Bluestone Wind Project

Case No. 16-F-0559

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 local law into consideration, and minimizes potential impacts (e.g., noise and shadow flicker) at sensitive receptors. The location and spacing of Facility components was initially based upon site constructability, landowner participation, wind resource data, environmental resource factors, access to bulk power transmission systems, and zoning constraints. 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 Section (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 largely 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 is defined as the distance that a wind turbine, building, or other structure must 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 area with a radius equal to the

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

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 655 to 673 feet. A fall zone with a radius of 673 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 I 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
GE 3.8-137	3.8 MW	131 meters (430 feet)	137 meters (449 feet)	200 meters (655 feet)
Nordex N149/4.0-4.5	4.0 – 4.5 MW	125 meters (410 feet)	149 meters (489 feet)	200 meters (655 feet)
Senvion M148-4.2	4.2 MW	130 meters (427 feet)	148 meters (486 feet)	204 meters (669 feet)
Siemens Gamesa SG4.2-145	4.2 MW	127.5 meters (418 feet)	145 meters (476 feet)	200 meters (656 feet)
Vestas V150	4.2 MW	130 meters (427 feet)	150 meters (492 feet)	205 meters (673 feet)

Setback distances proscribed by the Applicant, local laws and ordinances, and turbine manufacturers, and based on the 673-foot fall zone described above, are summarized in Table 6-2.

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

Feature	Setback			
	Applicant	Town of Sanford	Town of Windsor	Mfr.[2]
Drinking Water Well	None	None	None	None

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

Feature	Setback			
Gas Well[3]	None	None	None	None
Natural Gas Pipeline	1.2x fall zone (808 feet)	None	None	1.1x blade length (266 feet)
Noise-Related[4]	None	None	None	None
Non-Participating Parcel[5]	1.25x fall zone (841 feet)	1.25x fall zone (841 feet)	None	1.1x blade length (266 feet)
Non-Participating Residential Struct.[6]	1.5x fall zone (1009 feet)	1.25x fall zone (841 feet)	None	1.1x fall zone (740 feet)
Non-Residential Structure[7]	1.25x fall zone (841 feet)	1.25x fall zone (841 feet)	None	1.1x blade length (266 feet)
Other Wind Turbines	None	None	None	None
Overhead Utilities (i.e. electric distribution, communications)	None	None	None	None
Participating Residential Structure	1.5x fall zone (1009 feet)	1.25x fall zone (841 feet)	None	1.1x fall zone (740 feet)
Public Road (i.e., Public Way)	1.25x fall zone (841 feet)	1.25x fall zone (841 feet)	None	1.1x fall zone (740 feet)
Private Road	None	None	None	1.1x fall zone (740 feet)
State Land	1.25x fall zone (841 feet)	None	None	None
Substation	1.25x fall zone (841 feet)	None	None	1.1x blade length (266 feet)
Transmission Line (i.e., Power Line)	1.25x fall zone (841 feet)	1.25x fall zone (841 feet)	None	1.1x fall zone (740 feet)
NYSDEC Wetlands	100 feet	None	None	None
Height Restrictions				
Occupied Structures (O&M Bldg.)	None	None	None	None
Maximum Turbine Tip Height	None	None	None	None

[3] 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."

[4] Noise-related restrictions established by the Applicant, local laws and ordinances, and turbine manufacturers are typically decibel-based, not distance-based.

[5] The Town of Sanford also includes identical setback requirements for non-participating easements and non-participating rights-of-way.

[6] The Town of Sanford refers specifically to "Pre-Existing Structures" in its setback requirements; for the purposes of this exhibit, it is assumed that this includes Participating Residential Structures, Non-Residential Structures, and Non-Participating residential structures.

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

(1) Manufacturer's Setback Specifications

The Applicant has consulted with the turbine manufacturers listed in Table 6-1 above. The most stringent of the setback considerations established by these five 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. Senvion has no published setback standard for their turbines. If this turbine manufacturer is selected, the Applicant will coordinate with this manufacturer to ensure Facility turbines are sited appropriately.

