Heritage Wind Project

Case No. 16-F-0546

1001.9 Exhibit 9

Alternatives

TABLE OF CONTENTS

LIST OF TABLES

EXHIBIT 9 ALTERNATIVES

(a) Description of Reasonable Alternative Sites

The preliminary selection of wind turbine locations on a regional or statewide basis is constrained by several factors that are essential for a wind energy generating facility to operate in a manner that is viable both technically and economically. These factors include:

- An adequate wind resource;[1]
- Adequate access to the bulk power transmission system from the standpoints of proximity and ability of the system to accommodate the interconnection and accept and transmit the power from the facility;
- Contiguous areas of available land;
- Willing landowner participants and host communities;
- Limited population/residential development; and
- Avoiding areas of statewide significance or high environmental sensitivity (e.g., Adirondack Park, Iroquois National Wildlife Management Area, etc.).

Prior to obtaining specific property rights for the Facility, the Applicant conducted a high-level review to determine whether construction of a utility-scale wind-power electrical generation facility in the general vicinity of the Facility was feasible. As a preliminary matter, the Applicant assessed the wind resource in the area and determined that it is adequate for the type of wind turbine generator models under consideration for the Facility and included in this Application. Moreover, the Applicant determined that the transmission system that will receive electricity from the Facility could accommodate several hundred megawatts (MW) of electric power. Also, the Applicant identified a point of interconnection within the Facility Site that would not require an extended overhead transmission line.[2] This reduces the costs and adverse environmental impacts associated with overhead transmission lines (e.g., visual and environmental impacts).

The Applicant identified a broad area for the Facility in the Public Involvement Program (PIP) Plan. However, as a result of an iterative design process, the Facility Site are been significantly refined. The initial Facility Site as identified in the PIP was the entire Town of Barre (see Figure 9-1). This area was used to initiate support studies and public outreach efforts (see Exhibit 2). As these efforts progressed and the Facility design evolved, the extent of the Facility

[1] Across New York State, the wind resource varies based on topography, prevailing wind direction, and location. Large-scale wind power projects can only be built in certain areas that are conducive to wind energy production. The higher the wind speed at a site, the more desirable a site is, as the energy produced by a given turbine is a function of the cube of the wind speed.

[2] The point of interconnection (POI) substation is situated directly adjacent to the existing Lockport-Mortimer 115 kilovolt (kV) transmission line, reducing the need for an extensive overhead electric transmission line.

Site was significantly reduced. Much of the northwest portion of the Facility Site was eliminated between the PIP stage and the beginning of the Stipulations process in August 2018 to avoid potential impacts to the Pine Hill Airport. The Facility Site was refined further as part of the Final Scoping Statement (FSS) in October 2019. Of particular note, the Facility Site was reduced to avoid impacts to potential muckland soils in the southeast portion of the Site. The New York State Department of Agriculture and Markets (NYSDAM) identified these soils as an important agricultural resource, and the Applicant agreed to eliminate this area from the Facility Site to avoid potential impacts. In addition, the Applicant eliminated three turbine locations in the northcentral portion of the Facility Site which were in proximity to New York State Department of Environmental Conservation (NYSDEC) wetlands.

The Facility Site as presented herein represents a substantially smaller footprint than what was presented in the PIP and PSS. Additionally, the number of turbines has been reduced from 40 listed in the PSS to the 33 proposed in this Application. The Applicant has continued to refine the turbine layout, access road locations, and collection line design in parallel with ongoing field studies and environmental analyses to avoid or minimize adverse impacts to resources. Specific efforts to micro-site Facility components are described in Table 9-1 below. As a result of this process, the Applicant is proposing a 33 turbine layout which can generate up to 184.8 MW of renewable electricity.

The Applicant, as a private facility applicant, does not have eminent domain authority. As part of its initial assessment of the area in the vicinity of the Facility, the Applicant reviewed the land available for possible construction of a wind energy facility and determined that: the landowners and municipalities in the area were willing to work with the Applicant; land in the area is available to site components; and existing land uses (in particular, agriculture) are compatible with the Facility. Access to the site for component delivery and Facility operation is acceptable. Also, no areas of statewide significance or high environmental sensitivity are located within the Facility Site. More generally, a preliminary assessment of the area showed that the presence of wetlands and surface water bodies would not pose a significant obstacle to construction of a wind generating facility. As discussed in Section (b) below, the Facility Site presented in this Application has been further refined since the PIP and PSS to meet the conditions outlined above and minimize the impact on sensitive environmental receptors. A description of specific examples of the design evolution and resource impact avoidance and minimization is provided in Section (c)(4) and Table 9-1 below.

Because the Applicant is a private facility applicant, the identification and description of reasonably available alternative site locations in this Application need only include sites owned by or under contract/option to the Applicant (i.e., site locations within the Facility Site). The layout of Facility components within the Facility Site, as proposed in this Application, was designed through an iterative process where the technical and economic requirements of the Facility were weighed against impacts to recreational and cultural resources, the environment, and public safety, health, and environmental justice. The proposed Facility layout is the most reasonable layout possible given the constraints of the

Facility Site (e.g., proximity to existing transmission infrastructure, access from existing roads, conflicting sensitive resource concerns, etc.). A description of the Facility layout selection process, including specific examples of design evolution and resource impact avoidance and minimization, is described in Section (b) below.

(b) Comparison of Advantages and Disadvantages of Proposed and Alternative Locations

Given the unique nature and constraints associated with siting wind-powered electric generation facilities (e.g., adequate wind resource, willing landowner participants and host communities, and adequate access to the bulk power transmissions system, etc.), this Application does not include a fully developed evaluation of the comparative advantages and disadvantages of alternate locations. It is not practicable to procure land contracts, perform environmental and engineering studies, enter and progress through multiple interconnection permit processes, and conduct community outreach for alternative locations. Therefore, this Application provides information regarding the site selection process and the information and analyses utilized in developing the proposed Facility layout, as summarized below.

