EIGHT POINT WIND ENERGY CENTER

Case No. 16-F-0062

1001.6 Exhibit 6

Wind Power Facilities

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Exhibit 6: Wind Power Facilities

6(a) Setbacks - Requirements & Recommendations

The Applicant has sited the wind turbines and associated components to maximize the capture of the wind resource, while minimizing impacts to both the public and the environment. The Applicant has been diligent throughout the siting process to place wind turbines and Project Facilities in accordance with local laws and setbacks, to minimize impacts to public health and the environment, and to maintain the efficiency and economic viability of the Project. In doing so, the proposed Project minimizes impacts while still helping New York State meet its energy goals (discussed more in Exhibit 10).

Preliminary selection of wind turbine locations is driven by many essential operational factors, both technical and economical, many of which are unique to siting commercial-scale wind energy projects. The Applicant selected the proposed Project Area because of the presence of good wind resource, available land from willing landowners, good transportation corridors and roads to access the wind turbine sites, sufficient available capacity on the local grid and sufficient space at the point of interconnection. Additional factors are reasonable local laws, compatible land use, topography, cooperative landowners, and avoidance of areas considered of high local, state or federal significance, or environmental sensitivity, as well as turbine spacing, agricultural area protection, biological and cultural resource avoidance, minimization of visual and noise impacts, and ample distance from residences and other buildings. The Applicant has selected and presented a final design that considers all of these factors and one which abides all applicable local (substantive requirements), state, and federal regulations, ensures public safety, and minimizes impacts at residential or other sensitive structures.

The Facility Site is located in an area of Steuben County that has a rural and low-density population character, with forestland and agriculture as the dominant land uses. The Facility Site is mostly forested, with agricultural fields located on the plateaus at higher elevations. Residential land use is minimal in the Facility Site, with most single-family homes located along public roadways adjacent to the Project.

This section of the Exhibit provides an evaluation of the Facility's turbine setbacks. Specific to a wind energy facility, a setback is the distance which a wind turbine must be set back from a road, residence, property line, or other location appropriate for a setback. Proposed setback distances from homes, structures, utilities and roads are put in place to ensure protection for tower failure, blade (fragment) throw, and ice throw. Sound and shadow analyses, wetland and water surveys, health and setback analyses and more all went into the siting and design of the Project to ensure that public health considerations were addressed and the Project will be built with a design and in a manner that will not impose any health burdens upon people in the area.

Adequate setbacks between wind turbines and sensitive receptors will ensure the Project meets noise design goals. During the course of the noise impact assessment, the size of the Project Area was significantly reduced. Therefore, many receptors which were originally within one mile of the Project are now considerably further away from the Project but were retained in the evaluation for consistency. A map showing the location of sensitive sound receptors in relation to the Facility is provided in Figure 3-1 of the Noise Impact Assessment (NIA) in Appendix 19-1.

Planning and zoning within Steuben County is primarily regulated at the town level. The Towns of Greenwood and West Union have no zoning laws, however, they have adopted laws specific to wind energy in order to manage development in their towns. The following table provides a summary of the required setbacks in each town as well as the turbine manufacturer's suggested setbacks.

Table 6-1. Setback Requirements and Recommendations[1]

