

Broad Mountain Power LLC, Wind Project

Economic Impact Report: Construction and Annual Operations

Date: June 10, 2019

Submitted to Olivia Neter, Environmental Planner for Liberty Power



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Executive Summary

Broad Mountain Power LLC applied to Packer Township to build a 4,000-acre windmill farm with 21 wind turbines that will range in height from 480 to 656 feet tall. The plan includes roads, turbines on gravel pads and required infrastructure; for example, underground electrical collector lines, a substation, a switching station, and several access roads through private land. Each turbine will connect to the new substations through the collector system that transfers electricity to the transmission network. It is estimated that the windfarm could power approximately 25,000 homes.

Construction will have a one-time economic impact within the county. It is estimated that the \$76 million in modeled construction costs will yield a total, one-time economic impact of \$93 million within Carbon County; supporting 270 direct, indirect, and induced jobs with \$6 million in earnings over the construction period (see Figure ES.1). Within the Commonwealth of Pennsylvania, the construction will generate a one-time economic impact of \$128 million and support 420 annualized jobs with \$16 million in earnings over the construction period.

Figure ES.1: One-time Economic Impact from Construction of the Broad Mountain Wind Project

	Carbon County	Commonwealth of Pennsylvania
Total Economic Impact (\$M)	\$93	\$128
Jobs Supported (FTE)	270	420
Total Employee Compensation (\$M)	\$6	\$16

Source: Liberty Power (2019), IMPLAN (2015)

Operations include the direct expenditures and associated employees' salaries that will generate indirect and induced impacts. Each year, the direct operating expenditures at the Broad Mountain Power LLC Wind Project will generate an estimated \$3.1 million in economic impact within Pennsylvania and support 10 employees with \$1 million in earnings. Of this total impact, \$2.7 million will occur in Carbon County.

Figure ES.2: Annual Economic Impact from Operations

	Carbon County	Commonwealth of Pennsylvania
Total Economic Impact (\$M)	\$2.7	\$3.1
Jobs-Years Supported (FTE)	9	10
Total Employee Compensation (\$M)	\$0.8	\$1.0

Source: Liberty Power (2019), IMPLAN (2015)

Table of Contents

1.	Introduction	6
1.1.	Purpose of Report	6
1.2.	About Liberty Power	6
1.3.	About the Broad Mountain Wind Project	6
1.4.	About Wind Turbines	6
1.5.	Organization of the Report	7
2.	Impact from Construction	8
2.1.	Methodology	8
2.2.	Direct Footprint	8
2.3.	Economic Impact	9
2.4.	Industry Distribution of Employment Impact	10
2.5.	State Tax Revenue Impact	10
3.	Impact from Operations	11
3.1.	Direct Impact	11
3.2.	Economic Impact	11
3.3.	Local and State Tax Revenue Impact	12
3.4.	Community Benefits Agreement	12
	Appendix – Input Output Methodology in Detail	14
	Overview	14
	Input-Output Model Theory	14
	Input-Output Model Mechanics	14
	Employment and Wages Supported	15
	Tax Revenue Impact	15

About Econsult Solutions, Inc.

This report was produced by Econsult Solutions, Inc. (“ESI”). ESI is a Philadelphia-based economic consulting firm that provides businesses and public policy makers with economic consulting services in urban economics, real estate economics, transportation, public infrastructure, development, public policy and finance, community and neighborhood development, planning, as well as expert witness services for litigation support. Its principals are nationally recognized experts in urban development, real estate, government and public policy, planning, transportation, non-profit management, business strategy and administration, as well as litigation and commercial damages. Staff members have outstanding professional and academic credentials, including active positions at the university level, wide experience at the highest levels of the public policy process and extensive consulting experience.

1. Introduction

1.1. Purpose of Report

The purpose of this report is to quantify the estimated economic impacts and tax revenues that will be produced by Liberty Power's Broad Mountain Wind Project. The proposed wind farm, through its construction and future operations, will produce a stimulus to the regional and statewide economies through the creation of jobs and additional tax dollars.

Based on information provided by Liberty Power and industry averages specific to Carbon County, Pennsylvania, ESI calculated an aggregate amount of potential direct activity to be generated by the Broad Mountain Wind Project. ESI estimated the multiplier effect of these direct activities, in the form of total expenditures, employment, and earnings supported by it and by its spillover effects generated by it, by constructing an input-output model, which translates direct economic activity into a total scale and composition of economic activity within the Commonwealth.

