Economic Impacts Analysis of Pine Tree Offshore Wind's Maine Research Array (MeRA) and Assessment of Additional Benefits to Maine of Supporting an Offshore Wind Pilot Project

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1 Introduction

This report outlines the anticipated benefits of the Maine Research Array (MeRA), the first offshore floating wind project using commercial-scale turbines in the United States, to be developed in the Gulf of Maine. The primary purpose of this report is to support the case for approving the Power Purchase Agreement (PPA) for the MeRA pilot project by highlighting the significant benefits that will accrue to Maine's economy, to the environment, and to future commercial-scale offshore wind projects as a result of constructing and operating the MeRA project.

The benefits from the MeRA project fall into three broad categories:

(A) **Economic Impacts to the Maine Economy**: This section updates previous study results using updated cost estimates and the IMPLAN model, providing a comprehensive analysis of the positive economic effects the MeRA project will have on Maine's economy.

(B) **Environmental Benefits from Avoided Emissions**: This section estimates the environmental benefits associated with the MeRA project, particularly the reduction of greenhouse gas emissions and other pollutants, thereby contributing to Maine's environmental and public health goals.

(C) **Cost Reductions for Future Offshore Wind Development**: This section emphasizes the long-term benefits to be realized from the pilot project, including reduced costs and risks for future offshore wind developments, some of which is often referred to as "research" but has specific cost and risk reduction benefits. The knowledge gained and issues resolved through the MeRA project will significantly de-risk and streamline subsequent projects, ensuring that the investments made by ratepayers today will yield substantial returns in the form of more efficient and cost-effective future projects.

This report aims to quantify (often as a *range*) the significant near-and long-term benefits to Maine's economy and offshore wind industry of entering a negotiated power purchase agreement that enables the MeRA project's financing and construction.

Pine Tree Offshore Wind, MeRA's developer, has engaged Sustainable Energy Advantage (SEA), a clean energy market, policy, financial and strategic analysis firm, and EBP US, Inc. (EBP), a firm specializing in economic impacts analysis (hereafter the Consulting Team), to catalog and estimate the range of potential benefits in each of the aforementioned categories, and to discuss additional benefits which will accrue but are difficult to quantify.

The Consulting Team's approach to calculating economic impacts and emission benefits utilizes traditional methodologies and established data sources. Estimation of benefits accruing to subsequent commercial-scale projects has been conducted using a screening-level approach. This approach does not rely on detailed bottom-up, independent analysis or original research. Instead, the authors have based their estimates on a comprehensive literature review; calculations using independent data sources for costs, cost of energy, and financing assumptions for floating offshore wind; budget figures for MeRA provided by PTOW; and the consulting team's simplified analysis. This method conservatively applies the impacts to subsequent projects to account for (and avoid double-counting) scale economies that would be achieved independently of MeRA's existence. SEA's simplified assessment of the nature and scale of the benefits spans a range to reflect the likely magnitude of impacts, based on the estimations of seasoned industry experts in consultation with PTOW staff. Benefits were assumed to accrue to Maine ratepayers in the form of reduced bid prices for offshore wind purchases by Maine's utilities, specifically for those commercial-scale floating offshore wind projects whose bid pricing could be incrementally impacted by the development of the MeRA pilot project. This approach provides a credible and pragmatic estimation of benefits, acknowledging the inherent uncertainties in the projection of long-term impacts.

The report is organized as follows:

- Section 2 presents a summary of Key Findings.
- Section 3 presents the analysis results regarding economic impacts of the Maine Research Array.
- Section 4 summarizes the avoided emissions benefits attributable to MeRA production.
- Section 5 presents the quantified cost reductions for future offshore wind development resulting from deployment of the MeRA pilot project, as well as a qualitative discussion of other difficult to quantify benefits.

2 Summary of Key Findings

Deployment of MeRA will create economic benefits to the State of Maine through in-state spending and jobs, and environmental benefits through displaced emissions. In addition, research, investment, experimentation and other activities undertaken by MeRA or by others in the process of deploying MeRA, can reduce future costs otherwise borne by Maine ratepayers, *to the extent that avoided or reusable expenditures or the learning that they generate can be leveraged by subsequent Gulf of Maine commercial-scale floating offshore wind farms* supplying electricity to Maine and elsewhere, which would not otherwise have been able to benefit until learnings were available from later commercial scale projects.

Table 1 summarizes the results of our estimation of Economic Impacts to the Maine Economy[1]. The values in Table 1 denote additional income flowing to Maine from capital investment and O&M spending. Capital investments accrue during the development and construction phases. O&M investments apply over a 25-year operating period. The values in Table 1 are cumulative and shown in millions of 2024 US dollars. The details of this analysis are discussed further in Section 3.

Table 1 – Summary of Cumulative Economic Impacts to the Maine Economy

Impact: Value Added (GDP)[2]	Low Range ($M 2024 USD)	High Range ($M 2024 USD)
Direct (spending)	$227	$307
Indirect (supplier)	$162	$219
Induced (re-spending)	$176	$238
Total	**$565**	**$765**

Table 2 summarizes the results of our estimation of Avoided Emission Benefits, which are calculated based on estimates of marginal emissions rates and accrue over a 25-year operating period. The benefits of CO2 reduction occur regionally, nationally, and globally. Reduced SO2, NOx, and PM2.5 emissions contribute positively to Maine's public health objectives. This analysis is described in more detail in Section 4.

Table 2 – Summary of Cumulative Avoided Emissions Benefits

Subcategory	Low Range ($M 2024 USD)	High Range ($M 2024 USD)
Social Cost of Carbon (SCC)	$796	$1,297
Cost of SO2 Emissions	$10	$10
Cost of NOx Emissions	$10	$10
Cost of PM2.5 Emissions	$196	$196
Total	**$1,012**	**$1,513**

[1] And represents an update of the 2022 study by London Economics

[2] The values in this table have been calculating by applying a 15% error band around the detailed central estimates calculated in Section 3.

Finally, Table 3 summarizes the range of incremental Cost Reductions for Future Offshore Wind Development attributable to deployment of the MeRA pilot project. These benefits accrue to Maine ratepayers during the construction and operation of future commercial-scale wind deployed in the Gulf of Maine. These benefits are discussed in Section 5.

Table 3 – Summary of Cumulative Cost Reductions for Future Offshore Wind Development

Subcategory	Low Range ($M 2024 USD)	High Range ($M 2024 USD)
Department of Defense Required Curtailment	$112	$226
Port-Related Activities	$127	$229
Permitting & Stakeholder Activities	$2	$6
Technology Shakeout	$293	$739
Establish Maine as Hub for Floating OSW	$193	$343
Total	**$727**	**$1,543**

In addition to the range of potential benefits summarized above, additional benefits may be expected. In Section 5.5, we note examples of benefits associated with the broad categories of benefits corresponding to the rows in Table 3, but for which we have not attempted to quantify benefits. In addition, Section 5.5 also discusses additional difficult to quantify categories of activities stemming from the MeRA pilot project which we have not explicitly attempted to quantify. Finally, we note that, while there are likely to be additional benefits realized by other New England states hosting offshore wind supply chain servicing deployment in the Gulf of Maine or purchasing power from Gulf of Maine offshore wind projects, by virtue of cost reductions aided by the MeRA project, these benefits have not been quantified for this report.

3 Economic impacts of the Maine Research Array

This section evaluates the economic impact of spending associated with MeRA and is an update of a 2022 study by another consulting firm. This new analysis incorporates three main extensions from the previous report: 1) updated construction budget (spending) estimates, 2) a new updated economic impact model for Maine that is two years more recent, 3) the addition of an economic development opportunity analysis incorporating industry and occupation detail.

Methodology: Utilizing the IMPLAN model, EBP updated the potential economic impact of PTOW's planned 144 MW floating offshore wind project construction and operations. IMPLAN is an input-output (I-O) model, calibrated for Maine's economy, that uses relationships between various parts of the economy to track the effects of a change in each sector of the economy and evaluate its impacts on other parts of the economy. The project may have additional effects on costs in the economy associated with reductions in carbon and pollutant emissions; those effects are discussed elsewhere in this report.

The overall impacts are summarized here using four measures: *employment* (jobs generated), *gross business output* (sales revenue), *value added* (GDP), and *worker income generated*. The business output measure shows the biggest numbers, but economists recognize value added (GDP) as the most accurate measure of impact on Maine's economy because it deducts the cost of goods purchased from outside, so it shows the actual value of income flowing to workers and businesses in Maine. Worker income is a subset of value added. Since these economic measures are different ways of measuring the same economic effects, they cannot be added together. While these effects will occur over time in the future, all figures are shown in 2024 dollars. Each of these measures is broken down into direct (spending) effects, indirect (supplier sales) effects, and induced (worker income re-spending) effects:

- **Direct effects (spending):** PTOW provided the initial capital expenditures for direct effects. The EBP team analyzed this data and determined the initial direct impacts of the offshore wind project in the state of Maine. The I-O multipliers in the IMPLAN model evaluated how the initial direct effects will flow through the rest of Maine's economy affecting various sectors via indirect and induced effects.
- **Indirect effects (supplier):** Business-to-business purchases in the supply chain taking place in Maine that stem from the initial offshore wind project capital expenditures.
- **Induced effects (re-spending):** Employees within the business' supply chain generate labor income (net of taxes and savings) from the initial capital expenditures (direct effects), and households spend that income in the local economy making further overall economic contribution to the state.

Results Summary: Capital Investment (Project Development and Construction). Economic impacts are evaluated in terms of four economic outcome measures:

- **Employment (Labor Years):** The offshore wind construction project is estimated to support 7,150 jobs over three years in total. This figure represents 4.3% of all 2023 manufacturing employment in Maine, underscoring the importance of the project.
- **Labor income:** Total labor income impact is estimated at $431 million over three years, with an annual average impact of $144 million[3].
- **Value added (GDP):** Total economic impact in terms of value added is estimated at $554 million, which constitutes approximately 0.6% of the total Maine GDP of $91.1 billion in 2023, highlighting the contribution of the project to the overall Maine economy.
- **Gross output (Business Revenue):** Total economic impact of the offshore wind project in terms of gross output is estimated at $1.28 billion over three years. This economic contribution is comparable to the total gross output of the Maine's Hotel/Motel sector (including casino hotels), which in 2022 amounted to $1.3 billion.