Setback Requirement	Manufacturer's Suggested	Town of Greenwood	Town of West Union	Applicant Applied
Residences	1.5 times turbine height (897 feet for 3.43 MW turbine)	1,400 ft. from nearest off-site residence	1,400 ft. from nearest off-site residence	1,400 ft. from nearest residence
Site boundary/ property lines	1.1 times turbine height (645 feet for 3.43 MW turbine)	1.1 times the turbine height	1.2 times the turbine height	1.2 times the turbine height
Other built structures (barns, etc.)	1.1 times blade length	1.5 times the turbine height	1.5 times the turbine height	1.5 times the turbine height
Roads	1.1 times turbine height	1.1 times the turbine height	1.2 times the turbine height	1.2 times the turbine height
Aboveground utilities	1.1 times turbine height	1.1 times the turbine height	1.2 times the turbine height	1.2 times the turbine height
Wetlands	None specified	No specific ordinance	100 ft. from State Identified Wetlands	100 ft. from State Identified Wetlands
Noise related setbacks	None specified	Adequate distance from existing residence that the statistical sound pressure level generated by a WTG shall not exceed L_{10} - 50 dBA measured at the nearest residence located off the Site. If the ambient sound pressure level exceeds 50 dBA, the standard shall be ambient dBA plus 6 dBA	Adequate distance from existing residence that statistical sound pressure level generated by a WTG shall not exceed L_{10} - 50 dBA measured at the nearest residence located off the Site. If the ambient sound pressure level exceeds 50 dBA, the standard shall be ambient dBA plus 6 dBA	Adequate distance from existing residence that statistical sound pressure level generated by WTGs shall not exceed L_{10} of 50 dBA, and L_{eq} (8-hour) of 45 dBA measured at the nearest residence.

1 Turbine height is defined as the maximum height when the blade is aligned vertically with the tower and at its highest position.

As shown in Table 6-1 above, the Project meets and in some instances exceeds the Town's standards. The Applicant will utilize a standard setback of at least 1,400 feet from nearest off-site residence and 1.2 times the turbine height from roads, property lines and structures, which complies with setback requirements of all participating municipalities. The Applicant will site turbines no closer than 1.5 times turbine height in relation to electric transmission lines operating at 115 kV or greater (including the proposed Article VII facilities).

6(b) Facility Accommodation of Required/Recommended Turbine Setbacks

The proposed Facility locations will meet or exceed the manufacturer's and towns' setback requirements. The Towns of Greenwood and West Union both have enacted local laws which regulate the development of wind energy facilities within their respective towns. Complete copies of both laws are included as Appendices to this Application (Appendix 31-1 and Appendix 31-2, respectively). The turbine setbacks required by the Towns of Greenwood and West Union (as dictated in the local laws) are outlined in Table 6-1 above.

Figure 6-1 depicts the turbine layouts encompassed by various setback requirements including, residences, applicant standard setback distances, right-of-ways, property lines, built structures, and roads. There are no state regulated wetlands in the vicinity of the Project Facilities. Additionally, sound level criteria, including setbacks, is shown on representative mapping as part of the Noise Impact Assessment (NIA), included herein as Appendix 19-1 to Exhibit 19.

The following sections provide a detailed explanation of the degree to which the Applicant has accommodated in the facility layout the required and/or recommended turbine setbacks required for the Project.

(a) **Residences:** The manufacturer suggested setback for residences is 1.5 times the turbine height which is equivalent to 897 feet for 3.43 MW turbines. The Towns of Greenwood and West Union require turbines to be sited 1,400 feet from the nearest off-site residence. The Applicant will accommodate these requirements by siting turbines 1,400 feet from the nearest residence.

(b) **Applicant standard setback distances:** The Applicant's standard setback distance for this Project includes a minimum setback of 1,400 feet from residences, a setback of blade length from a property line (unless property owner(s) approve of less), and 1.5 times turbine height from transmission lines. These setbacks align with local town mandated setback requirements.

(c) **Rights-of-ways:** The manufacturer suggested setback for right-of-ways (ROWs) and above ground utilities is 1.1 times the turbine height which is 645 feet for a 3.43 MW turbine. The Town of Greenwood also requires a setback of 1.1 times the turbine height and the Town of West Union requires a setback of 1.2 times the turbine height. The Applicant will meet this requirement in siting turbines at 1.2 times the turbine height away from ROWs and above ground utilities.

(d) **Property Lines:** The suggested setback from the manufacturer is 1.1 times the turbine height. The Town of Greenwood requires a setback of 1.1 times the turbine height and the Town of

West Union requires 1.2 times the turbine height. The Applicant will comply with this requirement and will site turbines 1.2 times the turbine height away from property lines.