(1) Environmental Setting

The Facility Site consists of parcels that are under contract to the Applicant. The Facility Site is located within the Erie-Ontario Lowlands physiographic province of New York State. The Erie-Ontario Lowlands in Orleans County is characterized by generally subdued topography, except for the Niagara escarpment and drumlins south of Lake Ontario (NYSDOT, 2013). Elevations range from 246 feet above mean sea level (AMSL) along Lake Ontario to 700 feet AMSL in the southern and western portions of the Town of Barre. The Facility Site is characterized by relatively flat topography and is located entirely within the Oak Orchard-Twelve Mile watershed (HUC 04130001). Exhibits 21, 22, and 23 provide a full description of the geology, soils, terrestrial and aquatic ecology, wetlands, and water resources found within the Facility Site. A summary of these resources is presented below.

Most of the Orleans County population is within the Town of Albion, centrally located in the county. The Town of Barre is sparsely populated and has the lowest population of any town in Orleans County (U.S. Census Bureau, 2012). Within the Facility Site, anthropogenic disturbance is largely limited to agricultural activities.

Depth to bedrock within the Facility area typically ranges from 1 to more than 6.5 feet below ground surface. Predominate bedrock lithology consists of dolostone, limestone, and shale of the Akron Dolostone and Salina Group and the Lockport Group. Both groups originate from the Silurian geologic period. Surficial soils in the Facility Site are primarily silt loam and loamy sand with moderate to poor drainage abilities. Soils within Orleans County

formed from deposited glacial material from the Wisconsin glaciation (USDA, 1973). As the glacier moved southwestward, it scoured and picked up older glacial deposits, bedrock, and soil, and finally deposited unconsolidated materials.

The geology and topography of the Facility Site is somewhat supportive of wetlands. The Applicant delineated a total of 57 wetlands within the Wetland Study Area (see Exhibit 22 and Figure 22-3). These wetlands were field identified by qualified biologists based on the presence of hydrophytic vegetation, hydric soils, and wetland hydrology. The Applicant also delineated 56 streams within the Wetland Study Area. The delineated streams included intermittent, perennial, and ephemeral channels. See Exhibits 22 and 23 for a further discussion of terrestrial ecology, wetlands and streams, and potential Facility impacts. See Section (b)(5) below for specific avoidance and minimization measures.

A description of the ways in which the environmental setting of the site influenced the siting process (e.g., avoiding permanent impacts to water resources, complying with NYSDAM guidelines, limiting adverse effects in flood-prone areas, etc.) is outlined in Section (b)(5) below.

(2) Recreational, Cultural, and Other Concurrent Uses of the Site

The Applicant has identified several recreational facilities around the Facility Site, including, but not limited to, trails (i.e., hiking, snowmobile, biking, etc.) and two state Wildlife Management Areas (see Figure 4-8). Land use at the Facility Site consists of agricultural fields, scattered residential development along area roadways, and contiguous tracts of forestland. These resources were identified using publicly available data and during discussions with the Town of Barre. The Facility will be generally compatible with these land uses and will have primarily temporary impacts associated with construction. See Exhibit 4 of this Application for more detailed discussion of land use in the area around the Facility.

As discussed in Exhibit 20, a Phase 1A Historic Architectural Resources Survey and Work Plan was prepared during the development of the PSS. In a letter dated March 14, 2019, the New York State Office of Parks, Recreation and Historic Preservation (NYSOPRHP) provided a response to the Phase 1A Archaeological Survey Report and Phase 1B Fieldwork Plan, which recommended a more specific Phase 1B scope of work be submitted when a more defined area of potential effect (APE) is determined. An updated Phase 1B scope of work was submitted to NYSOPRHP on August 14, 2019. In correspondence dated September 9, 2019, the NYSOPRHP concurred with the scope of the work plan. See Exhibits 20 and 24 of this Application for more detailed information on the potential impact of the Project on recreational and cultural resources.

The site selection process relative to recreational, cultural, historic, and other concurrent uses was largely centered on avoidance. Early in the planning process, the preliminary Facility Site was progressively updated to avoid impacts to known recreational, cultural, and historic resources. As the Facility Site solidified and the preliminary locations of Facility components became known, these locations were compared to field data collected as part of the Article 10 Application process. Where conflicts were detected, Facility components were often moved to avoid impacts. A summary of these micro-siting efforts is provided in Table 9-1 below. Where impacts were unavoidable, mitigation measures are being considered.

(3) Engineering Feasibility

A Geotechnical Desktop Study was conducted that included a literature review of publicly available information pertaining to surface and subsurface soil, bedrock, and groundwater conditions near the proposed Facility (Appendix 21-A). In addition, a set of soil borings at representative turbine location was performed and is summarized in a Preliminary Geotechnical Engineering Report (Appendix 21-A). These geotechnical evaluations concluded that the Facility Site is generally suitable for the construction of the structures proposed in this Application (e.g., wind turbines, the substations, and the operation and maintenance [O&M] facility), and that spread footer foundations will be suitable for wind turbines. Blasting may be required for the construction of certain turbine foundations, specifically where depth to bedrock is shallow. It is expected that excavations during the construction of the Facility will be completed using conventional equipment, including bulldozers, track hoes, and possibly pan excavators. Geotechnical conditions and engineering feasibility are discussed further in Exhibit 21.

