The latest revision date of Appendix O to the Empire Offshore Wind COP is May 2022. This appendix was not revised as part of the November 2023 submittal; therefore, the date on the Appendix O cover sheet remains as May 2022.

APPENDIX O

Economic Impacts of the Empire Wind Project (EW 1 and EW 2)

Prepared for

equinor

TETRA TECH

MAY 2022

Economic Impacts of the Empire Wind Project (EW 1 and EW 2)

Date: January 19, 2022

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Disclaimer

This study was prepared by ICF Resources, L.L.C., using data and inputs provided by Empire Offshore Wind LLC, along with other information from publicly available sources. ICF was not involved in (and does not endorse) the input assumptions used in this study. ICF conducted this study using well established models that have been used in these types of analyses in the past. Any questions related to the input data should be addressed to Empire.

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Table of Contents

List of Figures

List of Tables

List of Acronyms

Acronym	Description
BOEM	Bureau of Ocean Energy Management
COP	Construction and Operations Plan
EW 1	Empire Wind 1
EW 2	Empire Wind 2
FTE	Full-time equivalent job (2,080 hours/year)
IMPLAN	IMpact analysis for PLANning
GSP	Gross State Product
MUSD	Million United States Dollars
NAICS	North American Industrial Classification System
NY	New York
NYS	New York State
NYSERDA	New York State Energy Research and Development Authority
O&M	Operation and maintenance
OSS	Offshore substation
PDE	Project Design Envelope
RFP	Request for Proposals
WTG	Wind turbine generator

Introduction

At the request of Empire Offshore Wind LLC ("Empire"), ICF prepared this report to support the Construction and Operations Plan ("COP") submitted to the Bureau of Ocean Energy Management ("BOEM") for BOEM's OCS A-0512 Lease Area ("Lease OCS A-0512"). Empire proposes to develop Lease OCS-A 0512 in two wind farms, known as Empire Wind 1 ("EW 1") and Empire Wind 2 ("EW 2") (collectively, "Project"). Project components in the Lease Area include:

- Up to 138[1] wind turbines and supporting tower structures;
- Two offshore substations;
- Up to 138 foundations and associated support and access structures (for aforementioned wind turbines and offshore substations);
- Up to 260 nm (481 km) of inter-array cable (up to 116 nm [214 km] for EW 1 and up to 144 nm [267 km] for EW 2); and
- Up to 66 nm (122 km) of submarine export cables, consisting of two routes:
  - Up to 40 nm (74 km) of the submarine export cable route to the EW 1 landfall, of which 24 nm (44 km) is in federal waters and 16 nm (30 km) in state waters; and
  - Up to 26 nm (48 km) of the submarine export cable route to the EW 2 landfall, of which 18 nm (33 km) is in federal waters and 8 nm (15 km) is in state waters.

This report is, in part, based on previous economic impact analyses conducted by ICF in support of submissions by Equinor Wind US LLC, Empire's affiliate, in 2019 and 2020 to the New York State Energy Research and Development Authority ("NYSERDA").[2]

This report provides estimates of expected local economic and employment benefits of the Project by evaluating the following scenarios, both of which are within the Project Design Envelope ("PDE") set forth in the COP:

- **Empire Wind 1** – staging and installation of wind turbine generators ("WTGs"), inter-array cables, one offshore substation, submarine export cables, and an onshore substation, and local transportation of components to the project site; and
- **Empire Wind 2** – staging and installation of WTGs, inter-array cables, one offshore substation, submarine export cables, and an onshore substation, and local transportation of components to the project site.

[1] The Project's PDE includes up to 174 foundation locations to allow flexibility in layout design. Empire has selected a 15-MW wind turbine for the Project, meaning up to 147 wind turbines may be installed to ensure Empire can meet its contractual obligations to New York. Nine of the 147 wind turbines allow for overplanting, as may be required for Empire to meet its contractual obligations. However, for the purposes of this analysis, to maintain a conservative approach, ICF's analysis uses 138 WTG foundations, excluding the potential overplanting.

[2] Economic Impacts of the Proposed Equinor Offshore Wind Power in New York, ICF Resources, L.L.C., 2019; Economic Impacts of Equinor's Offshore Wind Power Proposals in New York, ICF Resources, L.L.C., 2020. While this report compiles and summarizes certain portions of the foregoing reports, this report also reflects a narrower scope of analysis, as described further herein, commensurate with Empire's Construction and Operations Plan, in order to estimate anticipated benefits for the Project

The study summarizes estimates of these two conceptual scenarios using the IMPLAN economic model to estimate the short- and long-term employment and other socioeconomic impacts for New York State ("NYS"). Note, economic impacts discussed here are exclusively those that accrue to NYS; potential spillover benefits accruing to other states or regions within the U.S. are not captured in this study. Because the majority of the construction and O&M activities are anticipated in NYS under these scenarios, most of the socioeconomic benefits coming from these two facilities are expected to be in NYS, but some non-trivial benefits are likely to accrue to other regions, which are not captured in this study.

The next section discusses the IMPLAN modeling tool used to estimate the regional economic impacts. Brief descriptions of the modeling inputs used for the analyses are provided in the next section, followed by detailed discussions of the results of economic modeling. Separate benefit estimates are provided for the construction and O&M phases for both the EW 1 and EW 2 scenarios.

Economic Modeling Methodology

This section provides an overview of the economic impact modeling methodology, including an introduction to the IMPLAN model and overview of the modeled inputs.

Introduction to the IMPLAN Model

Empire's investments in offshore wind development in NYS will result in positive economic impacts for the state. These investments, including investments by contractors and their supply chains, will have impacts on employment, regional output, personal incomes, and state and local taxes.

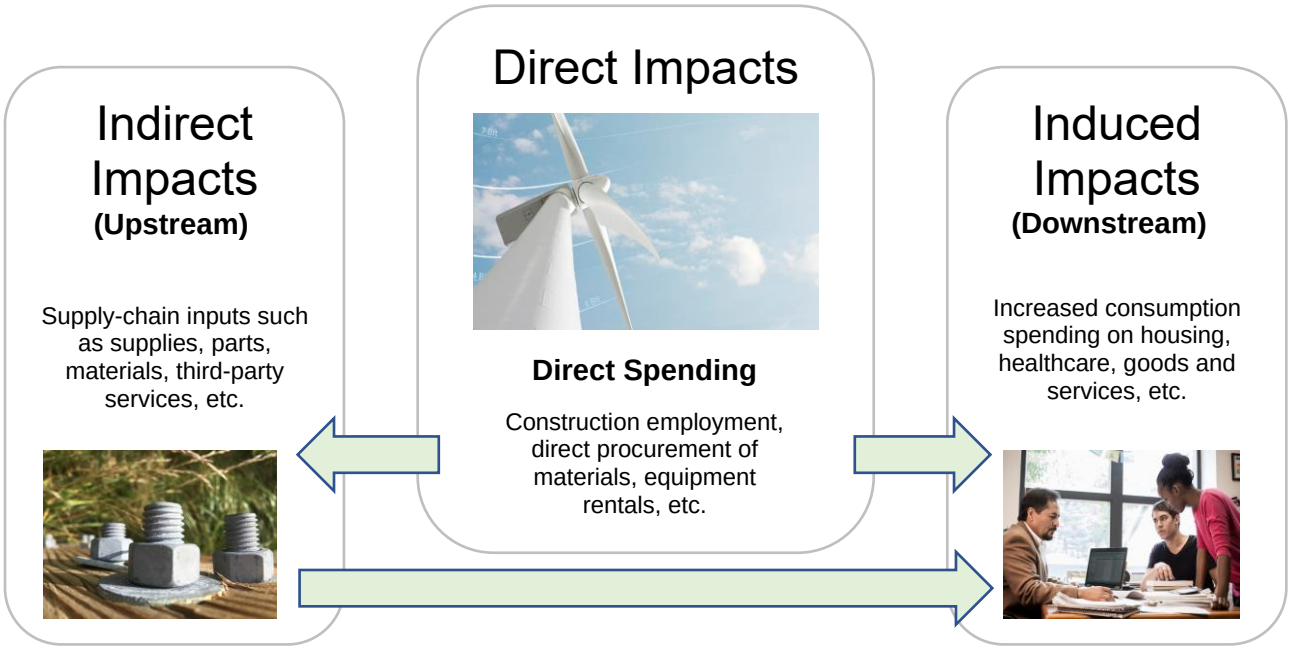
ICF used the IMPLAN model to estimate the state-wide economic impacts. IMPLAN is an economic input-output model that combines a set of extensive databases related to economic factors, economic multipliers, and demographic statistics within a refined and detailed system of modeling software. There are three primary types of impacts IMPLAN generates in terms of outputs:

- **Direct** – refers to the impacts on construction, operation, and project development-related industries directly related to the investments during the construction and operations phases of the facilities. These impacts are driven by activities related to the purchases of raw materials such as those needed for the foundations, as well as the equipment, machinery rentals and fuel purchases that are used to move materials to site and help in the construction and operation of the facilities over their lifetime.