Capital Investment Expenditures: This new analysis reflects significant updates in economic conditions compared to the 2022 report. This new analysis reflects a post-COVID period for Maine's economy, which is characterized by significant increases in worker wages and productivity, higher supply chain costs for materials and equipment coming from out-of-state, as well as increased development costs.

As a result of these economic changes, total direct capital expenditure in this analysis is $330 million higher than the 2022 study, tallying $1.48 billion (excluding insurance, financing, and licensing fees). Of this total, an average 44% is estimated to be spent in the local (Maine) economy, compared to 55% in the previous study. Altogether, the total direct spending flowing to Maine's economy is now estimated to be $652 million compared to $563 million in the 2022 study.

Table 4 provides a summary of total construction costs by spending category. Although not explicitly outlined in the table, Transportation and Installation are included in the total direct spending, and as such, Figure 1 and Figure 2 (at the end of this section) show the project's economic impact will also include the transportation sector. Note that Insurance, Financing, and Licensing fees are excluded from the impact assessment as they are considered transfer payments and do not generate economic impact the same way that direct construction spending does. Economic impact is typically generated when resources are used to create value and transfer payments do not directly lead to such productive activities as they are essentially redistribution of income rather than the creation of new income.

[3] All figures throughout the report are reported in constant 2024 dollars.

Table 4 – Projected Development and Construction Costs, Total $[4]

Spending category	Total direct spending	Portion in ME	ME share of total
Wind Turbine Generator	$341,515,667	$42,259,271	12%
Foundations/Moorings	$625,753,216	$488,191,438	78%
Offshore Cables	$303,339,517	$23,597,041	8%
Onshore Electrical	$39,691,009	$19,845,505	50%
Development & Project Management	$160,705,477	$68,996,917	43%
Stakeholder Relations	$7,000,000	$7,000,000	100%
Other[5]	$2,000,000	$2,000,000	100%
Total	$1,480,004,886	$651,890,171	44%

We are solely interested in analyzing the economic impact to Maine's economy, and therefore, any production or activity that takes place outside of Maine is not considered in the analysis as it will not impact and contribute to growth of the regional and state economy. Table 5 presents a summary of direct, indirect, and induced impacts on the Maine economy's total employment, labor income, value added, and output.

Table 5 – Economic Impact of MeRA Capital Investment Spending[6]

Impact	Employment	Labor Income	Value Added	Output
	(Labor Years)		(GDP)	(Business Revenue)
Direct (spending)	4,028	$238,997,528	$212,119,853	$651,890,172
Indirect (supplier)	1,485	$100,032,665	$164,196,084	$336,542,842
Induced (re-spending)	1,636	$91,867,285	$177,570,017	$295,671,364
Total	7,150[7]	$430,897,478	$553,885,954	$1,284,104,378
Average Annual	*2,383*	*$143,632,493*	*$184,628,651*	*$428,034,793*

The IMPLAN model evaluates the impact of a change in economic activity resulting from a change to a specified industry. EBP identified six key sectors that the offshore wind project will affect. More than half of the total project cost ($652 million) was attributed to Construction of new non-building structures (turbine towers), 27% to concrete manufacturing (foundations), 11% to Architectural, engineering, and related services, 6% to Water transport, 3% to Construction of new power structures, and 1% to public relations.

Table 6 summarizes tax impacts of the development and construction spending and evaluates those impacts at the state and regional levels (including county and sub-county level impacts). The project will generate more than $34 million in additional state revenue, and more than $22 million in additional local revenue.

[4] Accrues during the development and/or construction phase.
[5] Landfall / Port / O&M Prep / PCG
[6] Accrues during the development and/or construction phase.
[7] Represents an average of 2,383 jobs sustained over 3 years.

Table 6 – Tax Impact of MeRA Development and Construction Spending[8]

	State	Local	Total
State and Local Taxes	$34,189,680	$22,276,386	$56,466,066

Corporate Profits Tax	Personal Income Tax	Property Tax	Sales Tax
$4,546,143	$51,229,956	$22,265,615	$18,101,102

Operations and Maintenance (O&M) Expenditures: MeRA is expected to operate 25 years. Its ongoing operating and maintenance (O&M) expenses are expected to average $10 million annually, excluding decommissioning expenses. Approximately 78% of the total O&M spending will employ Maine economy's resources, or about $6.8 million per year of direct expenditure (excluding insurance). Table 7 and Table 8 summarize the total economic impact on Maine's economy during the commercial operations of the Research Array.

Table 7 – Economic Impact of MeRA O&M Spending[9]

Impact	Employment (Labor Years)	Labor Income	Value Added (GDP)	Output (Business Revenue)
Direct (spending)	406	$42,415,094	$54,962,586	$171,044,450
Indirect (supplier)	202	$15,606,110	$26,474,983	$52,405,901
Induced (re-spending)	275	$15,431,045	$29,811,866	$49,656,686
Total	882[10]	$73,452,249	$111,249,436	$273,107,037
Average Annual	*35*	$2,938,090	$4,449,977	$10,924,281

Table 8 – Tax Impact of MeRA O&M Spending[11]

	State	Local	Total
State and Local Taxes	$6,578,465	$4,449,171	$11,027,636

Corporate Profits Tax	Personal Income Tax	Property Tax	Sales Tax
$472,925	$1,988,550	$4,447,475	$3,618,425

Economic Development Consequences. The direct, indirect, and induced impacts on Maine's economy (Table 5) will generate economic growth and investment for a wide range of industries in Maine. The complex nature of the offshore wind project means that these sectors collectively drive significant economic growth, benefiting from increased demand for their services and contributing to the overall success of not only the involved sectors but also the renewable energy initiative.

The Construction sector stands out supporting more than 3,000 annual jobs, which accounts for close to 6% of all construction sector employment in the state in 2022. Professional Services and Manufacturing sectors rank second and third highest, respectively, supporting close to 700 and 550 annual jobs, accounting for close to 1% of total each sector employment in Maine in 2022. Although Transportation ranks somewhat lower in terms of absolute employment

[8] Accrues during the development and/or construction phase.
[9] Accrues during the assumed 25-year operating period.
[10] Represents an average of 35 additional jobs generated and sustained for 25 years
[11] Accrues during the assumed 25-year operating period.

contribution to Maine's economy, the project will support more than 330 jobs in the sector accounting for 1.2% of total Transportation sector employment in the state.

Average worker compensation in Maine is $61,243. Utilities, Management of Companies and Enterprises, and Professional Services sectors provide the highest labor income in the state. These sectors require specialized skills and expertise, which command higher wages. Skilled trades such as electricians and machine operators are essential to construction and manufacturing, and their expertise is critical to the efficiency and safety of operations. Additionally, these sectors often involve physically demanding and sometimes hazardous work, which will require higher compensation to attract and retain workers.

The offshore wind project will play a pivotal role in supporting jobs within high-paying sectors. The project requires extensive construction efforts, from installing turbines to laying underwater cables and constructing offshore and onshore facilities necessitating a wide range of services in the high- and average-labor-income sectors.

In the manufacturing sector, the project will stimulate demand for the production and fabrication of components occurring locally to optimize logistics and to support the regional economy. This activity will create demand for high-paying manufacturing jobs in the production, assembly, and maintenance of wind energy components. The project will not only provide immediate employment opportunities but will also foster long-term economic growth and stability in Maine's highest paying sectors.

Figure 1 and Figure 2 rank total business revenue and employment impacts (measured as labor years), respectively, by sector. Economic impacts in terms of business revenue will be most significant for Construction, Manufacturing, and Professional Services sectors due to their integral roles in the development and construction of such a project. The construction sector is directly involved with building the necessary infrastructure, including the installation of turbines and the construction of offshore facilities, which demands a significant workforce and generates substantial economic activity.

Manufacturing is crucial for producing specialized components and electrical systems, thereby driving demand for high-quality industrial production, and supporting local and regional manufacturing jobs. The Professional Services sector, encompassing engineering, project management, environmental consulting, legal services, provides the expertise to plan, design, and oversee the project, ensuring regulatory compliance and operational efficiency. The complex nature of the offshore wind project means that these sectors collectively drive significant economic growth, benefiting from increased demand for their services and contributing to the overall success of not only the involved sectors but also the renewable energy initiative.

