Economic Development and Jobs Analysis for the South Fork Wind Farm and the South Fork Export Cable

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1. EXECUTIVE SUMMARY

This advisory opinion was prepared by Navigant Consulting Inc. ("Navigant") at the request of Ørsted North America ("Ørsted") to conduct an analysis that estimates direct, indirect, and induced jobs and economic outputs that will result from the development of the South Fork Wind Farm ("SFWF") and the South Fork Export Cable ("SFEC"), collectively the "Project". This analysis was prepared to be submitted to the Bureau of Ocean Energy Management ("BOEM") and others as a key part of the project development and permitting process.

Navigant implemented two analyses to estimate impacts for this project: 1). In the United States (including New York state), and 2). In New York state.[1] The SFWF includes up to 15 wind turbine generators located in federal waters on the OCS, approximately 35 miles east of Montauk Point, NY and the SFEC is an electric cable that will connect the SFWF to the existing mainland electric grid in East Hampton, NY.

1.1 Analysis Approach

To assess the economic benefits that will result from the development of the Project including evaluation of direct, indirect, and induced jobs, associated earnings, output and economic value, Navigant utilized the offshore wind industry's foremost and widely recognized Jobs and Economic Development Impact ("JEDI") Offshore Wind Model developed by the National Renewable Energy Laboratory ("NREL"). The JEDI Offshore Wind Model is an open-source economic modeling tool that allows users to demonstrate the economic impact to a given state or region of the construction and operation of an offshore wind project. More information about JEDI is provided in the Methodology and **Error! Reference source not found.** sections.

The primary source for the model inputs was Ørsted, who provided capital and operating budgets including costs, employment, and percent local data that are specific to the proposed project.[2] Navigant then integrated this data into the JEDI model format. In cases where project specific data was not available, Navigant used the JEDI default values for New York projects.

1.2 Summary Results

The Project will clearly have a positive economic impact and will add a significant number of jobs to the United States and to the state of New York. The Project's U.S. capital expenditures will be approximately $150 million and New York in-state capital expenditures will be approximately $49.1 million. In addition, the project will all have an ongoing significant positive impact for the full operations period.

Summary results for each analysis and data tables are presented below and at the end of each section, and further descriptions of the JEDI model and methodology are presented in **Error! Reference source not found.**. Direct jobs and economic impact are those resulting from the initial capital expenditure

[1] The United States analysis includes investments in New York state as well as all other states. Therefore, the numbers in the two provided sets of estimates are not additive.

[2] Although Navigant did not do a detailed due diligence on the data provided by Ørsted, our independent review of the data indicates that the values are consistent with what we could expect for a project of this magnitude and we did not find any apparent anomalies in the data.

including on-site labor and professional services; indirect impacts arise from purchases from other industries necessary to produce the direct purchases (i.e., a result of local revenues, equipment, and supply chain impacts); and induced are local expenditures (i.e., increased spending of household earnings) from those receiving payments within the first two categories.

For the United States (including New York state), as shown in Table 1-1, the Value Added that is attributable to the project is approximately $213.2 million in the construction phase (starting in 2020) and approximately $9.5 million on an annual basis in the operations phase (in 2018 dollars). The Project will support an estimated 1,741 local job-years[3] during the construction phase and approximately 87 additional local annual jobs during the operations phase.

Table 1-1. Summary of Jobs and Investment Impacts in the United States

Project Phase	Impact Categories	Jobs	Earnings (Millions USD)	Output (Millions USD)	Value Added (Millions USD)
Construction	Direct	332	$56.4	$90.5	$64.9
	Indirect	790	$51.2	$190.3	$85.9
	Induced	620	$37.2	$116.4	$62.3
	Total	**1,741**	**$144.7**	**$397.3**	**$213.2**
Operations (Annual)	Direct	10	$1.6	$1.6	$1.6
	Indirect	48	$3.3	$11.4	$5.0
	Induced	29	$1.8	$5.7	$2.9
	Total	**87**	**$6.7**	**$18.7**	**$9.5**

Notes: Earnings, Output and Value-Added figures are in millions of 2018 dollars. Construction job figures are in job years, which are full-time equivalent (FTE) jobs multiplied by the number of construction years. Operations jobs are FTEs for a period of one year. The analysis does not include impacts associated with spending of wind farm profits. Totals may not add up due to independent rounding.

