Potential Economic Impacts from Offshore Wind in the United States – The Southeast Region

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Abstract
The Virginia Center for Wind Energy at James Madison University, supported by the National Renewable Energy Laboratory (NREL) and the U.S. Department of Energy (DOE), performed a study that applied the new offshore Jobs and Economic Development Impacts (JEDI) model to estimate the economic impacts associated with offshore wind power developed off the coasts of Virginia, North Carolina, South Carolina and Georgia. The Southeast region presents an ample wind resource in waters beyond 12 miles from the coast. The region currently employs an estimated 11% of the U.S. wind workforce. Construction costs for offshore wind are estimated to be among the lowest in the nation, suggesting a competitive advantage for this industry.
The major attributes associated with the region were identified and analyzed in order to define likely scenarios for offshore wind development in the region. Relevant data and justifiable assumptions were made to develop five scenarios for JEDI analysis. The results suggest that the more conservative scenarios do not offer the economic benefits to justify investment, whereas the more aggressive scenarios require the supply chain to develop at an unrealistic pace. A moderate scenario represents the best solution as it offers economic benefits that encourage steady and healthy growth in the industry.

KEYWORDS
Economic impacts; supply chain; Southeast region; JEDI; offshore wind

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1. Introduction
The offshore wind industry represents a major opportunity to provide clean, stable-priced energy using a domestic renewable resource, while promoting significant job growth and economic development. The industry is currently being driven by individual state policies, with Mid-Atlantic and Northeastern states all competing to become the ‘hub’ of this new industry. While

state-by-state competition can drive down costs, a regional approach would realize the full potential of the industry. Some of the benefits of a coordinated regional approach include,

- reduction of ratepayer impacts by spreading costs over a wider base
- the ability to spread costs and share lessons learned
- coordination of research, resource assessment and environmental studies
- expansion of the scope of transmission integration analyses
- allocation of economic development resources based on comparative strengths
- aggregated or collaborative procurement could result in lower energy costs[1]

In this study, a regional approach was adopted in the development of scenarios for application to the Jobs and Economic Development Impacts (JEDI) model, to investigate the potential economic impacts of offshore wind in the Southeast. A regional overview highlighting the comparative strengths the Southeast region – Virginia, North Carolina, South Carolina and Georgia – is provided in Section 2. The JEDI model is described in Section 3. In Section 4, the development of three distinct, justifiable offshore wind energy scenarios for the Southeast is discussed. Finally, in Sections 5 and 6, the results of JEDI model runs are presented followed by conclusions.

2. Regional Overview

In order to be able to develop reasonable justifiable assumptions for the offshore wind industry in the Southeast – defined in this study to be Virginia (1) (2) (3) (4), North Carolina (5), South Carolina (6) (7) and Georgia (8) (9), first the major characteristics of the region must be understood. This includes Federal and State activities, the wind resource, transmission infrastructure, ports and the existing supply chain in the region. Each state was researched thoroughly, through reliable sources as well as collaboration with local and regional experts in the region.

2.1 Federal and State Activities

The Bureau of Ocean Energy Management (BOEM) manages the exploration and development of the nation's offshore resources. BOEM runs a number of offshore Renewable Energy Programs[2] and it grants leases, easements, and rights-of-way for orderly, safe and environmentally responsible renewable energy development activities.

To assist the development of offshore wind energy in the region, BOEM established Renewable Energy Task Forces in Virginia[3], North Carolina[4] and South Carolina[5], to facilitate intergovernmental communications regarding outer continental shelf renewable energy activities.

[1] See www.secoastalwind.org for more information on how a regional approach can benefit the Southeast
[2] www.boem.gov/Renewable-Energy-Program/index.aspx
[3] http://www.boem.gov/Renewable-Energy-Program/State-Activities/Virginia.aspx
[4] http://www.boem.gov/Renewable-Energy-Program/State-Activities/North-Carolina.aspx

2.2 Wind Resource

According to the National Renewable Energy Laboratory (NREL), the Southeast region represent 45% of the total East Coast offshore wind resource and 82% of the resource in shallow water and more than 12 miles offshore, as shown in Figure 1. (10) NREL resource maps show that average wind speeds are slightly lower in the southern states. However, the most important metric is ultimately the Levelized Cost of Energy (LCOE), and the Southeast has numerous advantages that should result in lower LCOE in the region.

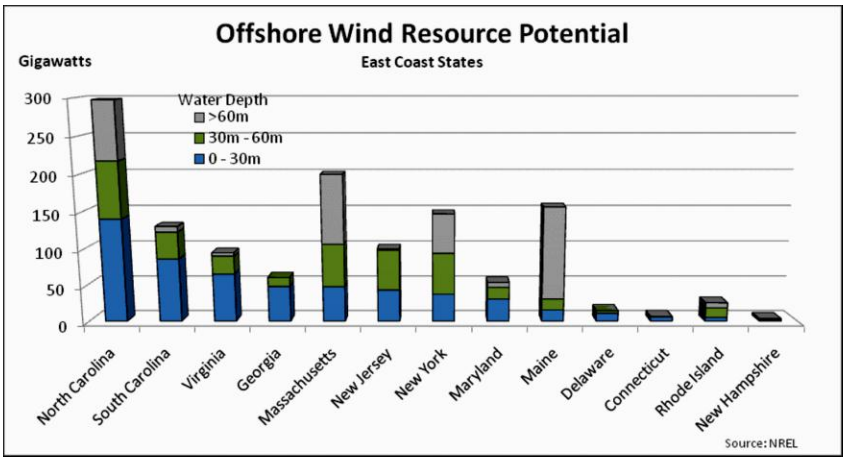

Figure 1. The Southeast region represents 45% of the total offshore wind resource and 82% of the resource in shallow water and more than 12 miles offshore

2.3 Market Size

The Southeastern states represent five of the six largest electricity markets on the East Coast with high per-capita electricity consumption and five of the six fastest growing populations (see Figure 2) (11). The low electricity rates in the region attract energy-intensive industries, which points to a high demand growth rate and the ability to accommodate long-term, large-scale offshore wind energy development.

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[5] http://www.boem.gov/Renewable-Energy-Program/State-Activities/South-Carolina.aspx

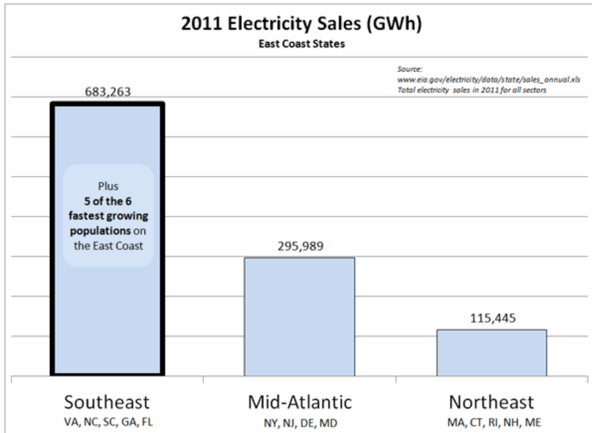

Figure 2. The Southeast region represents more than half of the total electricity sales on the East Coast.