1.2. About Liberty Power

Broad Mountain Power LLC is a subsidiary of Algonquin Power which is operating as Liberty Power. Liberty Power provides services in 14 states including over 50 utility territories to commercial, government, and residential accounts.¹ In Pennsylvania, Liberty Power offers a variety of fixed rate plans for standard or renewable energy. Liberty Power offers RECs (renewable energy credits) for households that want to offset their electricity consumption by having their bill spent on renewable energy infrastructure. Their mission is to not only provide its customers with affordable comprehensive energy solutions but to do so through an exceptional customer experience platform.

1.3. About the Broad Mountain Wind Project

Broad Mountain Power applied to Packer Township to build a 4,000-acre windmill farm with 21 wind turbines that will range in height from 480 to 656 feet tall. The plan includes the turbines on concrete pads, required infrastructure includes underground electrical collector lines, a substation, a switching station, and several access roads through private land. Each turbine will connect to the new substations, through the 34.5KV connector system that transfer electricity to the 69KV transmission network. It is estimated that the windfarm could power approximately 25,000 homes.

1.4. About Wind Turbines

A wind turbine uses the force of wind to turn the blades, which in turn spins a generator to produce electricity. Wind turbines are placed where there is an economically viable wind resource, including in bodies of water, and are most cost effective when placed in larger 'wind farms' where they can combine to generate more bulk energy or utility-scale wind.

¹ Algonquin Power & Utilities Corp. "Annual Information Form", 2017

Turbines will start to generate energy at wind speeds of six to nine mph and generate more energy with more wind, taller height, or greater rotor diameter. Modern turbines are becoming increasingly efficient, with the largest wind farms surpassing coal or natural gas power plants in terms of capacity factor and measuring almost twice as efficient as turbines from the early 2000's. Wind energy is often measured in terms of capacity factor – the amount of electricity a turbine produces annually relative to its maximum potential. Modern wind turbines generally operate at over 40% capacity factor, which is comparable to some forms of natural gas or coal power plants. For context, the average annual electricity consumption of a U.S. home was approximately 10,400 kilowatt hours (kWh) in 2017.² Liberty Power's Broad Mountain Wind Project is expected to generate 250,000 megawatt hours (MWh), enough to power 25,000 homes.

1.5. Organization of the Report

ESI constructed two economic impact models, one for the upfront construction of the project and one for its ongoing operations. Our economic impact models calculate the economic impact activity at the county level and the state level. This report identifies and quantifies the broad economic and tax revenue benefits of the proposed Broad Mountain Wind Project to Carbon County, Pennsylvania. Following, we discuss the methodology and results for estimating the economic impacts from construction of the wind turbines and from their operations.

² U.S. Energy Information Administration. *Residential Energy Consumption Survey, 2018*

2. Impact from Construction

2.1. Methodology

To estimate the full range of economic, employment, and labor income impacts associated with the Broad Mountain Wind Project, ESI used IMPLAN, an industry standard, input-output modeling software program, which uses geography-specific industry data to determine the impacts of new and existing economic activity. The role of input-output models is to determine the linkages across industries to calculate the magnitude and composition of the spillover impacts to all industries benefiting from spending in the subject industry.

In an inter-connected economy, every dollar spent generates two spillover impacts.

- First, some proportion of goods and services purchased gets circulated back into an economy when those goods and services are purchased from local vendors. This is the indirect effect.
- Second, some amount of the labor income gets circulated back into an economy when employees spend their earnings on various goods and services. This is the induced effect.
- The total economic impact of the project will therefore be the sum of the direct economic activity at the proposed new office tower, plus the indirect and induced effects generated by that direct economic activity.

These increases in economic activity are then translated into attendant fiscal impacts using a custom fiscal model for the Commonwealth of Pennsylvania, which is developed by comparing observed levels of economic activity with observed revenue collections (i.e. effective tax rates).