For New York state, as shown in Table 1-2, the Value Added that is attributable to the project is approximately $57.1 million in the construction phase (starting in 2020) and approximately $3.9 million on an annual basis in the operations phase (in 2018 dollars). The Project will support an estimated 413 local job-years[4] during the construction phase and approximately 31 additional local annual jobs during the operations phase.

[3] Job-years during the construction phase are defined as full-time equivalent (FTE) jobs multiplied by the number of construction years.
[4] Job-years during the construction phase are defined as full-time equivalent (FTE) jobs multiplied by the number of construction years.

Table 1-2. Summary of Jobs and Investment Impacts in New York

Project Phase	Impact Categories	Jobs	Earnings (Millions USD)	Output (Millions USD)	Value Added (Millions USD)
Construction	Direct	192	$31.1	$33.3	$31.8
	Indirect	139	$10.2	$33.9	$15.8
	Induced	82	$5.9	$14.7	$9.5
	Total	**413**	**$47.1**	**$81.9**	**$57.1**
Operations (Annual)	Direct	6	$0.9	$0.9	$0.9
	Indirect	18	$1.5	$4.5	$2.2
	Induced	7	$0.5	$1.3	$0.8
	Total	**31**	**$2.9**	**$6.8**	**$3.9**

Notes: Earnings, Output and Value-Added figures are in millions of 2018 dollars. Construction job figures are in job years, which are full-time equivalent (FTE) jobs multiplied by the number of construction years. Operations jobs are FTEs for a period of one year. The analysis does not include impacts associated with spending of wind farm profits. Totals may not add up due to independent rounding.

2. INTRODUCTION

2.1 Background

In 2015, the Long Island Power Authority (LIPA) implemented a competitive bid process to determine a cost-effective way to supply the South Fork's energy needs. LIPA received over a dozen proposals including several options for new fossil-fired power plants and solar installations. After considering all these options, and transmission alternatives as well, LIPA concluded that Ørsted's proposed South Fork Wind Farm was part of the most cost-effective portfolio to serve the area's need. The offshore wind farm will also help the Towns of East Hampton and Southampton meet their 100% renewable energy goals and New York State achieve its goal of 50% clean energy by 2030.

The South Fork needs new sources of power to meet its demand, which is growing faster than any other part of Long Island. When energy usage is highest, the wind farm will complement existing power sources to help ensure the area has enough power during peak hours. When energy needs are lower, the wind farm will generate enough electricity to power a significant portion of the South Fork. The wind farm will produce enough clean, renewable energy every year to power 50,000 typical homes and will also serve to offset emissions and improve overall public health.

Ørsted will fund 100% of the cost of building the Project and will be paid a competitive rate by LIPA for the energy it delivers to the East Hampton substation. Ørsted is committed to playing a positive role in the Long Island community including contributing to the local and state economy and creating new jobs for the area. The construction and operations of the wind farm will ultimately help to launch a local offshore wind industry on Long Island and the broader New York area.

2.2 Project Definition

This analysis includes two assessments of estimated jobs and economic output that result from the construction and operation of the Project: 1). for the United States, and 2). for New York state. The national assessment captures regional benefits in addition to the state of New York.

The SFWF will be located approximately 35 miles from Montauk Point, NY. SFWF includes up to 15 WTGs with a nameplate capacity of 6 to 12 MW per turbine, submarine cables between the WTGs (inter-array cables), and an offshore substation (OSS), all of which will be located within federal waters on the OCS, specifically in BOEM Renewable Energy Lease Area OCS-A-0486. The SFWF will also include an O&M facility in Montauk, New York. The SFEC will be located in both federal and New York state territorial waters. The SFEC includes an electric cable that will connect the SFWF to the existing mainland electric grid in the Town of East Hampton, New York. The SFEC includes a new interconnection facility.

The construction period for the Project is expected to begin in 2020, and the Project is scheduled to achieve commercial operations by the end of 2022. The facilities are expected to be in operation for 25 years from 2023 to 2047, at which point decommissioning will be initiated. Navigant does not typically include analysis of the decommissioning phase because these activities will not take place for multiple decades from now (more than 25 years in this case), resulting in highly speculative estimates. Most offshore wind project economic development analyses do not attempt to create decommissioning estimates because it occurs so far into the future and the additional benefits are negligible.

