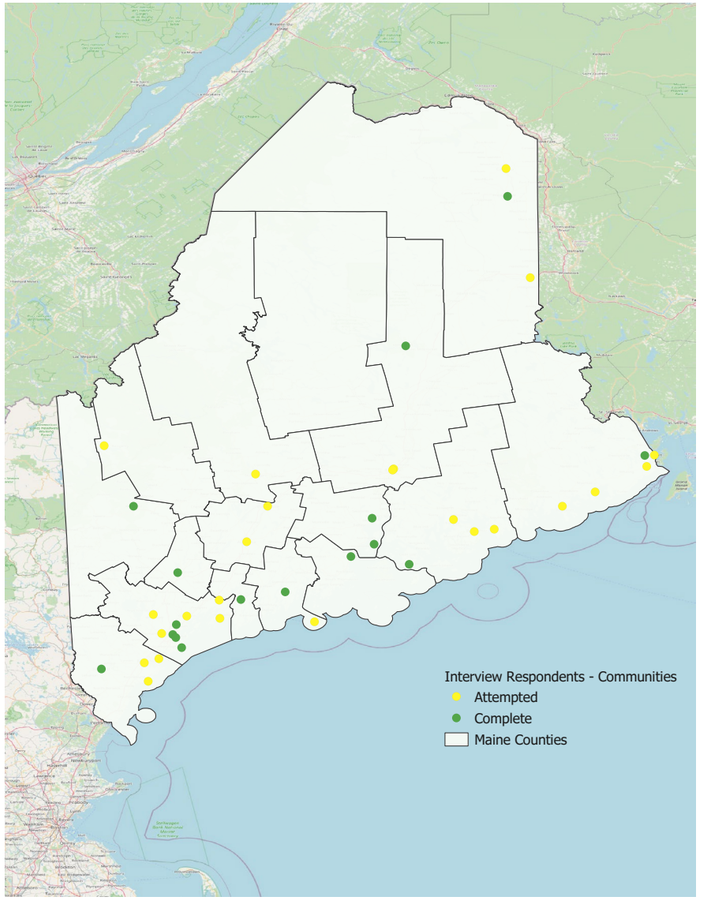
Issues in this category include homelessness, income disparities, and tribal diversity/equity/inclusion.

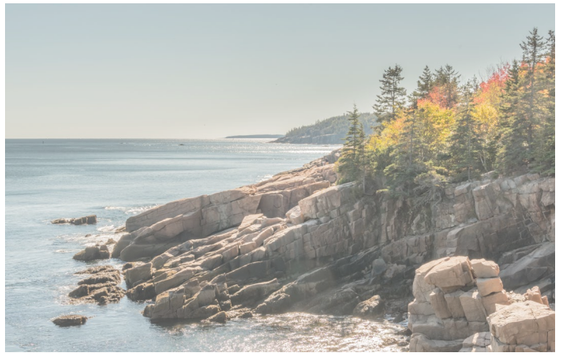
Most (59%) respondents are generally supportive the State's plan to move forward with OSW development in the Gulf of Maine.

The most enthusiastic supporters articulated a sense of urgency to mitigate climate change and reduce the dependence on fossil fuels. Three (18%) of the respondents expressed mixed opinions about OSW. One (6%) respondent strongly opposed OSW. Two-thirds (65%) of interviewees are aware of the state's clean energy goals, but not the details. Another 18% are familiar with the goals as well as the details.

Community respondents were concerned about some potential trade-offs from OSW.

The greatest concern was negative impacts to the commercial fishing industry. Overall, the 17 respondents indicated they are highly reliant on the commercial fishing industry with an average score of 4.3 on a 5-point scale. Respondents whose communities were more dependent on commercial fishing expressed stronger concerns about avoiding negative impacts to that industry. A natural aesthetic is important to many of the communities; approximately half (47%) of the respondents indicated that nature and natural beauty attracts tourism.





Local content and self-sufficiency are part of the Maine "brand."

One-third (30%) of respondents noted the importance of Maine being viewed as self-sufficient and suggested that there is an opportunity for OSW to expand on this concept by promoting "carbon-neutral" or "carbon-offset" experiences that are powered by wind from the Gulf of Maine.

Tourism and recreation

Interviewees are concerned about climate change and recognize that OSW can help mitigate it.

The majority (80%) of respondents noted climate change as a tourism and recreational industry concern. Some interviewees even noted the current impacts of climate change on their businesses, including the loss of seabird populations and the migration of whales further from whale boat tours' traditional routes.