2.2. Direct Footprint

The first component of economic impact generated by the project is associated with the construction of the windfarm. In total, the preliminary development cost is between \$145 million and \$165 million, which includes the purchase of the turbines, construction, development fees, and other associated construction costs. To be conservative, ESI assumed a construction budget of \$150 million, which is both reasonable and conservative for a windfarm of this size. The development budget is the input to estimate the one-time economic impact from construction. Since our geographic model is Pennsylvania, we are only modeling construction spending within Pennsylvania, not for the entirety of the projects. For instance, the turbines will be purchased from a manufacturer from outside of Pennsylvania. As such, we included just 10 percent of the entire expenditure to account for the transportation and installation of the turbines only. Additional construction items were scaled appropriately to ensure that only Pennsylvania expenditures were included in the economic model. The interest and financing costs are not included in the economic impact model as, for economic impact models, are not considered to circulate as typical expenditures through the economy. All told, of the \$150 million in total construction costs, it is estimated that \$70.2 million will generate economic impact within the Commonwealth of Pennsylvania (see Figure 2.1).

Figure 2.1: Proposed Construction Budget for the Broad Mountain Wind Project and the Components Modeled to Estimate Economic Impact in Pennsylvania

Proposed Construction	Project Budget	Modeled Expenditure	Proportion in PA	Modeled in PA
Turbines	\$71.1	\$71.1	10%	\$7.1
Balance of Plant	\$44.1	\$44.1	75%	\$33.1
Miscellaneous Soft Costs	\$18.8	\$18.8	98%	\$18.3
Interest and Financing	\$4.3	\$0.0	0%	\$0.0
Substations & Road Upgrades	\$11.7	\$11.7	100%	\$11.7
Total	\$150.0	\$145.7	48%	\$70.2

Source: Liberty Power (2019)

2.3. Economic Impact

The construction will take place within Carbon County. It will also generate spillover effects in Pennsylvania, stimulating business activity and supporting increased employment across a variety of sectors in the state. Construction will have a one-time economic impact within the county. It is estimated that the \$70 million in modeled construction costs will yield a total, one-time economic impact of \$93 million within Carbon County; supporting 270 direct, indirect, and induced jobs³ with \$6 million in earnings over the construction period (see Figure 2.2). Within the Commonwealth of Pennsylvania, the construction will generate a one-time economic impact of \$128 million and support 420 jobs with \$16 million in earnings over the construction period.⁴

Figure 2.2: One-time Economic Impact from Construction of the Broad Mountain Wind Project

	Carbon County	Commonwealth of Pennsylvania
Direct Impact (\$M)	\$70	\$70
Indirect & Induced Impact (\$M)	\$23	\$58
Total Economic Impact (\$M)	\$93	\$128
Jobs Supported (FTE)	270	420
Total Employee Compensation (\$M)	\$6	\$16

Source: Liberty Power (2019), IMPLAN (2015)

³ Throughout the report, jobs refer to the number of full-time equivalent jobs created or supported by the project. One FTE job is equivalent to one employee working full time but could be filled by multiple employees work part-time.

⁴ Earnings (Employee Compensation) include salaries and benefits of all direct, indirect, and induced employees.

2.4. Industry Distribution of Employment Impact

While the largest number of jobs supported by the construction of the windfarm will fall within the construction industry, a significant portion of the employment impact occurs in a range of industries. Direct, indirect, and induced jobs are supported in wholesale trade, retail trade, and the professional, scientific, and technical services industries, as well as additional industries across the state (see Figure 2.3)

Figure 2.3: Employment Impact Detailed by Industry

Industry	Direct, Indirect, and Induced FTEs	Employment Impact (%)
Construction	114	27%
Wholesale Trade	37	9%
Retail Trade	37	9%
Professional, Scientific, and Technical Services	35	8%
Administrative and Support and Waste Management	28	7%
Manufacturing	26	6%
Health Care and Social Assistance	25	6%
Transportation and Warehousing	25	6%
All Other Industries	93	22%
Total	420	

Source: IMPLAN (2015)

2.5. State Tax Revenue Impact

The construction of the windfarm will generate one-time tax revenues to the Commonwealth. The tax revenues modeled include income, sales, and business taxes. In total, construction activity will generate approximately \$1.9 million in one-time total tax revenues to the Commonwealth from the direct, indirect and induced economic activity (see Figure 2.4).