With respect to the proposed interconnection, the System Reliability Impact Study (SRIS) for the Facility found the National Grid Lockport-Mortimer 115 kV transmission line can accommodate the interconnection and accept and transmit the power from the Facility. See Exhibit 5, Appendix 5-A, and Section (b)(4) below for further details.

The Applicant has conducted a rigorous wind resource analysis for this Facility to assess the quality of the wind resource and optimize the turbine layout to maximize energy production within the context of the existing site-specific constraints. This analysis informed every change made to the layout of Facility turbines during the design phase. For example, if a turbine needed to be moved to avoid or minimize impacts on a resource, such as a wetland, the potential alternative locations for that turbine were limited to the small number of sites that would maintain engineering feasibility and not introduce additional environmental, social, cultural, or economic conflicts. See Exhibit 6 of this Application for additional information about the wind resource at the Facility Site.

(4) Reliability and Electric System Effects

As previously noted, a SRIS was completed in April 23, 2018 to evaluate the impact of the Facility on the reliability of the New York State Transmission System and to identify alternatives to eliminate adverse reliability impacts, if any, resulting from the Facility. The Facility is not expected to result in adverse impacts to the transmission system based on the results of the SRIS. See Exhibit 5 of this Application for a more detailed description of Facility effects on the reliability of the regional transmission system.

(5) Environmental Impacts, Including Assessment of Climate Change Impacts

The proposed Facility will have long-term beneficial environmental impacts. The Facility will generate up to 184.8 MW of clean, renewable energy without emitting any conventional air pollutants or greenhouse gases (GHGs), consuming cooling water, or generating wastewater.

Electricity generated from zero-emission wind energy facilities can displace the electricity generated from conventional power plants, thereby reducing the emissions of air pollutants. This conclusion is supported by a 2008 U.S. Department of Energy, National Renewable Energy Laboratory report, which states, "[w]ind energy is a preferred power source on an economic basis, because the operating costs to run the turbines are very low and there are no fuel costs. Thus, when the wind turbines produce power, this power source will displace generation at fossil fueled plants..." On a long-term basis, wind generated power also reduces the need to construct and operate new fossil fueled power plants (Jacobsen and High, 2008, pp. 9-10). See Section (f) below for additional information on the benefits of wind power.

The Facility is expected to displace approximately 112,065 short tons of carbon dioxide (CO_2) emissions from conventional power plants on an annual basis. See Exhibits 8 and 17 for a further discussion of air emissions.

Although the overall impact of the Facility will be positive, the construction and operation of the Facility will result in some unavoidable impacts to the environment. Most environmental impacts will be temporary and associated with construction. Long-term unavoidable impacts associated with the operation and maintenance of the Facility are anticipated to be relatively limited but will include aesthetic visual impacts due to turbine visibility, potential impacts to community character, direct mortality to avian and bat species, and impacts to streams and wetlands.

As described in this Exhibit, the process of designing the Facility layout involved balancing technical and economic constraints against impacts to sensitive resources. Ultimately, the Facility Site and individual Facility components were sited to avoid and minimize impacts wherever practicable.

General measures the Applicant initially took to avoid and minimize impacts to sensitive resources in the site selection/refinement process included: relocating Facility components, collocating Facility components (e.g., access roads and collection lines), routing Facility components along previous disturbance corridors (e.g., farm roads and adjacent to pipeline rights-of-way), reducing the size of the Facility Site, designing access roads to work with the native topography (e.g., avoiding steep slopes), siting the Facility away from flood-prone areas, and committing to the strategic use of trenchless technologies, such as horizontal directional drilling (HDD) and/or jack and bore when installing buried interconnects beneath high quality water resources.[3]

For wetlands, where avoidance was not practicable, impacts were minimized by selecting narrow and/or previously disturbed portions of the wetlands for crossing locations. Impacts to undisturbed wildlife habitat have been minimized by siting access roads and collection lines in or adjacent to agricultural land, which generally provides habitat for only a limited number of wildlife species. In addition, these areas are already subject to regular periodic disturbance in the form of mowing, plowing, harvesting, etc. Within agricultural land, efforts were made to locate Facility components so as to keep the parcels largely intact and thus facilitate farming activities (utilizing existing farm roads, locating roads along the parcel's edge to avoid dividing farmable parcels, locating roads in farm fields at grade to reduce impacts on farm equipment, etc.).

As the Facility Site and the layout of Facility components solidified, more specific measures were taken by the Applicant to avoid and minimize impacts to environmental resources. These measures are summarized in Table 9-1

[3] Specifically, trenchless technologies will be used where buried interconnection lines are the only component crossing forested wetlands and NYSDEC-protected streams.

Table 9-1 Alternative Design Measures Implemented by the Applicant that Avoid Impacts to Wetlands, Surface Waters, Vernal Pools, Land Use, Agriculture, Cultural, and Other Sensitive Resources.

