High Bridge Wind Project

Case No. 18-F-0262

1001.6 Exhibit 6

Wind Power Facilities

EXHIBIT 6 WIND POWER FACILITIES

(a) Statement of Setback Requirements/Recommendations

The primary goal of wind turbine siting and design is to maximize the capture of wind energy to assure economic viability, while providing a design that minimizes environmental impacts, meets turbine vendor site suitability requirements, takes applicable local laws into consideration, and minimizes potential impacts (e.g., noise and shadow flicker) at sensitive receptors. The location and spacing of Facility components were initially based upon site constructability, landowner participation, wind resource data, environmental resource factors, and access to bulk power transmission systems. As the project progressed, preliminary and final Facility component layouts were developed through an iterative process based on:

- The wind resource (as determined based on Site-specific modeling (see Exhibit 6(d));
- Distances between participating residences, non-participating residences, non-participating land parcels, roads, other infrastructure, etc., and Facility components;
- Turbine spacing requirements;
- Agricultural protection measures;
- Environmental (e.g., wetland, avian, etc.) and cultural resources identified within the Facility Site; and
- Visual, shadow flicker, and noise impacts.

As the Facility is rural and forested, development density is low, and high-density residential land use is limited. Facility components have been sited to avoid and/or minimize interaction with sensitive environmental and cultural resources (e.g., protected wetlands, streams, archaeological sites) to the maximum extent practicable. A more detailed discussion on the Facility's relationship to these and other resources (e.g., schools, recreational lands and historic properties) is provided in other sections of this Application. This section of the Application provides an evaluation of the Facility's turbine setbacks.

A setback can be described as the distance that a wind turbine, building, or other structure is recommended or required to be separated from a road, residence, property line, or other use/location. Wind turbine setbacks are designed to prevent turbines from being erected where sensitive resources would be in the "fall zone" or "fall-down distance," which is the area under or adjacent to a turbine that might be impacted by debris falling from the turbine in the unlikely event of blade failure, tower collapse, ice buildup, or other mechanical problems.[1] The fall zone or fall-down distance is an

[1] See Exhibit 15 for additional information about potential public safety issues associated with wind energy facilities.

area with a radius equal to the maximum blade tip height, i.e., the height of the turbine, measured from the base of the tower to the tip of the blade oriented in its highest position. For example, a turbine with a maximum blade tip height of 500 feet would have a "fall zone" with a radius of 500 feet.

Due to market factors such as availability and cost, a specific turbine model has not yet been selected for the Facility. Turbine models that have been determined to be suitable for the Facility include those identified in Table 6-1. The total height for these turbine models ranges from 656 to 671 feet. A fall zone with a radius of 671 feet accounts for the heights of the full range of turbine models under consideration for the proposed Facility. The Applicant may select a turbine model not presented in this Application provided that the total height, rotor diameter, and sound power level output of the selected turbine are not greater than those analyzed in this Application. See Appendix 06-A of this Application for turbine brochures containing additional information about wind turbine technology.

Table 6-1. Approximate Turbine Dimensions by Model

Turbine Model	Rated Power	Hub Height	Rotor Diameter	Total Height
GE158-5.x	4.8 – 5.5 MW	125.4 meters (411 feet)	158 meters (518 feet)	204.4 meters (671 feet)
Nordex N149/4.0-4.8	4.0 – 4.8 MW	125 meters (410 feet)	149 meters (489 feet)	200 meters (656 feet)
SG145-4.x	4.2 – 4.8 MW	127.5 meters (418 feet)	145 meters (476 feet)	200 meters (656 feet)
V150-5.6	5.6 MW	125 meters (410 feet)	150 meters (492 feet)	200 meters (656 feet)

Setback distances proscribed by the Applicant, local laws and ordinances, and turbine manufacturers, and based on the 671-foot fall zone described above, are summarized in Table 6-2. As noted below, there are presently no local laws or ordinances which apply to wind turbines in the Town of Guilford. The Town is considering a proposed law; should one be adopted, the Application will be updated to address the setbacks contained therein, and the Applicant's compliance therewith.

