

Heritage Wind Project

Case No. 16-F-0546

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, accounts for local laws and resources, and minimizes potential impacts at residential and sensitive receptors (e.g., sound and shadow flicker). The location and spacing of the Facility components were initially based upon site constructability, landowner participation, wind resource assessment, environmental resource factors, access to bulk power transmission systems, and review of the Facility's zoning constraints. As the Project progressed, preliminary and final Facility component layouts were developed through an iterative process based on:

- Wind resource assessment (see Exhibit 6(d));
- Distances between participating residences, non-participating residences, non-participating land parcels, roads, other infrastructure, etc. and Facility components;
- Sufficient spacing between turbines (i.e., to avoid turbine wake effects);
- 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 Site is located in a rural area in which development density is generally low and high-density residential land use is limited, Facility components have been sited to avoid and/or minimize interaction with sensitive natural and cultural resources (e.g., protected wetlands, streams, archaeological sites) to the maximum extent practicable. A more detailed discussion of 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 in the unlikely event of debris falling from the turbine, blade failure, tower collapse, ice buildup, or other mechanical problems. The fall zone or fall-down distance is an 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 650 feet would have a “fall zone” with a radius of 650 feet. For more information regarding potential public safety issues associated with wind energy facilities, and the unlikelihood of their occurrence, see Exhibit 15.

Due to market factors such as availability, cost, and the rapid evolution of available turbine technology, 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 675 feet. A fall zone with a radius of 675 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 6-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
Vestas 162-5.6	5.6 MW	125 meters (410 feet)	162 meters (531 feet)	206 meters (675 feet)
Nordex N149-4.8	4.8 MW	125 meters (410 feet)	149 meters (489 feet)	199.5 meters (655 feet)
GE158-5.5	5.5 MW	125 meters (410 feet)	158 meters (518 feet)	204 meters (669 feet)

Setback distances defined by the Applicant, local laws and ordinances, and turbine manufacturers, and based on the maximum 675-foot fall zone described above, are summarized in Table 6-2. Additionally, Figure 6-1 shows setback requirements applicable to the tallest turbine, the Vestas V162-5.6 MW, for a worst-case scenario setback analysis.

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

Feature	Setback		
	Applicant	Town of Barre¹	Manufacturer²
Area of Public Gathering (Park)	1.5x Tip Height	-	1.1x Tip Height
Drinking Water Well	1.1x Tip Height	-	-
Gas Well	1.1x Tip Height	-	-
Commercial Building	1,000 feet	1,000 feet	1.1x Tip Height
Natural Gas Pipeline (N/A)	1.5x Tip Height	-	1.1x Tip Height
Non-Participating Parcel	1.5x Tip Height	1.5x Tip Height	1.1x Tip Height
Non-Participating Residential Structure	1,500 feet	1,000 feet	1.1x Tip Height

Feature	Setback		
	Applicant	Town of Barre ¹	Manufacturer ²
Non-Residential Structure (e.g., barns, unoccupied structures)	1,000 feet	1,000 feet ³	1.1x Blade Length
Participating Residential Structure	1,225 feet	1,000 feet	1.1x Tip Height
Participating Parcel	Rotor Radius +4m (236 ft) (72m)	1.5x Tip Height ¹	1.1x Blade Length
Public Road	1.5x Tip Height	1.5x Tip Height	1.1x Tip Height
Private Road	82 feet (25 m)	-	-
State Land (N/A)	-	-	1.1x Tip Height
Substation (N/A)	1.1x Tip Height	-	1.1x Tip Height
Transmission Line (i.e., power line)	1.5x Tip Height	1.5x Tip Height	1.1x Tip Height
NYSDEC Wetlands	100 feet	-	-
Height Restrictions			
Occupied Structures (O&M Bldg.)	-	-	-
Maximum Turbine Tip Height	-	500 feet ⁴	-

¹According to § 350-104 of the Town of Barre Zoning Ordinance, the setback distances and noise limits defined in the ordinance are waived by operation of law upon the Applicant obtaining written consent from affected property owners. These waivers are automatic, and no additional approvals are required from the Town to effectuate them. Therefore, the setbacks are applicable only to non-participants who have not executed an agreement with the Applicant to waive the setback by operation of law.