Facility Component	Resource(s)	Alternative Design Measure(s)	Result
Wind Turbine			
T2	Forest, Agricultural	Typical work area and limit of clearing reduced to minimize clearing at wood edge near agricultural field	Impacts to forest reduced.
T9	Wetlands	Typical work area and limit of clearing shifted and reduced to minimize land disturbance to wetland	Impacts to wetlands reduced.
T11	Streams, Wetlands	Typical work area and limit of clearing shifted and reduced to minimize land disturbance to wetland and stream	Impacts to wetlands and stream reduced.
T12	Wetlands	Typical work area and limit of clearing shifted to minimize land disturbance to wetland	Impacts to wetlands reduced.
T30	Archeological	Typical work area and limit of clearing reduced to minimize land disturbance over archeological sites	Impacts to archeological sites eliminated.
T32	Streams, Wetlands	Typical work area and limit of clearing shifted and reduced to minimize land disturbance to wetland and stream	Impacts to wetlands and stream reduced.
Access Road			
Access Road between T1 and T2	Land Use, Agricultural	Access road relocated approximately 150 feet to the east between the boundary of two distinct fields	Impacts to agricultural fields reduced.
Access Road to T7	Land Use, Agricultural	Access road relocated approximately 50 feet west to edge of existing hedgerow.	Impacts to agricultural field avoided.
Access Road to T8	Land Use, Agricultural	Access road will be located along the field edges.	Impacts to agricultural field reduced.
Access road to T11/T12	Land Use, Wetlands	Access road moved west out of forested wetland.	Impacts to wetlands avoided.
Access Road between T11 and T12	Land Use, Agricultural	Permanent access road between T11 and T12 relocated east to edge of field. Temporary access road added to design to allow component deliveries.	Impacts to agricultural field reduced.
Access Road to T17	Land Use, Agricultural	Access Road to Turbine 17 relocated north to avoid conflicts with drainage tiles and to run along the edge of the field.	Impacts to agricultural field reduced.
Access Road to T20	Land Use, Agricultural	Access road to T20 relocated north to edge of field. Temporary construction road with wide turning radius to be utilized to allow component deliveries.	Impacts to agricultural field reduced.
Access Road to T21	Wetlands	Access road shifted south to follow existing farm lane.	Impacts to wetlands avoided.

Facility Component	Resource(s)	Alternative Design Measure(s)	Result
Access Road to T29 / T31 / T33	Land Use, Agricultural	Access road re-aligned north to edge of field. Temporary construction road with wide turning radius to be utilized to allow component deliveries.	Impacts to agricultural field avoided.
Access Roads to T29-T30-T32-T33	Land Use, Agricultural	Separate access roads combined as central access following field edges.	Impacts to agricultural field avoided.
Access Road to T 30	Cultural Resources	Access road coming from the east shifted to the south and between identified archeological resources.	Avoid direct impacts to an archeological area.
Collection Lines			
Collection line between T25 and T21	Land Use, Agricultural	Adjusted circuit layout to connect to T18 and remove this connection that had significant wetland and agricultural field impacts.	Impacts to wetlands and agricultural field avoided.
Collection line between T6-T7, T8-T9, T17-T22,	Land Use, Wetlands	Using trenchless installation to reduce tree clearing and soil disturbances within wetlands.	Impacts to wetlands avoided.

Based on final impact calculations to wetlands and streams, the Applicant will implement compensatory mitigation to satisfy the requirements of the NYSDEC and U.S. Army Corps of Engineers (USACE) (see Exhibit 22).

More generally, approximately 206 acres (3.5%) of the approximately 5,813-acre Facility Site will be temporarily disturbed during construction, while permanent loss of habitat through conversion of natural habitat to built facilities will total 47.61 acres (0.8%) of the approximately 5,813-acre Facility Site. However, these impacts will not result in any landscape-scale habitat fragmentation effects as the nearby landscape has abundant available habitat with wildlife value like that found in the Facility Site. See Exhibit 22 and 23 of this Application for more detailed information on impacts to wetlands, streams, and wildlife habitat at the Facility Site, along with specific proposed mitigation measures.

To minimize visual and environmental impacts, the Applicant has consolidated the overall layout design to occupy as small an area as practicable. Although the comparatively small size of the Facility limits the area of potential visibility within the Visual Study Area, the presence (i.e., visibility) of Facility turbines will likely result in a change in perceived land use from some viewpoints. The public reaction to the aesthetic qualities of the proposed Facility is difficult to gauge but will likely vary depending on turbine proximity, the affected landscape, and the individual viewer's attitude towards wind power. See Exhibit 24 of this Application for more detailed information on turbine visibility and visual impacts near the Facility Site.

(6) Economic Considerations

The Applicant's intent is to create an economically viable wind-powered electrical-generating facility that will provide a significant source of renewable energy to the New York power grid. Designing a facility that is scaled and sited properly is a key part of this process. All other things being equal, a larger scale project produces lower cost energy. Accordingly, the Facility has been scaled to maximize production while accounting for all other design constraints. A facility with significantly smaller production capacity would pose challenges to the economic feasibility of the Facility. Economies of scale related to construction costs would not be realized while fixed costs would remain the same (e.g., mobilization costs for expensive equipment such as erection cranes). Additionally, the cost of environmental monitoring and mitigation would be proportionately higher (see Section (c)(3) below for further discussion of scale).

As discussed previously, the Facility Site has the wind resource necessary to produce a profitable amount of energy, while the proximity of the Facility Site to the National Grid Lockport-Mortimer 115 kV transmission line reduces grid connectivity costs. Furthermore, individual turbine locations have been progressively refined to maximize capture of the wind resource, while minimizing environmental and economic costs associated with constructing and maintaining access roads, collection lines, and other Facility infrastructure, i.e., turbines have been sited in the densest configuration that does not result in turbulence or wake effects. See Exhibit 6 of this Application for additional information about the wind resource at the Facility Site and see Exhibit 34 for additional information about the electric interconnection.

This Application provides an estimate of the total capital costs of the Facility in conjunction with Exhibit 14. However, because capital cost information is considered proprietary and is retained as a trade secret, this data has been provided in the form of an internal work paper that also describes the assumptions in estimating the total capital costs. 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 proposed Facility is anticipated to have local, regional, and statewide economic benefits. Wind power development, like other commercial development projects, can expand the local, regional, and statewide economies through both direct and indirect means. Income generated from direct employment during the construction and operation phases of a wind energy generating facility is used to purchase local goods and services, creating a ripple effect throughout the State.