2.4 Cost

The U.S. Energy Information Administration (EIA) estimates that the Southeast region offers the lowest construction costs for offshore wind energy among East Coast states, as shown in Figure 3 (12). This advantage would result in lower capital and expenditures (CAPEX) and energy costs from offshore wind and a competitive advantage for manufacturers that locate facilities in the region.

The electricity supplies in the Southeast derive primarily coal, nuclear and natural gas (11) – all are susceptible to fuel price volatility and large-scale outages. Wind energy would diversify the region's electricity supply and provide long-term, stable-priced energy.

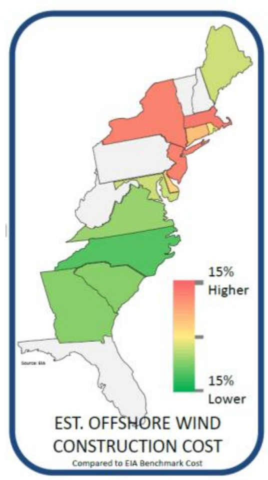

Figure 3. - The Southeast are expected to enjoy significantly lower constructions costs for offshore wind energy than other regions on the East Coast.

2.5 Infrastructure and Workforce

The Southeast is home to some of the largest and industrious ports and logistics infrastructure in the United States, including ports at Norfolk Harbor (VA), Newport News (VA), Morehead City (NC), Wilmington (NC), Charleston (SC) and Savannah (GA) (13). The region has a highly skilled manufacturing and maritime workforce and employs thousands of people in the land-based wind industry, despite having no utility-scale wind. (14) (15)

3. The Offshore Wind JEDI Model

The Offshore Wind Jobs and Economic Development Impact Model (JEDI) was developed by the National Renewable Energy Laboratory (NREL) in order to demonstrate the magnitude of economic impacts associated with developing and operating offshore wind power plants in the United States. (16)

The JEDI model uses input-output analysis[6] to estimate project capital and operating expenditures as well as the number of jobs, income (wages and salary), and economic activity that will accrue to the state (or region) from the project. Three separate impacts are examined,

- Project Development and Onsite Labor Impacts
- Turbine and Supply Chain Impacts
- Induced Impacts

In order to accomplish this analysis, multipliers and expenditure patterns were used to derive these results. These regional multipliers for employment, wage and salary income and output and personal expenditure patterns were derived from the Impact Analysis for Planning (IMPLAN) model 3.0[7] (17).

3.1 Model Input

JEDI utilizes construction cost data, operating cost data as well as data pertaining to the percentage of goods and services acquired in the region to produce outputs. From a broad perspective, JEDI input variables can be classified into three main categories

- **Market and Deployment** – The number and size of wind turbines deployed each year.
- **Regional Investment** – The percentage, for each component or service, which is being acquired or produced regionally.
- **Cost** – The cost (per MW capacity) of an offshore wind project.

3.2 Model Output

JEDI provides information to understand the magnitude of the economic impacts associated with the region being analyzed, including construction-related spending and operations and

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[6] Input-output analysis is a method of evaluating and summing the impacts of a series of effects generated by expenditure.

[7] A 'User Add-in Location' feature was added to allow users to derive the necessary data to complete analysis for specific regions. The necessary inputs include direct, indirect, and induced multipliers for employment, earnings and output, and personal consumption expenditure patterns – calculated as a percentage for each industry, for the 14 aggregated industries and the IMPLAN 432 industry sectors

maintenance, as well as the portion of the spending that occurs regionally. JEDI reports the local jobs (in Full-Time Equivalents[8] (FTEs)), earnings and output[9] supported as a result of the project for the construction phase and for the ongoing operations phase.

3.3 Caveats

First, the offshore wind JEDI model is intended to construct a reasonable profile of expenditures and demonstrates the magnitude of *gross* economic impacts, and is an *estimate*, not a prediction.

Second, the JEDI is a static model that relies on inter-industry relationships and personal consumption patterns and does not account for demand increases or decreases, inflation, or constraints on labor, goods or money.

Third, the model was not designed to provide cash flow projections or for use as a cash flow analysis tool and results is *not* a measure of project viability or profitability.

Finally, the analysis assumes that sufficient revenues are generated for equity and debt repayment and annual operating expenditures.

4 Scenario Development

4.1 Introduction

As discussed in Section 3, the JEDI model is built around three major variables – *Market and Deployment*, *Regional Investment*, and *Cost*, based on information gathered and other similar studies. (18) For each, three distinct 'paths' with varying rates for how these variables change over time were developed. Three distinct scenarios, running from 2020-2030 for offshore wind energy in the Southeast were generated, and JEDI was run for each year.

4.2 Market and Deployment

For *Market and Deployment*, a conservative, a moderate and an aggressive approach to the deployment of offshore wind turbines in the Southeast region were created. An analysis of the historical growth rates for electricity capacity, as shown in Table 1, indicates that this is around 2.2 GW/year[10]. It was assumed that the Southeast could support a maximum build-in rate of around 1.1 GW/year.

For *Low Market and Deployment*, as shown in Table 2, investment in the offshore wind industry was assumed to be very conservative, defined by pilot projects and small wind farms. For *Medium Market and Deployment*, as in Table 3, a moderate level of investment in the industry was assumed. Initially, this path is similar to that of the low growth path, with a more consistent

[8] A FTE is equivalent to 2,080 hours of work, and could also mean 2 part-time jobs of 1,040 hours each.
[9] Economic activity in the region
[10] Note that nearly half of this capacity growth occurred between 2000 and 2004.

level of growth being observed in the later years of the model run. For *High Market and Deployment*, as in Table 4, an aggressive level of offshore wind turbine deployment was assumed, and assumed a large percentage or new power-generating plants derived from offshore wind facilities.

4.3 Regional Investment

As in the case of *Market and Deployment*, three different paths for how the regional supply chain could develop were built. The higher the regional share percentage in a specific line item, say wind turbine blades, the more money is being circulated into the regional economy, thereby creating more regional jobs.

Each individual component was examined separately when determining its potential for regional sourcing. The regional share of many of these components and services were not expected to change over time, called static components and services[11]. A list of these, with regional share percentages and justifications are given in Table 5. Components and services of which the regional share is expected to vary over time are called dynamic components and services,[12] and are discussed in the next section.

4.3.1 Dynamic Components and Services

For the *Low Regional Investment* path, it was assumed that the development of the regional supply chain is minimal due to uncertainties in the industry. However, due to the presence of manufacturers and developers already in the region, some regional contributions are expected, but development of supply chain is slow.

Initially, the *Medium Regional Investment* path was assumed to be similar to the low path, but higher growth rates are applied, as more of the larger components are manufactured regionally, and as expertise is gained. Approximately half of manufacturing and services are assumed to be regional by 2030.