- **Indirect** – refers to the impacts in inter-industry purchases resulting from direct spending on materials, equipment, and construction labor as well as support activities related to the operations of the facilities. These impacts represent the upstream supply chain impacts that are created due to the industry linkages caused by project-related industries purchasing from other industries such as raw materials sectors supplying the steel industry.

- **Induced** – refers to the downstream impacts created in all local industries due to consumers' consumption expenditures arising increases in personal income caused by the direct and indirect effects. These impacts represent the local economic benefits arising from workers on these facilities spending on local goods and services.[3]

The total impact is the sum of the multiple rounds of secondary indirect and induced impacts that remain in the region (as opposed to "leaking out" to other regions or states). IMPLAN then uses this total impact to calculate subsequent impacts such as total jobs created and tax impacts. These three categories are summarized below.



IMPLAN allows for the development of local-level input-output models that can estimate the economic impact of investments on local communities. The model identifies direct impacts by sector and then develops a set of indirect and induced impacts by sector using industry-specific multipliers, local purchase coefficients, income-to-output ratios, and other factors and relationships. The model is comprehensive in its level of detail, with a breakdown of the economy into roughly 500 sectors. For this analysis, ICF utilized the NYS specific IMPLAN model, although the model can be customized to any area being studied, and can be applied at various scales, such as at the state or county level. The use of the IMPLAN model allows for the estimation of the total impacts of construction activity on the regional economy in terms of the following types of impacts:

- **Employment** – employment supported by offshore wind investment. IMPLAN estimates employment by aggregated sector.

- **Output** – the contribution of the investments to total local and state economic activity.

[3] NYS guidance indicated that results submitted with the bids should show impacts with and without the induced effects. For the purposes of this report, however, we present results broken down into direct, indirect, and induced but the totals always include the induced impacts.

- **Value added** – the difference between industry output and the cost of intermediate inputs. This value represents the project's contribution to state gross domestic product (GSP).

- **Personal income** – wages and salaries (including benefits) paid to workers, plus proprietor income, supported by offshore wind investment.

- **Tax revenues** – tax revenues from businesses, sales, excise, and property from all project-related activity.

Modeling Inputs

Modeling inputs used for both EW 1 and EW 2 analyses came exclusively from Empire, based on detailed investment expenditure estimates for each proposal submitted to NYSERDA, as modified to reflect the scope of the Empire COP. ICF worked with Empire to categorize each investment based on the categories delineated in the relevant New York RFPs. Note, ICF did not include estimated property tax payments in its estimate of local economic benefits. In particular, this report focuses on the economic benefits of Empire's expenditures directly related to the two offshore wind facilities and excludes benefits derived from the expenditures on port upgrades. The report excludes expenditures from fabricating large components (such as foundations, towers, or transition pieces) and associated economic impacts. The report also excludes economic impacts associated with ratepayer impacts to recoup costs as well as any benefits derived from emission reductions.

Empire Wind 1

The following discussion details the data and calculations used to create the inputs for EW 1 economic modeling exercise. Empire provided the detailed input data, divided into three separate categories of benefits based on NYS guidance. These three categories include:

- Category 1 – project-specific spending and job creation in NYS
- Category 2 – offshore wind industry-related supply chain and infrastructure investment
- Category 3 – input activities related to improvements to the NYS workforce, businesses, and the relevance of NYS in offshore wind. Economic impacts of these inputs are excluded in the results presented below.

Empire provided data with a level of detail that allowed for individual procurement and employment costs to be assigned to specific North American Industrial Classification Sectors (NAICS) codes. The category-by-category input descriptions represent incremental local investment only and are aggregated to a level higher than that of the source data. All classification of data by category, activity, and detail were provided by Empire and were then matched to appropriate economic sectors for the modeling exercise. All input data, as well as all output values for EW 1 are in 2020$ million.

Empire provided two major types of Category 1 investments. The first involves the activities associated with the installation of foundations, WTGs, substations, and other infrastructure necessary for an offshore wind project. The second involves long-term O&M costs, including equipment, supplies, and personnel throughout the expected lifespan of the project (assumed to

be 34 years).. After the components are fabricated and transported to the staging port, the installation of the foundations, WTGs, offshore substations, and cables are expected to be conducted by foreign vessels using foreign crews. However, Empire expects to source fuel and supplies such as food locally. Additionally, foreign crews will be on a two-week rotation, allowing them to spend their wages in local communities. There is also additional local investment related to the construction of the onshore substation and the connection of the offshore wind project to the electrical grid. Following construction, Empire expects significant total O&M investments for the lifespan of the project. According to the data provided by Empire, O&M investments start in 2021, and Empire estimates those to be annual investments in supplies, equipment, and necessary personnel of approximately $20 million. These investments are expected to occur annually for 34 years (through 2054). Empire's decision to base O&M locally creates significant near- and long-term local investment regardless of foundation type or nameplate capacity.

In addition to the investments Empire is planning to make during the construction and operations phases of EW 1 and EW 2, Empire is also planning to invest between $25 million and $30 million in setting up funds that are expected to aid in community development and various workforce training programs in NYS. These investments are associated with both EW 1 and EW 2 and are intended over the lifetime of the two facilities (2019 – 2055). These funds are designed to support workforce readiness initiatives, various other educational initiatives in the local communities and other green initiatives aimed at developing a robust supply chain. These investments would help further the development of the offshore wind industry in NYS and enhance the relevance of NYS as a key player in the U.S. offshore wind industry.[4]

Table 1 below provides a summary of the inputs used in the economic impacts analysis. Empire estimates a total investment in NYS of around $941 million for EW 1. Out of this total, almost 30%, or over $280 million, is expected to be in short-term activities associated with the installation of various components, and most of these investments are estimated to be concentrated in the 2023 to 2025 timeframe. Empire estimates that over 40% of these investments would be for activities related to the need to upgrade the infrastructure to move the electricity to load centers via investments in building the onshore substation and other grid interconnection costs. Staging for the WTGs makes up the bulk of the remaining investment needs, with an $80 million investment in 2025. In addition to these short-term construction-related investments, Empire anticipates spending the remaining 70% or almost $660 million, on the longer-term operation of the Project, which would support permanent jobs in NYS. These operations-related expenditures are anticipated to start in 2021 at low levels, but with the bulk of the expenditures starting from 2024 and going out to 2054. The bulk of these expenditures are for running the facility, including crew manning costs and other operating costs, such as purchasing fuel for transport and other marine logistics. About a quarter of these O&M costs are estimated to be for payment of land lease in NYS.

Table 1: Empire Wind 1 Local Investments

[4] Since these funds are cumulative across both EW 1 and EW 2, they are not included in the inputs for EW 1 shown in Table 1. Socioeconomic impacts of these investments are discussed separately in the Results section below.

Project Phase	Detail	Component	Investment (millions $)	Time Period
Construction	*Project Management*	Project Management/Studies	39.0	2019-2025
	WTG Installation	Fuel	3.5	2025
		Supplies	1.0	2025
		Crew Personal Spending	1.8	2025
	Cable Installation	Fuel	3.3	2024
		Supplies	0.8	2024
		Crew Personal Spending	1.5	2024
	Foundation and OSS Installation	Fuel	7.5	2024
		Supplies	2.3	2024
		Crew Personal Spending	3.3	2024
	Onshore Substation	Construction	42.0	2023-2025
	Landfall and Cable Route Construction	Construction	1.0	2023-2025
	Grid Interconnection	Construction	75.0	2020-2023
	Staging	Crew Transfer Vessel	6.5	2025
		WTG Staging	80.0	2025
		WTG Contractor Site Team	12.6	2025
Construction Total				**281.1**
O&M		O&M Crew Manning Costs	160	2021-2054
		Other O&M Costs	121.5	
		Land Lease	176.6	
		Marine Logistics	201.5	
O&M Total				**659.6**
Grand Total			**940.7**	

Empire Wind 2

The following section presents the data and calculations used to create the inputs for the EW 2 economic modeling exercise. Empire provided the detailed input data that were classified as those for two separate phases – short-term staging and installation and long-term operations.

Empire provided data with a level of detail that allowed for individual procurement and employment costs to be assigned to NAICS codes. The category-by-category input descriptions represent incremental local investment only and are aggregated to a level higher than that of the source data. All classification of data by category, activity, and detail were provided by Empire and were then matched to appropriate economic sectors for the modeling exercise. All input data, as well as all output values for EW 2 are in 2020$ million.