The Facility will create approximately 205 full-time equivalent jobs (FTE) during the construction phase. Operation and maintenance of the proposed Facility will generate approximately 8 long-term full-time jobs. When turbine, local revenue, and supply chain impacts, and induced impacts are factored in, the Facility will create 510 FTE jobs during the construction phase and 24 FTE jobs during the operation phase. These workers will receive $37.6 million in payroll during construction and $1.9 million annually for the life of the Facility during operation. A No Action alternative to the proposed Facility would mean forgoing those jobs and benefits, as well as the ripple effects of these investments throughout the State's economy.

In addition, the Facility will result in direct payments to landowners that have agreements with the Applicant. These payments will provide a source of funds that will supplement any income generated from the existing land use (e.g., timber harvesting, agricultural production, etc.). Taxing districts within the Facility Site include Orleans County, the Town of Barre, and the Albion and Oakfield-Alabama Central School Districts. These taxing districts will receive substantial payments through Payment in Lieu of Taxes (PILOT) Agreements and Host Community Agreements. At the same time, the proposed Facility will make few, if any, demands on local government services. Therefore, the payments made to local taxing jurisdictions will be net positive gains and represent an important economic benefit to the local area. See Exhibit 27 of this Application for more detailed information on the socioeconomic effects of the proposed Facility.

(7) Environmental Justice

No environmental justice areas occur within the Facility Site, and the Facility is not expected to impact any environmental justice areas. Therefore, alternatives were not evaluated to avoid impacts on environmental justice areas. See Exhibit 28 for additional information about environmental justice concerns.

(8) Security, Public Safety, and Emergency Planning

Overall safety and security risks associated with the Facility are anticipated to be minimal. To ensure the safety of construction and operations personnel, as well as the security of the Facility overall, the Applicant has developed and will implement a Site Security Plan and an Emergency Action Plan (EAP). These plans are described in Exhibit 18 of this Application. The information contained in the EAP has been provided to local emergency service providers (see Exhibit 18) and will be made available to the employees of the Applicant and any visitors or workers to the Facility Site. This plan outlines the procedures to follow in the event of an emergency.

Risks to the community posed by wind energy generating projects such as the Facility are minimal because the turbines themselves are generally safe. Further, most wind energy generating projects are sited in rural

landscapes, away from population centers. Risks theoretically posed by wind power—ice shedding, tower collapse, blade failure, and fire in the turbines—are readily addressed through the proposed setbacks. See Exhibit 6 for details regarding Facility setbacks and Exhibit 15 for details about public safety.

(9) Public Health

The Facility is not expected to impact public health. Claims of health impacts related to noise and shadow flicker have been considered, but the scientific literature on the topic are largely in agreement that public health claims are largely inapplicable to modern wind energy generating facilities that follow appropriate setback and design standards (see Exhibit 15). Consistent with that finding, the Facility has been designed to follow appropriate design and setback standards and thus is not expected to impact public health. Public health and noise are discussed in full in Exhibits 15 and 19 of this Application, respectively.

(10) Vulnerability to Seismic Disturbances and Climate Change Impacts

Based on the 2014 New York State Hazard Map, the Facility is in an area of low seismic hazard, with a 3% to 4% chance that peak ground acceleration[4] in a 50-year period will exceed 10% of standard gravity (NYDHSES, 2014). A total of 25 earthquakes have been recorded in Orleans County between 1900 and 2005, none of which caused significant damage. Though several fault lines exist in Orleans County originating from the Clarendon-Linden fault system, none are anticipated to pose an imminent threat. Exhibit 21 of this Application provides a more detailed description of the Facility's potential vulnerability to seismic disturbance.

In New York State, climate change is predicted to result in rising sea levels, more frequent intense precipitation events, and higher average temperatures. Although the Facility Site will not be affected by rising seas, changes in precipitation intensity could lead to more frequent flooding in low-lying areas. Federal Emergency Management Agency (FEMA) flood insurance rate maps indicate that sections of Manning Muckland Creek and a few unnamed tributaries within the Facility Site contain a 100-year floodplain (FEMA, 1981). To minimize risks associated with flooding, the Applicant has developed a flood mitigation strategy that focuses on two main components: (1) Facility siting/design and (2) mitigation/minimization measures to be deployed during Facility construction. Potential flood-related impacts and mitigation/minimization measures are addressed in Exhibit 23 of this Application.

[4] Peak acceleration is the largest increase in velocity recorded by a station during an earthquake.

Temperature increases linked to climate change may drive broad shifts in ecosystems across New York State (NYSERDA, 2011). Ecological communities most vulnerable to climate change (e.g., boreal spruce-fir forests, high elevation alpine tundra communities, etc.) do not occur within the Facility Site.

(11) Objectives and Capabilities of the Applicant

With respect to capabilities, the Applicant—a privately held limited liability company—is a wholly owned subsidiary of Apex Clean Energy Inc. (Apex), which is headquartered in Charlottesville, Virginia, and has a local Facility office in Albion, New York. Apex is focused on advancing the shift to clean electricity through the development, financing, construction, and management of renewable energy-producing assets, including utility-scale wind projects. Apex is constructing one of the nation's largest, most diversified portfolios of renewable energy resources, capable of producing more than 12,000 MW of clean energy. From 2012 through 2019, Apex brought online 13 new clean energy facilities comprising nearly 3 GW of capacity.

Given the Applicant's capabilities, the proposed Facility advances company objectives, as well as the State Energy Plan, Clean Energy Standard, and Reforming the Energy Vision initiative as well as New York's recently enacted Climate Leadership and Community Protection Act (CLCPA).