The *High Regional Investment* path assumed immediate and significant regional investment into the offshore wind industry, resulting in a rapid development of the supply chain. Nearly all components and services are regionally sourced by 2030. A summary of all three *Regional Investment* paths are given is Table 6.[13]

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[11] Generally, these are components and services which are easily produced regionally, such as concrete and legal services

[12] These are components and services which require expertise in offshore wind industry, such as foundations and project financing.

[13] A linear scaling system was applied for *Regional Investment* percentages between 2021 and 2024, and 2026 to 2029.

4.4 Cost

Three simple *Cost* reduction models were established for application to the JEDI model, which may occur due to technological advancements, economies of scale, and other factors. These paths, establish upper and lower bounds for cost reduction in the Southeast. A baseline *Cost* of $5,600/MW in 2015 was established based on 2010 Energy Information Administration (EIA) estimates for the industry in the region (12).

For the *High Cost* path, there is limited development in offshore wind energy technologies, and a cost reduction of 3.5% every 5 years was applied, resulting in an overall cost reduction of around 10%. For the *Medium Cost* path, a more aggressive cost reduction model was applied, representing more significant technological advances. A cost reduction of 7.2% every 5 years was applied, resulting in an overall cost reduction of around 20%. For the *Low Cost* path, the most aggressive cost reduction model was applied, representing optimal improvements in the technology. The average cost of offshore wind is assumed to decrease by 11.2% every 5 years, for an overall cost reduction of around 30%. A summary of the cost reduction models are given in Table 7.

4.5 Scenario Compilation

Using this method, three combinations of these variables were combined that best represented all the combinations and to reduce redundancy. *Scenario A*, shown in Table 8, is the most conservative of the three scenarios, representing a small industry with limited regional investment due to uncertainties. As such, much of the labor and capital is outsourced and the high cost reduction model was adapted. *Scenario B,* as shown in Table 9, represents an 'average case' marked by moderate and steady growth in both *Market and Deployment* and *Regional Investment*. This growth helps spurn advancements and efficiencies and the medium *Cost* reduction model was applied. The details of *Scenario C* are given in Table 10 and represent the 'best case' scenario for the offshore wind industry. Therefore, a high *Market and Deployment* and *Regional Investment* paths were selected, presenting a situation where the industry grows very quickly, resulting in a low *Cost* reduction model being selected for this scenario.

5 Results

5.1 Jobs

5.1.1 Construction

During construction, labor is highly intensive and requires a large number of workers to complete a project, resulting in thousands of new jobs. However, unless the offshore wind market is robust with multiple projects in the pipeline, these jobs will cease to exist after construction.

For *Scenario A*, the offshore wind industry is projected to create around 1,000 FTEs, increasing to over 4,000 FTEs in 2030, as shown in Figure 4. In other words, the industry is expected to require four times more labor after 10 years, despite conservative increases in *Market and Deployment* and *Regional Investment*. Many of the total jobs created are from supply chain and induced impacts.

Scenario B, as shown in Figure 5, shows significantly higher projected jobs throughout the modeling period, increasing from under 4,000 FTEs in 2020 to over 18,000 FTEs in 2030. *Scenario C*, as shown in Figure 6, projects the most FTEs by a significant margin, with the 2020 estimate of 15,000 FTEs being very close to the 2030 value of *Scenario B*. By 2030, if all the assumptions made hold, this Scenario projects over 40,000 FTEs.

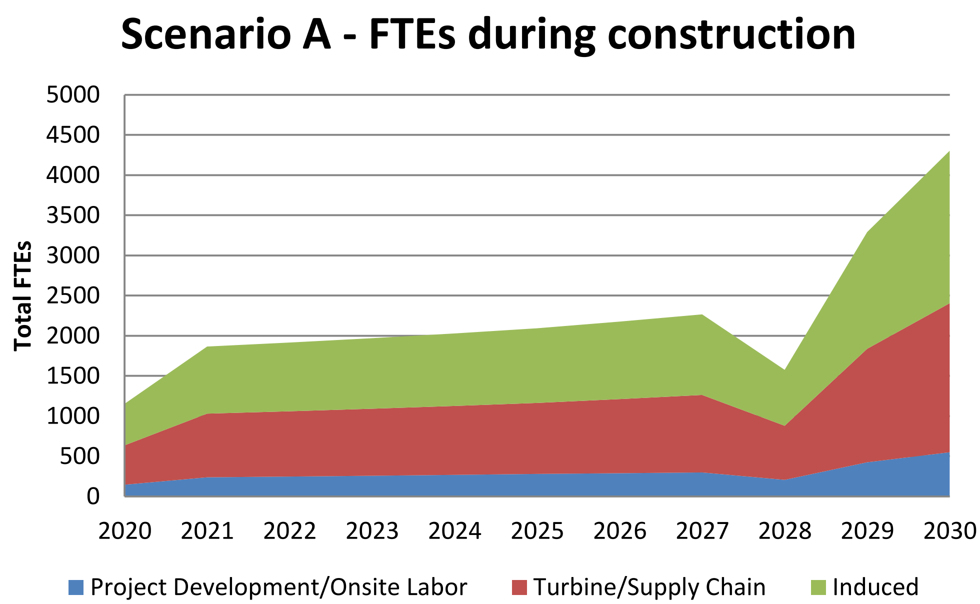

Figure 4. Total FTEs projected during construction from 2020 to 2030 for Scenario A

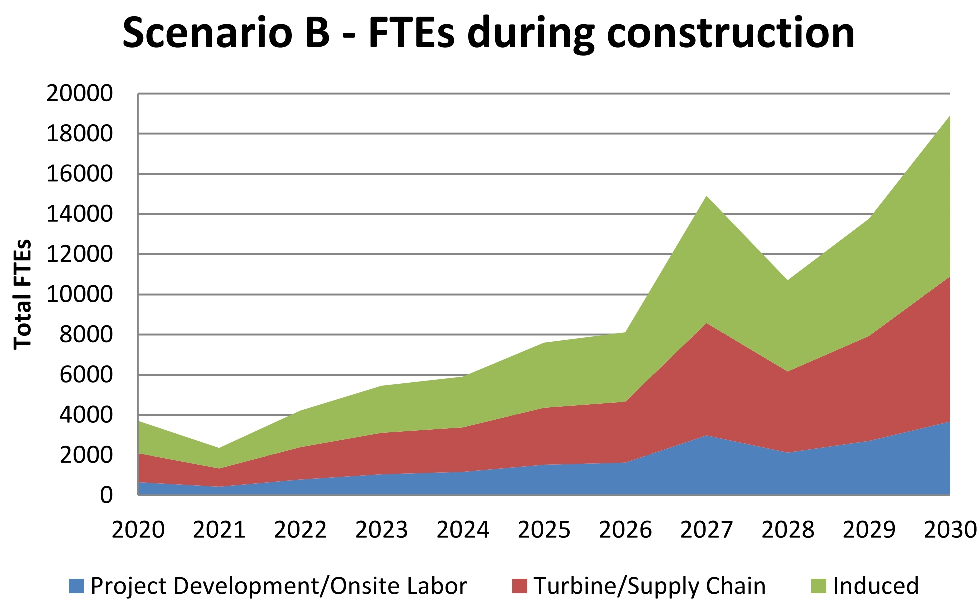

Figure 5. Total FTEs projected during construction from 2020 to 2030 for Scenario B