3. METHODOLOGY

3.1 JEDI Offshore Wind Model

The JEDI models rely on the widely recognized and well-known input/output (I/O) multiplier data provided by the Minnesota Impact Analysis for Planning (IMPLAN) Group. Offshore wind is the latest addition to this suite, which already includes biofuels, coal, concentrating solar power, natural gas, solar photovoltaics, land-based wind, and marine/hydrokinetic power.[5] JEDI uses a methodology similar to 'analysis by parts' to simulate a customized offshore wind industry with the IMPLAN multipliers by aggregating industry sectors into relevant categories for offshore wind.[6] Please refer to Appendix A for more information on the JEDI models.

JEDI requires detailed estimates of project expenditures and the share of each individual expenditure line item that is procured locally. These data must be developed for both the construction and operations period of the plant life cycle. As offshore wind is only a nascent industry in the U.S. and only one project has been completed in the U.S. (Ørsted's Block Island Wind Farm), the JEDI Offshore Wind Model relies on projected costs for individual project elements. This analysis evaluates resulting impacts for the construction and operations of this project.

JEDI requires expenditure data that approximates the expected engineering, material, and office costs as well as labor requirements for proposed infrastructure projects to estimate the economic impact within the New York or U.S. economy. JEDI captures all monetary transactions for expenditures and consumption. Inputs to JEDI include projected capital and operational costs and the percentage local assumptions for each line item. In this report, percentage local means the percentage of expenditures that will occur either in the state of New York or in the total U.S.

JEDI's outputs include estimates of the effects of a change in one or several economic activities on the regional, state, or local economy. Under the JEDI framework, economic activities include Jobs, Earnings, Output, and Value Added.

Direct jobs are defined as on-site labor and professional services. Construction jobs are given as FTE job-years since they are spread over a multi-year construction period. Job-years are defined as full-time equivalent (FTE) jobs multiplied by the number of construction years. Some construction jobs will last only a portion of a year while others may last the entire expected construction period of multiple years. Operations jobs are given as annual FTE jobs over the entire operating period.

Indirect jobs are driven by the increase in demand for goods and services from direct on-site project spending. Indirect jobs are in companies like construction material and component suppliers, analysts and attorneys involved with project feasibility assessments or contract negotiations, equipment or replacement part manufacturers and others.

[5] NREL's JEDI models are publicly available spreadsheet tools that apply state-specific IMPLAN year 2014 multipliers. The JEDI analysis tools were developed by NREL in conjunction with MRG & Associates. For more information on the JEDI tools, see Appendix A or http://www.nrel.gov/analysis/jedi/.

[6] The 14 categories include: 1. Agriculture 2. Construction 3. Electrical equipment 4. Fabricated metals 5. Finance, insurance, and real estate 6. Government 7. Machinery 8. Mining 9. Other manufacturing 10. Other services 11. Professional services 12. Retail trade 13. Transportation, communication, and public utilities 14. Wholesale trade

Induced jobs are driven by the local expenditures of those receiving payments within the direct and indirect categories. These jobs are typically associated with those resulting from increased business at local restaurants, entertainment and retail establishments as well as child care providers or any other entity affected by the increased economic activity and spending occurring from direct and indirect impacts.

Labor Earnings encompass the additional earnings (wages and employer paid benefits) associated with the additional local jobs.

Gross Output is the sum value of all goods and services at all stages of production (i.e., as a raw material and as a finished product) resulting from the project.

Value Added is the best indicator of economic development benefits to the local New York or U.S. economy. The total of value added of all enterprises and self-employed in a given state comprises that state's GDP. These values are the sum of earnings from capital and labor or the difference between total gross output and the cost of intermediate inputs. It is comprised of payments made to workers, proprietary income, other property type income, indirect business taxes, and taxes on production and imports less subsidies.

These terms are further defined in Appendix A. Table 3-1 shows the categories of jobs and investment impacts that are included in the analysis, along with examples of expenditures in each category.