Figure 1 – Three-year Total Output (M$2024)

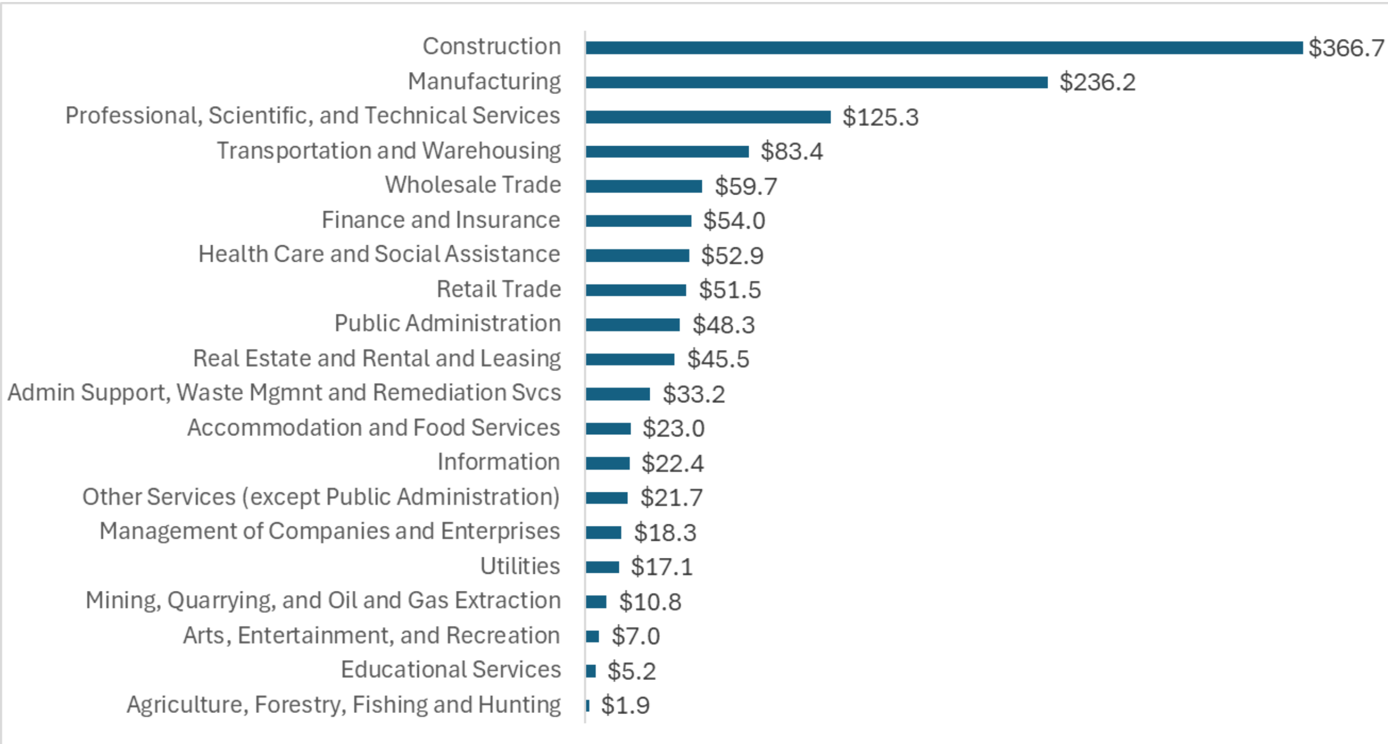


Figure 2 – Three-year Employment (Labor Years) Impacts

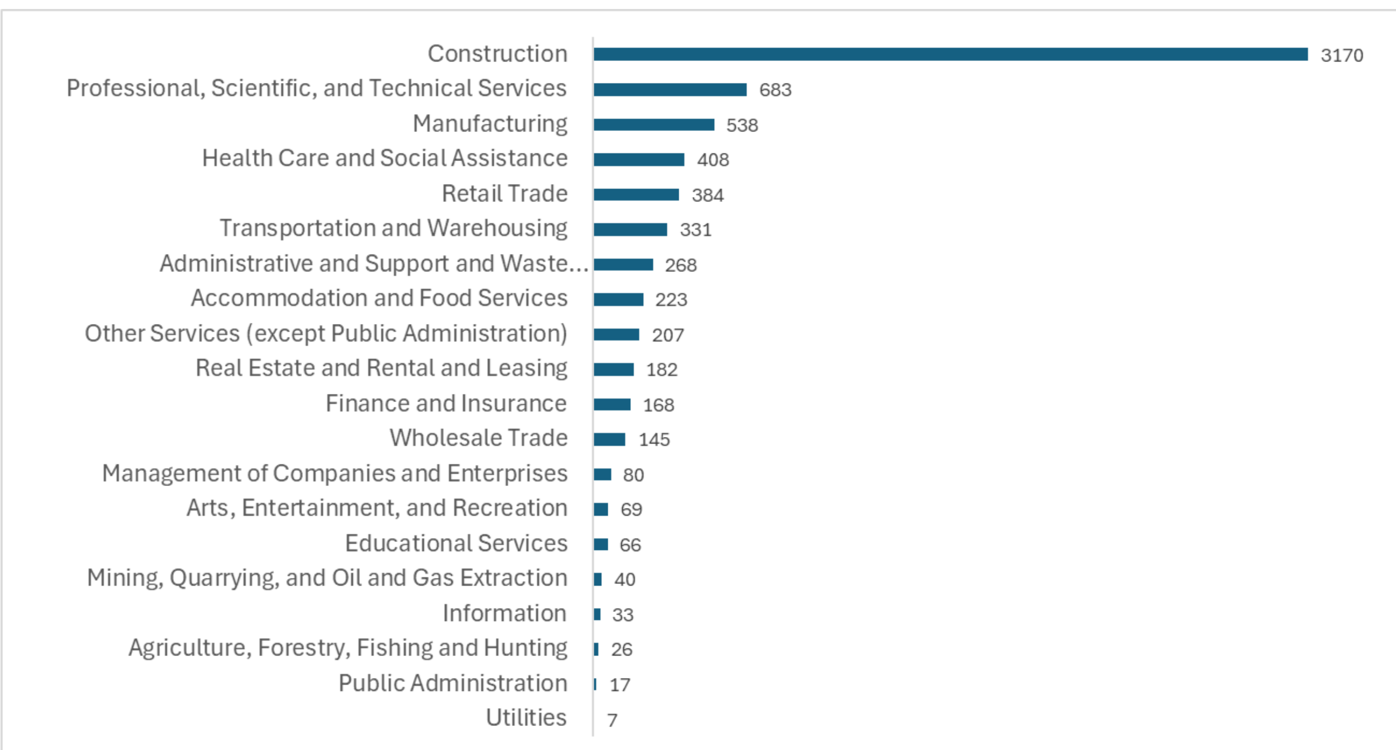
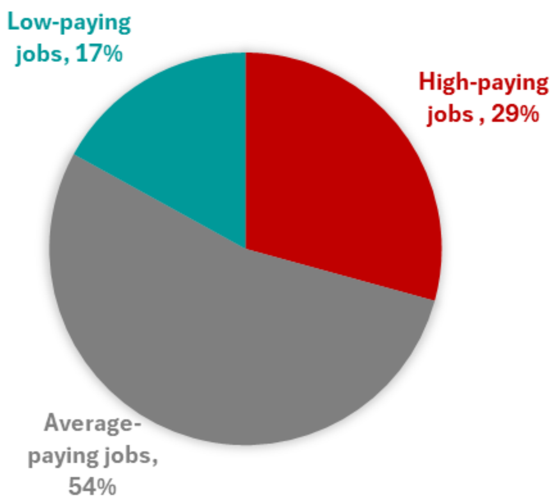


Figure 3 illustrates further impacts of the project, evaluated in terms of jobs impact by income level. Almost 30% of 7,150 jobs supported by the offshore wind project will be in Maine's high-paying sectors such as Professional Services and Manufacturing. About half of 7,150 jobs supported by the offshore wind project will be in Maine's sectors providing average pay rates such as Construction and Transportation. And only 17% of the jobs supported by the offshore wind construction will be in Maine's sectors that provide below average worker income, such as Education, Retail, and Hospitality.

There are also longer-term impacts for supply chain business activity and jobs in Maine. Since this project is a prototype for larger floating wind farms in the future, it will also support the advancement of a Maine-based supply chain for production and/or assembly of generator components, steel towers, anchors, and cable systems, as well as services for ports and logistics. The economic analysis in this report assumes a relatively low portion of Maine-based sources for many elements of the Research Array, but ultimately Maine can encourage development of a larger in-state supply chain along with labor skill training for the corresponding engineering, metal working, operator, assembly, and maintenance occupations.

Figure 3 – Jobs Impact by Income Level



4 Avoided emissions benefits attributable to MeRA production

Production from the MeRA project will result in reduced greenhouse gas (GHG) and co-pollutant emissions. This contributes to the realization of GHG objectives and produces both environmental and health benefits – which can be quantified. This section estimates the dollar value benefits of reducing carbon dioxide (CO2), sulfur dioxide (SO2), nitrogen oxides (NOx) and particulate matter (PM2.5). The analysis of avoided emissions benefits was conducted using as follows:

1. **Social Cost of Carbon (SCC):** The SCC estimates the long-term economic damage caused by a ton of CO_2 emissions, including impacts on agriculture and health, as well as property damage from increased natural disasters. By estimating the reduction in CO2 emissions resulting from the MeRA project and applying the SCC, we can quantify the monetary value of the climate benefits achieved through this reduction.

Valuation: The value of avoided CO2 emissions benefits is a function of MeRA production (by hour), the marginal CO2 emissions avoided in that hour (in metric tons/MWh)), and the SCC (in $/metric ton). The estimate of MeRA's hourly production was provided by Pine Tree Offshore Wind. The SCC comes from EPA's December 2023 report titled "*EPA Report on the Social Cost of Greenhouse Gases: Estimates Incorporating Recent Scientific Advances*.[12]" The reduction in marginal emissions is estimated in two ways – which enables the calculation of a range of potential avoided CO2 emissions benefits. The lower end of the range is calculated using hourly estimates of avoided emissions from the 2024 Avoided Energy Supply Cost (AESC) Report[13]. The higher end of the range is calculated using the annualized estimate of CO2 avoided by offshore wind from EPA's Avoided Emissions and generation Tool (AVERT) model – and forecasted using a compounded annual growth rate. The annualized AVERT estimate was then scaled to the hourly level using the 8760 profile from AESC.

The value of avoided CO2 benefits associated with 25 years of production from the MeRA facility is shown in Table 9 and Figure 4 below in 2024 dollars, and have been discounted back to 2024 from the years in which the benefits occur.

2. **Health Benefits:** This component estimates the dollar value of public health benefits resulting from reduced emissions of sulfur dioxide (SO_2), nitrogen oxides (NO_x), and particulate matter (PM2.5).
   Valuation: Like the SCC methodology, the value of avoided SO2, NOx, and PM2.5 is a function of MeRA production, estimated marginal SO2, NOx, and PM2.5 emissions rates, and the estimated cost impact in $/metric ton. The estimate of MeRA's hourly production was provided by Pine Tree Offshore Wind. The social cost of each pollutant comes from EPA's "*Technical Support Document: Estimating the Benefit per Ton of Reducing PM2.5 Precursors from 17 Sectors (February 2018).*[14]" The reduction in marginal emissions for each of SO2, NOx, and PM2.5 comes from EPA's AVERT model and is specific to offshore wind.