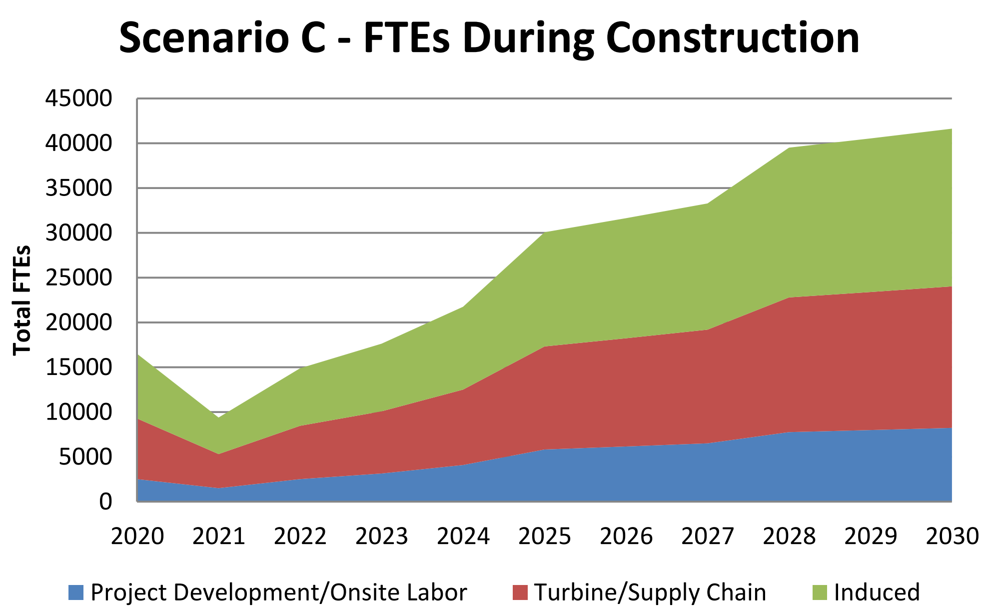

Figure 6. Total FTEs projected during construction from 2020 to 2030 for Scenario C

5.1.2 Operations and Maintenance

For operations and maintenance, the total number of FTEs projected is significantly less than for construction. However, these jobs last for 20 to 25 years, the typical lifetime of an offshore wind project, and are therefore *permanent, career-length* opportunities.

The results for FTEs projected for Scenarios A, B, and C are given in Figure 7, 8 and 9 respectively and show very similar patterns as for construction. The majority of the jobs is in supply chain and induced impacts – this trend is even more prevalent in the operations and maintenance charts.

Similarly to the analysis in the previous section, Scenario A projected the least FTEs; with around 2,700 FTEs over 1,695 MW total generating capacity by 2030. On the other hand, Scenario B projected around 7,000 FTEs over 4,027 MW generating capacity, and the expected total for Scenario C is over 16,000 FTEs over 9,760MW capacity by 2030. As expected, the normalized FTEs per MW capacity increased as the *Regional Investment* increases.

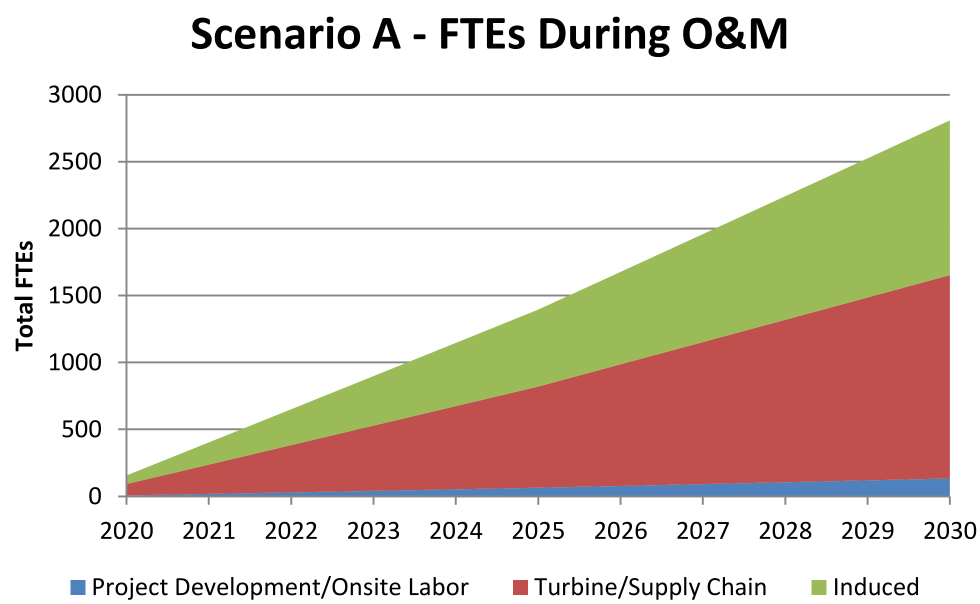

Figure 7. Total FTEs projected during the O&M phase for Scenario A from 2020 to 2030.

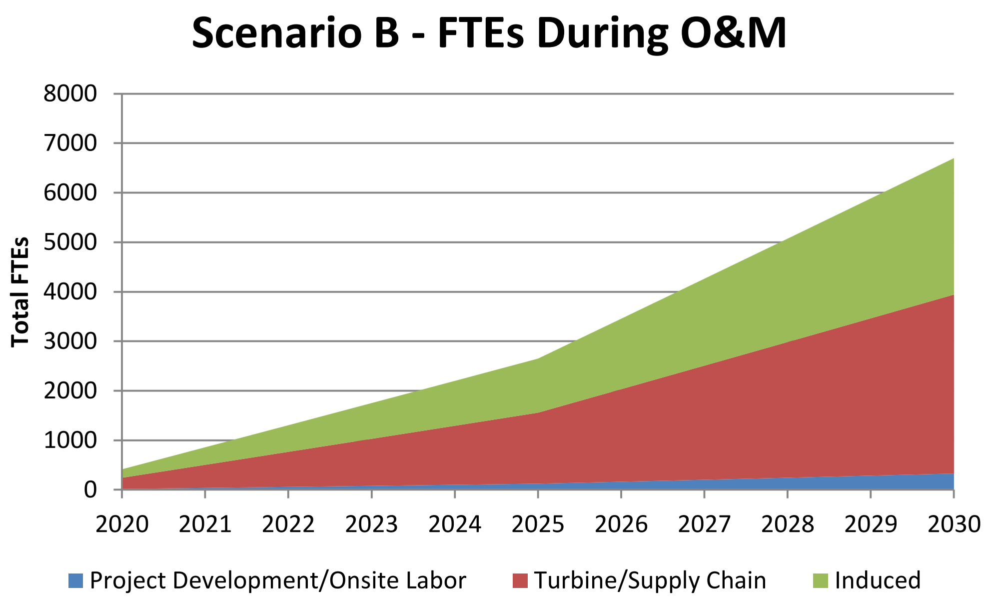

Figure 8. Total FTEs projected during the O&M phase for Scenario A from 2020 to 2030.