The Town of Barre has been selected as the location of the proposed Facility because the Applicant has determined that the area meets the company's objective of creating an economically viable wind-powered electrical-generating facility that will:

- Satisfy regional energy needs in an efficient and environmentally sound manner;
- Supplement and offset fossil-fuel energy generation in the region;
- Reduce the amount of electricity imported to New York State;
- Realize the potential of the Orleans County wind resource;
- Provide energy not coupled to commodity prices;
- Produce electricity without the generation of carbon dioxide or other greenhouse gases that contribute to climate change;
- Promote the long-term economic viability of rural areas in New York; and
- Assist New York State in meeting its renewable energy consumption and greenhouse gas emission reduction goals under the State Energy Plan, Renewable Portfolio Standard, and CLCPA.

(c) Description of Reasonable Alternatives to the Proposed Facility at the Proposed Location

As previously noted, unlike state or municipal entities, private developers do not have the power of condemnation or eminent domain. Consequently, the Applicant does not have the unfettered ability to locate projects in any area or on any parcel of land but must site Facility components on private property where landowners have agreed to allow such construction. The agreements the Applicant has developed with landowners within the Facility Site strictly limit the use of land to a wind energy generating facility, and as such, do not allow the Applicant to site other alternative energy production facilities (e.g., solar). These and other constraints sharply limit the alternatives that can be reasonably considered.

(1) General Arrangement and Design

As discussed above, the arrangement and design of the Facility has evolved since the filing of the PIP. Further, the Facility design is constrained by several factors. These factors are discussed in Section (c)(4) below. The Facility Site is 5,813 acres in size and extends east from County Road (CR) 5 to CR 83. Turbines are arranged to provide the best access to the wind resource. Table 9.1 above lists changes made by the Applicant to re-configure or shift the Facility layout or arrangement to avoid and/or minimize impacts. See Exhibit 3 and Exhibit 11 for a full description of the arrangement and design of Facility components.

(2) Technology

The turbines proposed for the Facility will utilize the latest in wind power generation technology to enhance energy production and project efficiency and safety. Each wind turbine consists of three major components: the tower, the nacelle, and the rotor. The nacelle sits atop the tower, and the rotor hub is mounted to the front of the nacelle. “Hub height” is the height of the center of the rotor, as measured from the base of the tower (excluding the subsurface foundation), while total turbine height is the height of the entire turbine, as measured from the tower base to the tip of the highest blade when rotated to the highest position.

Due to market factors such as availability and cost, a specific turbine model has not yet been selected for the Facility. Table 9-2 presents the dimensions for each of the alternative turbine models under consideration for the Facility.

Table 9-2. Approximate Turbine Dimensions by Model

Turbine Model	Rated Power	Hub Height	Rotor Diameter	Total Height
Vestas V162-5.6	5.6 MW	125 meters (410 feet)	162 meters (531 feet)	206 meters (676 feet)
Nordex N149-4.8	4.8 MW	125 meters (410 feet)	149 meters (489 feet)	199.5 meters (655 feet)
GE 158-5.5	5.5 MW	125 meters (410 feet)	158 meters (518 feet)	204 meters (669 feet)

The turbine model selected for the Facility may be one of these models or an equivalent model. If a different turbine model is selected, it will not have a greater total height, rotor swept area, or sound power level output than those analyzed in this Application. See Appendix 6-A of this Application for turbine brochures containing additional information about wind turbine technology.

Note that the use of shorter turbines would require the installation of more turbines to meet the same 184.8 MW output proposed for the Facility. The installation of more turbines would likely result in greater impacts to ecological communities, including wetlands, streams, vernal pools and forest cover. Regardless of turbine size, a Facility with more turbines would require more access roads and collection lines. In addition, impacts to visual resources, public health and safety, and transportation would likely increase with the associated larger project footprint. As previously noted, the compact 33-turbine layout proposed by the Applicant avoids and minimizes impacts wherever possible, while maintaining the feasibility of the Project.

(3) Scale or Magnitude

As mentioned previously, numerous siting constraints dictate the size and layout of a wind energy generating facility, as do the practical constraints inherent in the limited number of turbine models and technologies available to the Applicant. These constraints reduce the feasibility of constructing a facility with electric power generation capabilities above 184.8 MW within the proposed Facility Site. Considering the Applicant is a private facility applicant, expanding the physical size of the Facility Site is not an option.

Constructing a facility with a reduced generating capacity would not be economically advantageous. The Applicant is doing business in a highly competitive, price sensitive wholesale electric market. Given the economies of scale involved in the development and construction of a wind project, all other things being equal, a larger scale project produces lower cost energy. Since the Facility has a 184.8 MW interconnection request with National Grid, the preferred alternative is to construct a facility that can produce up to 184.8 MW. A facility with significantly smaller

production capacity would pose challenges to the economic feasibility of the Facility and would not meet its stated objectives.

In particular, if the proposed generating capacity were significantly reduced: (1) the maximum benefit of the available wind resource would not be realized; (2) the Facility would not as readily address the significant State policy considerations relating to reducing greenhouse gas emissions, increasing renewable energy generation, and de-carbonizing the electric system; (3) economies of scale related to construction costs would not be realized while fixed costs related to constructing the Facility would remain the same (e.g., mobilization costs for expensive equipment such as erection cranes); and (4) the cost of environmental monitoring and mitigation would be proportionately higher.

With respect to the economic benefits to the community, reducing the scale/magnitude of the Facility would also reduce PILOT and Host Community Agreement contributions to local taxing jurisdictions, which are typically developed per MW or per turbine. In addition, if the physical extent of the Facility Site was reduced, revenues related to landowner agreements would also be reduced. Finally, the smaller the Facility, the smaller the direct and indirect economic benefits associated with its construction and operation.