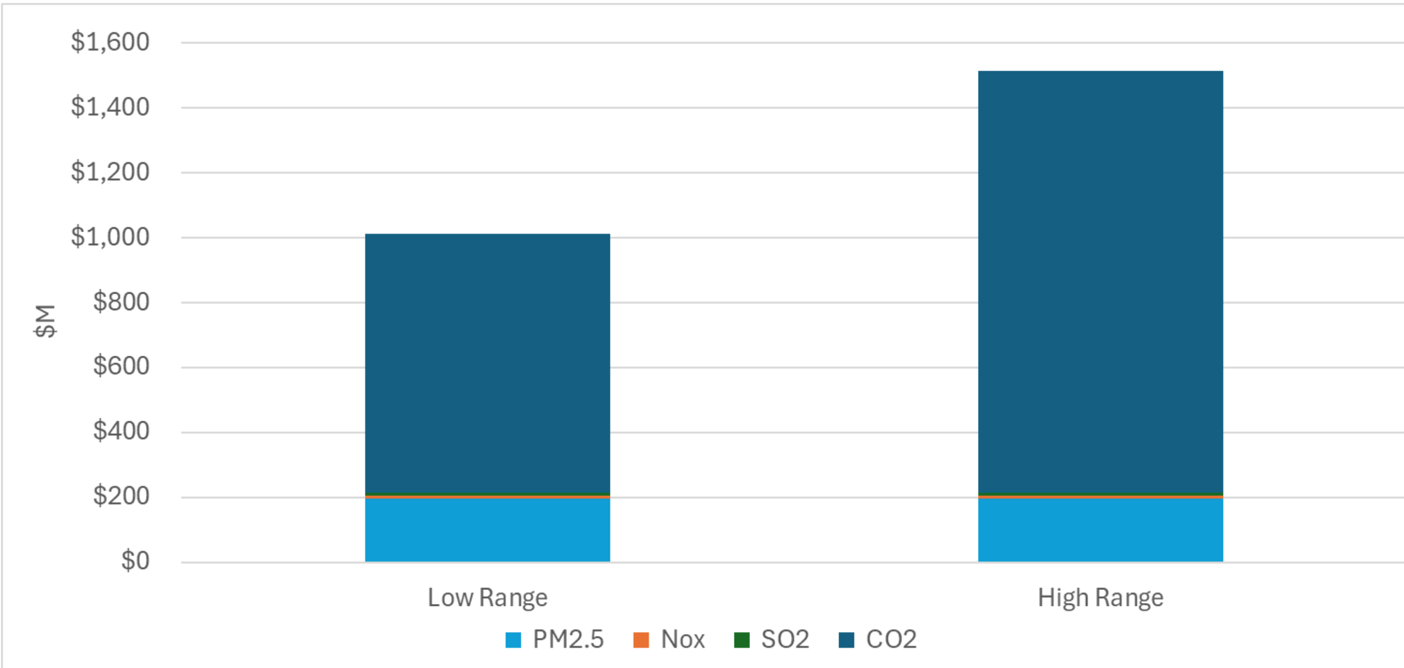
   The value of avoided SO2, NOx, and PM2.5 benefits associated with 25 years of production from the MeRA facility are shown in Table 9 and Figure 4 below in 2024 dollars. and have been discounted back to 2024 from the years in which the benefits occur.

Table 9 – Summary of Avoided Emissions Benefits

Subcategory	Low Range ($M 2024 USD)	High Range ($M 2024 USD)
Social Cost of Carbon (SCC)	$796	$1,297,454,896
Cost of SO2 Emissions	$10	$10
Cost of NOx Emissions	$10	$10
Cost of PM2.5 Emissions	$196	$196
Total	**$1,012**	**$1,513**

[12] https://www.epa.gov/system/files/documents/2023-12/epa_scghg_2023_report_final.pdf
[13] Specifically, Counterfactual #5.
[14] https://www.epa.gov/sites/default/files/ 201802/documents/sourceapportionmentbptt sd_2018.pdf

Figure 4 – Net Present Value Summary of Avoided Emissions Benefits, $M 2024 USD



5 Cost Reductions for Future Offshore Wind Development

This section estimates a potential range of long-term benefits to be realized from the Maine Research Array (MeRA) pilot project, including reduced costs and risks for future offshore wind developments. The knowledge gained and issues resolved through the MeRA pilot project will significantly de-risk and streamline subsequent projects, ensuring that the investments made by ratepayers today in support of MeRA will yield substantial returns in the form of more efficient and cost-effective future projects, and capturing economic activity in Maine that might otherwise be deployed elsewhere.

As a first-of-its-kind (FOIK) project in the United States, the MeRA pilot project holds several pioneering distinctions:

- It will be the first offshore floating wind project in the U.S.
- It will operate under unique environmental, geophysical, marine, and operational conditions specific to the Gulf of Maine.
- It will be the first offshore wind project built in the Gulf of Maine, and the first to rely materially on supply chain based in Maine.
- It will be the first to utilize certain innovative techniques and technologies.
- It will be the first offshore wind project to navigate a variety of state permitting and stakeholder interactions necessary for offshore wind deployment in the Gulf of Maine.

These factors introduce the concept of delayed, deferred, or continuing benefits accruing to and realized by subsequent projects – which can be thought of as return on investment (ROI) created as a result of MeRA but realized after the MeRA project is complete. The MeRA project will set precedents and establish best practices, which will lead to substantial cost and risk reductions in future commercial-scale offshore wind projects.

In consultation with PTOW staff, we have identified several categories of activities that will create future benefits. These activities will have specific impacts that can be translated into reductions in the costs of future offshore wind commercial deployment. In this section, we discuss:

1. **Timing of MeRA Activities and Impacts:** This subsection discusses the timeline of MeRA and the various cost reduction and de-risking activities. It explains how the timing of these activities will impact subsequent commercial projects, and the realization of incremental benefits compared to a counterfactual scenario in which there is no MeRA floating offshore wind pilot project.
2. **Categories of Expected Benefits:** This subsection identifies several categories of benefits that are reasonably expected from the MeRA project. These include technological advancements, improved operational efficiencies, regulatory, permitting and stakeholder process efficiencies, port and supply chain activities.
3. **Nature of Benefits and Impacts (Manifestation of Benefits):** This subsection delves into the specific nature of the benefits and impacts, providing examples of how these benefits will manifest as cost and risk reductions for future projects.
4. **Estimation of Potential Benefits:** This subsection provides a discussion and estimation of the range of potential benefits in each identified category for which we have estimated a range of benefits. The estimation relies on quantitative and qualitative analyses to project the long-term economic value of these benefits, considering a range of possible outcomes.
5. **Unquantified Potential Benefits:** This section discusses examples of additional potential benefits that have not been quantified for this report.

By systematically analyzing these elements, this section aims to demonstrate that the deployment of the MeRA project and its associated activities will significantly enhance the feasibility and economic viability of, and reduce the cost of, future offshore wind developments in Maine and beyond, resulting in real benefits to accrue to the state of Maine.

5.1 Timing of activities impacts realization of benefits

The timing of activities in development of the MeRA project is crucial for understanding when and how the benefits of the pilot project will be realized. The schematic below outlines the likely timeline for the different phases of MeRA development activities. Each phase will yield specific learnings, and these learnings will follow the activities in time. It also lays out the expected timelines of development activities associated with subsequent commercial scale activities.

The timeline shown in Figure 5was developed by SEA[15] to reflect deployment and procurement by Maine of Gulf of Maine floating offshore wind projects consistent with LD 1895 – *An Act Regarding the Procurement of Energy from Offshore Wind Resources* (July 2023) which established a goal of 3 GW of offshore wind procurement by 2040, through PUC procurements seeking at least 600 MW no more than 3 years apart.[16] The timeline reflects a scenario in which Maine meets its 3 GW procurement goal in 600 MW increments over 5 procurement events (with RFP issuance spanning 2026 to 2033). We have developed and utilized an assumed timing of procurement and deployment, and the associated development, approval, and procurement milestones associated with the resultant commercial development.

For commercial-scale offshore wind projects to benefit from MeRA, the learnings must be available in time to utilize them. For instance, innovations and process definitions established during the permitting phase can only benefit the permitting

[15] Timeline developed by SEA in consultation with PTOW staff. Abbreviations: BOEM (Bureau of Ocean Energy Management), RFP (Request for Proposal issued), PPA (Power Purchase Agreement executed), COP (Construction & Operation Plan receives Record of Decision indicating BOEM approval), FID (Financial Investment Decision), COD (Commercial Operation Date)

[16] This 3-year spacing expectation is also to reflect port capacity limitations that may not allow construction of multiple projects concurrently.