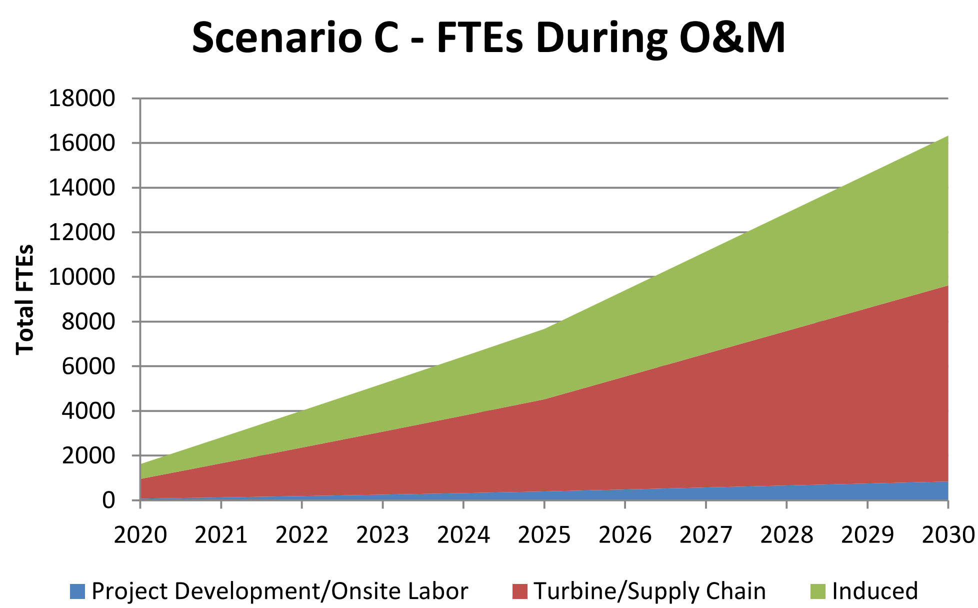

Figure 9. Total FTEs projected during the O&M phase for Scenario A from 2020 to 2030.

5.2 Earnings and Output

As explained previously, earnings refer to wages and salaries paid to workers, while output refers to the total economic activity generated by the current project. These two metrics can be compared and monitored by another metric called the *Earnings-to-Output* (ETP) ratio, and it measures the efficiency of labor relative to the value of the project.

For *Scenario A*, the ETP ratio is projected to be around 1:2[14] in 2020, and increases to 1:3[15] by 2030, indicating a 50% increase in labor efficiency over the modeling period. Most of this gain can be attributed to increases in *Regional Investment*, which are very low in 2020.

For *Scenario B*, the ETP ratio is about 1:3.33[16] in 2020, and this increases to 1:3.89[17] in 2030. Much higher efficiencies are observed in the estimates, which indicate that Scenario B could be a much better investment for developers, manufacturers, utilities and other investors.

On the other hand, for *Scenario C*, a drop in the ETP ratios - 1:3[18] in 2020 to 1:2.68[19] in 2030 are observed. This result seems to indicate that at a certain point, the industry has grown to be too large, thereby reducing some of the labor efficiencies. Earnings and output charts for Scenarios A, B and C and be seen in Figures 10, 11 and 12 respectively.

[14] $100 million against $200 million
[15] $450 million against $1.4 billion
[16] $300 million against $1 billion
[17] $1.8 billion against $7 billion
[18] $1.25 billion vs. $3.75 billion
[19] $4.25 billion vs. $11 billion

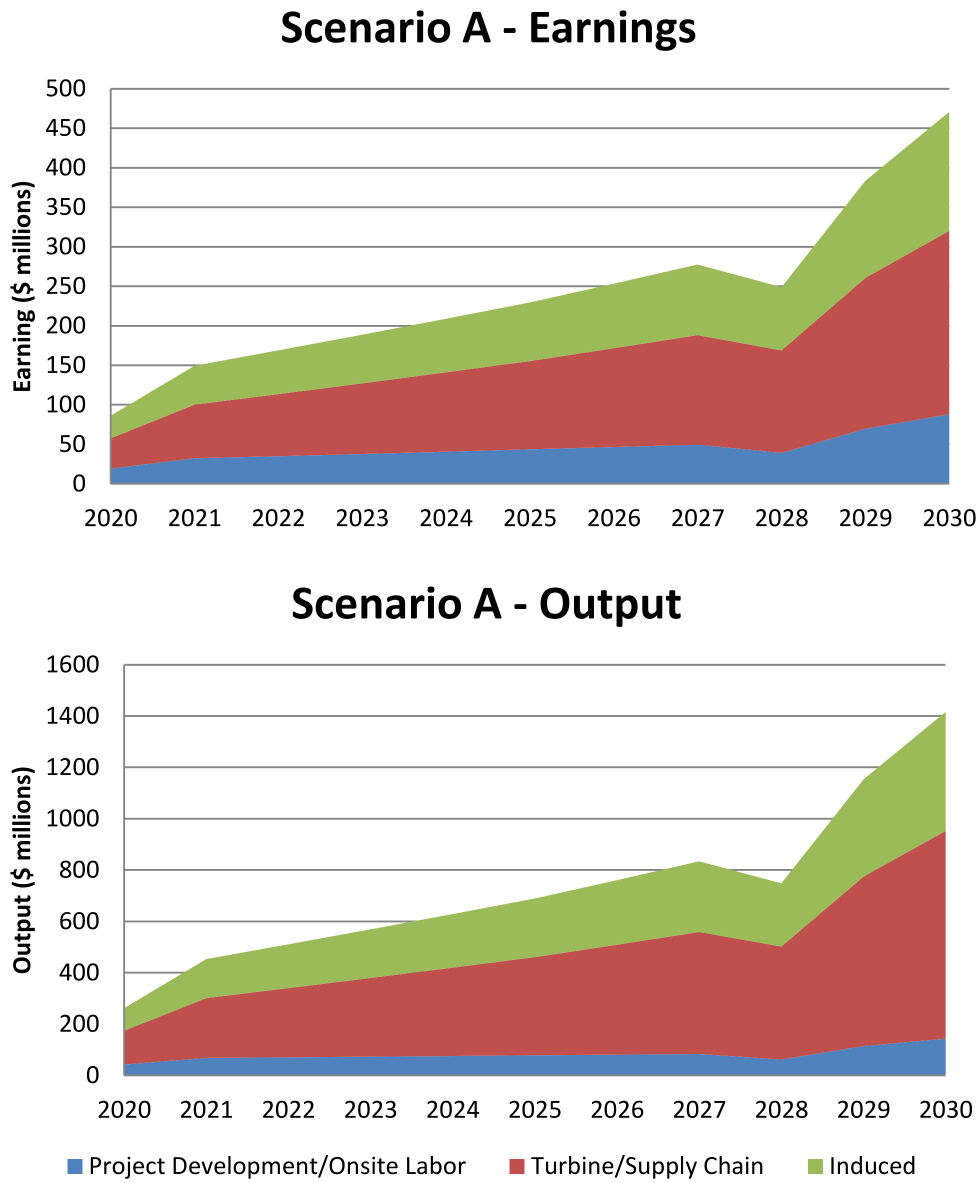

Figure 10. Comparison of Earnings (above) against Output (below) for Scenario A show similar growth patterns from 2020 to 2030, but the ETP ratio increases over time.