Table 2 below provides a summary of the costs related to EW 2 that are relevant for modeling the economic impacts to NYS. Empire estimates a total investment of over $1.5 billion for EW 2, significantly higher than the $941 million investment for EW 1. Similar to trends for EW 1, around a third of this total is expected to be during the staging and installation phase, which amounts to close to $508 million. Most of these investments are expected to occur between 2023 and 2027. Over 72% of these short-term investments, or about $368 million, are estimated to be for the construction of the onshore substation and the infrastructure needed for the grid interconnection costs. Staging and installation for the WTGs make up the bulk of the remaining construction costs, around $121 million. Following construction, Empire expects significant total O&M investments for the lifespan of the facility, which account for the remaining two-thirds of the total investments, at slightly over $1 billion in total or about $30 million/year. These operations related expenditures are anticipated to start in 2022 at low levels, with the bulk of the expenditures starting around 2024 and going out to 2055. The bulk of these expenditures are for running the facility, including crew manning costs and other operating costs, such as purchasing fuel for transport and other marine logistics. About a quarter of these O&M costs are estimated to be for payment of land lease in NYS.

As discussed above, Empire is also investing in the local communities through various community development and workforce training funds. Empire estimates a total of somewhere between $25 million and $30 million allocated for such funds over the lifetime of EW 1 and EW 2 (2019 – 2055). These funds are designed to support workforce readiness initiatives, various other educational initiatives in the local communities and other green initiatives aimed at developing a robust supply chain. These investments would help further the development of the offshore wind industry in NYS and enhance the relevance of NYS as a key player in the U.S. offshore wind industry.[5]

Table 2: Empire Wind 2 Local Investments

Project Phase	Detail	Component	Investment (millions $)	Time Period

[5] Since these funds are cumulative across both EW 1 and EW 2, they are not included in the inputs for EW 2 shown in Table 2. Socioeconomic impacts of these investments are discussed separately in the Results section below.

Construction	*Project Management*	Project Management	19.0	2020-2027*
	Onshore Substation	Electrical Components	6.8	2022-2025
		Professional Services	9.5	
		Construction	68.9	
	Grid Interconnection	Real Estate	18.8	2023-2026
		Professional Services	55.1	
		Electrical Components	4.5	
		Concrete	4.6	
		Metals	14.6	
		Construction	185.0	
	WTG Staging	Professional Services	112.0	2026-2027
	WTG Installation	Professional Services	9.0	2025-2027
Construction Total				**507.8**
O&M		O&M Crew Manning Costs	247	2022-2055
		Other O&M Costs	187.6	
		Land Lease	265.1	
		Marine Logistics	311.1	
O&M Total				**1,010.8**
Total			**1,518.6**	

**Empire estimates small amounts of project management expenditures beyond 2027, not shown in the Table above.*

Modeling Results

This section discusses the results of the economic modeling conducted for the EW 1 and EW 2 scenarios defined above. Detailed results discussed below are separated out by EW 1 and EW 2, along with a summary of the cumulative economic impacts from EW 1 and EW 2 combined. Economic metrics used to discuss the results include employment impacts, expressed as full-time equivalents ("FTEs"), along with impacts on state economic output (value added GSP) and personal income changes.

Table 3 shows the employment impacts of EW1 and EW 2, separated further by impacts during the construction and the operations phases. Construction phase for EW 1 is expected to last from 2019 to 2025 and support a total of over 2,300 job-years. As discussed below, most of these jobs occur between 2023 and 2025 when the bulk of the construction activities take place. Prior to that, there are some job impacts related to project management and various developmental studies conducted in preparation for the construction phase. Over one-half of these jobs, or over 1,260 jobs are anticipated to be direct jobs in sectors that are expected to contribute directly in the construction of the EW 1 facility. The remaining jobs during the construction phase are estimated to be split between indirect and induced job impacts. During the operations phase of EW 1, the study estimates there could be over 4,000 cumulative job-years, over roughly a 34-year time period (till 2054). A little less than one-half of these jobs, or almost 1,800 cumulative job-years, are expected to be direct, with the remaining split between indirect and induced.

Table 3: Summary Economic Impacts (Job-Years)

	Empire Wind 1		Empire Wind 2		Total	
	Development/ Construction (2019-2025)	**O&M (2021-2054)**	**Development/ Construction (2020-2027)**	**O&M (2022-2055)**	**Development/ Construction (2019-2027)**	**O&M (2021-2055)**
Direct	1,261	1,797	2,154	2,723	3,415	4,520
Indirect	421	1,244	764	1,887	1,185	3,131
Induced	645	1,029	1,127	1,563	1,772	2,591
Total	**2,326**	**4,069**	**4,046**	**6,173**	**6,372**	**10,242**

For EW 2, the construction phase is expected to last from 2020 to 2027 and support a total of over 4,040 job-years. However, similar to the pattern on EW 1, most of these jobs are likely to occur between 2023 and 2027. Jobs prior to 2023 are expected to be relatively few and associated with project management and development studies. Also, over one-half of these jobs are expected to be direct with the remaining split between indirect and induced job impacts. During the operations phase of EW 2, the study estimates there could be over 6,100 cumulative job-years, over roughly a 34-year time period (till 2055). About 45% of these jobs, or about 2,700 cumulative job-years, are expected to be direct, with the remaining split between indirect and induced.

Thus, EW 1 and EW 2 collectively are expected to support over 6,300 total job-years during the construction phase and over 10,200 job-years during the operations phase. In addition to the estimated job impacts shown in the Table above, Empire is also investing in various community development and workforce training and readiness funds in the state. Empire estimates that the aggregate value for these funds could be between $25 million and $30 million for *both* EW 1 and EW 2, over the entire lifetime of the two facilities (2019 – 2055). The actual annual contributions of these funds are relatively small at less than a $1 million per year and are likely to support an additional 10 – 15 jobs annually in the state for the entire 30+ years of operation. More importantly, however, the socioeconomic impacts of these contributions by Empire are likely to be far greater than the jobs they will support in the region. These funds will provide vital resources in supporting workforce training and readiness and help support efforts for just transition of the workforce, while also providing benefits to the local communities as they rebound from the Covid-19 induced recession.

Below we discuss results for each individual facility separated by their construction and operations phases.

Empire Wind 1 Economic Benefits

The EW 1 project will provide significant economic benefits in NYS (and elsewhere though the modeling here was restricted to NYS only) by supporting both temporary and permanent jobs, increasing the GSP and personal income, as well as contributing to local, state, and federal taxes, both during the construction and operations phases of the project.

Construction Phase Economic Impacts

The following are incremental economic benefits that would result from EW 1. The estimated construction job impacts described in Table 4 are a result of investment in employment and procurement related to the construction of WTGs, an offshore substation, submarine export cables, and an onshore substation to the project site. It does not include O&M, infrastructure improvements, transport of foundation and towers, or the fabrication of components.

Table 4: Empire Wind 1 Construction Job Impacts

Impact	Annual Jobs	Cumulative Job-Years
Direct	180	1,261
Indirect	60	421
Induced	92	645
Total	**332**	**2,326**

The construction and installation phase is expected to support around 180 direct, 60 indirect and about 92 induced jobs in NYS annually between 2019 and 2025. Thus, over 50% of the total jobs in each year (about 54%) are expected to be direct, with the remaining split between indirect and induced job impacts. Cumulatively, these translate to over 1,200 direct FTEs between 2019 and

2025. Including indirect and induced impacts, this portion of the project could result in over 2,300 FTEs in NYS, with similar ratios for direct, indirect and induced job impacts.

Table 5 shows the total economic impacts of EW 1's construction phase in terms of state output and income. Construction and installation is expected to produce over $280 million in state economic output over the 2019 to 2025 time period. For total personal income, this phase could generate about $195 million in income for state residents from all of the economic activity expected to take place for EW 1. Out of these total amounts, *direct* value added and personal income impacts could be over $150 and $114 million, respectively. Additionally, the indirect and induced impacts during the construction and installation phase for EW 1 is expected to generate an additional $130 million in state output and another $81 million or so in state income.

Table 5: Empire Wind 1 Construction Total Economic Impacts (2020$ MUSD)

Impact	Gross State Product (Value Added)	Personal Income
Direct	152.8	114.1
Indirect	54.6	37.8
Induced	75.6	43.0
Total	**283.0**	**194.9**

Table 6 describes the tax impacts of EW 1's construction phase. EW 1 is expected to generate roughly $25 million in state and local taxes and an additional $38 million in federal tax revenues during the construction phase, for a total of over $63 million in total fiscal impacts for the state, local and federal coffers.

