Assessment of the Economic Benefits of Offshore Wind in the Mid-Atlantic

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Delivered to: Atlantic Grid Development

Overview

- Impact Results
  - New Jersey
- Tipping Point Discussion

Economic Impact Results Review

- Summary results shown here are based on the geographically specific expenditures described previously
- Capex data for AWC grid and offshore wind farms are cumulative, and therefore economic impact results cover total impacts over the project period
  - Project period is 2016-2026 for US and regional analysis
  - State level results based on state components with each phase of construction schedule
    - NJ: 2016 – 2024
    - DE: 2016 – 2024
    - MD: 2016 – 2024
    - VA: 2020 – 2026
- O&M data is an annual expenditure

Economic Impact Results Review

- Sourcing allocations for the AWC grid and wind farm capex are based on Atlantic Grid and IHS understanding of existing supply chain capabilities and capacity
  - As such, EI results for the US are well grounded and should be reflective of the industry response to the production schedule
- Regional model utilizes same inputs as US model
  - Existing grid and wind farm supply chain is distributed across the US
  - Baseline Scenario 2 for the AWC grid assumes quick transfer of supply base to the region
  - Wind farm capex of all US production transferred within the region would be more likely a ceiling than a baseline scenario
  - O&M expenditures and impacts will likely be allocated regionally so full application of those figures to the model is representative of the likely industry response

Economic Impact Results Review cont.

- State models utilize similar component shares as US model, but grid and wind farm capex values based on state MW share of total
  - Baseline Scenario 2 for AWC grid will be less likely to be representative of initial ability of state to meet supply needs
  - Scenario 2 state level results can frame the discussion of what the impacts would be if existing domestic supply capabilities could be built up locally
  - Wind farm capex figures, which apply US sourcing shares to the state, should frame the discussion about how these significant expenditures can drive economic benefits locally if industry demand can be guaranteed and sourcing can be encouraged
- O&M expenditures will likely occur locally, especially if supply chain development occurs to support repair demand for parts and equipment, making impact results for O&M at the state level representative of likely industry response

Economic Impact Definitions

- Value Added
  - Value added is payment to labor and capital used in the production of an industry. It is defined as the sum of labor income, indirect business taxes and business income.
- Output
  - Output is the total industry output, or gross sales.
- Employment
  - Employment is the average annual full- & part-time jobs.
- Labor Income
  - Labor income is defined as wages and salaries and benefits as well as proprietors' income.

Economic Impact Definitions

- Economic Impacts
  - Direct Effect
    - Direct effect refers to the response of the economy to the change in the final demand of a given industry, refers to those directly involved in the activity.
  - Indirect Effect
    - Indirect effect refers to the response of the economy to the change in the final demand of the industries that are dependent on the direct spending industries for their input, also known as the supplier effect.
  - Induced Effect
    - Induced effect refers to the response of the economy to changes in household expenditure as a result of income generated by the direct and indirect effects, also known as the income effect.

Economic Impact Results – NJ AWC Grid Summary

100% View

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	5,053	$516,996,244	$947,721,687	$2,785,118,168
Indirect Effect	4,008	$369,724,251	$589,476,642	$1,186,686,910
Induced Effect	3,914	$234,633,974	$424,424,894	$714,690,459
Total Effect	12,975	$1,121,354,469	$1,961,623,224	$4,686,495,537

AWC Scenario 1

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	3,764	$391,104,067	$683,452,184	$2,083,736,149
Indirect Effect	3,246	$296,425,626	$472,786,653	$952,451,552
Induced Effect	3,037	$182,031,329	$329,283,391	$554,469,675
Total Effect	10,046	$869,561,021	$1,485,522,228	$3,590,657,375

AWC Scenario 2

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	2,119	$222,236,991	$342,026,149	$1,097,459,866
Indirect Effect	2,066	$184,890,174	$292,652,494	$579,276,449
Induced Effect	1,801	$107,934,226	$195,261,778	$328,777,585
Total Effect	5,986	$515,061,391	$829,940,421	$2,005,513,900