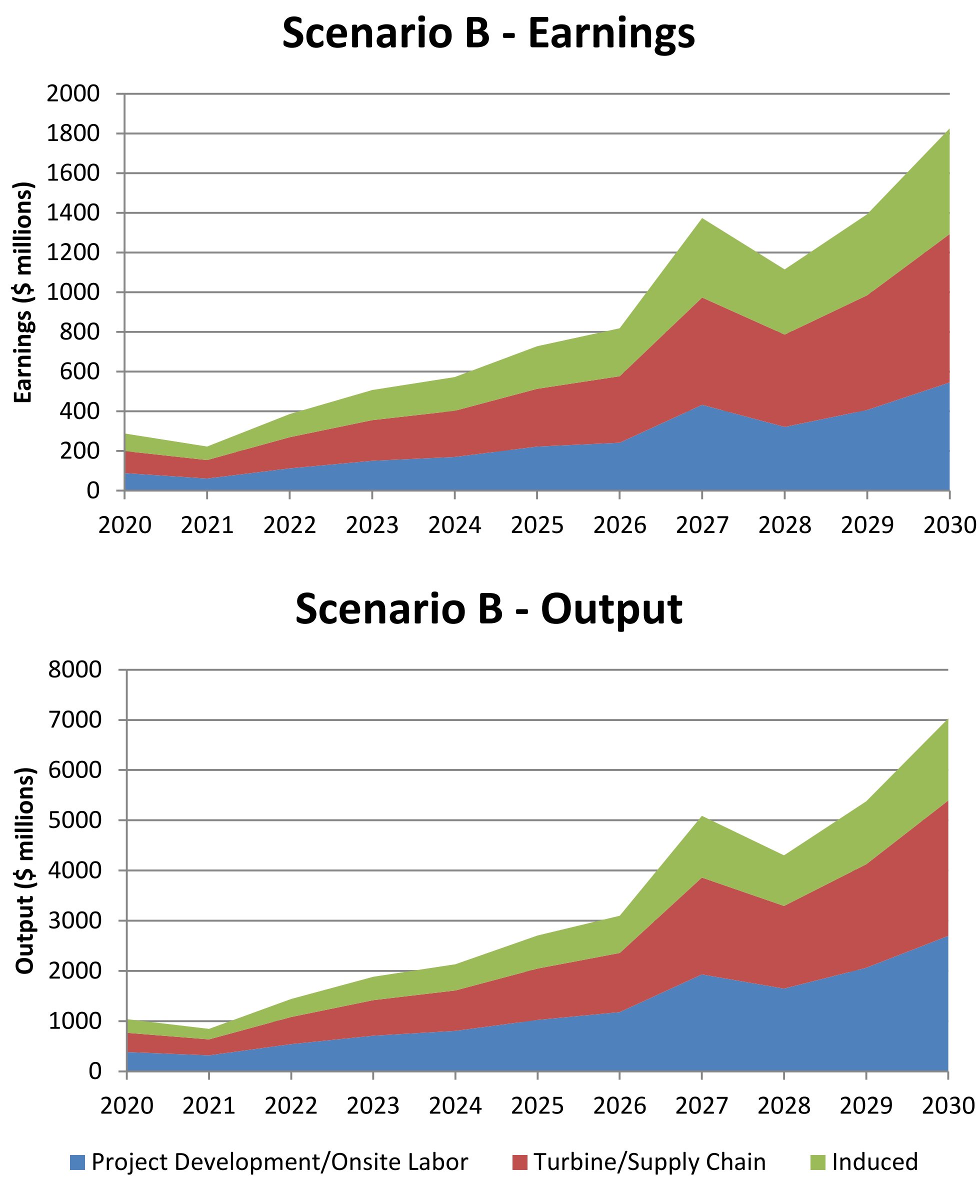

Figure 11. Comparison of Earnings (above) against Output (below) for Scenario B show similar growth patterns from 2020 to 2030, but the ETP ratio increases over time.