(4) Alternative Turbine Layouts

(i) Factors Considered During Layout Design

Turbine models are selected based upon numerous factors, such as site suitability, design features, availability and price. For the proposed Facility, turbine locations will ultimately be chosen from among the specific locations identified in the Application and will be based on the wind resource and other siting factors. However, to assure a worst-case evaluation, the Application has assessed the impacts associated with up to 33 turbine locations, even though fewer turbines may be built. See Exhibit 3, Figure 3-1, which identifies the position of all proposed wind turbine sites for the layout proposed in this Application.

The proposed location and spacing of wind turbines are directly related to various factors, including landowner participation, the wind resource assessment, the location of existing access roads, environmental factors, constructability issues, and the consideration of adjacent land uses or any potential zoning constraints. Factors considered during layout design include the following:

- *Wind Resource Assessment* – Using on-site meteorological data, topographic and surface roughness data, wind flow modeling, and wind plant design software, wind turbines will be sited to optimize exposure to wind from all directions, with an emphasis on exposure to the west winds that prevail in the Facility Site.
- *Topograph*y – Higher elevations typically correspond with a greater wind resource. In addition, turbine manufacturers require that certain elevation and topography criteria be met or else they will not certify the turbine location as suitable, precluding construction. All proposed turbine locations were sited to meet specific elevation and topography criteria and satisfy turbine manufacturer requirements.
- *Sufficient Turbine Spacing* – Each operating wind turbine creates downwind turbulence in its wake; wind speeds are greatly reduced in this wake. As the flow proceeds downwind, there is a spreading of the wake and recovery to free-stream wind conditions. Electricity production can be greatly reduced and wear on mechanical turbine components can increase when turbines are sited too close to one another. Turbines in the proposed Facility will be sited to minimize wake losses and maximize the capture of wind energy.
- *Local Zoning* – The Town of Barre has adopted Wind Energy Regulations. These regulations specify criteria under which applications for commercial wind energy conversion systems will be evaluated. To the maximum extent practicable, the Facility was designed to meet the requirements contained these local ordinances. Any exceptions are discussed in Exhibit 31.
- *Wetlands, Waterbodies, and Other Sensitive Habitats* – Facility components will avoid and/or minimize impacts to wetlands, waterbodies, and other sensitive habitats to the greatest extent practicable.
- *Communication Interference* – Turbines have been sited outside of known microwave pathways, and far enough from land mobile and emergency service communication towers and AM/FM radio stations to minimize any effect that they would have on existing communications.
- *Recreational Resources* – Turbines have been sited to avoid any material adverse effects to the Town's or County's existing or proposed trails, trail facilities, and recreation areas.
- *Cultural Resources* – Facility construction will be conducted in such a way that does not cause any significant direct or indirect impacts to prehistoric or historic archeological resources. Avoidance measures, proposed in consultation with the NYSOPRHP, are discussed in Exhibit 20.

As previously noted, general measures the Applicant initially took to avoid and minimize impacts to sensitive resources in site selection/refinement process included: relocating Facility components, collocating Facility components (e.g., access roads and collection lines), routing Facility components along previous disturbance

corridors (e.g., farm roads), reducing the size of the Facility Site, designing access roads to work with the native topography (e.g., avoiding steep slopes), precluding construction in flood-prone areas where possible, and committing to the strategic use of trenchless technologies, such as HDD and/or jack and bore, when installing buried interconnects beneath high quality water resources.

For wetlands, where avoidance was not practicable, impacts were minimized by selecting narrow and/or previously disturbed portions of the wetlands for crossing locations. Impacts to undisturbed wildlife habitat have been minimized by siting access roads and collection lines in or adjacent to agricultural land, which generally provides habitat for only a limited number of wildlife species. In addition, these areas are already subject to regular periodic disturbance in the form of mowing, plowing, harvesting, etc.

As noted in Section (a) above, the initial Facility Site was significantly larger than the current layout. After submission of the PIP Plan, the Applicant eliminated large sections of the initial site to avoid impacts to sensitive resources and address other siting concerns. As the Facility Site and component layout solidified, more specific measures were taken by the Applicant to avoid and minimize impacts to environmental resources. These measures are summarized in bulleted list above.

(5) Timing of In-service Date in Relation to Other Capacity Changes to the Electric System

The Facility is not anticipated to have any adverse effects on the New York State power grid. See Exhibit 5 for a more detailed discussion of electrical system effects.

(d) Why the Proposed Location Best Promotes Public Health and Welfare

The proposed location is best suited to promote public health and welfare because it properly balances the siting constraints discussed in Section (a), while providing public health benefits associated with wind energy generation. Electricity generated from zero-emission wind energy facilities like the proposed Facility can displace electricity generated from conventional power plants, reducing emissions of conventional air pollutants, such as mercury, sulfur, nitrogen oxides, and GHGs (e.g., carbon dioxide).

(e) Why the Proposed Facility Best Promotes Public Health and Welfare

The proposed Facility will promote public health and welfare by positively impacting socioeconomics (through increased employment, increased revenues to local municipalities, and revenues to participating landowners), air quality improvements, and reduced climate change impacts (through a reduction of GHGs that contribute to climate change).

The proposed Facility also generates electricity without using water—a valuable resource—and without requiring the extraction of fossil fuels. Also, operation of the proposed Facility will not generate any residuals—such as waste byproducts—that require management and disposal. In facilitating an overall reduction in pollutants and GHGs, the Facility will help to protect sensitive environmental resources (e.g., water quality) and human health.