Figure 2.41: One-time Tax Revenue Impact from Construction of the Broad Mountain Wind Project

	Commonwealth of Pennsylvania
Income Tax	\$284,000
Sales Tax	\$1,231,000
Business Tax	\$392,000
Total	\$1,907,000

Source: Liberty Power (2019), IMPLAN (2015), Commonwealth of Pennsylvania (2017)

3. Impact from Operations

3.1. Direct Impact

Because the project has not yet been constructed and the actual operating budget has yet to be established, the direct and therefore spillover impacts of annual operations are subject to change. This, of course, is dependent on the number of turbines on site, the operating structure of the windfarm, and the annual wages paid to the employees. Using data from Liberty Power combined with industry standards where data was unavailable, ESI estimated operating costs and employees on a per turbine basis as a proxy for the actual future operating metrics.

It is estimated that a 21 turbine wind turbine farm will have operating expenses of approximately \$2.1 million, of which \$720,000 will go towards the salaries and benefits for its six full-time equivalent employees.⁵ It should be noted that these operating numbers are both preliminary and conservative as there is a possibility that the windfarm will exceed previously stated turbine and substation estimates.

3.2. Economic Impact

These direct expenditures and associated employees' salaries will generate indirect and induced impacts, which sum to the total economic output associated with the windfarm. In addition, these direct, indirect, and induced expenditures will support additional employment and related earnings within Pennsylvania. Each year, the direct operating expenditures at the Broad Mountain Wind Project will generate an estimated \$3.1 million in economic impact within Pennsylvania and support 10 employees with \$1 million in earnings. Of this total impact, \$2.7 million will occur within Carbon County (see Figure 3.1).

Figure 3.1: Annual Economic Impact from Operations

	Carbon County	Commonwealth of Pennsylvania
Direct Impact (\$M)	\$2.1	\$2.1
Indirect & Induced Impact (\$M)	\$0.6	\$1.0
Total Economic Impact (\$M)	\$2.7	\$3.1
Jobs-Years Supported (FTE)	9	10
Total Employee Compensation (\$M)	\$0.8	\$1.0

Source: Liberty Power (2019), IMPLAN (2015)

⁵ Liberty plans on employing one to two full-time equivalent Broad Mountain employees and four to five employees through its subcontractors.

3.3. Local and State Tax Revenue Impact

The increases in economic output and employment associated with the windfarm’s operations also yield increases in state and local tax bases. Tax revenues result both from the set of direct taxes and from increases in tax revenue associated with the additional income generated by operations. These revenues result not only from the direct operations and employment, but from the impacts of the indirect and induced impacts estimated above on various state tax bases.

Figure 3.2: Annual Tax Revenue Impact from Operations the Broad Mountain Wind Project

	Commonwealth of Pennsylvania
Income Tax	\$15,000
Sales Tax	\$32,000
Business Tax	\$10,000
Total	\$57,000

Source: Liberty Power (2019), IMPLAN (2015), Commonwealth of Pennsylvania (2017)

In addition to taxes generated for the Commonwealth, approximately \$100,900 in property tax revenues will be paid to local jurisdictions. Each year, \$82,100 in property taxes will go to Weatherly School District, \$17,760 to Carbon County, and \$1,040 to Packer Township (see Figure 3.3).

Figure 3.3: Annual Property Tax Revenue Impact from the Broad Mountain Wind Project

	Carbon County	Packer Township	Weatherly Area School District	Total
Projected Fair Market Value	\$3,800,000	\$3,800,000	\$3,800,000	\$3,800,000
County Common Level Ratio	45.6%	45.6%	45.6%	45.6%
Projected Assessed Value	\$1,732,800	\$1,732,800	\$1,732,800	\$1,732,800
Millage Rate	10.25	0.60	47.38	58.23
Real Estate Tax Revenue	\$17,760	\$1,040	\$82,100	\$100,900

Source: Liberty Power (2019). Pennsylvania Department of Revenue (2019)

3.4. Community Benefits Agreement

Community Benefits Agreements can be used as a way to get the community affected by an economic development project involved in the planning process. By providing the community with either monetary support or specific amenities, the developer can gain support from the local businesses and residents.

In 2016, a Host Community Benefits Agreement (HCBA) was reached in Hector Township, PA which allowed for Eolian Renewable Energy LLC to begin its Big Level Wind Project, a wind farm built over 7,000-acres of private forestland in Potter County. The \$150 million site includes 24 turbines that are

over 600 feet in height and produce 90MW of electricity which is fed into the grid through a First Energy Line⁶. Big Level Wind agreed to pay \$2,250 per rated MW, less its tax bill, to the Township each year through its HCBA.⁷

Modeled after the 2016 Hector Township HCBA, Liberty Power proposed a similar Host Community Benefits Agreement to Packer Township in February 2019 to create the Broad Mountain Wind Project. They agreed to pay \$2,250 per rated MW, less its tax bill, to the Township each year, which will likely equate to nearly \$80,000. However, the project has met opposition from the surrounding community and, after several zoning hearings, no agreement has been made.