Table 6-2. Setback Requirements/Recommendations Established by the Applicant, Local Laws and Ordinances, and Turbine Manufacturers

Feature	Setback		
	Applicant	Town of Guilford[2]	Manufacturer[3]
Drinking Water Well	100 feet	None	None
Gas Well[4]	None	None	None
Natural Gas Pipeline	1.25x fall zone (839 feet)	None	1.1x blade length (285 feet)
Non-Participating Parcel	1.25x fall zone (839 feet)	None	1.1x blade length (285 feet)
Non-Participating Residential Struct.	1.5x fall zone (1,007 feet)	None	1.1x fall zone (738 feet)
Non-Residential Structure[5]	1.25x fall zone (839 feet)	None	1.1x blade length (285 feet)
Other Wind Turbines	None	None	None
Overhead Utilities (i.e. electric distribution, communications)	None	None	None
Participating Residential Structure	1.5x fall zone (1,007 feet)	None	1.1x fall zone (738 feet)
Public Road[6]	1.25x fall zone (839 feet)	None	1.1x fall zone (738 feet)
Private Road	None	None	1.1x fall zone (738 feet)
State Land	1.25x fall zone (839 feet)	None	None
Substation	1.25x fall zone (839 feet)	None	1.1x blade length (285 feet)
Transmission Line (i.e., Power Line)	1.5x fall zone (1007 feet)	None	1.1x fall zone (738 feet)
NYSDEC Wetlands	100 feet	None	None
Height Restrictions			
Occupied Structures (O&M Bldg.)	None	None	None
Maximum Turbine Tip Height	None	None	None

(1) Manufacturer's Setback Specifications

[2] The Town of Guilford is currently considering a local law governing renewable energy systems, including wind facilities. However, as of the time of Application, no law has been adopted. If and when the Town adopts such a law, the Applicant will submit updates to this Application assessing the Facility's compliance with the substantive provisions contained therein.

[3] Note, the manufacturer setback recommendations listed in this table reflect the most stringent specifications established by the four manufactures with turbine models under consideration.

[4] In this context, Gas Wells includes all active or pending oil or gas wells in the New York State Department of Environmental Conservation (NYSDEC) dataset (i.e., wells with a status of "Active," "Application Received to Drill/Plug/Convert," "Drilling Completed," "Drilled Deeper," "Drilling in Progress," "Not Listed," "Permit Issued," "Temporarily Abandoned," or "Transferred Permit."

[5] This includes barns, sheds, seasonal residences, and other unoccupied structures. No areas of public gathering are located within the Facility Site.

[6] Measured from the road centerline.

The Applicant has consulted with the turbine manufacturers listed in Table 6-1 above. The most stringent of the setback considerations established by these four manufacturers are listed in Table 6-2. General Electric provided the most comprehensive setback considerations: 1.1 times the fall zone for residential structures, public and private roads, natural gas pipelines, and transmission lines; and 1.1 times the blade length for non-participating parcels and non-residential structures. Nordex provided similar, but less extensive setback recommendations: 1.1 times the fall zone for non-participating residences, participating residences, public roads, and transmission lines. Vestas and Siemens Gamesa have both published statements that specify that permanent setbacks are not required for their turbines.

(2) Applicant's Internal Setback Standards

The recommended internal setback standards provided by the Applicant in Table 6-2 ensure the safety of the public and neighboring properties by siting turbines away from non-participating property lines, roads, and other public infrastructure at a distance of at least the maximum blade tip height; its setbacks also are designed to minimize impacts related to sound or shadow flicker. See Exhibit 15(e) for a detailed discussion of Facility safety standards and Exhibits 19 and 24, respectively, for a detailed discussion of Facility impacts related to noise and shadow flicker.

(3) Setbacks Required by Local Law or Ordinance

Zoning jurisdiction within Chenango County is at the town level. The proposed turbines are sited in the Town of Guilford, which does not presently have zoning or any local laws applicable to wind facilities. As of the time of this Application, the Town is considering a proposed wind law, though nothing has been adopted. In the event the Town adopts an applicable law, the Applicant will submit updates to this Application discussing the setbacks contained therein. See Exhibit 31 for additional information on local laws.

(b) Explanation of the Degree to which the Facility Layout Accommodates Turbine Setbacks.

The Facility will be designed to meet all setback requirements recommended by the Applicant, the turbine manufacturer and the local municipalities. The Applicant's setbacks from residential structures, property lines, transmission lines (115 kV and greater), and roads are shown in Figure 11-1.