²Based on "Setback Considerations for Wind Turbine Siting" published by GE in 2017. The Applicant has confirmed that Vestas and Nordex do not maintain a similar document with setback recommendations.

³Only as applied to "commercial" structures."

⁴See Exhibit 31 for a discussion of the Applicant's request for a waiver of this restriction.

(1) Manufacturer's Setback Specifications

The Applicant has reviewed available information from turbine manufacturers to determine recommended setbacks, to the extent that information was available. The information the Applicant was able to obtain is listed in Table 6-2. GE provided the setback considerations outlined in this table, suggesting a setback of 1.1 times the fall zone for residential structures, public and private roads, natural gas pipelines, transmission lines and other features listed above and 1.1 times the blade length for non-participating parcels and non-residential structures.

(2) Applicant's Internal Setback Standards

The recommended internal setback standards provided by the Applicant in Table 6-2 are the minimum standards used by the Applicant to 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 for most features; 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. However, where local requirements

exceed the Applicant's internal minimum setbacks, the Applicant has designed the facility to comply with the more stringent local requirements. Discussion of compliance with local setbacks is contained in Exhibit 31.

(3) Setbacks Required by Local Law or Ordinance

Zoning jurisdiction within Orleans County is at the town level. The proposed turbines are sited in the Town of Barre, which has its own set of regulations for the siting of wind facilities. These regulations are contained in Section 350 of the Code of the Town of Barre (the Code). Setbacks defined in § 350-104 of the Code are provided in Table 6-2 above. The Town Zoning Law defines a "building" as "Any structure which is permanently affixed to the land, has one or more floors and a roof, and is intended for the shelter, housing or enclosure of persons, animals, or property." Barre Town Code § 350-11. The law further defines "structure" as "Anything constructed or erected with a fixed location on the ground or attached to something having a fixed location on the ground. For example, structures include buildings, mobile homes, walls, fences, signs, sheds, billboards and poster panels, docks, and/or similar construction types." Barre Town Code § 350-11.

The Town of Barre adopted its Wind Law in 2008, which is included in Article XI of the Town's Zoning legislation. Under that law, all wind energy conversion units (WECS), shall only be located, installed, or constructed on the parcel in accordance with the following setbacks:

- A distance not less than 1.5 times the tip height of the wind energy generating unit as measured from any and all public roadways or aboveground power lines in the vicinity of said unit, to the base of such unit.
- A distance not less than 1,000 feet from any existing non-participating residential or commercial building.
- A distance not less than 1.5 times the tip height of the wind energy generating unit as measured from non-participating property lines. Wind Energy Law Article XI, § 350-103(8) and 104.

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 setback requirements recommended by the Applicant, the turbine manufacturer and as set forth in the zoning regulations for the Town of Barre—whichever of these three setback requirements is stricter. The Applicant's setbacks from residential structures, property lines, transmission lines (115 kV and greater), and roads are shown in Figure 11-1. See Exhibit 31 for additional information pertaining to the Facility's compliance with local laws.

(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, 4.8 MW to 5.6 MW represents the range of turbine sizes being 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.

An example of a third-party certification for a turbine by at least one of the manufacturers under consideration for the Facility is included with this Application as a confidential submission (see Appendix 5-C). 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 60-meter tall meteorological towers were installed in Barre, the first in April 2017 and the second in July 2018, and an 80-meter tall meteorological tower was installed in Barre in July 2018. 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.

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 the design evolution and iterative process). 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 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 Class¹	Average Wind Speed (m/s) at Hub Height	Extreme 50-year Gust (m/s)	Turbulence Intensity Class²
Vestas 162-5.6	IEC S	8.5	37.5	11%
Nordex N149-4.8	IEC S	8.5	37.5	16%
GE158-5.5	IEC S	8.5	37.5	11%

¹ There are five wind turbine classes recognized by the 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.

² 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.