Table 6: Empire Wind 1 Construction Tax Impacts (2020$ MUSD)

State and Local Tax	Federal Tax	Total Tax
24.9	38.4	**63.4**

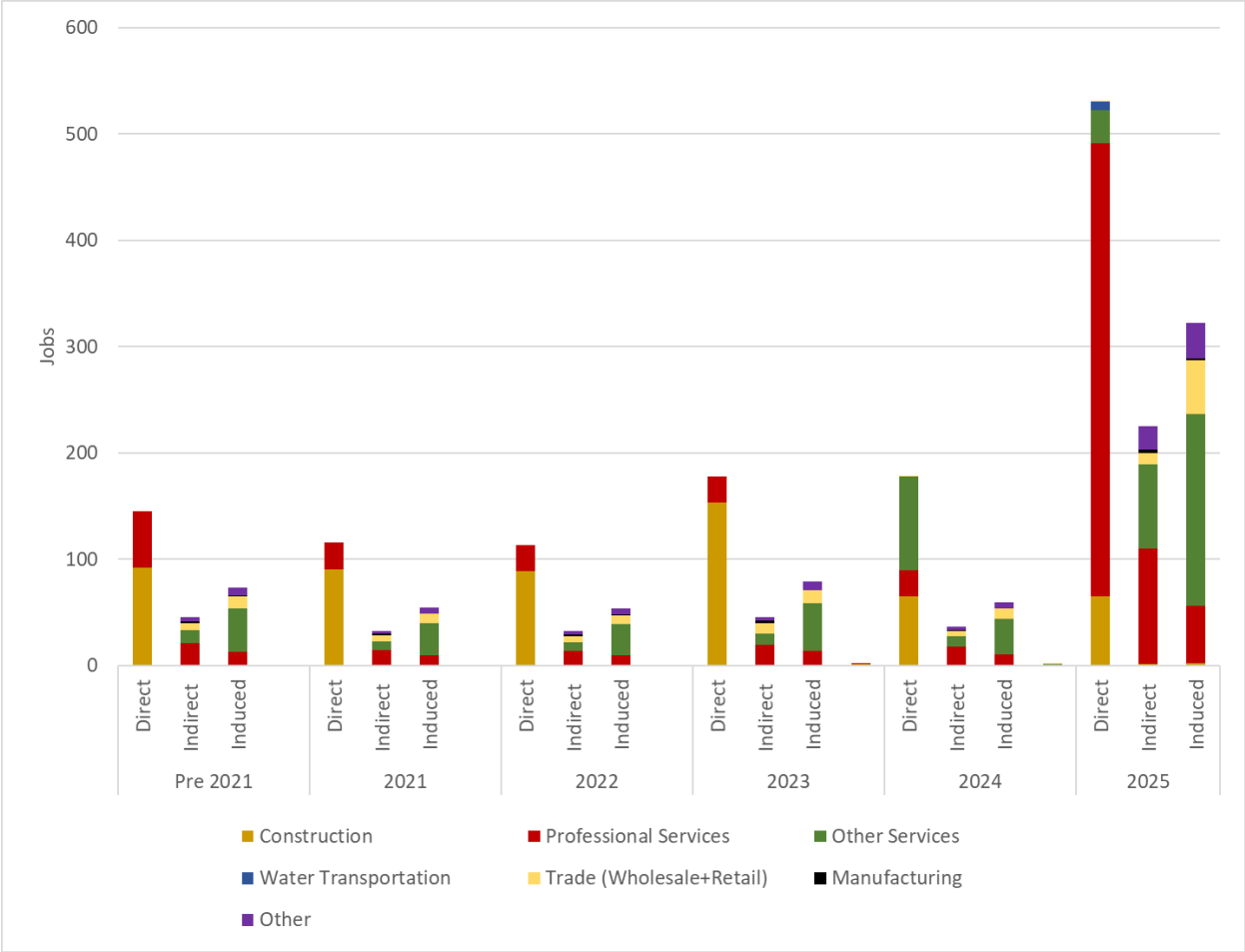
Table 7 presents an illustrative list of average compensation levels for the various economic sectors likely to benefit from these jobs supported during EW 1. Note that these average compensation levels are based on IMPLAN data and do not reflect actual salary levels for individual workers in the state. These compensation levels provide an overview of the types of incomes that jobs in these sectors could generate, *on average* in NYS. Employees in the commercial and industrial equipment rental sector and professional services sector are expected to have the highest average compensation among the relevant sectors, both averaging over $110,000. Employees in the water transportation and fabricated structural metal manufacturing sectors also have high average compensation, both averaging above $85,000.

Table 7: IMPLAN Sectors and Average Compensation

Sector	Average Compensation (2020$ USD)
Construction of new power structures	$74,180
Professional services	$111,565
Construction of new highways and streets	$78,621
Other real estate	$47,609
Iron and steel forging	$78,810
Commercial and industrial equipment rental	$119,093
Fabricated structural metal manufacturing	$85,407
Facilities support services	$53,472
Ready-mix concrete manufacturing	$76,973
Water transportation	$89,797
Maintenance and repair	$74,012

Figure 1 below shows the detailed sectoral job impacts for the main years during the construction phase, separated by direct, indirect, and induced impacts.

Figure 1: Empire Wind 1 Construction Sectoral Jobs



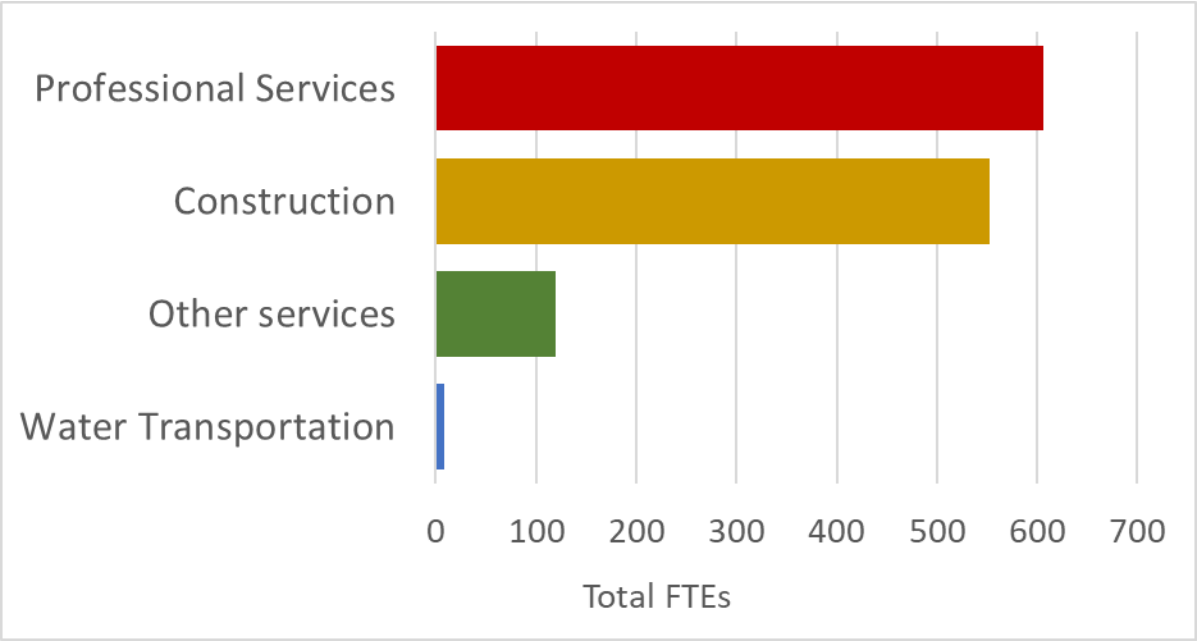
** Pre 2021 includes impacts in 2019 and 2020.*

The economic sectors used in modeling were grouped into broader sector categories, including construction, professional services, other services, water transportation, trade, manufacturing and other. Other services include food & beverage services, hospitality services, laundry services, recreational activity services, and more. Sectors in the "other" category include agriculture, resource mining, power generation, and other miscellaneous sectors.

As Figure 1 shows, the biggest sectoral beneficiaries of Empire's investments in offshore wind in NYS are expected to be in construction and the relatively well-paid services sectors, including significant contributions coming from the white-collar professional services sector, especially in the latter years.

Because of the importance of the direct jobs supported by EW 1 in NYS, Figure 2 below shows the sectoral *direct* only job impacts over the entire construction phase of the project and presents data for the cumulative job-years that could be supported in these sectors over time.

Figure 2: Empire Wind 1 Construction Direct Jobs by Sector (Cumulative 2019-2025)



Over 47% of the direct jobs that result from EW 1 construction and installation investments are in the professional services sector, mostly related to architectural, engineering, and related services. Construction sector jobs make up approximately another 43% of the direct employment. These jobs are mostly associated with the construction of new power and communication structures. The remaining direct jobs are from water transportation, wholesale trade, as well as other non-professional service sectors such as food and entertainment.

Operations and Maintenance Phase Economic Impacts

The following section describes the impacts and benefits that will arise from the O&M phase of EW 1. This phase consists of upkeep of the project infrastructure, operations of the facilities, and real estate costs associated with operation.