Table 3-1. Categories of Jobs and Investment Impact

Impact Categories	Construction	Operations
Direct	• Project development (engineering, design, permitting, surveys, and other professional services) • Onsite labor including contractors and crews hired to construct the plant	• Onsite labor for operation and maintenance of the plant (plant technicians, operators, management, and administration)
Indirect	• Turbine and supply chain (inter-industry purchases of materials, equipment, manufacturing, and other services)	• Local revenue (sales and property taxes and ROI for local owners) • Supply chain (components, off-site labor)
Induced	• Increased spending of household earnings from project development and on-site labor impacts as well as turbine and supply chain impacts. This includes increased business at local restaurants, hotels, and retail establishments, childcare providers and service providers.	

3.2 Data Collection and Assumptions

Ørsted provided Navigant with the raw cost, employment, and percent local data for the project, which serve as the primary inputs to the JEDI model. Data was provided in three basic categories: project descriptive data, capital costs, and operations & maintenance (O&M) costs.

The total capital expenditures are estimated to be between approximately $833 million in nominal dollars.[7] Operations expenditures are expected to occur during the period 2023-2047. Total annual operations expenditures are estimated at approximately $17 million.[8]

Navigant made the following assumptions based on the data provided by Ørsted:

- All operation and maintenance costs are averaged over total years of operation.
- For both the U.S. and the state of New York, sales taxes are assumed to be 0%.[9]
- For both New York and the U.S., property taxes are assumed to be 0% based on renewable energy property tax exemptions in New York, New Jersey, Rhode Island, Massachusetts, and Connecticut.[10]
- All jobs are assumed to have a 30% employee payroll overhead cost based on data provided by Ørsted.
- Impacts of annual lease payments to BOEM are not included.

4. RESULTS

The following subsections present the estimated economic project impacts on income, employment opportunities, wages and output. Direct effects include those due to the initial capital expenditure. Indirect effects arise from purchases from other industries in the state necessary to produce the direct purchases. Induced effects come from increased spending of household earnings from project development and on-site labor impacts as well as turbine and supply chain impacts on goods and services provided by businesses in the specific area (e.g., businesses in the U.S. and in New York state for this analysis). This includes increased business at local restaurants, hotels, and retail establishments, childcare providers and service providers.

4.1 United States Benefits

A summary of the Project's potential overall economic benefits in the United States including Value Added, Local Jobs, Labor Earnings, and Gross Output are shown in Table 4-1.[11]

Value Added. The total Value Added from the Project is $213.2 million during the expected two-year construction phase and $9.5 million per year (in 2018 dollars) during the operations phase.

[7] Note that this capital cost estimate does not include costs associated with financing or taxes.

[8] Note that this operation cost estimate does not include financing or taxes.

[9] Navigant does not offer tax advice and therefore, this document does not attempt to take a position on the Project's sales tax liability.

[10] Property tax exemptions for renewables can be found here: http://programs.dsireusa.org/system/program?fromSir=0&state=NY

[11] This analysis includes New York state and is not additive to the following New York state benefits section.

Based on the JEDI analysis, the Project is expected to account for a total of 1,741 job-years in the construction phase and 87 FTE jobs on an annual basis during the operations phase. These additional jobs result from the increased spending from the Project in the U.S.

Direct jobs. The Project will result in 332 national direct job-years in the development and construction phase and 10 FTE national direct annual jobs in the operations phase. 332 job-years during the 2-year construction phase is equivalent to 166 jobs each lasting 2 years. "National" is defined by jobs in the United States.

Indirect jobs. The Project will result in 790 national indirect job-years in the construction phase and 48 FTE national indirect annual jobs in the operations phase.

Induced jobs. The Project will result in 620 national induced job-years in the construction phase and 29 FTE national induced annual jobs in the operations phase.

Labor Earnings. The effect on wages or Labor Earnings is estimated as a total increase of $144.7 million (in 2018 dollars) in the construction phase and $6.7 million per year in the operations phase.

Gross Output. National Gross Output is estimated as $397.3 million in the construction phase and $18.7 million annually in the operations phase.

Total national capital expenditures in the U.S. are estimated at approximately $150 million in nominal dollars.[12] Operations expenditures are expected to occur during the period 2023 to 2047. Total annual operations expenditures in the U.S. are estimated at approximately $7 million.