The tourism and recreation industry is unfamiliar with Maine's renewable energy goals and the GEO's conversations surrounding OSW.

Very few respondents (13%) were aware of the GEO OSW working groups. Only 20% were familiar with Maine's renewable energy goals. Several interviewees expressed gratitude for being included in this effort and to be allowed to speak on behalf of the tourism and recreational industry. These interviewees also suggested opportunities to include them more in the OSW process moving forward, specifically through direct communication.

Interviews and existing research indicate there are mixed reactions to the sight of OSW turbines.

All respondents stated that Maine's scenery, natural beauty, and "untouched" feel are the main draw for tourists and recreators. Half said visible wind turbines would harm their business by obstructing Maine's scenery and natural beauty. Existing research on the Block Island wind farm off the coast of Rhode Island found that the reactions of tourist and recreational groups were mixed and trended toward positive. Other research suggested that wind turbines could increase tourism through "curiosity trips" to see the turbines.

If placed far enough from shore, the turbines will be minimally visible, if at all.

DNV's analysis on the daytime visibility of OSW turbines determined that there will be little to no visibility (from the shore at sea level) of an OSW turbine installed at least 10 miles offshore. The current preferred site for the Research array is no closer than 23 miles from shore.

Recreational organizations and tourism businesses that rely on wildlife to attract customers expressed concern about the potential impact of OSW on wildlife such as whales and seabirds.

These parties referenced the noise (under and above water), light, and turbine speed as having potentially negative and sometimes detrimental impacts on seabird populations by disorienting and ultimately displacing them. Interviewees cite experiencing the negative impacts of climate change on seabird and whale populations in the Gulf of Maine and hope that OSW is developed to avoid more harm to these populations that their businesses rely on.

OSW development could increase recreational fishing.

Though our interviews did not address the impacts of OSW on recreational fishing, our literature review did suggest that underwater fixed-bottom structures, such as those used for OSW development, can act as fish aggregators for things like mussel growth, fish attraction, and artificial reefs. This could create new recreational fishing opportunities. Increased recreational fishing opportunities could be beneficial to some, though it might also contribute to over-crowding in certain areas of the ocean.

Port development and industry advancement

DNV anticipates that at least one port on the Gulf of Maine will benefit from a rising need for specialized and improved port facilities.

Benefits will scale with the degree of OSW development in the Gulf of Maine. Additionally, DNV has identified the potential for cascading benefits from early port development. European experiences show that ports that develop early OSW construction support are likely to be re-used as staging ports for later OSW development. Maine is actively researching port infrastructure capabilities to support the OSW industry

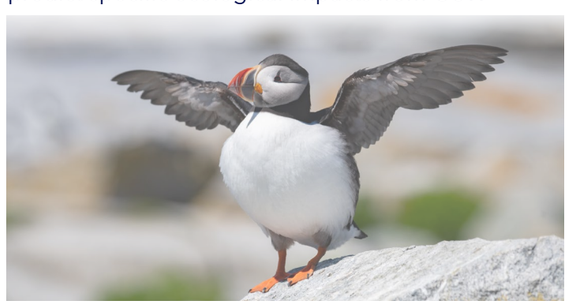
OSW creates an opportunity to grow other Maine businesses that are part of the supply chain.

This includes the manufacture and assembly of all components other than the turbines. The University of Maine is already a leading OSW research institution and would likely find expanded research opportunities from commercial installations in the Gulf of Maine.

Potential ecological impacts

More research is needed to understand the ecological impacts of floating OSW development as an emerging technology in the Gulf of Maine.

There are potentially positive and negative ecological impacts from OSW development. With the currently available information, DNV cannot predict specific ecological impacts from OSW development. Specifics about arrays that are not known until much further along in the development process also inform potential ecological effects. Details such as specific foundation technology, nacelle height, blade length, layout, inter-array cabling, and mooring all matter. Studies of observed effects of floating arrays in other parts of the world will provide some information about ecological effects. And more local studies will be necessary to understand interactions with the unique characteristics of the Gulf of Maine. What can be said with confidence at this point is that the magnitude and probability of ecological impacts will increase with additional OSW deployment.



Energy equity

Increased electricity rates are a risk, especially for low- and moderate-income households.