Table 8 describes the cumulative and average annual employment impacts of the O&M phase of the project, which will span from 2021 to 2054.

Table 8: Empire Wind 1 O&M Job Impacts

Impact	Annual Jobs	Cumulative Job-Years
Direct	53	1,797
Indirect	37	1,244
Induced	30	1,029
Total	**120**	**4,069**

EW 1 is expected to support over 50 direct, long-term jobs for operating the facility, along with an additional 37 indirect and 30 induced jobs every year. Cumulatively, EW 1 will support over 4,000 total job-years during the entire lifespan of EW 1, with roughly 45% of those in direct (about 1,800 job-years) and around 1,200 and 1,000 job-years each for indirect and induced, respectively. Note that these jobs are in addition to the over 2,300 job-years associated with the construction phase, for a total of almost 6,400 job-years during both phases.

Table 9 shows the total economic impacts of the O&M phase of EW 1.

Table 9: Empire Wind 1 O&M Total Economic Impacts (2020$ MUSD)

Impact	Gross State Product (Value Added)	Personal Income
Direct	215.8	137.9
Indirect	158.4	103.4
Induced	119.6	68.0
Total	**493.8**	**309.3**

O&M is expected to produce direct value-added economic output and direct personal income impacts of $215.8 million and $137.9 million, respectively. Including indirect and induced impacts, O&M investments under EW 1 are expected to generate total economic output in NYS of close to one-half billion dollars about $494 million over the roughly 34-year time period. In terms of total personal labor income, EW 1 is expected to generate almost $310 million in the same 34-year time period.

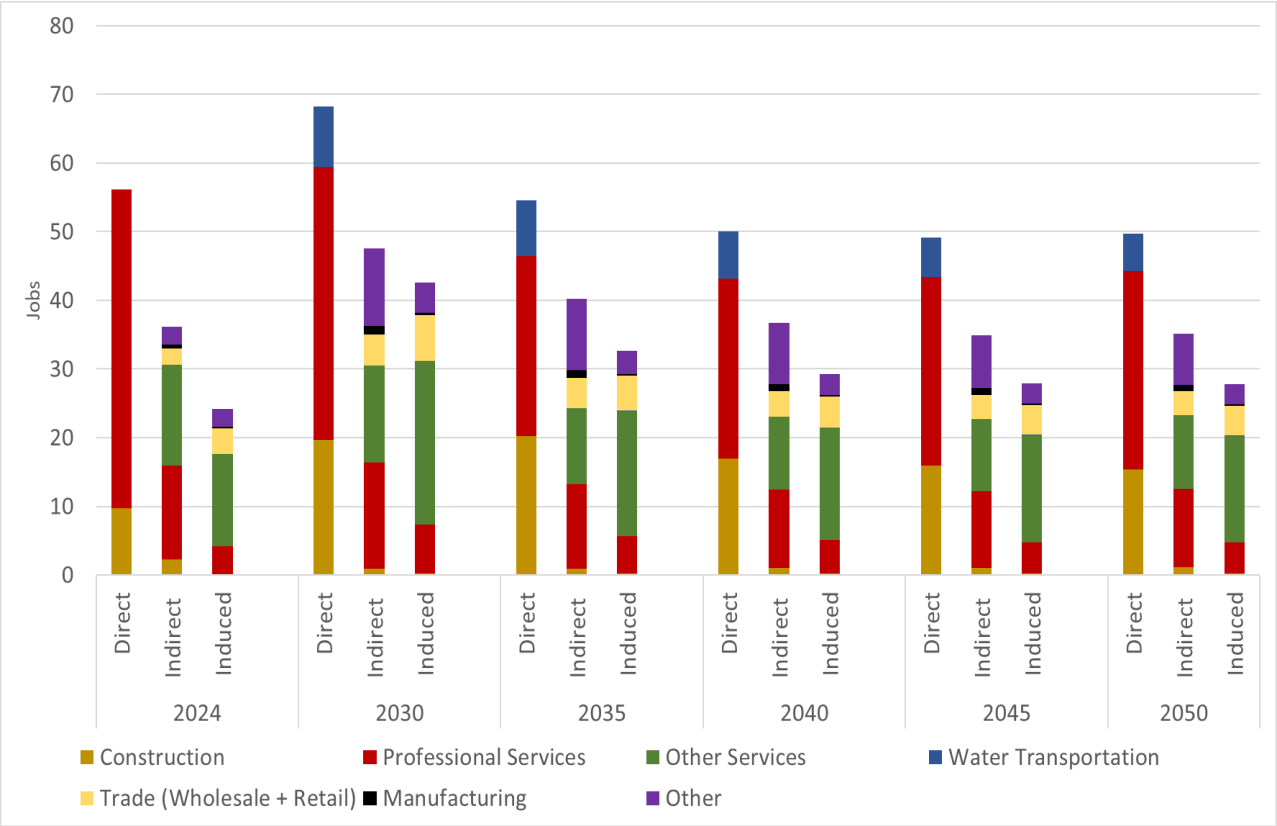
Table 10 below presents the fiscal impacts related to the operations phase of EW 1. Federal tax revenues and total state and local tax revenues are estimated at $63 million and about $49 million, respectively, for a total fiscal impact of about $112 million in the 34-year time period.

Table 10 Empire Wind 1: O&M Tax Impacts

State and Local Tax	Federal Tax	Total Tax
48.8	63	**111.8**

Figure 3 below presents the detailed sectoral job impacts by year for representative years only, separated by direct, indirect, and induced employment impacts.

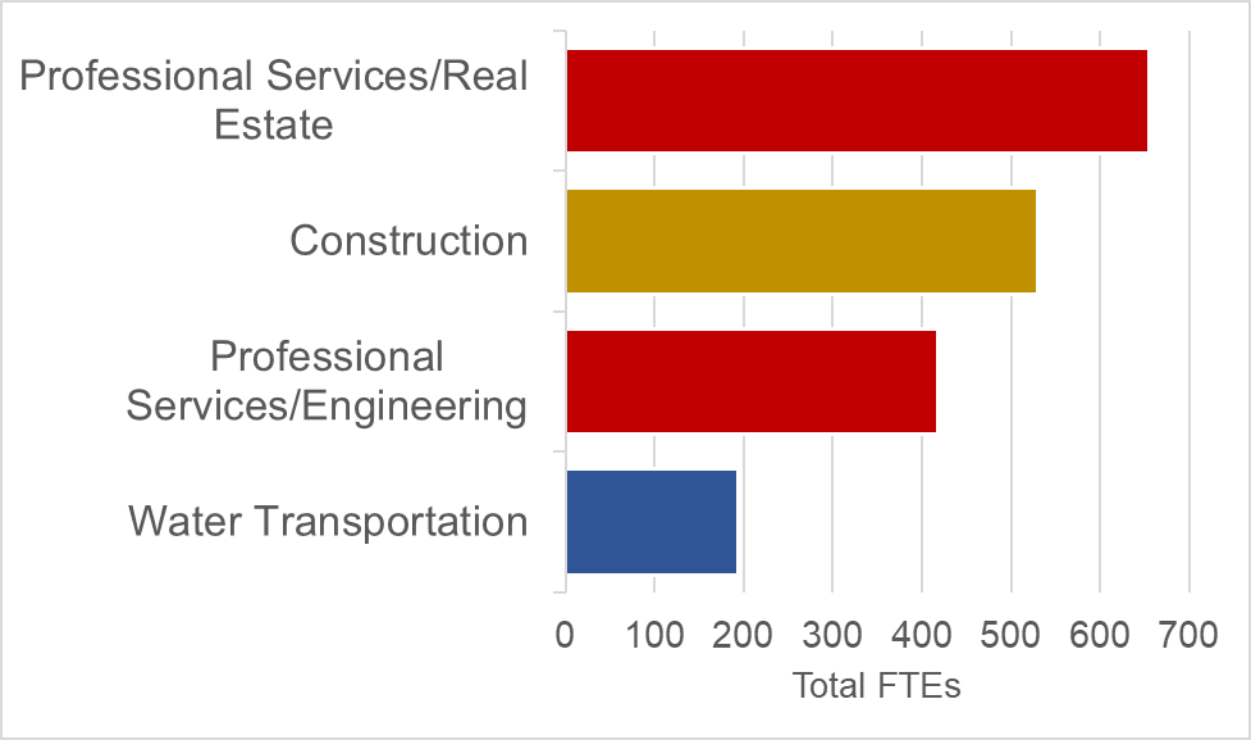
Figure 3: Empire Wind 1 Total O&M Jobs by Sector



A significant portion of the job impacts come from service sectors in NYS, including real estate services (for land lease payments) and other professional and technical services. Construction accounts for about 30% of the total job-years, concentrated mostly in the direct FTEs, which includes sectors such as maintenance and repairs. Another major beneficiary of state job impacts is the sector related to water transportation, which accounts for about 11% of the total jobs. And as expected, manufacturing sector impacts are relatively small for a state like NY, given its limited manufacturing activity. There are likely to be significant spillover impacts for manufacturing jobs that are likely to benefit other states in the U.S., but those were outside the scope of this study.