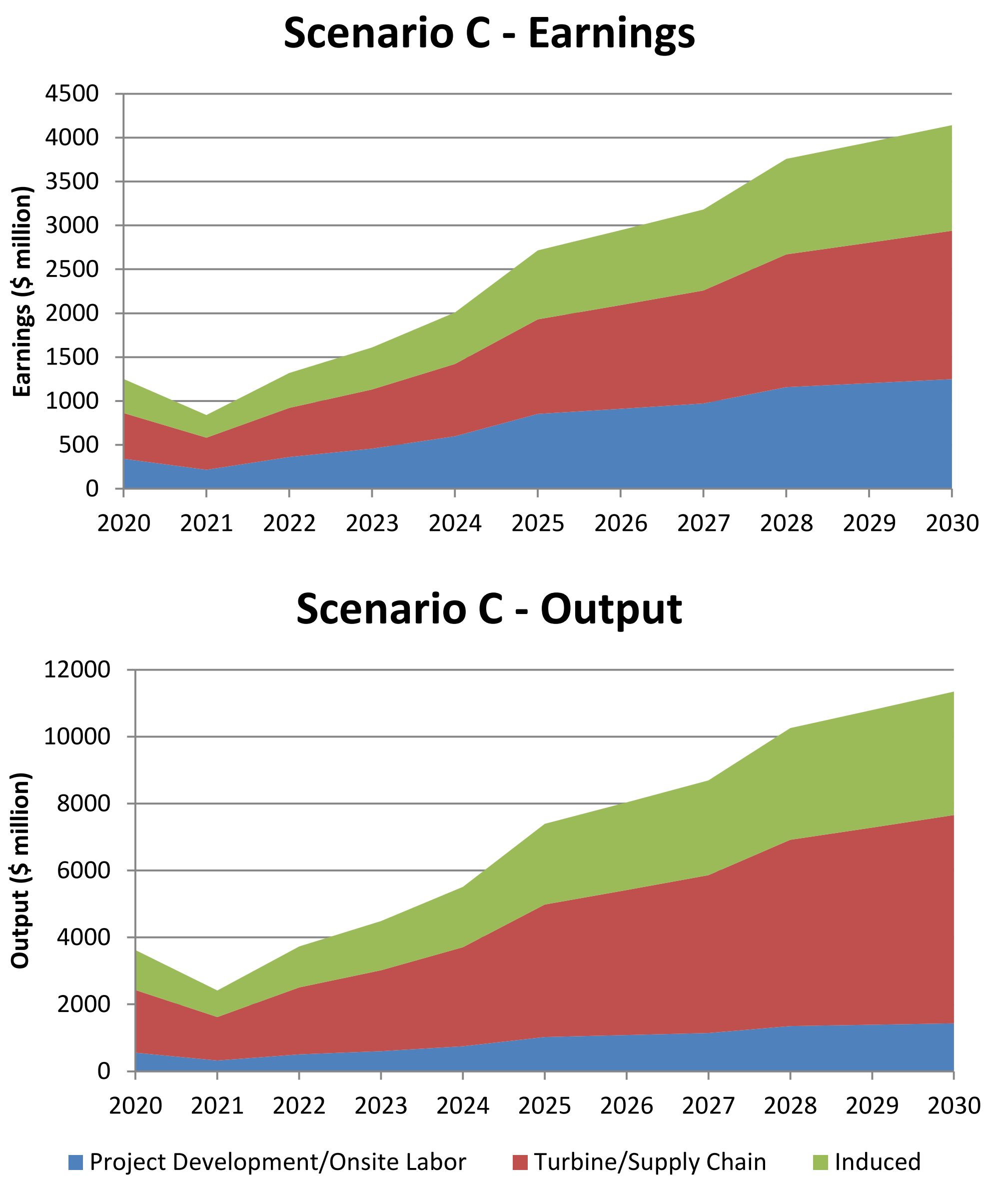

Figure 12. Comparison of Earnings (above) against Output (below) for Scenario C show similar growth patterns from 2020 to 2030, but the ETP ratio decreases over time, indicating that the size of the industry is too large for optimal labor.

6 Conclusions

The Southeast has the capacity to become a long-term leader in offshore wind energy, with ample resources for the industry to thrive. A very good shallow wind resource, low manufacturing costs, manufacturing expertise and access to some of the largest and most industrious ports on the East Coast are all very attractive features of this region.

The JEDI model was used to provide estimates of the magnitude of economic impacts for the region using three distinct scenarios. *Scenario A* projected the least economic activity and is considered to be too small to encourage industry growth. *Scenario C* projects the largest gross economic impacts, but it requires the regional supply chain to develop at an unrealistically fast rate. Finally, *Scenario B* is the closest to an average case and offers sufficient economic returns to encourage growth. The moderate, balanced approach of *Scenario B* was selected as the most suitable model for the Southeast.

As described previously, the results of this study are only estimates intended to provide a reasonable profile of what the offshore wind industry could look like in the Southeast region. Since the industry does not currently exist in the United States, revisions of this model would be required in the future, as the impacts of the industry are better understood.

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	Virginia		North Carolina		South Carolina		Georgia		Totals	
Year	Capacity	Growth	Capacity	Growth	Capacity	Growth	Capacity	Growth	Capacity	Growth
1990	16,155	N/A	22,075	N/A	16,721	N/A	22,302	N/A	77,253	N/A
1991	16,644	489	22,120	44	17,963	1,242	23,947	1,646	80,674	3,421
1992	18,095	1,451	22,175	55	17,969	6	24,277	329	82,516	1,842
1993	18,466	370	22,172	-3	17,832	-137	24,228	-49	82,697	181
1994	18,647	181	22,309	138	18,449	617	25,144	915	84,548	1,852
1995	19,111	464	23,475	1,165	18,443	-6	25,949	805	86,978	2,429
1996	19,858	747	23,918	443	18,845	402	25,693	-256	88,315	1,337
1997	20,217	359	23,866	-52	19,221	375	26,492	799	89,796	1,481
1998	20,064	-153	23,949	83	19,255	34	26,487	-5	89,755	-41
1999	20,041	-23	24,129	179	19,332	77	26,666	179	90,168	413
2000	20,854	813	25,986	1,857	19,925	593	29,427	2,761	96,192	6,024
2001	22,047	1,193	27,780	1,794	20,914	989	31,605	2,178	102,346	6,154
2002	21,919	-128	28,538	758	21,761	847	37,176	5,571	109,394	7,048
2003	23,041	1,122	29,342	804	22,258	497	37,626	450	112,267	2,873
2004	24,497	1,456	29,023	-319	24,117	1,859	38,498	872	116,135	3,868
2005	24,431	-66	29,013	-10	24,155	38	39,792	1,294	117,391	1,256
2006	24,415	-16	29,022	9	24,500	345	39,758	-34	117,695	304
2007	25,270	855	29,654	632	25,078	578	39,767	9	119,769	2,074
2008	25,642	372	29,647	-7	25,698	620	39,641	-126	120,628	859
2009	25,833	191	30,103	456	25,790	92	39,639	-2	121,365	737
2010	25,912	79	30,197	94	25,878	88	39,665	26	121,652	287
Total		9,757		8,122		9,157		17,363		44,399
Average		488		406		458		868		2,220

Table 1. Historical electricity capacity data (1990-2010) for the Southeast.

Year	**Virginia**		**North Carolina**		**South Carolina**		**Georgia**		**Total**	
	Market	Total	Market	Total	Market	Total	Market	Total	Market	Total
2018	36	36	0	0	0	0	0	0	36	36
2019	0	36	9	9	0	0	0	0	9	45
2020	0	36	0	9	40	40	10	10	50	95
2021	150	186	0	9	0	40	0	10	150	245
2022	50	236	100	109	0	40	0	10	150	395
2023	0	236	150	259	0	40	0	10	150	545
2024	0	236	0	259	150	190	0	10	150	695
2025	0	236	0	259	0	190	150	160	150	845
2026	0	236	150	409	0	190	0	160	150	995
2027	0	236	150	559	0	190	0	160	150	1145
2028	0	236	100	659	0	190	0	160	100	1245
2029	100	336	100	759	0	190	0	160	200	1445
2030	250	586	0	759	0	190	0	160	250	1695

Table 2. Low Market and Deployment path for the Southeast.