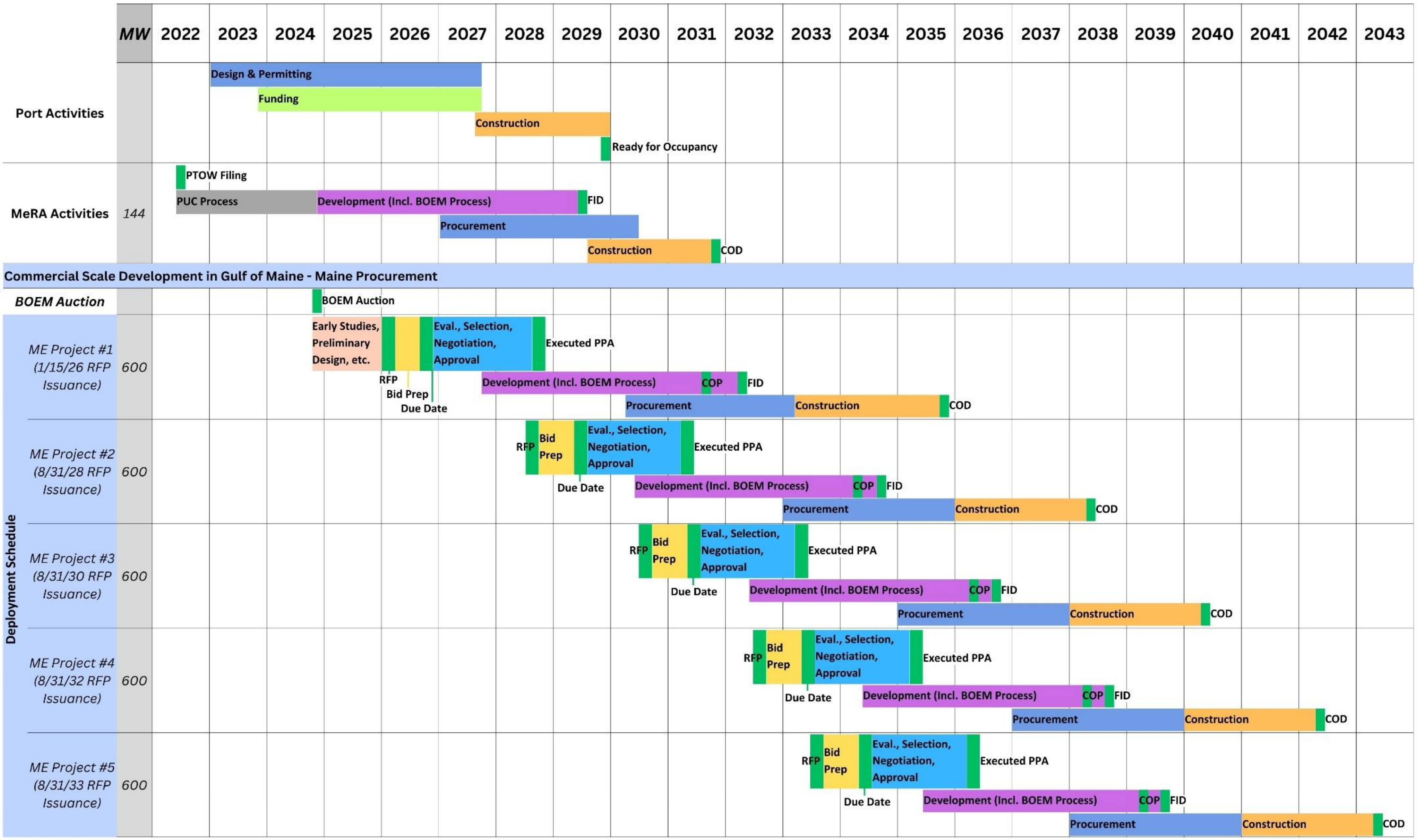
of subsequent projects if they precede the commercial-scale permitting activities. Similarly, learnings from the proof of concept for a mooring system must follow its deployment and precede the design, engineering, and contracting for the supply of moorings for a commercial-scale system. This information can only de-risk the price of that project if it is available with sufficient lead time before bids are due for commercial offshore wind procurements.

The first round of Maine's Request for Proposals (RFP) for commercial-scale offshore wind procurement may launch before all the learnings from MeRA are fully available. However, even in such cases, MeRA will still influence the costs of projects procured in subsequent rounds of Maine offshore wind procurement, as well as offshore wind procurements by other states seeking supply from the Gulf of Maine.

To assess the potential *incremental* benefits attributable to deployment of the MeRA pilot project, we identify the phase of MeRA development that yields each benefit and determine when the learnings from that benefit would be available. By assessing the development process of future commercial-scale projects, we can understand when the learnings must be available to realize the first-of-its-kind (FOIK) benefits. This, in turn, will dictate which projects can incrementally benefit from MeRA. However, in the absence of a pilot project, the first commercial scale project would create learnings that would likley benefit subsequent projects in a similar manner. The deployment of a pilot project enables learning earlier, and likely, far more cost effectively, with investment in exploration, and learning from experience, on a much smaller scale, with higher unit cost of a small project but materially lower total cost. Therefore, to determine the incremental benefits attributable to MeRA, we considered when learnings would be available from MeRA and applicable to subsequent projects, relative to learnings from a first commercial project and application of those learnings to subsequent projects in the absence of MeRA and related port and supply chain activities.

This approach has been utilized for each specific benefit identified in the analysis, considering the relative timing of learnings available and application of those learnings under a MeRA development scenario compared to a counterfactual in which no pilot project is deployed, and the first commercial scale project creates learnings that can benefit later projects For example, if a MeRA-related activity would benefit the 2nd through 5th commercial scale projects, and a first commercial project in the absence of a pilot project would benefit the 4th and 5th commercial scale project, then deploying the MeRA pilot benefits two incremental projects (and associated 1200 MW). The analysis resulted in incremental benefit to from zero to three additional projects (600 to 1800 MW), depending on the specific activity and its timing.

Figure 5: Gulf of Maine OSW Development and Procurement Timelines



5.2 Categories of Benefits from the First-of-its-Kind Maine Research Array

MeRA is anticipated to generate a range of benefits that will significantly impact the future development of offshore wind projects in the Gulf of Maine. The categories of benefits identified as likely to result from the MeRA pilot project, and which we have estimated a range of potential benefits, include:

- **Department of Defense Required Curtailment:** Understanding and mitigating any required curtailments by the DOD will streamline future project approvals and operations, and derisk projects that will understand the curtailment parameters before they bid.
- **Port-Related Activities:** Investments and improvements in port infrastructure will benefit future projects to the extent that they can be reused or leveraged.
- **Permitting: and Stakeholder Activities:** Developing and defining efficient permitting processes will expedite future project approvals and reduce associated costs and delays, avoid duplication of some activities by commercial projects whose developers may stand on the shoulders of resolutions from the pilot activities, and resolving accommodations to and mitigation of permitting agency and stakeholder concerns ahead of competitive bids will reduce contingencies of unknown.
- **Technology Shakeout (Technical Derisking):** Research and deployment activities involving testing and validating new technologies will reduce technical risks and lower the costs of adopting these technologies in subsequent projects, and materially reduce contingency margins utilized by bidders to reflect uncertainties and unknowns in bid price determination.
- **Establish Maine as Hub for Floating OSW:** Establishing Maine as a central hub for the offshore wind supply chain will create economic efficiencies and boost local economic activity.

In Section 5.4, we describe the nature of these benefits and explain the basis for the estimated range of benefits.

Additional categories of anticipated, but more difficult to quantify, benefits are listed below. In Section 5.5, we discuss further both unquantified activities associated with the categories of benefits listed above, and the following additional benefits categories:

- **Fisheries Impact Mitigation:** Establishing best practices for co-existence along with compensating fisheries, where appropriate, will facilitate smoother negotiations and operations with local fishing communities.
- **Workforce Development & Training:** Building a skilled workforce will ensure that future projects have access to trained personnel, reducing training costs and increasing project efficiency – and increase the likelihood that future jobs will go to Mainers.
- **Cable Right-of-Way:** Securing and optimizing cable routes will minimize future project delays and costs related to grid connection.
- **Determination of Federal Inflation Reduction Act (IRA) Bonus Tax Incentives:** Clarifying eligibility and processes for obtaining IRA bonus tax incentives will enhance financial planning and reduce costs for future projects.

5.3 Nature of Benefits & Impacts (Manifestation of Benefits)

The value derived from the MeRA pilot project is expected to manifest through a variety of impacts. Each category of benefits can contribute to significant cost reductions and enhanced economic value for future offshore wind development in the Gulf of Maine. The key types of benefits and their impacts considered include:

- **Reusable Research or Reusable Investment:** Investments and research conducted during the MeRA project can be reused in future projects. This reuse can remove some of the initial costs that future projects would otherwise incur, effectively lowering their overall expenses.

- **Established Process:** By developing and standardizing processes during the MeRA project, future projects can benefit from reduced contingencies. With proven processes in place, risks are minimized, leading to lower prices and more predictable project timelines.
- **Technology Demonstration/Proof of Concept:** Demonstrating and validating new technologies through the MeRA project can avoid expenses related to untested technologies. By reducing uncertainties, the need for large contingencies is diminished, making future projects more cost-effective and reliable.
- **Scale Economies:** Investments in infrastructure and technology during the MeRA project create residual infrastructure that can be leveraged by future projects. This leads to reduced unit costs for subsequent developments, as these projects can take advantage of existing resources and efficiencies.
- **Cost Curve Acceleration:** Future commercial projects will benefit from the experience and lessons learned from the FOIK MeRA project. These projects will not have to bear the 'shakeout premium' associated with initial deployments. Contractors and suppliers who have previously participated in the MeRA project will be able to offer more competitive, derisked pricing.

By identifying and understanding these types of benefits and their impacts, we can better estimate the potential cost reductions and economic advantages that will accrue to Maine and the region as offshore wind projects continue to develop and expand.

5.4 Estimation of Potential Benefits

Utilizing each of the elements of the analysis discussed in Sections 5.1 through 5.3, SEA has identified in consultation with PTOW staff for each category the activities likely to yield benefits, and utilized PTOW-provided MeRA budget data and in addition, cost estimates of future commercial-scale floating OSW development from National Renewable Energy Laboratory's 2023 Annual Technology Baseline, to estimate a range of monetary benefits. SEA considered how such benefits might be manifested, the degree to which it scales with project size, and reduced the expected impact to reflect SEA's estimate of benefits to be realized through scale economies alone (and thus not attributable to the MeRA pilot project). In each section, we have included some high-level context to put the benefits attributable to the pilot project in perspective. Where benefits of activities were too difficult or speculative to quantify, they were excluded from the analysis.

5.4.1 Department of Defense Required Curtailment

To eliminate radar interference, the Department of Defense (DOD) will periodically require curtailment of the entire MeRA wind farm, and other commercial wind farms in the Gulf of Maine, while it conducts sea trials of military marine vessels constructed at shipyards in the area.