DNV's State of the Offshore Wind Industry report, prepared alongside this report, predicts that generation costs for floating OSW will decrease substantially over time. Furthermore, generation costs are not the only factor that determines consumers' electricity rates. Other cost-of-service factors such as transmission and distribution also make a difference. Finally, the scenarios upon which this study was based assume aggressive energy efficiency program implementation and electrification of home heating and transportation fuels. Even if electricity costs more than it does today, electrified heating and vehicles are significantly more efficient than most current fossil-fueled technologies. These efficiency gains could partially or fully offset any increases in electricity rates on energy burdens and affordability in the shorter term.

Ensuring equitable access to electricity requires mindful policy.

In many parts of the country, tribal lands have substantially less access to electricity than other areas. Non-tribal rural areas may also have historically less access than urban areas. As generation capacity increases, new policies could help increase access to electricity in these areas.

As the Roadmap process unfolds, there will be more opportunity to engage with frontline and BIPOC (black, Indigenous, and people of color) communities.

Responsible engagement of historically marginalized groups is an ongoing process. About one-third of the community interviews were with communities with high socioeconomic vulnerability scores, and continued interaction with those types of communities will keep them in the conversation and yield additional insights as the OSW development process evolves. Because researchers in this study were unable to contact Indigenous representatives, we cannot report on their concerns at this time.

Workforce development programs will be necessary to ensure equitable participation in new jobs.

This study anticipates substantial new jobs and economic impacts for the state of Maine arising from anticipated OSW development in the Gulf of Maine. Maine does not currently have a sufficient workforce to fill all those jobs, so training will be necessary to maximize the local share of labor. Equity requires ensuring that those workforce development opportunities and new jobs are accessible to people in economically vulnerable areas.

The health and environmental benefits described in this study are considered at the regional level.

Locational health and environmental impacts were not feasible for this study. However, the estimated benefits are calculated by considering avoided costs. Thus, to the extent that specific areas suffer greater harm from pollution emitted by fossil-fuel infrastructure, those areas would also experience proportionately more of the benefits accounted for in this study.

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Ongoing research opportunities

The areas with the greatest need for additional research are the ecological effects of floating OSW, the interactions of planned arrays with current commercial fishing activities, and gathering additional input from tribes and other historically under-represented communities. As the OSW development process matures, more details will emerge about where and how many turbines will be placed in the Gulf. Additionally, the technologies used for floating arrays also will continue to mature, and observations from existing research and commercial arrays will provide more information about how those technologies interact with ocean ecology and other ocean users. Additional research should be done to calculate meaningful estimates of potential impacts on commercial fisheries, which requires the following information:

- The specific areas of the ocean where turbines will be installed, the configuration of the turbines, mooring technology, and inter-array cabling
- Corridors, technology, and depth of ocean-to-shore transmission cabling
- Levels and specific types of harvesting currently happening in areas where arrays and transmission are proposed. Sources such as the Northeast Ocean Data portal and the Department of Marine Resources have data of this nature.
- The proximity of realistic alternative areas to harvest

Some of this information will become available when BOEM announces the lease areas (predicted for mid-2023). At that point, it will be possible to determine potential overlaps between wind arrays and harvesting areas to produce a high-level estimate of potential impacts.

The more information that is available about the harvesting activities happening in those areas, the better the impact estimates will be. A collaborative research study with members of the fishing industry that gathers data about the locations, species, and magnitude of harvesting occurring in the proposed lease areas would help inform the design and siting of arrays to minimize impacts on other ocean users.

As developers specify precise locations for arrays and the designs and layouts of those arrays, more precise estimates of ecological and economic effects will be possible. At this point, details such as array locations, foundation distances, inter-array cabling, mooring technology, and ocean-to-shore transmission locations and depths will be known with a high degree of specificity. This is also the point when permitting studies often occur and offer an opportunity to develop these estimates.

BOEM continues to fund additional research on OSW, floating technologies, and unique ecological impacts in the Gulf of Maine. These efforts include research on North Atlantic right whales and other protected species; behavior effects from sound generated by offshore construction; and marine, migratory, and federally-listed bird impacts.

A collaboration between Maine Sea Grant, the Department of Energy, and NOAA is funding additional research on community engagement and the coexistence of offshore energy generation and Northeast fishing and coastal communities.

About DNV

DNV is a global quality assurance and risk management company. Driven by our purpose of safeguarding life, property and the environment, we enable our customers to advance the safety and sustainability of their business. We provide classification, technical assurance, software and independent expert advisory services to the maritime, oil & gas, power and renewables industries. We also provide certification, supply chain and data management services to customers across a wide range of industries. Operating in more than 100 countries, our experts are dedicated to helping customers make the world safer, smarter and greener.

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