Figure 4 shows the sectoral *direct* only job impacts over the entire O&M phase of the project that shows the cumulative job-years that could be supported in these sectors over time.

Figure 4: Empire Wind 1 Direct O&M Job-Years by Sector



Significant investments in real estate is expected to support a total of 655 direct job-years over the 34 year time period. Most other direct long-term jobs due to O&M are expected to be split between support activities for construction and professional services positions such as engineers and project managers. A smaller number of long-term direct jobs related to water transportation are expected in the facilities support services sector.

Empire Wind 2 Economic Benefits

EW 2 is being planned with an estimated total investment in NYS only of over $1.5 billion. EW 2 is estimated to provide significant economic benefits to New York (and outside NYS as well) by supporting both temporary and permanent jobs, increasing GSP and workers income, as well as contributing to local, state, and federal taxes, both during the construction and operations phases of the facility.

Construction Phase Economic Impacts

Table 11 presents job impacts associated with the construction phase of EW 2. Recall that the construction phase of EW 2 is expected to lead to almost $508 million in investments in NYS on activities related to staging and installation of WTGs and significant investments related to substation and interconnection costs. All these investments are expected to support about 2,154 direct FTEs during the entire construction period, or between 2020 and 2027. Including indirect and induced impacts, this portion of the project could result in over 4,000job-years in NYS for the total construction phase. Given that the in-state investment levels for EW 2 are higher than those for EW 1 ($508 million for EW 2 compared to $281 million for EW 1), total employment impacts for EW 2 are also higher at over 4,000 job-years compared to around 2,300 job-years for EW 1.

Table 11: Empire Wind 2 Construction Job Impacts

Impact	Annual Jobs	Cumulative Job-Years
Direct	269	2,154
Indirect	96	764
Induced	141	1,127
Total	**506**	**4,046**

In terms of average annual impacts, the construction phase of EW 2 is expected to support roughly about 269 direct jobs/year and an additional 237 secondary jobs (i.e., indirect and induced) for a total of 506 jobs/year in average annual terms. Thus, similar to the trends seen for EW 1, over one-half of the jobs are estimated to be direct with the remaining split between indirect or induced secondary employment impacts.

Table 12 below shows the total economic impacts of EW 2's construction phase in terms of state output and income. Construction and installation is expected to produce over $500 million in state economic output. For total personal income, this phase could generate around $340 million in income for state residents from all of the economic activity expected to take place for EW 2. Out of these total amounts, *direct* value added and personal income impacts could be over $270 million and almost $200 million, respectively. These correspond to more than 50% of the total impacts, similar to the trends observed in the employment impacts. Additionally, the indirect and

induced impacts during the construction and installation phase for EW 2 is expected to generate an additional $232 million in state output and another $143 million or so in state income.

Table 12: Empire Wind 2 Construction Total Economic Impacts

Impact	Value Added (2020$ MUSD)	Personal Income (2020$ MUSD)
Direct	273.9	197.9
Indirect	99.9	67.4
Induced	132.2	75.2
Total	**506.0**	**340.5**

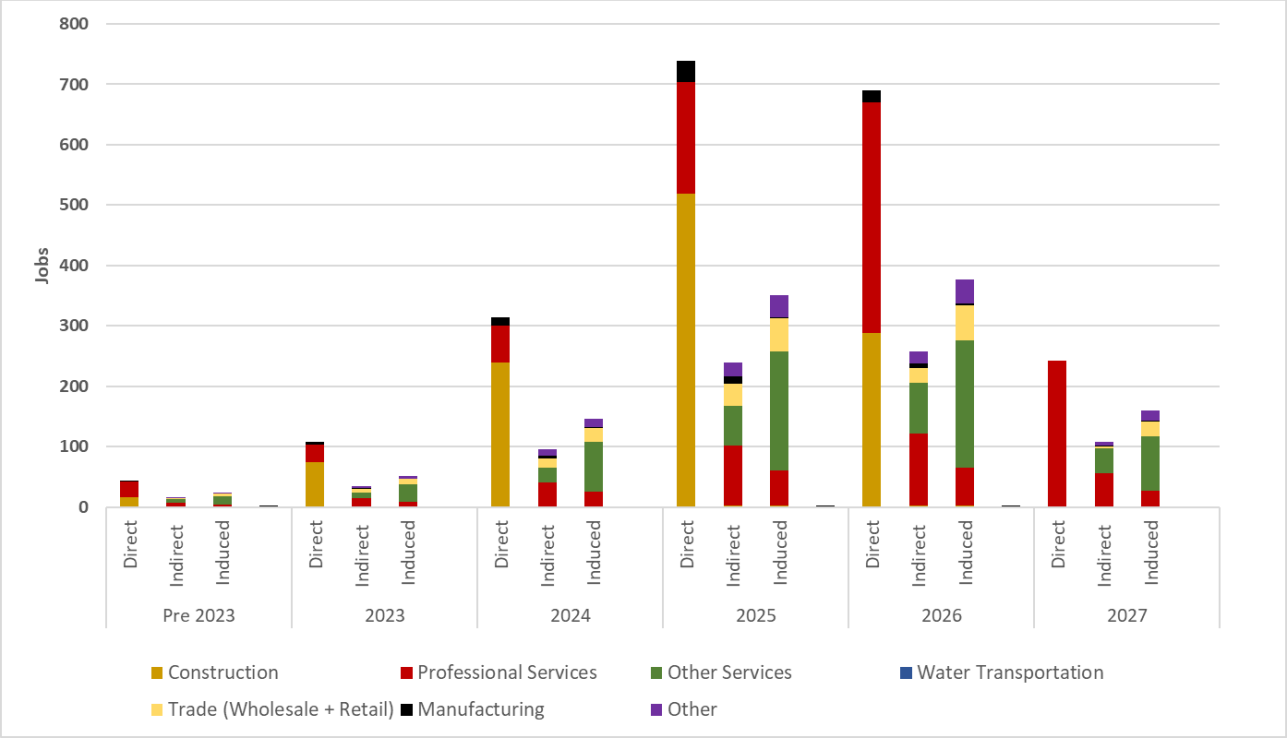
Table 13 shows the fiscal impacts of EW 2's construction phase. EW 2 is expected to generate roughly $43 million in state and local taxes and roughly $67 million in federal tax revenues during the construction phase, for a total of almost $110 million in total fiscal impacts for the local, state and federal coffers. Again, similar to the trends seen above, fiscal impacts of EW 2's construction phase are estimated to be higher than EW 1, which totaled about $63 million.

Table 13: Empire Wind 2 Construction Tax Impacts

State and Local Tax	Federal Tax	Total Tax
42.6	67.1	**109.7**

Figure 5 shows the detailed sectoral job impacts during the construction phase for the years with significant construction activities, separated by direct, indirect, and induced employment impacts. Sector definitions used for this Figure are consistent with those used for EW 1 above for comparison purposes. Sectors were grouped into broader sector categories, including construction, professional services, other services, water transportation, trade, manufacturing and other. Other services include food & beverage services, hospitality services, laundry services, recreational activity services, and more. Sectors in the "other" category include agriculture, resource mining, power generation, and other miscellaneous sectors.