(e) **Built structures:** The manufacturer suggested setback is 1.1 times the blade length for other built structures. The Towns of Greenwood and West Union require 1.5 times the turbine height. The Applicant will meet this requirement and will apply a setback of 1.5 times the turbine height.

(f) **Roads:** The manufacturer suggests, and the Town of Greenwood requires a setback of 1.1 times the turbine height. The Town of West Union requires 1.2 times the turbine height. The Applicant will exceed these requirements and has sited turbines 1.5 times the turbine height away from roads.

(g) **Wetlands:** The turbine manufacturer and the Town of Greenwood do not have any suggested requirements for wetland setbacks. Similarly to the New York State Department of Environmental Conservation (NYSDEC) requirements, the Town of West Union requires turbines to be 100 feet from State regulated wetlands. There are no State regulated wetlands mapped within 100 feet of the Project Facilities, therefore, the Project is in compliance with this requirement. There are no setbacks required for non-State regulated wetlands in West Union and Greenwood.

(h) **Sound level criteria:** The manufacturer does not have a suggested setback for sound level criteria. The Towns of Greenwood and West Union require turbines to be sited an adequate distance that the statistical sound pressure level generated by a turbine and measured at the nearest residence off site shall not exceed L_{10} – 50 dBA. If the ambient sound level exceeds 50 dBA, the standard shall be ambient dBA plus 6 dBA.

6(c) Third-Party Review and Certification

Based on information on the quality of the existing wind resource, Eight Point Wind anticipates utilizing 27 GE 3.43 MW wind turbines and 4 GE 2.3 MW wind turbines. These turbines are three-bladed, up wind, horizontal-axis wind turbine with rotor blade diameters of 137 meters (449.5 feet) and 116 meters (380.6 feet), respectively. The turbine rotor and nacelle are expected to be mounted on top of 110 meter and 94 meter tubular steel towers, respectively. Please see Appendix 2-1 and Appendix 2-2 for additional specifications for these wind turbines.

GE has conducted a review of the wind conditions at the Project site and analysis to determine the suitability of the proposed 3.43 MW and 2.3 MW wind turbines for use at the site. The analysis was completed using the actual turbine locations, wind data from the site and considered among other things wind speed, wind direction, fatigue, extreme loads, weather conditions, wind shear, and turbulence. The analysis certifies that the wind turbines proposed for the site are within IEC 61400 TC design load standards and installation and operation of these wind turbines are approved. The full report which is included as Appendix 5-4 contains confidential information therefore the Applicant will seek the requisite trade secret protection for this information pursuant to POL Section 87(2)(d), 16 NYCRR § 6-1.3, other applicable law, and/or a protective order as necessary.

6(d) Wind Turbine Classes

There are many factors to consider when reviewing whether adequate wind conditions exist to support the estimated capacity factor for a specific Project. Table 6-2 below has been adapted from Burton, et al. (2001) and displays wind turbine classes and turbulence intensity for large wind turbines. These wind turbine classes are utilized by the International Electrotechnical Commission (IEC) to evaluate large wind turbines and determine wind speeds, gusts and turbulence limits for each turbine class.

Table 6-2. International Electrotechnical Commission (IEC) Large Wind Turbine Classes

Wind speed in m/s		High Wind		Medium Wind		Low Wind		Ultra Low Wind	
		I		II		III		IV	
Annual Average Wind Speed	Vavg	10		8.5		7.5		6	
Reference Wind Speed	Vref	50		42.5		37.5		30	
50-Year Return Gust Speed	1.4 Vref	70		59.5		52.5		42	
1-year Return Gust Speed	1.05 Vref	52.5		44.6		39.4		31.5	
		A	B	A	B	A	B	A	B
Turbulence Intensity at 15 m/s	I15	18%	16%	18%	16%	18%	16%	18%	16%
		2	3	2	3	2	3	2	3