Table 4-1. Summary of Jobs and Investment Impacts in the United States

Project Phase	Impact Categories	Jobs	Earnings (Millions USD)	Output (Millions USD)	Value Added (Millions USD)
Construction	Direct	332	$56.4	$90.5	$64.9
	Indirect	790	$51.2	$190.3	$85.9
	Induced	620	$37.2	$116.4	$62.3
	Total	**1,741**	**$144.7**	**$397.3**	**$213.2**
Operations (Annual)	Direct	10	$1.6	$1.6	$1.6
	Indirect	48	$3.3	$11.4	$5.0
	Induced	29	$1.8	$5.7	$2.9
	Total	**87**	**$6.7**	**$18.7**	**$9.5**

Notes: Earnings, Output and Value Added figures are in millions of 2018 dollars. Construction job figures are in job years, which are full-time equivalent (FTE) jobs multiplied by the number of construction years. Operations jobs are FTEs for a period of one year. The analysis does not include impacts associated with spending of wind farm profits. Totals may not add up due to independent rounding.

[12] Note that this capital cost estimate does not include costs associated with financing and includes a tax rate of 5.66%.

4.2 New York Benefits

A summary of the Project's potential overall economic benefits for the project in the state of New York including Value Added, Local Jobs, Labor Earnings, and Gross Output are shown in Table 4-2.

Value Added. The total Value Added from the 120 MW project is $57.1 million during the expected two-year construction phase and $3.9 million per year (in 2018 dollars) during the operations phase.

Based on the JEDI analysis, the Project is expected to account for a total of 413 job-years in the construction phase and 31 FTE jobs on an annual basis during the operations phase. These additional jobs result from the increased spending from the Project in the state of New York.

Direct jobs. The Project will result in 192 local direct job-years in the development and construction phase and 6 FTE local direct annual jobs in the operations phase. 192 FTE job-years during the 2-year construction phase is equivalent to 96 jobs each lasting 2 years. "Local" is defined by jobs in New York.

Indirect jobs. The Project will result in 139 local indirect job-years in the construction phase and 18 FTE local indirect annual jobs in the operations phase.

Induced jobs. The Project will result in 82 local induced job-years in the construction phase and 7 FTE local induced annual jobs in the operations phase.

Labor Earnings. The effect on wages or Labor Earnings is estimated as a total increase of $47.1 million (in 2018 dollars) in the construction phase and $2.9 million per year in the operations phase.

Gross Output. Local Gross Output is estimated as $81.9 million in the construction phase and $6.8 million annually in the operations phase.

Total local capital expenditures in New York are estimated at approximately $49.1 million in nominal dollars.[13] Operations expenditures are expected to occur during the period 2023 to 2047. Total annual operations expenditures in New York are estimated at approximately $4 million.[14]

Table 4-2. Summary of Jobs and Investment Impacts in New York

Project Phase	Impact Categories	Jobs	Earnings (Millions USD)	Output (Millions USD)	Value Added (Millions USD)
Construction	Direct	192	$31.1	$33.3	$31.8
	Indirect	139	$10.2	$33.9	$15.8
	Induced	82	$5.9	$14.7	$9.5
	Total	**413**	**$47.1**	**$81.9**	**$57.1**

[13] Note that this capital cost estimate does not include costs associated with financing and sales tax.
[14] Note that this operating cost does not include costs associated with financing and sales tax.

Operations (Annual)	Direct	6	$0.9	$0.9	$0.9
	Indirect	18	$1.5	$4.5	$2.2
	Induced	7	$0.5	$1.3	$0.8
	Total	**31**	**$2.9**	**$6.8**	**$3.9**

Notes: Earnings, Output and Value Added figures are in millions of 2018 dollars. Construction job figures are in job years, which are full-time equivalent (FTE) jobs multiplied by the number of construction years. Operations jobs are FTEs for a period of one year. The analysis does not include impacts associated with spending of wind farm profits. Totals may not add up due to independent rounding.

4.3 Conclusion

In summary, Table 4-1 shows the total Jobs and Value Added values for both the total U.S. and the state of New York only. These results are then further described after the summary table.