Figure 5: Empire Wind 2 Construction Sectoral Jobs

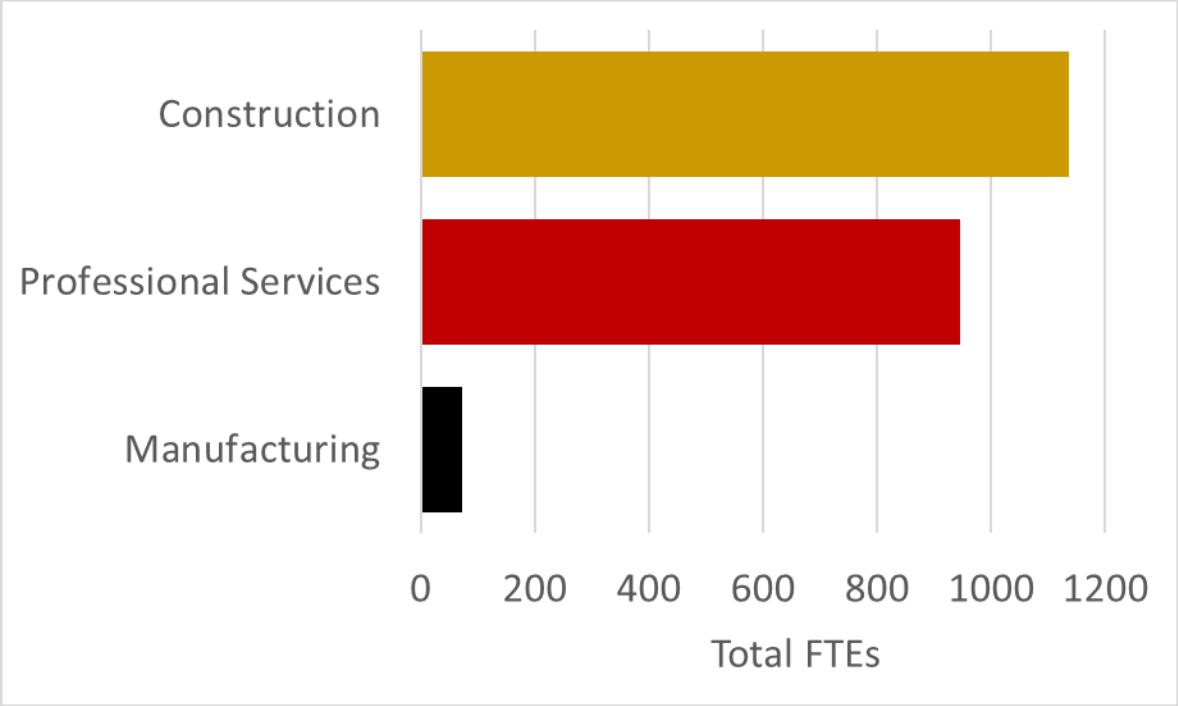


** Pre 2023 includes 2020, 2021, and 2022. Some 2027 professional services impacts may extend beyond for a couple more years.*

Note that while the construction phase modeled here is expected to last from 2020 to 2027, most of the economic impacts are expected to occur between 2024 and 2027. For the other years, we expect nominal impacts due to development studies needed in association with the actual construction activities. Two of the biggest beneficiaries of the EW 2 construction activities are expected to be the construction sectors (especially as they relate to the direct jobs) as well as the various service sectors, including professional and technical services as well as other services, primarily driven by secondary job impacts. Some residual benefits also accrue to selected manufacturing sectors.

Because of the importance of direct jobs on the overall socioeconomic benefits of Empire, Figure 6 below shows the sectoral direct only job impacts over the construction phase of the project that shows the cumulative job-years that could be supported in these sectors over time. The majority of direct jobs generated by construction investments are in the construction sector, with 1,136 total jobs. The professional services and manufacturing sectors also generate a significant number of direct jobs with 945 and 73 total jobs, respectively.

Figure 6: Empire Wind 2 Construction Direct Jobs by Sector



Operations and Maintenance Phase Economic Impacts

The following section describes the impacts and benefits that are expected from the O&M phase of the EW 2 project. This phase consists of upkeep of the project infrastructure, operations of the facilities, and real estate costs associated with operation.

Table 14 presents employment impacts during this O&M phase of EW 2 which will span from 2022 to 2055. Given that EW 2 is expected to have a higher generation capacity compared to EW 1, permanent jobs associated with EW 2 are also expected to be higher in NYS compared to EW 1.

Table 14: Empire Wind 2 O&M Job Impacts (2022-2055)

Impact	Annual Jobs	Cumulative Job-Years
Direct	80	2,723
Indirect	56	1,887
Induced	46	1,563
Total	**182**	**6,173**

EW 2 is expected to support 80 direct, long-term permanent jobs for operating the facility, along with an additional 56 indirect and 46 induced jobs every year. Cumulatively, EW 2 will support close to 6,200 total job-years during the entire lifespan of EW 2, with roughly 45% of those in

direct (about 2,700 job-years in total) and around 1,500 and 1,900 job-years each for indirect and induced. Note that these jobs are in addition to the over 5,100 job-years associated with the construction phase, for a total of more than 11,200 job-years during both phases.

Table 15 shows the total economic impacts of the entire O&M phase of EW 2, expressed as total value added GSP and personal income. EW 2 is estimated to generate roughly $327 million in direct value added GSP and roughly $209 million in direct personal income during its O&M phase. We anticipate an additional over $422 million in secondary GSP (indirect plus induced) and about $260 million in secondary income benefits for NYS.

Table 15: Empire Wind 2 O&M Total Economic Impacts

Impact	Value Added (2020$ MUSD)	Personal Income (2020$ MUSD)
Direct	327.3	209.3
Indirect	240.6	157
Induced	181.8	103.4
Total	**749.7**	**469.8**

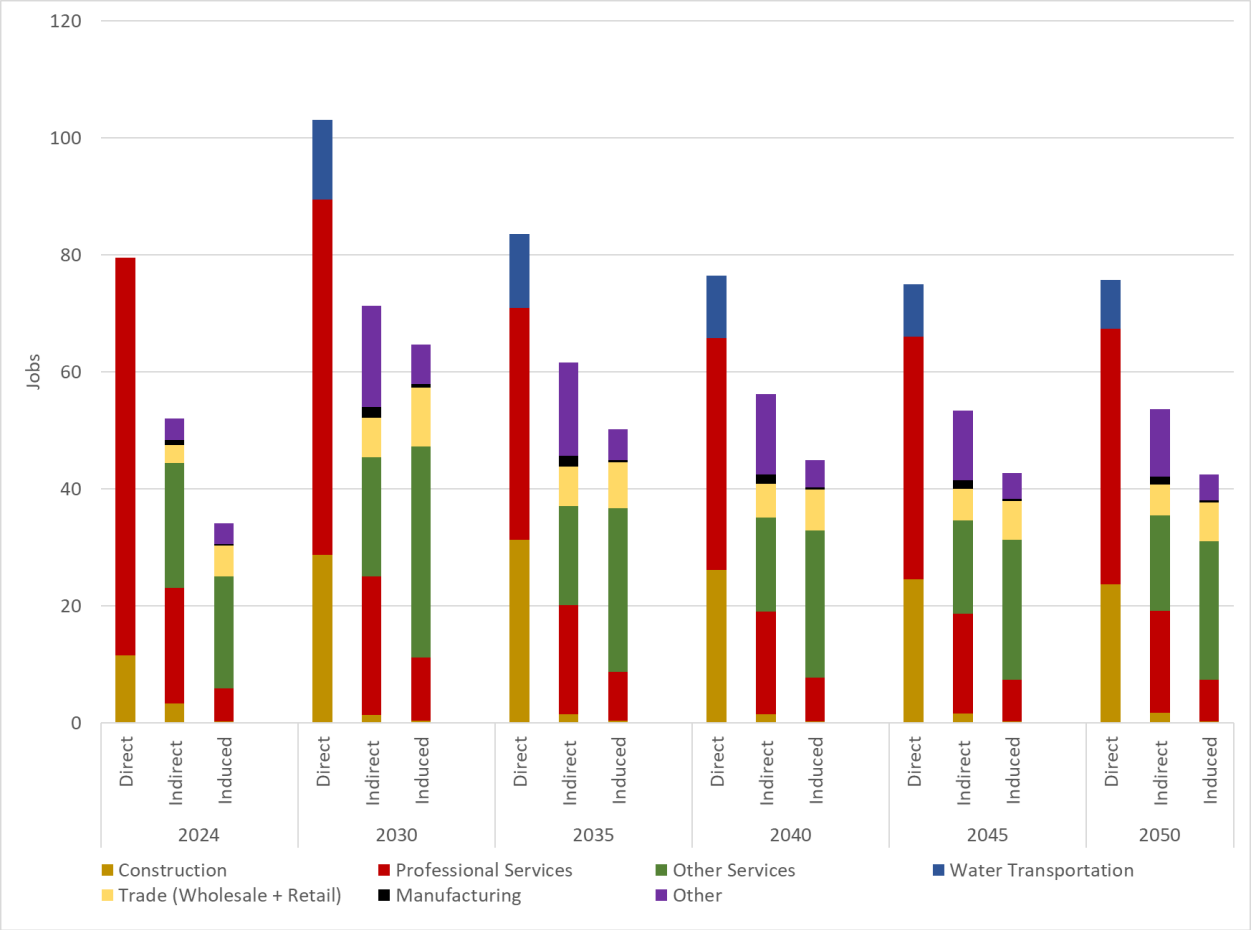
Table 16 describes the fiscal impacts of EW 2's O&M phase. EW 2 is expected to generate roughly $74 million in state and local taxes and over $95 million in federal tax revenues during the O&M phase. Thus, in aggregate, EW 2 is expected to generate almost $170 million in various fiscal impacts during the 35 years of operations in NYS.