⁶ National Wind Watch, Endeavor News. "Wind Turbines Coming", July 2016

⁷ Hector Township Host Community Agreement & Commissioning Plan, 2016

Appendix – Input Output Methodology in Detail

Overview

Economic impact estimates are generated by utilizing input-output models to translate an initial amount of direct economic activity into the total amount of economic activity that it supports, which includes multiple waves of spillover impacts generated by spending on goods and services and by spending of labor income by employees. This section summarizes the methodologies and tools used to construct, use, and interpret the input-output models needed to estimate this project’s economic impact.

Input-Output Model Theory

In an inter-connected economy, every dollar spent generates two spillover impacts:

- First, some amount of the proportion of that expenditure that goes to the purchase of goods and services gets circulated back into an economy when those goods and services are purchased from local vendors. This is the “indirect effect,” and reflects the fact that local purchases of goods and services support local vendors, who in turn require additional purchasing with their own set of vendors.
- Second, some amount of the proportion of that expenditure that goes to labor income gets circulated back into an economy when those employees spend some of their earnings on various goods and services. This is the “induced effect,” and reflects the fact that some of those goods and services will be purchased from local vendors, further stimulating a local economy.

The role of input-output models is to determine the linkages across industries in order to model out the magnitude and composition of spillover impact to all industries of a dollar spent in any one industry. Thus, the total economic impact is the sum of its own direct economic footprint plus the indirect and induced effects generated by that direct footprint.

Input-Output Model Mechanics

To model the impacts resulting from the direct expenditures, Econsult Solutions, Inc. developed a customized economic impact model using the IMPLAN input/output modeling system. IMPLAN represents an industry standard approach to assess the economic and job creation impacts of economic development projects, the creation of new businesses, and public policy changes within its surrounding area. IMPLAN has developed a social accounting matrix (SAM) that accounts for the flow of commodities through economics. From this matrix, IMPLAN also determines the regional purchase coefficient (RPC), the proportion of local supply that satisfies local demand. These values not only establish the types of goods and services supported by an industry or institution, but also the level in which they are acquired locally. This assessment determines the multiplier basis for the local and regional models created in the IMPLAN modeling system. IMPLAN takes the multipliers and divides them into 536 industry categories in accordance to the North American Industrial Classification System (NAICS) codes.

The IMPLAN modeling system also allows for customization of its inputs which alters multiplier outputs. Where necessary, certain institutions may have different levels of demand for commodities. When this occurs, an “analysis-by-parts” (ABP) approach is taken. This allows the user to model the impacts of direct economic activity related to an institution or industry with greater accuracy. Where inputs are unknown, IMPLAN is able to estimate other inputs based on the level of employment, earnings, or output by an industry or institution.

Employment and Wages Supported

IMPLAN generates job estimates based on the term “job-years”, or how many jobs will be supported each year. For instance, if a construction project takes two years, and IMPLAN estimates there are 100 employees, or more correctly “job-years” supported, over two years, that represents 50 annual jobs. Additionally, these can be a mix of a full and part-time employment. Consequently, job creation could feature more part-time jobs than full-time jobs. To account for this, IMPLAN has a multiplier to convert annual jobs to full-time equivalent jobs.

Income to direct, indirect, and induced jobs is calculated as employee compensation. This includes wage and salary, all benefits (e.g., health, retirement) and payroll taxes (both sides of social security, unemployment taxes, etc.). Therefore, IMPLAN’s measure of income estimates gross pay opposed to just strictly wages.

Tax Revenue Impact

The economic impacts in turn produce one-time or ongoing increases in various tax bases, which yield temporary or permanent increases in various tax revenues. To estimate these increases, Econsult Solutions, Inc. created a tax revenue impact model to translate total economic impacts into their commensurate tax revenue gains. These tax revenue gains only account for a subset of the total tax revenue generation that an institution or industry may have on the economy. Furthermore, where institutions are tax exempt, only the tax revenue generation from supported indirect and induced industries is accounted for.