PTOW is negotiating with DOD a replicable coordination agreement and procedures, the results of which would be available prior to commercial scale project development, allowing their developers to reduce the degree of assumed projection lost to curtailment.

During discussions with the DOD for development of the New England Aqua Ventus (NEAV) floating demonstration project, the DOD requested 300 hours per year of curtailment; for purposes of this report, we presume similar requirements may apply to MeRA and to subsequent commercial scale projects. We illustrate here the potential nature and scale of the benefit of resolving curtailment issues through the MeRA project. Assuming DOD would apply similar restrictions on a commercial scale project, in the absence of an agreement for coordination with project planned maintenance, developers bidding into procurements would have to assume that those curtailments came during operating hours, and potentially, at highest load hours (In the authors' opinion, this is likely how risk averse lenders would look at this risk exposure). Without mitigation, bidders of future projects would increase bid prices to reflect reduced annual energy production.

PTOW is undertaking the negotiation of timing and notice provisions for required shutdown which may be sufficient to enable some degree of coordination of planned maintenance shutdowns with periods of curtailment. In securing a replicable agreement that bounds the worst case and provides characteristics of notice provisions which may allow optimizing planned maintenance scheduling and strategies to align at least some of maintenance hours with curtailment hours, subsequent project developers can reduce curtailment loss assumptions in preparing bid process. Key assumptions and results of this analysis, applicable to impacting 2 incremental projects (1200 MW) are shown in Table 10.*

Table 10: Cumulative Benefits of Negotiating DOD Curtailment Agreement

	Worst Case Curtailment (counterfactual)	Negotiated - Worst case (low end of range)	Negotiated - best case (high end of range)
Description	Up to 300 hours of full wind farm curtailment, - worst case = any hour	only able to align limited curtailment during maintenance)	maximize curtailment during maintenance
% Curtailment Hours during Maintenance	0%	25%	50%
Hours of Curtailment not during planned maintenance	300	225	150
Total Savings over 1200 MW Impacted (2024$)	$0	$112 million	$226 million

For context, the above figures represent a range of 1.3% to 2.6% average reduction in bid prices.

5.4.2 Port-Related Activities

Investments and improvements in port infrastructure will benefit future projects to the extent that they can be reused or leveraged. The following activities have been considered in this analysis:

- **Heavy Equipment Purchased or Mobilized to Site:** Equipment such as cranes, self-propelled modular transporters (SPMTs), and gantries, once purchased or mobilized to the site for the MeRA project, can be used for future projects, constituting reusable infrastructure.
- **Concrete Batch Plant:** The establishment of a concrete batch plant represents a significant infrastructure investment that can serve future projects, reducing setup costs and lead times.
- **Site Yard Improvements:** Enhancements such as concrete pads and additional utilities improve the functionality of the site and can be utilized in subsequent projects.
- **Traffic Flow Management:** Developing and optimizing traffic flow management processes can streamline operations for future projects, representing a reusable process.
- **Establishment of Site Security:** Investments in site security infrastructure can be reused, reducing the need for future expenditures in securing the site.
- **Installation of Wet Storage Moorings:** These moorings will facilitate the storage of equipment and materials for future projects, providing ongoing value.
- **Pilot Training and Knowledge of Vessels and Site Navigation:** Training pilots and developing expertise in site navigation are reusable processes that will benefit future projects.

- **Establishment of Site Layout for Foundation Fabrication and WTG Storage:** Creating an efficient site layout for these purposes will streamline future projects and reduce costs.
- **Building the First Project at the Port:** This activity helps leverage future grant opportunities for port expansion, providing financial and operational benefits.
- **Proving the Launching Mechanism by MDOT:** Demonstrating the efficacy of the launching mechanism will ensure that future projects can utilize this proven technology, reducing risk and cost.

These port-related activities are expected to drive several types of benefits:

1. **Reusable Research and/or Investment:** This removes costs from future projects as existing infrastructure and investments can be leveraged.
2. **Established Process:** By derisking operations and reducing project contingencies, these processes can lower bid prices for future projects.
3. **Scale Economies:** Residual infrastructure investments reduce future unit costs, making subsequent projects more economically viable.

Due to the relative timing of the MeRA pilot project and commercial-scale development, individual MeRA-driven port-related activities are expected to impact between two and three commercial-scale projects' bid prices. On average, these activities will influence approximately 1,440 MW of subsequent development, highlighting the significant potential for cost reductions and efficiency improvements in future offshore wind projects. Table 11 summarizes the results of this analysis.

Table 11: Cumulative Benefits from MeRA-Associated Port-Related Activities

	Low Range ($M 2024 USD)	High Range ($M 2024 USD)
Total Savings over MW Impacted (2024$)	$127	$229

To account for uncertainties and unknowns at the time of bid development – which are many – bidders will in one manner or another add a percentage contingency to their cost estimates. MeRA will reduce or eliminate a range of uncertainties related to the activities detailed above. Roughly two-thirds of the port related benefits shown in Table 11 derive from an assumed reduction by 1.25% to 2.5% in the assumed bid contingency factor applied to the applicable future capital expenditures (CAPEX), so they are relative to over $6 billion (2024$) of CAPEX. The remainder of these benefits represent a reduction in costs for future projects which can benefit from the investments or expenditures made by MeRA.

5.4.3 Permitting and Stakeholder Activities

Developing and defining efficient permitting processes will expedite future project approvals and reduce associated costs and delays. By avoiding duplication of activities and resolving accommodations and mitigation of permitting agency and stakeholder concerns ahead of competitive bids, these processes will reduce contingencies of the unknown for future projects. The following activities have been considered in this analysis:

Design:

- **Vet Cable Routing Alternatives to Wyman and/or Maine Yankee POIs:** Likely Points of Interconnection (POIs) for any Gulf of Maine (GoM) project interconnecting to Maine, including sites 0562/0563. Ground truthing desktop interpretations of existing geophysical imagery will improve future interpretations, and reconnaissance survey data will avoid steps for commercial projects.

Permitting:

- **Learning and Training Opportunity:** As the first project in the Gulf of Maine, MeRA will be a learning and training opportunity for state and federal resource and permitting agency personnel.
- **State and Federal Agency Approvals:** Approvals of site characterization and baseline survey plans.
- **Scope of NEPA Review:** Defining the scope of analysis for the Environmental Impact Statement.
- **Permit Applications Scope and Content:** Ensuring "completeness" determinations by state and federal agencies.
- **Clarify Agency Expectations:** Clarifying expectations for permitting and supporting analysis to streamline future reviews.
- **Clarify Monitoring, Impact Avoidance, and Minimization Measures:** Protecting Endangered Species Act (ESA), Marine Mammal Protection Act (MMPA), and Magnuson-Stevens Fishery Conservation and Management Act listed species.
- **Establish Basis for Permit Approvals:** Setting the foundation for state and federal permit approvals.
- **Assess Permitting Appeal Risks:** Identifying and mitigating risks of permitting appeals.
- **Clarify Bird and Bat Protection Measures:** Establishing monitoring technologies, curtailment, anti-attraction, or deterrent devices.
- **Permitting Envelope Siting Criteria:** Working through siting criteria with state and federal agencies, balancing appropriate levels of detail for permitting versus final engineering location and design of anchors and inter-array cables.

Safety/Navigation:

- **Establish Requirements for Aids to Navigation:** Defining requirements for safe navigation in and around the research array.
- **Establish BSEE/USGC Floating Wind Requirements:** Defining safety requirements for floating wind by the Bureau of Safety and Environmental Enforcement (BSEE) and the U.S. Coast Guard (USGC).

Stakeholder Engagement:

- **Stakeholder Engagement Process:** Identifying communities and stakeholders, establishing open communications, and identifying key issues, solutions, and mitigations.
- **Fishing Industry Engagement:** Establishing project-level communication protocols with the fishing community through the first Fisheries Communications Plan in the Gulf of Maine, clarifying roles and responsibilities for Marine Affairs Manager, Fisheries Liaison(s), and Fisheries Representative(s).
- **Community Benefit Agreements:** Clarifying expectations for community benefit agreements.

These activities are expected to drive several types of benefits:

1. **Reusable Research and/or Investment:** Removing costs from future projects by leveraging existing infrastructure and investments.
2. **Established Process:** Reducing project contingencies and lowering bid prices by standardizing and derisking processes.

Due to the relative timing of the MeRA pilot project and commercial-scale development, individual MeRA activities listed here are expected to incrementally impact about one project and 600 MW (on average) of subsequent development. Table 12 summarizes the results of this analysis.

Table 12: Cumulative Benefits from Permitting & Stakeholder Activities

	Low Range ($M 2024 USD)	High Range ($M 2024 USD)
Total Savings over MW Impacted (2024$)	$2	$6

The scale of benefits from this category of activities is materially smaller than other categories due to the relatively smaller share of overall costs associated with permitting, and the limited number of future projects impacted by these activities. This is attributed to the assumption that commercial leaseholders are likely to start investing in permitting activities only after significant lease investments. For reusable research or investment in this category of activities, estimates were derived by scaling the PTOW budget for permitting or stakeholder relations development expense (as applicable), and assuming that most but not all of the learnings from these activities could be avoided by subsequent projects. For activities expected to reduce contingency by derisking future projects, PTOW budgeted expenditures were scaled up somewhat to account for a commercial scale project impacting a larger footprint, and we assumed a reduction by 5% to 10% in the assumed bid contingency factor applied to the applicable permitting or stakeholder relations development expense budgets

5.4.4 Technology Shakeout

Testing and validating new technologies will reduce technical risks and lower the costs of adopting these technologies in subsequent projects. This will materially reduce contingency margins utilized by bidders to reflect uncertainties and unknowns in bid price determination. The following activities have been considered in this analysis:

Foundation:

- **Developing Industrialized Approach to Foundation Fabrication:** This will decrease production time and improve efficiency.
- **First Floating Foundation through US Certification:** Achieving certification from bodies like ABS (American Bureau of Shipping) or DNV (Det Norske Veritas) will validate the technology and reduce risks.
- **Deployment of a 15MW Turbine on a Floating Platform:** Confirming and reducing risks associated with deploying a large turbine on a floating platform, potentially a global first, will provide invaluable data and reduce future project risks.