(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 Broome County is at the town level. The proposed turbines are sited in the Towns of Windsor and Sanford. The preliminary layout was provided to the Towns for review on 6/19/2018. Although the Town of Windsor does not have a wind energy law, it has adopted a zoning code that establishes the following yard requirements for buildings/structures located in Agriculture Districts where the Facility will be located: front yard – 35 feet, side yard – 10 feet, rear yard – 30 feet. Town of Windsor Code § 93-20 (yard requirements). These setback requirements are well within the Applicant's recommended setbacks set forth in Table 6-2.

The Town of Sanford adopted a wind law in January 2017, which has been incorporated into the Town's Zoning Code. Under that law, all wind energy conversion systems (WECS) "shall be set back from adjacent Non-Participant property lines, right of ways, easements, public ways, power lines (not to include individual residential feed lines and not otherwise directly connected to the WECS), and any pre-existing structures by a distance at

least equal to its fall zone as certified by a New York State Licensed Professional Engineer plus an additional twenty-five percent (25%) of its fall zone." Sanford Land Use Management Law Article XIV, § 1402.5(A)(4). Consistent with the discussion in Section (a) above, the fall zone is assumed to be the maximum blade tip height of the turbine, which would be 673 feet for this Facility. These setbacks are shown in detail in Table 6-2.

Definitions from the Town of Sanford code required to understand the Town's setback requirements are found in Sanford Land Use Management Law Article XIV, § 1402 (A).

- Accessory Facilities or Equipment: "Any structure other than a wind turbine, including substations, meteorological towers, overhead and underground electrical lines, guy wires, access roads, operations and maintenance building or other facility related to the use and purpose of deriving energy from such tower."
- Non-Participant: "A parcel of land which is not subject to any lease, good neighbor agreement or other contract with the applicant which authorizes WECS development by Applicant."
- Right of Way: "A strip of land acquired by reservation, dedication, forced dedication, prescription, or condemnation and intended to be occupied by a road, crosswalk, railroad, electric transmission lines, oil and gas pipeline, water line, sanitary storm sewer or other similar use."
- Wind Energy-Deriving Tower or Wind Turbine: "Any tower, pole or other structure, whether attached to a building, guyed, or freestanding, designed to be used for the support of a rotor that consists of blades and hub, as well as a nacelle and generator for producing electricity.
- Wind Energy Conversion System (WECS): "[A]ny mechanism including a wind turbine designed for the purpose of converting wind energy into electrical energy and all accessory facilities related thereto. A WECS may be:
    a. Commercial—A WECS that primarily produces energy for off-site sale or consumption or any WECS that has a capacity of 200 kilowatts or more…"

See Exhibit 31 of this Application 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 and as set forth in the zoning regulations for the Towns of Windsor and Sanford. The Town of Windsor has no established setbacks specific to wind turbines. However, the Facility will be designed to meet or exceed the Town's yard requirements for buildings located in Agricultural Districts. With respect to the Town of Sanford, the Facility will be designed to meet the turbine setbacks established in the Town Zoning Code.

The Applicant's setbacks from residential structures, property lines, transmission lines (115 kV and greater), and roads in each town are shown on the site plans submitted as part of Exhibit 11 (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, 3.6 MW to 4.5 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 F), 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

A 60-meter tall meteorological tower was installed in Windsor in August 2016 and a 100-meter tower was installed in Sanford in August 2017. 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[8]	Average Wind Speed (m/s) at Hub Height	Extreme 50-year Gust (m/s)	Turbulence Intensity Class[9]
GE 3.8-137	S	8.5	42.5	B
Nordex N149	S	7.5	37.5	A
Senvion M148	S	7.5	52.5	A
SGRE SG4.2-145	II	8.5	59.5	B
Vestas V150	S	7.0	52.5	A

[8] 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.

[9] 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.