Table 4-1. Summary of Project Benefits at the State and National Level

		New York		United States	
Project Phase		**Jobs**	**Value Added**	**Jobs**	**Value Added**
Construction	Direct	192	$31.8	332	$64.9
	Indirect	139	$15.8	790	$85.9
	Induced	82	$9.5	620	$62.3
	Total	**413**	**$57.1**	**1,741**	**$213.2**
Operations (Annual)	Direct	6	$0.9	10	$1.6
	Indirect	18	$2.2	48	$5.0
	Induced	7	$0.8	29	$2.9
	Total	**31**	**$3.9**	**87**	**$9.5**

Notes: Value Added figures are in millions of 2018 dollars. Construction job figures are in job years, which are full-time equivalent (FTE) jobs multiplied by the number of construction years. Operations jobs are FTEs for a period of one year. The analysis does not include impacts associated with spending of wind farm profits. Totals may not add up due to independent rounding.

Navigant's analysis shows that for the total capital costs of about $833 million,[15] $49.1 million will be spent in New York, resulting in 413 total job-years and $57.1 million Value Added during the construction phase. Comparatively, about $150 million will be spent in the United States, or almost $101.1 million in

[15] This is given as a range because two different tax rates were used for model scenario: the New York model used 4% and the US model used 5.66%.

states other than New York, subsequently resulting in 1,741 total job-years and $213.2 million Value Added during the construction phase.

During the plant's 25 years of operation, $7 million will be spent annually in the United States, resulting in an estimated in 87 total annual jobs and $9.5 million Value Added per year in the operations phase. Approximately $3.98 million of that $7 million will be spent annually in New York resulting in 31 total annual jobs and $3.9 million Value Added per year.[16]

[16] Navigant has provided the above jobs and investment impacts on a best-efforts basis given the data available at the time of this analysis and the assumptions provided by Ørsted.

APPENDIX A. BACKGROUND ON MODELS

A.1 Background on JEDI Models

Economic development occurs when a specific area or region of interest secures new sources of investment and when at least a portion of those investments is captured by local businesses and individuals. Economic development analysis seeks to track new investments in a specific location, distinguish different types of expenditures in those regions, and then examine the impact of those investments in the given locality. For those expenditures that are local, the impacts entail the initial investment plus potential downstream effects in the supply chain and in the consumer and retail sectors of the economy. If an expenditure associated with a given project is not captured locally, it is treated as economic leakage and has no economic development value for the region of interest.

Economic development activity is typically estimated using input-output (I/O) models. I/O models apply historical relationships between demand (i.e., specific expenditures within a given sector of the economy) and the resulting economic activity to estimate how new expenditures will affect economic development metrics.

Although some I/O models incorporate dynamic elements, many are static (they measure inter-industry relationships for a given time period) and linear (they assume that any change in demand, regardless of magnitude, has the same proportional result). However, the inter-industry relationships utilized in I/O modeling tend to change only gradually over a long period of time, and I/O modeling is a widely used methodology for measuring economic development activity.

NREL has developed a set of I/O models known as the Jobs and Economic Development Impacts (JEDI) models. The JEDI models are Excel-based models that estimate the economic impacts of constructing and operating power plants, fuel production facilities, and other projects at the local (usually state) level. These models rely on the widely recognized and well known I/O multiplier data provided by the Minnesota IMPLAN Group. Offshore wind is the latest addition to this suite, which already includes biofuels, coal, concentrating solar power, natural gas, solar photovoltaics, wind, and marine/hydrokinetic power.[17] The Offshore Wind JEDI model is specifically tailored to offshore wind facilities and calculates the economic impact to a given region of the construction and operation of an offshore wind project.

A.1.1 Model Inputs

The JEDI Offshore Wind Model works in a similar way to other models in the JEDI family, allowing the user to specify general characteristics about the wind project such as capacity, number of turbines, distance from shore, water depth, etc., as well as specific cost components that are part of the construction or operations phase of the project.

Calculations can be based either on the entered cost data or on default inputs, which are derived from industry norms. The model asks for several categories of expenditure as well as the percentage of expenditures that will happen locally (in this case meaning in the state of New York or the total U.S.). If project-specific inputs are not available, the model comes with default inputs so a result can be generated with incomplete data.

[17] NREL's JEDI models are publicly available spreadsheet tools that apply state-specific IMPLAN year 2014 multipliers. The JEDI analysis tools were developed by NREL in conjunction with MRG & Associates. For more information on the JEDI tools, see http://www.nrel.gov/analysis/jedi/.