Economic Impact Results – NJ Wind Farm and O&M Summary

Wind Farm

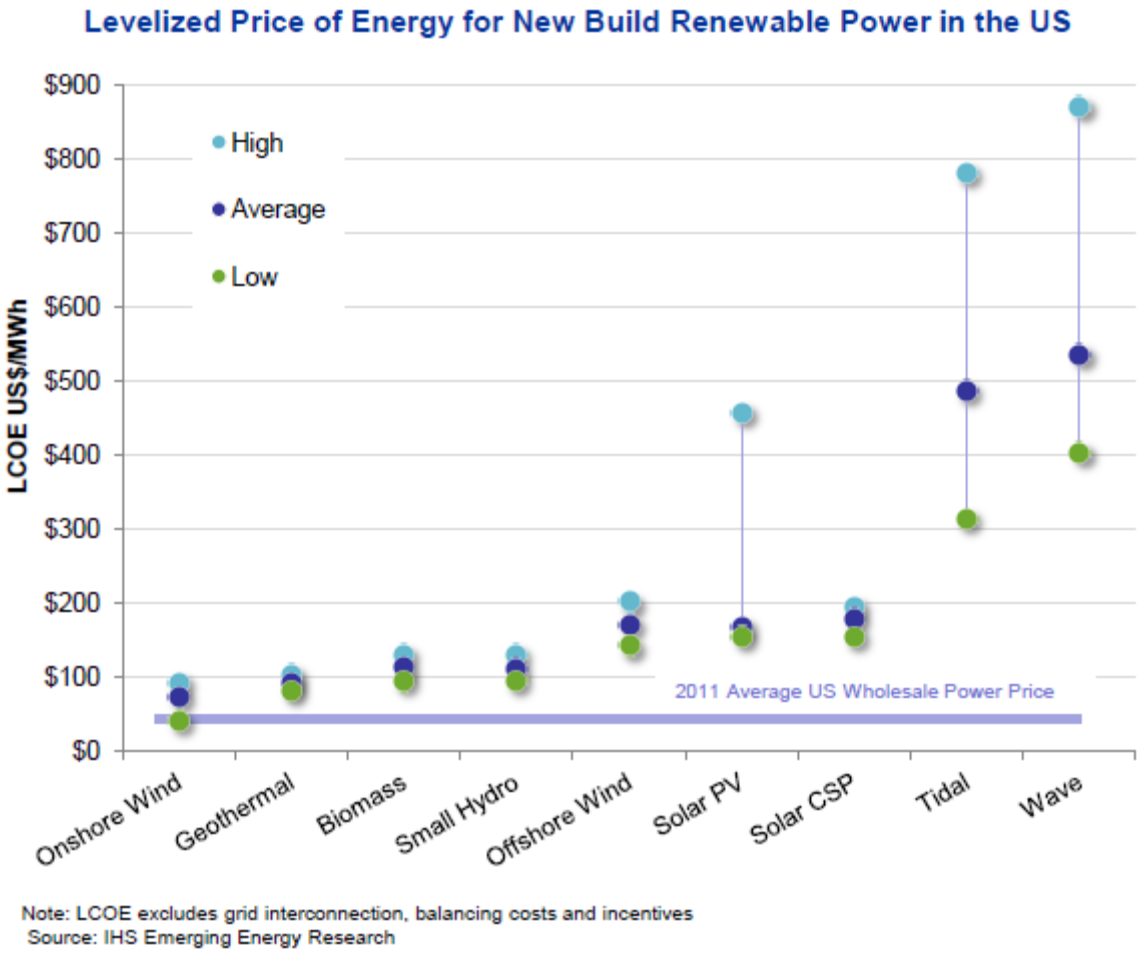
Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	29,300	$2,496,466,797	$3,295,022,268	$8,594,691,277
Indirect Effect	17,065	$1,469,989,658	$2,280,773,657	$4,524,842,020
Induced Effect	17,562	$1,051,808,059	$1,903,098,564	$3,204,056,638
Total Effect	63,928	$5,018,264,514	$7,478,894,489	$16,323,589,936

Fully Operational Wind Farm O&M

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	1,303	$137,645,401	$188,932,323	$447,138,951
Indirect Effect	952	$88,174,316	$133,748,280	$245,196,950
Induced Effect	921	$59,721,066	$108,036,247	$185,600,874
Total Effect	3,176	$285,540,782	$430,716,850	$877,936,775

- Construction impacts will occur over the life of the construction period, which is expected to be 9 years based on full schedule
- Total construction jobs will be 70,000 – 77,000 over 9 years
- O&M expenditures are an annual expense so the jobs supported will be permanent jobs

Offshore Wind and Solar Are Currently Comparable in Terms of Cost Position



Note: LCOE excludes grid interconnection, balancing costs and incentives
Source: IHS Emerging Energy Research

- Onshore wind should retain its current cost position relative to other renewable power options
- Offshore wind, at the low cost range, can provide lower prices than solar, and therefore shift development away from solar as a way to meet targets