The proposed technology, scale, and timing of the Facility are best suited to promote public health and welfare. The turbines proposed for the Facility will utilize the latest in wind power generation technology to enhance project efficiency and safety and minimize impacts (e.g., noise). If the scale of the proposed Facility (i.e., generating capacity) were significantly reduced, the maximum benefit of the available wind resource would not be realized, reducing economic and public health benefits, and potentially rendering the project economically unviable. Consistent with the discussion above, using shorter turbines would increase the number of turbines above the 33 sites evaluated in this Application without increasing the generating capacity of the Facility. This change would increase impacts to agricultural and forested land and wildlife habitat, and would likely result in greater visual, shadow flicker, and noise impacts, including impacts to certain recreational and cultural resources, without any added energy generation benefit.

Regarding timing, the State Energy Plan (SEP) calls for reducing GHG emissions 40% from 1990 levels and generating 50% of electricity from renewable energy sources by 2030 (NYSEPB, 2015). The recently enacted CLCPA increases the 50% renewable energy goal to 70% by 2030 and calls for all electricity to be generated from renewable sources by 2040. These aggressive targets require significant new sources of renewable energy to be brought online as soon as possible. Furthermore, New York State is already experiencing adverse impacts from climate change, including rising temperatures and sea levels, decreased winter snow cover, more widespread vector-borne infections and diseases, and more extreme precipitation events and summer heat waves. Therefore, the timing of the Facility best promotes public health and welfare.

(f) No Action Alternative

The no action alternative assumes that the Facility Site would continue to exist as is. This no action alternative would not beneficially or adversely affect current land use, ambient noise conditions, traffic or public road conditions, television/communication systems, and would maintain the area's community character, socioeconomic, and energy-generating conditions as they currently exist.

The No Action Alternative is not best suited to promote public health and welfare because it would deprive the State and the region of a major source of clean, renewable electricity. As discussed above, electricity generated from wind energy facilities can displace electricity generated from conventional power plants, reducing emissions of both

conventional and GHG pollutants. On a long-term basis, increasing the production of wind generated power will reduce the need to construct and operate new fossil fueled power plants (Jacobsen and High, 2008).

The No Action Alternative is not best suited to promote public welfare because it would deprive the State of a new source of renewable energy that would help achieve the objectives of the SEP, the Governor's Reforming the Energy Vision (REV) initiative, and the Clean Energy Standard (CES), and the CLCPA. The 2015 SEP contains a series of policy objectives to increase the use of energy systems that enable the State to significantly reduce GHG emissions while stabilizing energy costs. The SEP commits to achieving a 40% reduction in GHG emissions from 1990 levels by 2030 and reducing total carbon emissions 80% by 2050. In addition, the SEP calls for 50% of generation of electricity from renewable energy sources by 2030 (NYSEPB, 2015) while the CLCPA requires that all electricity be generated from renewable sources by 2040. The No Action Alternative would not advance the objectives of the SEP, CLCPA and other State energy initiatives (i.e., it would not contribute toward reducing GHG emissions or assist the State in achieving the CLCPA's 100% renewable energy generation mandate).

REV is a strategy to build a clean, resilient, and affordable energy system for all of New York. The Public Service Commission (PSC) issued their *Order Adopting Regulatory Policy Framework and Implementation Plan* on February 26, 2015 that outlines issues and tasks to resolve the technical, marketplace, and regulatory challenges necessary to achieve the REV plan and goals. As stated by the PSC in the REV Order, "A significant increase in the penetration of renewable resources is essential to meeting our objectives, state goals and proposed federal requirements" (PSC, 2015, p. 82). The REV Order recognizes that large-scale renewables (LSR), such as the proposed Facility, will be critically important to meeting GHG emissions reduction goals. On December 2, 2015, Governor Andrew Cuomo directed the Department of Public Service to develop a CES, which would change the targets identified in the SEP to required mandates. The No Action Alternative would not contribute to State policy objectives, because it would not provide additional electrical capacity produced by renewable energy.

(g) Energy Supply Source Alternatives

In considering alternative energy supply sources, the objectives and capabilities of the sponsor need to be considered. The objective of the Heritage Wind Project is to add a significant source of renewable energy to the State's electric system that will qualify for participation in the CES program. This objective excludes consideration of non-renewable facilities and impounded hydroelectric facilities, the only hydroelectric technology that could generate the quantity of energy the Heritage Wind Project will produce. Solar energy is a rising technology used to produce large amounts of energy; however, the development of solar energy requires the acquisition of large tracts of contiguous land. Additionally, solar development reduces the quantity of land available for agricultural practices. By comparison, wind

facilities are compatible with agricultural activities. Siting a wind facility in the Town of Barre allows the Applicant to meet their objectives or capabilities, while preserving current land use in the community.

(h) Comparison of Advantages and Disadvantages of Proposed and Alternative Energy Sources

Energy supply source and demand-reducing alternatives do not meet the objectives or capabilities of the Applicant. Therefore, energy supply source and demand-reducing alternatives are not evaluated in this Application.

(i) Why the Proposed Project Best Promotes Public Health and Welfare

The Applicant has designed the Facility layout to optimize the balance between energy generation and the protection of agricultural, environmental, and aesthetic resources, as well as public health and welfare. The design of the Facility has evolved through an iterative process that incorporates various siting constraints, including: wind resource availability; landowner considerations; site accessibility; stream, wetland, cultural, and visual impact avoidance/minimization; noise and shadow flicker minimization; and agricultural land protection. Each of these issues are discussed in detail in this Application. As the analysis of the alternative turbine layout in Section (c)(4) shows, the proposed Facility is best suited to promote public health and welfare.

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