(c) Third-party Review and Certification of Wind Turbines

Equipment reliability is an important criterion in turbine selection. As previously noted, the Applicant has not made a final determination of the wind turbine manufacturer or model. However, based on preliminary evaluations, the Applicant is presenting a range of turbine models determined to be suitable for the Facility in this Application. The Applicant may select a turbine model not presented in this Application provided that the turbine total height and sound power level output of the selected turbine is not greater than those analyzed in this Application. Based on preliminary evaluations, 4.0 MW to 5.6 MW represents the range of turbine size types considered for this Facility.

Turbine models are certified as meeting international design standards by independent product safety certification organizations such as Germanischer Lloyd and Underwriters Laboratories. These certifications require that the wind turbines have a design life of at least 20 years for the specified wind regime. The wind regime considers factors such as weather extremes, average wind speed, wind gusts, and turbulence intensity.

A third-party certification for at least one of the turbines under consideration for the Facility is being submitted concurrently with this Application (Appendix 05-C), but under seal due to the confidential nature of this document. The certification conforms to the requirements of International Electrotechnical Commission (IEC) 61400. The Applicant will ultimately select a turbine that has achieved the necessary third-party certification and proposes to submit this information to the Siting Board as a post-Certification compliance filing. The Applicant will provide updates to the information submitted in response to this item as appropriate throughout this proceeding.

(d) Wind Meteorological Analyses

Two temporary meteorological towers have been installed within the Facility Site: a 60-meter tower, installed in 2017; and a 100-meter tower was installed in 2019. The meteorological towers have been erected to generate the site-specific data necessary for modeling purposes and validation of the wind resource. Wind resource analyses were performed to optimize the turbine layout for maximum energy production within the context of the existing, site-specific constraints and support the estimated capacity factor for the Facility.

During the wind analysis, micro-scale wind modeling tools WAsP, the DNV GL implementation of the Star-CCM+ Computational Fluid Dynamics (CFD) software package, and WindFarmer along with mesoscale wind resource databases, reanalysis datasets, and high-resolution terrain data were utilized to develop the wind resource map.

A number of preliminary turbine layouts were then devised utilizing the wind resource map with input from third-party wind resource experts and the Applicant (see Exhibit 9 for a full discussion of one of these preliminary layouts). The final layout was determined by correlating the most energetic layouts with the most constructible and logistically economical designs while minimizing potential impacts on the environment and stakeholders.

The detailed results of these analyses are proprietary and are typically retained as trade secrets. Therefore, a copy of the wind meteorological analysis is not being provided with this Application, but rather will be provided to the New York State Department of Public Service under a separate cover. The Applicant is seeking the requisite trade secret protection for this information pursuant to New York Public Officer's Law § 87(2)(d) and 16 NYCRR § 6-1.3.

The wind turbines proposed for the Facility are rated to withstand wind speeds above those likely to occur in the Facility Site. International standards for wind turbines are developed by working groups of Technical Committee-88 of the IEC, a world-recognized body for standards development. All turbines under consideration for the Facility are designed to meet the standards of the IEC-61400 series and are rated for specific IEC wind classes. Table 6-3 lists the wind classes associated with each turbine model under consideration for the Facility. The turbines under consideration are suitable for use in conditions typical of the Facility Site.

Table 6-3. Wind Speed Class by Turbine Model

Turbine Model	Wind Turbine Class[7]	Average Wind Speed (m/s) at Hub Height	Extreme 50-year Gust (m/s)	Turbulence Intensity Class[8]
GE158-5.x	S	8.5	56.7	B
Nordex N149/4.0-4.8	S	7.5	37.5	A
SG145-4.x	II	8.5	59.5	B
V150-5.6	S	8.5	37.5	A

[7] There are five wind turbine classes recognized by the International Electrotechnical Commission (IEC). Wind speed at hub height averages 10 meters per second (m/s) for Class I, 8.5 m/s for Class II, 7.5 m/s for Class III, 6 m/s for Class IV, and is user defined for Class S.

[8] Turbulence intensity is a measure of the variability in wind speed (i.e., the standard deviation of the wind speed within a period divided by the average wind speed over that same period) that a turbine is designed to withstand. Turbulence intensity is measured at 15 meters per second and three classes are recognized by the IEC. Mean turbulence intensity at 15 m/s is >14% for Class A, 12% - 14% for Class B, and <12% for Class C.