Year	Virginia		North Carolina		South Carolina		Georgia		Total	
	Market	Total	Market	Total	Market	Total	Market	Total	Market	Total
2018	32	32	15	15	0	0	0	0	47	47
2019	0	32	0	15	80	80	25	25	105	152
2020	100	132	0	15	0	80	0	25	100	252
2021	150	282	0	15	0	80	0	25	150	402
2022	0	282	100	115	150	230	0	25	250	652
2023	0	282	200	315	100	330	0	25	300	952
2024	150	432	150	465	0	330	0	25	300	1252
2025	150	582	200	665	0	330	0	25	350	1602
2026	200	782	0	665	150	480	0	25	350	1952
2027	200	982	250	915	150	630	0	25	600	2552
2028	0	982	250	1165	150	780	0	25	400	2952
2029	0	982	250	1415	150	930	75	100	475	3427
2030	0	982	200	1615	200	1,130	200	300	600	4027

Table 3. Medium Market and Deployment path for the Southeast

Year	Virginia		North Carolina		South Carolina		Georgia		Total	
	Market	Total	Market	Total	Market	Total	Market	Total	Market	Total
2018	64	64	30	30	0	0	0	0	94	94
2019	136	200	150	180	80	80	25	25	391	485
2020	150	350	150	330	200	280	0	25	500	985
2021	150	500	150	480	200	480	0	25	500	1,485
2022	150	650	300	780	250	730	0	25	700	2,185
2023	150	800	325	1,105	250	980	0	25	725	2,910
2024	150	950	325	1,430	300	1,280	0	25	775	3,685
2025	150	1,100	350	1,780	300	1,580	100	125	900	4,585
2026	150	1,250	350	2,130	300	1,880	125	250	925	5,510
2027	150	1,400	350	2,480	300	2,180	150	400	950	6,460
2028	200	1,600	400	2,880	300	2,480	200	600	1,100	7,560
2029	200	1,800	400	3,280	300	2,780	200	800	1,100	8,660
2030	200	2,000	400	3,680	300	3,080	200	1000	1,100	9,760

Table 4. High Market and Deployment path for the Southeast

Component	Regional	Justification
Construction		
Materials and Other Equipment		
Basic Construction (concrete, rebar, gravel, etc.)	100%	All basic construction materials are produced locally and are therefore assumed to be sourced locally
Labor Costs		
Management/Supervision	100%	It is assumed that a wind project in the region would leverage local management and supervision
Development Services/Other Costs		
Engineering (project and interconnection facility design)	100%	This requires local knowledge and the region has engineering firms that can design and plan offshore wind projects
Legal Services	100%	This requires local knowledge for many items, and for general legal support. There are a number of law firms with offices in the Southeast that specialize in projects of this nature.
Public Relations	100%	This is typically done by local firms that have relations with local media and decision-makers
Ports and Staging	100%	The Southeast region has a number of suitable ports for offshore wind development, and it is assumed that a regional wind project would be built out of the nearest suitable port
Site Certificate/Permitting	100%	This requires local knowledge of laws, regulations, and agencies, and therefore it is assumed that all related work would be sourced locally
Air Transportation	100%	These services would be more cost effective if they were provided for by local companies
Marine Transportation	100%	
Operation and Maintenance		
Labor		
Technician Salaries	100%	It is assumed that local land-based staff service the facility
Monitoring and Daily Operations Staff and Other Craft Labor	100%	
Administrative	100%	
Materials and Services		
Water Transport	100%	These services will primarily be provided from the servicing port and the surrounding area.
Site Facilities	100%	
Machinery and Equipment	100%	
Subcontractors	100%	
Corrective Maintenance Parts	100%	Assuming no catastrophic failures (ex. Blade failure), the majority of maintenance parts will be sourced locally
Financing		
Equity Financing/Repayment		
Individual Investors	0%	All equity is expected to come from corporations
Tax Parameters		
Property Tax	100%	These are local taxes by definition
Sales Tax	100%	
Other Local Taxes	100%	

Table 5. Summary of regional share percentages for static components with justifications

	Low Investment			Medium Investment			High Investment		
Component	**2020**	**2025**	**2030**	**2020**	**2025**	**2030**	**2020**	**2025**	**2030**
Nacelle/Drivetrain	10%	15%	25%	10%	25%	50%	20%	50%	70%
Blades and Towers	10%	15%	25%	10%	30%	45%	20%	50%	70%
Substructures and Foundation	10%	15%	20%	25%	50%	75%	35%	85%	95%
Substructure and Foundation Labor	10%	15%	20%	25%	50%	75%	25%	80%	95%
Project Collection, HV Cable, Convertor Stations, Substation	15%	20%	30%	15%	35%	50%	30%	60%	80%
Construction Financing	0%	0%	0%	0%	10%	20%	0%	30%	75%
Management of Operating Plants	50%	60%	70%	50%	65%	80%	45%	95%	95%
Erection and Installation Services	50%	50%	65%	50%	65%	80%	50%	75%	95%

Table 6. Low, Medium, and High Regional Investment paths for the dynamic components for offshore wind in the Southeast

	Cost in 2015 (per kW)	**Cost in 2020 (per kW)**	**Cost in 2025 (per kW)**	**Cost in 2030 (per kW)**
High	$5,600	$5,407	$5,220	$5,040
Medium	$5,600	$5,119	$4,826	$4,480
Low	$5,600	$4,972	$4,415	$3,920

Table 7. High, Medium and Low cost reduction paths for the Southeast are consistent with Department of Energy estimates. (Source: http://en.openei.org/apps/TCDB/)

Year		**2020**	**2025**	**2030**
Market and Deployment	Market (MW)	50	150	250
	Total (MW)	95	845	1,695
Regional Investment	**Nacelle/Drivetrain**	10%	15%	25%
	Blades and Towers	10%	15%	25%
	Substructures and Foundation	10%	15%	20%
	Substructure and Foundation Labor	10%	15%	20%
	Project Collection, HV Cable, Convertor Stations, Substation	15%	20%	30%
	Construction Financing	0%	0%	0%
	Management of Operating Plants	50%	60%	70%
	Erection and Installation Services	50%	50%	65%
Cost ($/kW)		5,407	5,220	5,040

Table 8. Summary statistics for Scenario A

Year		2020	2025	2030
Market Growth	Market (MW)	100	350	600
	Total (MW)	252	1,602	4,027
Regional Investment	**Nacelle/Drivetrain**	10%	25%	50%
	Blades and Towers	10%	30%	45%
	Substructures and Foundation	25%	50%	75%
	Substructure and Foundation Labor	25%	50%	75%
	Project Collection, HV Cable, Convertor Stations, Substation	15%	35%	50%
	Construction Financing	0%	10%	20%
	Management of Operating Plants	50%	65%	80%
	Erection and Installation Services	50%	65%	80%
Cost ($/kW)		5,119	4,826	3,920

Table 9 - Summary statistics for Scenario B

Year		2020	2025	2030
Market Growth	Market (MW)	500	900	1,100
	Total (MW)	985	4,585	9,760
Regional Investment	**Nacelle/Drivetrain**	20%	50%	70%
	Blades and Towers	20%	50%	70%
	Substructures and Foundation	35%	85%	95%
	Substructure and Foundation Labor	25%	80%	95%
	Project Collection, HV Cable, Convertor Stations, Substation	30%	60%	80%
	Construction Financing	0%	30%	75%
	Management of Operating Plants	45%	95%	95%
	Erection and Installation Services	50%	75%	95%
Cost ($/kW)		4,972	4,415	3,920

Table 10 - Summary statistics for Scenario C