I15 Characteristic value of hub-height turbulence intensity at a ten-minute average wind speed of 15 m/s

a: Slope parameter used in the turbulence intensity equation

Note: 10-minute averages, hub height wind speed. Air density, 1.225 kg/m3

Adapted from IEC 61400-1; cited in Wind Energy Handbook, Tony Burton, et al, John Wiley & Sons UK, 2001, ISBN: 0-471-48997-2, p. 210

Table 6-3, below, displays the Project-specific temperature extremes, average wind speed, gust speeds and turbulence intensity at the Facility Site. This information was extrapolated from Modern-Era Retrospective analysis for Research and Applications (MEERA) data, as well as collected meteorological data and other modeling performed by the Applicant. As shown in Table 6-3, the GE 3.4 MW and 2.3 MW wind turbines proposed for the Project are both suitable for Class III winds as noted in the turbines specifications in Appendix 2-1 and Appendix 2-2. Please see Section 6(e), below, for additional discussion regarding wind meteorological analyses for the Project.

Table 6-3. Project-specific Wind Regime Suitability

Wind Regime Factors	Measurement
20-year maximum hub height temperature at any turbine location	33.4 ºC
20-year minimum hub height temperature at any turbine location	-28.8 ºC
20-year average hub height temperature at site average elevation	7.3 ºC
average wind speed (m/s)	7.26 m/s
50-year recurrence, 10-min average wind speed at HH (m/s)[1]	30 m/s
1-year recurrence, 3-sec average wind speed at HH (m/s)[1]	33.6 m/s

[1] The 50 year, 10 minute extreme value distributions were fitted using historical 10 minutes wind speed information from each met tower. The 1 year 3 second gust value was then derived based on IEC 64100 guideline. By visual inspection the extreme winds at the met tower was used as a proxy for each turbine depending on location and relative distance to the tower.

6(e) Wind Meteorological Analyses

The wind resource analysis is used to optimize the turbine layout to maximize energy production within the context of the existing, site-specific constraints. The Applicant has had one meteorological tower on site since 2014 and one sound navigation and ranging (SODAR) device on site since 2013. The detailed results of these analyses are proprietary. Therefore, a copy of the wind energy resource (meteorological) analysis is being provided with the Article 10 Application as Appendix 6-1. Eight Point Wind will seek the requisite trade secret protection for this information pursuant to N.Y. Public Officer's Law ("POL") Section 87(2)(d) and 16 NYCRR § 6-1.3.

Through the use of on-site meteorological data collected at the wind measurement tower and SODAR unit mentioned above, topographic and surface roughness data, wind flow modeling, and wind plant design software, the wind turbines are selected and sited to optimize exposure to wind from all directions, with emphasis on exposure to the prevailing wind direction in the Project Area. This analysis has shown that the available wind resource when captured with the modern wind turbine technology. The strategic location of wind turbines presented in this Application was determined by correlating the highest wind resource areas with various siting constraints and impact avoidance measures, while also considering the most constructible and logistically economical designs.

Analysis was performed utilizing the quality-checked data from one on-site met tower, one on- site SODAR and multiple long-term data points from the Modern-Era Retrospective Analysis for Research and Applications (MERRA) data set as compiled by the National Aeronautics and Space Administration (NASA) to demonstrate sufficient wind resource areas within the Project Area that the Facility Site has been sited. There have been significant developments in wind turbine technology in the last five years and the turbine models proposed are designed to maximize wind energy yields in this region of New York.

Based on the models completed by the Applicant, Eight Point Wind Project is estimated to have an average annual net capacity factor (NCF) of approximately 38 percent. NCF is the ratio of an actual electrical energy output over a given period of time to the maximum possible electrical energy output over the same amount of time. Annual NCF is a good means of comparing the productivity of wind power projects. For example, NYISO's Power Trends 2017 states that the average NCF for all operating wind projects in New York was 25% in 2016. In a typical full calendar year the Project would produce approximately 340,000 MWh of energy.

References

Adapted from IEC 61400-1; cited in Wind Energy Handbook, Tony Burton, et al, John Wiley & Sons UK, 2001, ISBN:0-471-48997-2, p. 210