Table 16: Empire Wind 2 O&M Tax Impacts

State and Local Tax	Federal Tax	Total Tax
74.1	95.7	**169.8**

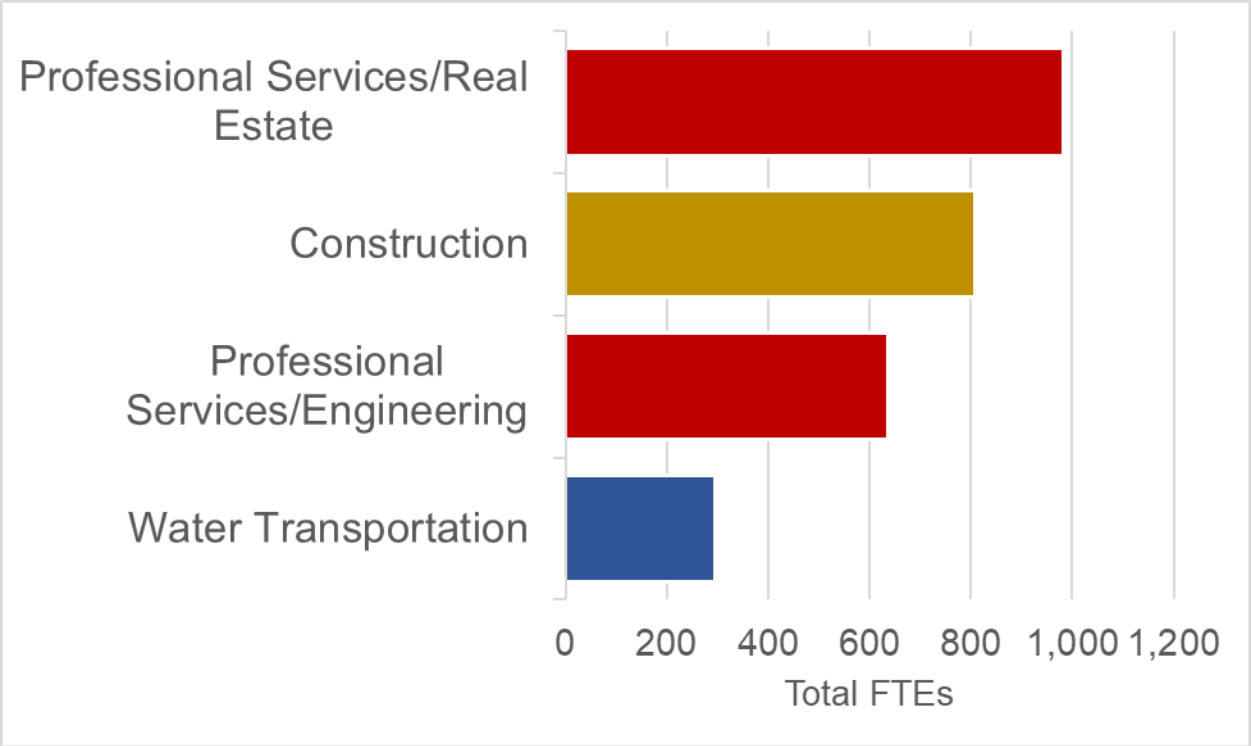
Figure 7 presents the detailed sectoral job impacts from investments made during the O&M phase of EW 2, separated by direct, indirect and induced job categories. Note that the O&M phase spans from 2022 to 2055, but for brevity, only selected years are shown in the Figure below.

Figure 7: Empire Wind 2 O&M Sectoral Jobs



Similar to the trends seen above, most of the job benefits accrue to service sectors in NYS, including real estate services for the land lease payments as well as other professional and technical service sectors. Some job benefits also accrue to construction, water transportation and wholesale and retail trade sectors in NYS. The direct job impacts are primarily concentrated in the service and construction related sectors, with additional jobs in the water transport related sectors in out years. As one would expect, wholesale and retail trade related sectors benefit from secondary job impacts from the upstream supply chain activities driving indirect job impacts as well as downstream consumer spending activities driving induced job impacts. Given the importance of the direct jobs in understanding the socioeconomic benefits of these investments, Figure 8 shows the sectoral breakdown of the direct jobs only over the entire O&M phase of the project that shows the cumulative job-years that could be supported in these sectors over time.

Figure 8: Empire Wind 2 O&M Direct Jobs by Sector



From the O&M phase, real estate accounts for 36% of direct jobs. An additional 23% of direct jobs comes from the professional services sector, which includes architectural, engineering, and related services, as well as other real estate. Construction accounts for about 30% of direct jobs, which includes services such as maintenance and repair activities. The rest of the direct jobs come from water transportation, which accounts for about 11%.

Conclusion

Empire's investments in EW 1 and EW 2 in NYS are expected to generate significant local economic benefits, including support for short- and long-term jobs, additional economic output and increased personal income for NYS residents. In addition, these economic benefits will also benefit the community through workforce development and green initiatives. Finally, these investments will help further the development of offshore wind in NYS and enhance the relevance of NYS as a key player in the U.S. offshore wind industry.

Table 17 summarizes the employment impacts of both EW 1 and EW 2 for the scenarios studied.

Table 17: Summary Economic Impacts

	Empire Wind 1		Empire Wind 2		Total	
	Development/ Construction (2019-2025)	**O&M (2021-2054)**	**Development/ Construction (2020-2027)**	**O&M (2022-2055)**	**Development/ Construction (2019-2027)**	**O&M (2021-2055)**
Direct	1,261	1,797	2,154	2,723	3,415	4,520
Indirect	421	1,244	764	1,887	1,185	3,131
Induced	645	1,029	1,127	1,563	1,772	2,591
Total	**2,326**	**4,069**	**4,046**	**6,173**	**6,372**	**10,242**

Based on the data provided by Empire, this study estimates that the scenarios studied for EW 1 and EW 2, located off the coast of New York, are expected to support over 16,600 total job-years in the state over the entire life of the two facilities. Of these, over 6,300 job-years are expected to be short-term construction related opportunities in NYS. The remaining over 10,000 job-years are expected to be more permanent long-term opportunities associated with the operation of the two facilities. About 50% of these jobs are expected to be direct jobs in sectors that will contribute directly to the facilities, with the remaining 50% or so coming from secondary (indirect and induced) job impacts. And because EW 2 is a larger facility compared to EW 1, with a greater number of turbines, the relative contributions of the two facilities follow similar patterns, with roughly 60% of the impacts associated with EW 2 and the remaining 40% associated with EW 1. On an average annual basis, EW 1 is expected to support over 180 jobs per year, calculated over a 35-year time period, and EW 2 is expected to support over 280 jobs per year in NYS, calculated over a 36-year time period, for a combined total of around 460 FTEs annually.

In addition to the estimated job impacts shown in Table 17 above, Empire is also investing in various community development and workforce training and readiness funds in the state. Empire estimates that the aggregate value for these funds could be between $25 million and $30 million for *both* EW 1 and EW2, over the entire lifetime of the two facilities (2019 – 2055). The actual annual contributions of these funds are relatively small at less than a $1 million per year and are likely to support an additional 10 – 15 jobs annually in the state for the entire 30+ years of

operation. More importantly, however, the socioeconomic impacts of these contributions by Empire are likely to be far greater than the jobs they will support in the region. These funds will provide vital resources in supporting workforce training and readiness and help support efforts for just transition of the workforce, while also providing benefits to the local communities as they rebound from the Covid-19 induced recession.

In terms of the construction and operations phase of the two facilities, most of the over 2,300 construction job-years for EW 1 and over 4,000 construction job-years for EW 2 are a result of the investments in employment and procurement related to the construction of WTGs, an offshore substation, submarine export cables, an onshore substation, and transporting various components to the project site. Longer term O&M job-years (cumulatively about 4,000 for EW 1 and almost 6,200 for EW 2) come from the need for upkeep of the project infrastructure, operations of the facilities, and real estate costs associated with operation.

Table 18 presents the total economic impacts of EW 1 and EW 2.

Table 18: Total Economic Impacts (2020$ MUSD)

Impact	Gross State Product (Value Added)	Personal Income
Direct	969.8	659.2
Indirect	553.5	365.6
Induced	509.2	289.7
Total	**2,032.5**	**1,314.4**

Combined, EW 1 and EW 2 are expected to generate over $2.0 billion in cumulative GSP over the life of the facilities, along with around $+1.3 billion in personal income. Of these amounts, around $970 million in GSP and about $660 million in personal income are estimated to be the direct contributions of EW 1 and EW 2 with the remaining coming from indirect and induced effects.

Table 19 below presents the total fiscal impacts of EW 1 and EW 2. Cumulatively, the two combined projects are estimated to contribute $191 million in state and local taxes, and another $264 million in federal taxes, resulting in a total of over $450 million in total fiscal contributions.

Table 19: Total Tax Impacts

State and Local Tax	Federal Tax	Total Tax
190.5	264.2	**454.7**


ICF