JEDI model defaults are based on interviews with industry experts and project developers.[18] Economic multipliers contained within the model are derived from Minnesota IMPLAN Group's IMPLAN regional input-output software and state data files. The IMPLAN database contains county, state, zip code, and federal economic statistics which are specialized by region, not estimated from national averages and can be used to measure the effect on a regional or local economy of a given change or event in the economy's activity. IMPLAN is based on input-output tables, employment and wage data, data on trade flows, and data on how personal income is spent. Input-output tables are compiled at the national level by the Bureau of Economic Analysis (BEA), an agency within the Department of Commerce. State and county specific input-output tables are derived by adjusting the BEA national tables by adjusting the distribution of production among industries, based on employment data by industry, and deriving imports and exports to and from the state through a combination of the input-output relationships and trade flow data.

A.1.2 Model Outputs

Based on project-specific inputs from the user, the model estimates job creation, earnings, and output (total economic activity) for a given power generation project. This includes the direct, indirect, and induced economic impacts on the state economy associated with its construction and operation phases. By determining the regional economic impacts and job creation for a proposed power facility, the JEDI Offshore Wind Model can be used to answer questions about the impacts of offshore wind power in a given state, region, or local community.

NREL's JEDI models present outputs for the following economic metrics:

- *Jobs* – Additional jobs resulting from the increased final spending.
- *Earnings* – The additional earnings (wages and employer paid benefits) associated with the additional jobs.
- *Output* – The additional output that drives the increase in jobs. Output is defined more broadly than other metrics of economic activity, including value added or GDP; output is the sum value of all goods and services at all stages of production (i.e., as a raw material and as a finished product).
- *Value Added* – The difference between total gross output and the cost of intermediate inputs. It is the sum total of earnings of capital and labor, comprised of payments made to workers, proprietary income, other property type income, indirect business taxes, and taxes on production and imports less subsidies. The sum total of value added of all enterprises and self-employed in a state comprises that state's GDP.

JEDI models classify results into three categories: direct, indirect, and induced. Direct results are defined as on-site labor and professional services. These are the impacts from dollars spent on labor by companies engaged in development and on-site construction and operation of power generation and transmission. These results do not include materials—only labor. With its exclusive emphasis on labor, JEDI's first tier of impacts is narrower than typical direct economic impacts. Companies or businesses that fall into this category include project developers, environmental and permitting consultants, road builders, concrete-pouring companies, construction companies, tower erection crews, crane operators, and O&M personnel.

Indirect effects are reported in JEDI as local revenues, equipment, and supply chain results. These results are driven by the increase in demand for goods and services from direct on-site project spending.

[18] Default values are based on analysis of proprietary data provided by NREL, Navigant, Green Giraffe Energy Bankers, Ocean & Coastal Consultants, and the U.S. Department of Labor Bureau of Labor Statistics. In those instances where data from the sources was not an exact match for the system parameters, the best available information was used to derive appropriate values.

Businesses and companies included in the second tier of economic activity include construction material and component suppliers, analysts and attorneys who assess project feasibility and negotiate contract agreements, banks financing the projects, all equipment manufacturers (i.e., blade manufacturers), and manufacturers of replacement and repair parts.

Induced effects are the third and final category and are driven by the local expenditures of those receiving payments within the first two categories. These are often associated with increased business at local restaurants, entertainment, and retail establishments, as well as child care providers or any other entity affected by the increased economic activity and spending occurring in the first two tiers.

JEDI model results are displayed in two different time periods: construction and operations. Construction period results are inherently short-term. Jobs are defined as full-time equivalents (FTE), or 2,080-hour units of labor. (One construction period job equates to one full-time job for one year.) Equipment manufacturing jobs, such as tower manufacturing, are included in construction period jobs as it is ultimately new construction that drives equipment manufacturing. All employment related to the construction of the project is reported in FTE. Operations period results are long-term, for the life of the project, and are reported as annual FTE jobs and economic activity. Operation period impacts continue to accrue throughout the operating life of the facility.

JEDI results are not intended to be a precise forecast; they are an estimate of potential activity resulting from a specific set of projects or scenarios. In addition, JEDI results presuppose that projects are financially viable and can be justified independent of their economic development value. Importantly, results generated by the JEDI models are gross (not net) results. They do not consider potential increases or decreases in electricity rates resulting from investments in new infrastructure, nor do they consider whether the respective projects displace economic activity elsewhere.