Launching, Integration and Tow Out:

- **Develop Procedures and Techniques for Safely Launching Foundations:** This will ensure safe and efficient deployment of foundations.
- **Develop Techniques for Faster/Safer Wind Turbine Generator (WTG) Integration:** Improving integration techniques, whether floating or grounded, will enhance safety and efficiency.
- **Develop Foundation + Turbine Tow-Out Arrangement/Plans:** Optimizing tow-out plans will streamline the deployment process.
- **Develop Foundation Ballasting Procedures:** Enhancing ballasting procedures will improve stability and safety during deployment.

Stationkeeping System:

- **Developing Design of Quick Connect Systems for Mooring Lines and Dynamic Cables:** This will facilitate faster and more secure connections.
- **Technology Development for Installing Large Drag Anchors:** This will improve the efficiency and reliability of anchor installations.
- **Development of Alternative Anchor Solutions:** Exploring options like drilled anchors will provide flexible solutions for different seabed conditions.
- **Complete Mooring Line Synthetic Rope Development/Testing:** Confirming design criteria will ensure the reliability and durability of mooring lines.

These activities are expected to drive several types of benefits:

1. **Reusable Research and/or Investment:** Removing costs from future projects by leveraging existing research and infrastructure investments.
2. **Established Process:** Reducing project contingencies and lowering bid prices by standardizing and derisking processes.
3. **Technology Demonstration/Proof of Concept:** Avoiding expenses and reducing contingencies by validating new technologies.
4. **Cost Curve Acceleration:** Ensuring that subsequent commercial projects will not have to bear the shakeout premium. Contractors and suppliers will have prior experience, allowing them to quote derisked prices.

Due to the relative timing of the MeRA pilot project and commercial-scale development, individual MeRA activities listed here are expected to incrementally impact one project of 600 MW. This technology shakeout will ensure that subsequent projects can proceed with greater confidence, reduced costs, and lower risks, benefiting the overall offshore wind industry in the Gulf of Maine. Table 13 summarizes the results of this analysis.

Table 13: Cumulative Benefits from Technology Shakeout Activities

	Low Range ($M 2024 USD)	High Range ($M 2024 USD)
Total Savings over MW Impacted (2024$)	$293	$739

While activities in this category are only assumed to benefit one incremental project, the savings can be material, relative to over $2.7 billion (2024$) CAPEX of impacted projects. The quantification of benefits was derived from the sum of three categories of impacts:

i. approximately 20% of the total technology shakeout related benefit shown in Table 13 Table 11derives from an assumed reduction by 2.5% to 5% in the assumed bid contingency factor applied to the applicable future capital expenditures (CAPEX);

ii. approximately 30% to 40% of the total technology shakeout related benefit shown in Table 13 derives from an assume reduction in impacted commercial-scale project debt financing costs of 50 to 100 basis points .

iii. the remainder of savings in total or per unit costs primarily for expenditures on items such as anchor and mooring system development and installation, and foundation fabrication were assumed to represent a modest range, varying in the 10% (low) to 10%-40% (high); these percentages were or applied to the applicable PTOW budget figures for the activities, scaled based on a range of reasonable factors intended to account for economies of scale (to avoid double counting those benefits). This category represents 37% to 50% of the total technology shakeout related benefit shown in Table 13.

5.4.5 Establish Maine as Hub for Floating OSW

Establishing Maine as a central hub for the offshore wind supply chain will create economic efficiencies and boost local economic activity. Iowa's well documented experience as a first mover in land-based wind is suggestive of benefits that could accrue to the state of Maine in deployment of the new, floating offshore wind industry.[17] As noted by Collaborative

[17] See:
Collaborative Economics, *Clean Energy Economic Development Series: IOWA'S WIND ENERGY JOURNEY*, prepared for Environmental Defense Fund, November 2012.

Economics, "Iowa has embraced the wind industry, which has allowed the state to diversify its economy while maintaining its rural roots and manufacturing strengths. The actions that Iowa stakeholders have taken to build a robust wind energy economy have led to impressive results. The state has emerged as a leader in wind component manufacturing and has demonstrated strong customer demand for wind energy products and services… wind-related companies are increasingly choosing Iowa as a place to locate and grow, bringing significant economic benefits to the state." "The investment and work to stimulate demand, seed innovation, recruit companies, and develop a new workforce has paid dividends across the value chain. Iowa has built a wind energy economy that includes a variety of companies and activities, all of which operate across the energy technology value chain."[18]

The following activities have been considered in this analysis:

- **Establish an O&M Center:** Developing an Operations and Maintenance (O&M) center will serve as a central location for the ongoing maintenance and operations of offshore wind projects.
- **Promote Workforce Training and Job Creation:** Initiatives to train and employ local workers will create a skilled workforce, essential for the growth of the offshore wind industry.
- **Workers Move to Area:** Attracting workers to the area will increase local workforce, housing demand and drive new housing developments and related economic activities.
- **New Housing for Workforce:** The construction of new housing to accommodate the influx of workers will boost the local construction industry.
- **Increased/New Business for Concrete Material Suppliers:** Suppliers of concrete materials, including aggregate, sand, and Portland cement, will see increased demand.
- **Expansion of Existing or New Concrete Construction Companies:** The growth of the offshore wind industry will drive the expansion of concrete construction companies, both existing and new.
- **Attract New Vessels to Gulf of Maine:** The establishment of Maine as a hub will attract new vessels to the Gulf of Maine, enhancing local maritime activities.
- **New Heavy Equipment Suppliers:** The demand for heavy equipment will attract new suppliers to the area, supporting the offshore wind supply chain.
- **New Local Chain, Rope, and Anchor Suppliers:** Suppliers of chains, ropes, and anchors will set up operations locally, reducing supply chain costs and lead times.
- **New Local Chain, Rope, and Anchor Storage:** Developing local storage facilities for these materials will enhance logistical efficiencies.
- **Local Post Tensioning and Rebar Suppliers/Storage:** Establishing local suppliers and storage for post tensioning and rebar materials will support construction activities and reduce costs.

These activities are expected to drive several types of benefits:

1. **Reusable Research and/or Investment:** Leveraging existing investments and research can remove costs from future projects.
2. **Established Process:** Standardizing processes can derisk future projects, reducing contingencies and lowering bid prices.

Environmental Law & Policy Center, *The Wind Energy Supply Chain in Iowa*, November 2010. https://www.novoco.com/public-media/documents/elpc_iowa-wind-supply-chain_113010_0.pdf
U.S. Department of Energy, *Wind Energy, Supply Chain Deep Dive Assessment, U.S. Department of Energy Response to Executive Order 14017, "America's Supply Chains"*, February 24, 2022. https://www.energy.gov/sites/default/files/2022-02/Wind%20Energy%20Supply%20Chain%20Report%20-%20Final.pdf
[18] Collaborative Economics, p. 14

3. **Scale Economies:** Residual infrastructure investments will reduce unit costs for future projects, enhancing economic efficiency.
4. **Cost Curve Acceleration:** Subsequent commercial projects will not have to pay the shakeout premium borne by FOIK projects. Contractors and suppliers will have prior experience, allowing them to quote derisked prices.

Due to the relative timing of the MeRA pilot project and commercial-scale development, individual MeRA activities listed here are expected to incrementally impact three projects totaling 1,800 MW. Establishing Maine as a hub for floating offshore wind will ensure that future projects can proceed with greater efficiency, reduced costs, and lower risks, ultimately benefiting the overall offshore wind industry in the Gulf of Maine. Table 14 summarizes the results of this analysis.

Table 14: Cumulative Benefits to Commercial Scale Projects from Establishing Maine as Hub for Floating OSW

	Low Range ($M 2024 USD)	High Range ($M 2024 USD)
Total Savings over MW Impacted (2024$)	$193	$343

Activities in this category impact three incremental projects, so while the savings can be material, they are modest relative to the over $8 billion (2024$) CAPEX of impacted projects. Over 50% of the estimated benefits in this category derive from an assumed reduction by 1.25% to 2.5% in the assumed bid contingency factor applied to the applicable future capital expenditures (CAPEX).

5.5 Other Unquantified Potential Benefits

5.5.1 Unquantified Benefits Related to Quantified Categories

In the category of Technology Shakeout, additional activities were identified through interviews with PTOW staff that could potentially benefit future projects. However, these activities were found to be too difficult to quantify, relatively small, or less certain in likelihood than the activities for which benefits were quantified. These unquantified benefits include:

- Foundation Construction Techniques:
  - **Verifying Cold Weather Concrete Construction Techniques:** Ensuring that concrete foundation construction techniques are effective in cold weather conditions is crucial for the Gulf of Maine's climate, potentially improving the reliability and safety of future foundations.
  - **Developing Concrete Painting Techniques:** Innovations in concrete painting techniques aimed at decreasing painting time and improving production rates could streamline the construction process and enhance efficiency.
  - **Establishing Quality Control Methods/Procedures:** Implementing robust quality control methods to improve concrete quality and reduce the need for repairs can lead to longer-lasting foundations and lower maintenance costs.
- Stationkeeping System:
  - **Determining an Effective Anchor System for the Gulf of Maine:** Identifying anchor systems that work well in Gulf of Maine sea bottom conditions will help inform future projects.
  - **Proving Mooring Installation Procedures:** Demonstrating effective mooring installation procedures, including line tensioning with specialized anchor handlers and tensioning devices, can improve the efficiency and reliability of future mooring operations.

- Foundation Design Collaboration:
  - **Completing Detailed Design with OEM/Foundation Designer:** Being the first project to complete detailed design in collaboration with original equipment manufacturers (OEM) and foundation designers can improve computational methods and derisk future projects through enhanced design practices.
- Marine Works:
  - **Establishing Buffer Zones for Construction:** Defining buffer zones for construction activities and coordinating with mariners can ensure safer and more efficient construction processes, reducing conflicts with local marine traffic.