Overview

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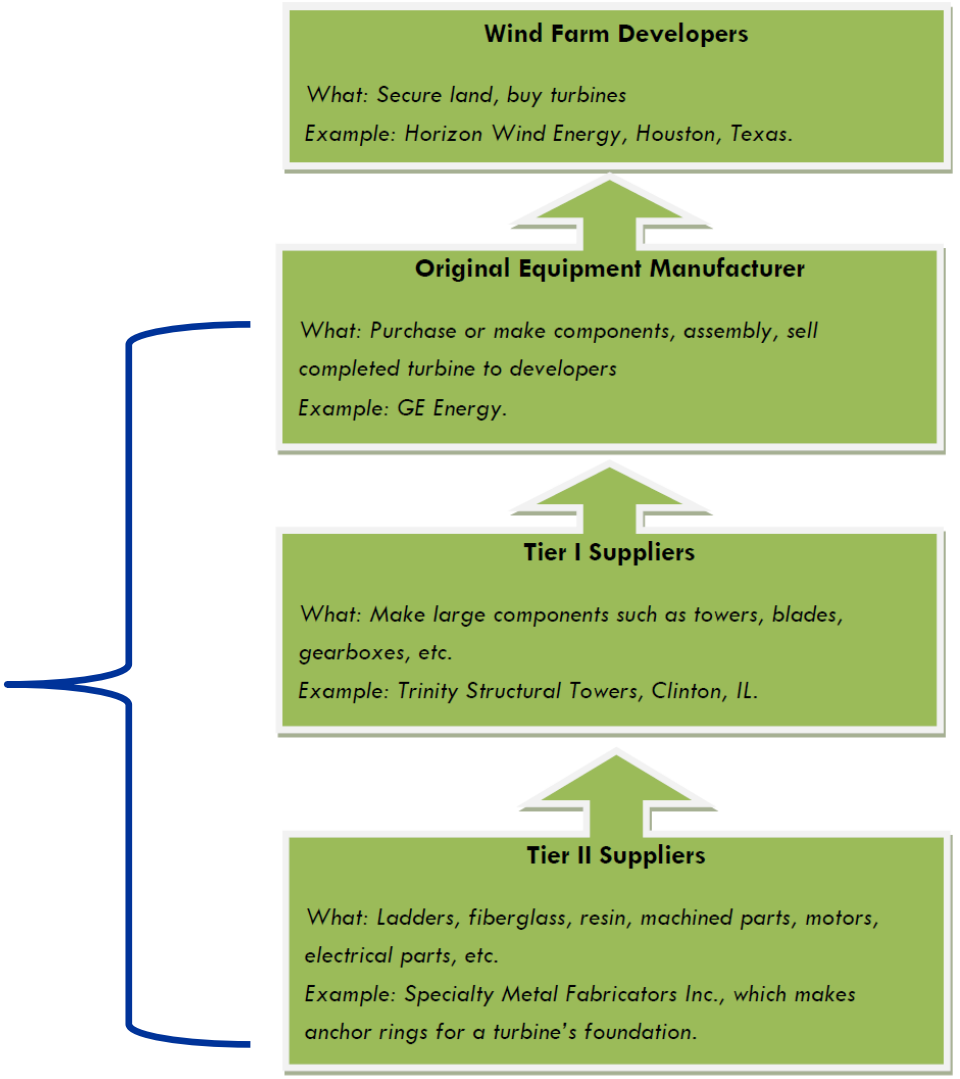
  - New Jersey
- Tipping Point Discussion

Tipping Point Analysis – Offshore Wind Supply Chain

- Direct employment growth impact primarily in construction of, and operation/maintenance of, the energy production system.

- But also significant opportunities to develop local manufacturing supply chain to manufacture components for the wind energy sector.

Typical Existing Wind Manufacturing Supply Chain



Tipping Point Analysis – Offshore Wind Supply Chain

- Modern wind turbines have over 8,000 components, ranging from steel towers to gearboxes to electrical wiring. Only about 2/3 of the components in U.S. wind turbines is currently manufactured domestically, presenting significant opportunities to local manufacturers.
- Local sourcing is preferred for towers, castings, forging services, nacelle cover and spinner to reduce transportation costs, decrease currency risk, and increase just-in-time turbine availability, product quality and service.
- As turbines become larger, few suppliers are equipped to produce the unique components and the size makes the components expensive and difficult to transport. The offshore wind industry's development will open up new markets for local suppliers and make retooling necessary.

Tipping Point Analysis – Offshore Wind Supply Chain

NAICS Code Subsectors Typically Associated with Wind Energy Sector Component Manufacturing

221	Utilities
484	Truck Transportation
3312	Steel Product Manufacturing from Purchased Steel
326199	Cement Manufacturing
327310	All Other Plastics Product Manufacturing
331511	Iron Foundries
332312	Fabricated Structural Metal Manufacturing
332991	Ball and Roller Bearing Manufacturing
333412	Industrial and Commercial Fan and Blower Manufacturing
333611	Turbine and Turbine Generator Set Units Manufacturing
333612	Speed Changer, Industrial High-Speed Drive, and Gear Manufacturing
333613	Mechanical Power Transmission Equipment Manufacturing
334418	Printed Circuit Assembly (Electronic Assembly) Manufacturing
334519	Other Measuring and Controlling Device Manufacturing
335312	Motor and Generator Manufacturing
335999	All Other Miscellaneous Electrical Equipment and Component Manufacturing
541620	Environmental Consulting Services
541690	Other Scientific and Technical Consulting Services
541990	All Other Professional, Scientific, and Technical Services

Tipping Point Analysis – NJ Capacity Review

Location Quotient for Key Wind Power Industrial Sectors in NJ

STATE	NAICS CODE		2006	2011	2016
NJ	221	Utilities	0.821	0.880	0.834
NJ	484	Truck Transportation	0.954	0.901	0.916
NJ	3312	Steel Product Manufacturing from Purchased Steel	0.642	0.454	0.413
NJ	326199	Cement Manufacturing	**18.818**	**13.960**	**9.345**
NJ	327310	All Other Plastics Product Manufacturing	0.003	0.006	0.007
NJ	331511	Iron Foundries	0.560	0.219	0.148
NJ	332312	Fabricated Structural Metal Manufacturing	0.396	0.442	0.470
NJ	332991	Ball and Roller Bearing Manufacturing	0.544	0.385	0.430
NJ	333412	Industrial and Commercial Fan and Blower Manufacturing	0.045	0.078	0.121
NJ	333611	Turbine and Turbine Generator Set Units Manufacturing	0.077	0.289	0.247
NJ	333612	Speed Changer, Industrial High-Speed Drive, and Gear Manufacturing	0.377	0.496	0.557
NJ	333613	Mechanical Power Transmission Equipment Manufacturing	0.176	0.475	0.316
NJ	334418	Printed Circuit Assembly (Electronic Assembly) Manufacturing	0.338	0.119	0.086
NJ	334519	Other Measuring and Controlling Device Manufacturing	0.496	0.422	0.376
NJ	335312	Motor and Generator Manufacturing	0.183	0.213	0.231
NJ	335999	All Other Miscellaneous Electrical Equipment and Component Manufacturing	**1.223**	**1.134**	**1.032**
NJ	541620	Environmental Consulting Services	**1.379**	**1.240**	**1.247**
NJ	541690	Other Scientific and Technical Consulting Services	**1.074**	0.676	0.659
NJ	541990	All Other Professional, Scientific, and Technical Services	**1.629**	0.722	0.581

Tipping Point Analysis – Existing Industrial Capacity Review

- In 2004, NJ was one of top 20 states (ranked by average investment) for having firms with the technical potential to become active manufacturers of wind turbine components (especially rotor & nacelle & controls; also gearbox & drive train, generator & power electronics, & tower).
- In 2011, NJ already had above average employment concentration in key component manufacturing industry categories including misc. electrical equipment manufacturing, and environmental consulting services.
- And NJ had significant employment concentrations in several other key component manufacturing industry categories such as fabricated structural metal manufacturing and mechanical power transmission equipment manufacturing suggesting a strong manufacturing base to support the development of local component manufacturing supply chains.

Tipping Point Analysis – Impact of Industrial Development

- Most of the labor for offshore wind will draw from local and regional sources. Analysis done at NREL extrapolated from European studies (EWEA 2009) estimated that offshore wind will create approximately 20.7 jobs per annual megawatt in the United States. In addition, approximately 0.8 jobs would be created for every cumulative megawatt of offshore wind in operation. (Source: NREL, Sept.2010)
- A 2004 report estimated that potentially 2,920 FTE jobs would be created in New Jersey's manufacturing sector based on average wind energy investment growth scenarios.
- The leadership position of the region's industry clusters (LQ>1) would most likely be accelerated by new demand from offshore wind development.
- A detailed analysis based on the current base of companies within the state would generate a more informed understanding of how New Jersey can best leverage wind sector investment to spur local component manufacturing (and other) supply chain development.