While these activities were not included in the quantified benefits due to challenges in measurement, their successful implementation could still provide valuable lessons and improvements for future offshore wind projects. These unquantified benefits, though less certain or smaller in impact, contribute to the overall advancement and optimization of offshore wind technology and processes in the Gulf of Maine.

5.5.2 Fisheries Impact Mitigation

Additional research and stakeholder activities, which could potentially benefit future projects via establishing best practices for coexistence along with compensating fisheries (where appropriate) were identified in consultation with PTOW staff and in consideration of offshore wind and fisheries stakeholder interactions to date. However, these activities were found to be too difficult to quantify at this point in time, particularly in the absence of fishing density data upon which one could value displacement or mitigation of displacement. These unquantified benefits include:

- **Establishing Best Practices:** Developing and implementing best practices for fisheries coexistence, mitigation and/or compensation will facilitate smoother negotiations and operations alongside local fishing communities. By setting a standard for mitigation or compensation, the industry can reduce contingency costs and minimize litigation risks.
- **Multi-State Agreement:** Exploring the possibility of a multi-state agreement for paying into a compensation fund could streamline compensation processes and ensure fairness across different jurisdictions.
- **Minimal Interference with Lobster Fisheries:** The MeRA and future offshore wind projects are expected to have minimal interference with lobster fisheries. However, they may impact mobile gear fisheries, highlighting the importance of tailored mitigation or compensation strategies.
- **Displacement for Cable Installation:** Recognizing and addressing the displacement caused by cable installation can help mitigate impacts on fisheries and ensure smoother project implementation.
- **Negotiating Scalable Mitigation Settlements:** Establishing a model for negotiating scalable mitigation settlements for both the lobster industry and mobile gear fisheries can provide a framework for future projects. This approach can reduce the perception of risk and litigation, leading to more streamlined project approvals.
- **Reducing Developer Risk:** By negotiating agreements pre-final investment decision (FID), developers can reduce the risk of lawsuits holding up development. This proactive approach can lower overall project risks and costs.
- **Optimizing Fisheries Yield:** Narrowing fishing exclusion zones within 1-3 years following commercial operation date (COD) can enhance fisheries yield and support sustainable fishing practices alongside offshore wind development.

While these fisheries compensation activities were not included in the quantified benefits due to challenges in measurement, their successful implementation could provide significant advantages. By establishing clear compensation frameworks and reducing litigation risks, these activities contribute to the overall success and acceptance of offshore wind projects, fostering a cooperative relationship between developers and local fishing communities.

5.5.3 Workforce Development & Training

During interviews with PTOW staff, additional activities related to workforce development and training were identified that could benefit future projects. However, we have not attempted to quantify these benefits. These unquantified benefits could include:

- **Building a Skilled Workforce:** Investing in workforce development and training programs will ensure that future offshore wind projects have access to a pool of trained and skilled personnel. This reduces the need for extensive training on new projects, leading to increased efficiency and lower operational costs.
- **Reducing Training Costs:** By establishing robust training programs, future projects can benefit from reduced training costs. Workers who are already trained and experienced in offshore wind technologies and processes can be quickly integrated into new projects, minimizing downtime and enhancing productivity.
- **Increasing Project Efficiency:** A well-trained workforce can significantly improve project efficiency. Skilled workers are more adept at handling complex tasks, reducing the likelihood of errors and delays. This can lead to faster project completion times and lower overall costs.
- **Ensuring Local Employment:** Workforce development initiatives increase the likelihood that future jobs will go to Maine residents. By prioritizing local hiring, these programs can support the local economy and create long-term employment opportunities for Mainers.
- **Enhancing Economic Benefits:** Training programs can attract new talent to the region, fostering a culture of innovation and expertise in offshore wind technologies. This can have broader economic benefits, as a skilled workforce can attract additional investments and projects to the area.
- **Fostering Industry Growth:** Developing a local workforce skilled in offshore wind can position Maine as a leader in the industry. This can attract further projects and investments, creating a positive feedback loop of growth and development.

A study of the first fixed-bottom offshore wind pilot project in the United States – the 30 MW Block Island Wind Farm (BIWF) located in state waters of Rhode Island – cataloged the local workforce engaged in development of that project. Now that commercial scale development is moving forward, many of the "project managers, engineers, scientists, lawyers, commercial finance [experts], regulatory [experts], electricians, plumbers, pipefitters, operating engineers, cement masons, laborers, mechanics, machinists, dockworkers, truck drivers, training professionals, health and safety experts, vessel builders, and vessel operators" who gained experience as a result of BIWF are available to support subsequent development.[19] It is reasonable to expect this story to repeat in Maine as a result of MeRA.

While these workforce development and training activities were not included in the quantified benefits due to challenges in measurement, their successful implementation could provide significant advantages. By building a skilled and efficient workforce, future offshore wind projects can benefit from reduced costs, increased efficiency, and enhanced economic benefits for the region. These efforts will ensure that Maine remains a competitive and attractive location for offshore wind development.

5.5.4 Cable Rights-of-Way (ROWs)

During interviews with PTOW staff, additional activities related to cable rights-of-way (ROWs) in state waters were identified that could benefit future projects. However, these activities were found to be too difficult to quantify, relatively small, or less certain in likelihood than the activities for which benefits were quantified. These unquantified benefits include:

[19] Workforce Development Institute, *CASE STUDY: BLOCK ISLAND WIND FARM, NEW YORK STATE AND THE JOBS OF OFFSHORE WIND ENERGY*, Spring 2017.
https://wdiny.org/Portals/0/New%20York%20State%20and%20The%20Jobs%20Of%20Offshore%20Wind%20Energy_%20WDI2017.pdf?ver=2017-05-03-150746-023

Cable Right-of-Way:

- **Securing and Optimizing Cable Routes:** Securing and optimizing cable routes may minimize future project delays and costs related to grid connection. By identifying the most efficient and least disruptive routes for cable installation, future projects may avoid costly delays and ensure timely grid connections.
- **Acceptable Methods and Procedures:** Developing and standardizing acceptable methods and procedures for cable installation can streamline future projects. These established methods will provide a clear framework for subsequent projects, reducing uncertainties and improving efficiency.
- **Seabed Interpretation and Standards Development:** Conducting thorough seabed and riverbed interpretations and developing standards for cable installation can enhance the reliability and safety of future projects. These standards will provide guidelines for navigating the unique conditions in state waters abutting the Gulf of Maine, reducing risks associated with cable installation.
- **Establishing the Process:** Creating a standardized process for securing cable rights-of-way will simplify the regulatory and logistical aspects of future projects. This process will provide a clear roadmap for securing necessary approvals and agreements, reducing administrative burdens and expediting project timelines.
- **Establishing Actual Right-of-Way:** Securing the physical right-of-way for cable routes will provide a tangible benefit for future projects. This will ensure that necessary pathways are reserved and available for subsequent cable installations, preventing conflicts and delays.

While some of these benefits are site-specific, the limited number of viable onshore points of interconnection available in Maine for commercial-scale offshore wind means that securing and optimizing cable routes in these locations could provide residual benefits to other projects utilizing the same ROWs. Additionally, processes and methods developed, as well as surveys undertaken during the MeRA project, could obviate the need for subsequent projects to undertake (at least part of) the same efforts.

Although these cable ROW activities were not included in the quantified benefits due to challenges in measurement, their successful implementation could provide significant advantages. By securing and optimizing cable routes, developing standards and procedures, and establishing clear processes, future offshore wind projects can benefit from reduced costs, minimized delays, and increased efficiency. These efforts will ensure that Maine remains a competitive and attractive location for offshore wind development, with well-established infrastructure to support future projects.

5.5.5 Determination of Federal Inflation Reduction Act (IRA) Bonus Tax Incentives

There remain many uncertainties associated with application of IRA tax credits to floating offshore wind. Whereas the Domestic Content bonus should be well demonstrated for fixed bottom projects, whether the means and methods of sourcing raw materials and fabricating versus manufacturing floating foundations will qualify projects for this bonus will be tested and confirmed by the MeRA. Similar with the Energy Communities bonus – a grid interconnection location tested for compliance by MeRA, could forge a more certain path for later commercial scale projects. Certainty is typically derived through securing from the Internal Revenue Service private letter rulings relating to specific circumstances. While such private letter rulings do not strictly have applicability to other circumstances, they do provide confidence relating to how the IRS would likely rule in similar circumstances. While commercial scale projects would ultimately determine for themselves the applicability of these bonuses, by virtue of doing so first, MeRA may relieve subsequent commercial projects of a material portion of the expense in arriving at determination for purposes of bid development, and may also reduce uncertainty (provide bidder with more confidence) where IRS determinations may not have otherwise been rendered.

5.5.6 Other:

In addition to the topics described above, additional sources of MeRA impact and benefits may be derived from each of the following. We have not attempted to quantify these impacts and benefits, but the existence of some benefits in each of these categories in likely.

- Supply Chain Investment: Establishing a robust supply chain during the MeRA project will stimulate additional economic activity in Maine. This investment can lead to substantial economic benefits, because a well-developed supply chain supports local businesses and workforce development, which in turn would further drive down costs for future offshore wind projects. Additional economic activity stimulated as a result of MeRA earlier than it might be stimulated by subsequent commercial scale projects, would be attributable to MeRA. In addition, the possibility exists that MeRA activity could create a first-mover advantage, for Maine such that a supply chain is established in Maine for the MeRA project that would otherwise have accrued to other states in the absence of a pilot project.
- Benefits to other states buying OSW output from Gulf of Maine Leases: Other New England states are certain to purchase offshore wind output from commercial scale floating projects located in the Gulf of Maine. To the extent that any of them benefit from cost reductions of a similar nature that result from MeRA, they may also benefit in the form of lower PPA bid prices. While these benefits may not directly accrue to Maine ratepayers – and as a result, the PUC may give them little weight – these benefits to the broader region could be substantial.