High Bridge Wind Project

Case No. 18-F-0262

1001.9 Exhibit 9

Alternatives

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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; and
- Limited population/residential development to facilitate compliance with applicable setbacks.

The Facility Site presented in this Application has been extensively refined to carefully meet the conditions outlined above and minimize the impact on sensitive environmental receptors. The wind resource within the Facility Site is adequate for the wind turbine generator models selected and included in this Application. The transmission system that will receive electricity from the Facility can accommodate the Applicant's proposed 100.8 megawatts (MW) of electric power generation (see Exhibit 5) and the point of interconnection is close enough that an extensive overhead transmission lines will not be necessary.[2] This reduces costs and adverse environmental impacts associated with overhead transmission lines (e.g., visual and environmental impacts). No other interconnections are proposed at the point of interconnection (POI) substation. The Applicant, as a private facility applicant, does not have eminent domain authority; however, landowners and municipalities within the Facility Site are willing to work with the Applicant, and land within the Facility Site is suitable and available to site project components. Access to the site for component delivery and Facility operation is acceptable. No areas of statewide significance or high environmental sensitivity area located within the Facility.

Therefore, the preferred alternative is to construct a facility that can produce up to 100.8 MW of renewable energy within the Facility Site identified in this Application. Considering the Applicant is a private facility applicant, the identification and description of reasonably available alternative site locations in this Application need only include sites

[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] An approximately 200-foot span of overhead transmission line is proposed between the collection and point of interconnection substations.

owned by or under contract/option to the Applicant (i.e., site locations within the Facility Site). The Facility components' layout within the Facility Site, as proposed in this Application, was the result of an iterative process where the technical and economic requirements of the Facility were weighed against impacts to recreation, cultural resources, and the environment. The proposed Facility layout is the most reasonable layout possible, given the constraints of the Facility Site (e.g., proximity to existing transmission infrastructure, site topography, access from existing roads, conflicting sensitive resource concerns, etc.). A description of the Facility layout selection process is described in Exhibit 9(b). A description of specific examples of the design evolution and resource impact avoidance and minimization is provided in Exhibit 9(c)(4) and Table 9.1.

(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, 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 glaciated Appalachian Plateau physiographic province of New York State. This physiographic province was formed as a result of uplift and erosion and consists mainly of glacial till, outwash sand and gravel and kame features. Chenango County lies within two major drainage basins, the Chenango River Basin and the Upper Susquehanna River Basin. Topography of is characterized by deeply eroded, steep-sided, flat-bottomed valleys, and flat to generally rolling plateaus. Elevations within the county vary in relief from a low of approximately 930 feet in the south portion of the County to a high of approximately 2,040 feet. 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.

The proposed Facility will be in a rural portion of Chenango County that is characterized by a mix of agricultural and forested land. According to the *Chenango County Agricultural & Farmland Development Plan,* as of 2007, farms in Chenango County comprised approximately 177,267 acres of land, or approximately 30% of the county's

land mass. Within the Facility Site, anthropogenic disturbance is largely limited to the valleys where the soil is fertile, while the ridges and upper slopes are relatively undisturbed.

Depth to bedrock within the Facility Site typically ranges from 0 to more than 8 feet on the hilltops where wind turbines will generally be located. The bedrock units dip gently to the south, which causes the oldest units to be exposed in the north and progressively younger units exposed to the south. The predominant bedrock lithology is anticipated to consist of interbedded sandstone, siltstone, and shale of the Enfield & Kattel and/or Moscow Formations (Upper and Middle Devonian periods).

The geology and topography of the Facility Site (i.e., a high elevation plateau with interspersed rolling hills) is supportive of wetlands. The Applicant delineated a total of 121 wetlands totaling 103.3 acres within the Wetland Study Area (see Exhibit 22(i) and Figure 22-2). These wetlands were field identified by qualified biologists based on the presence of hydrophytic vegetation, hydric soils, and wetland hydrology. The Applicant also delineated 83 totaling approximately 36,874 linear feet (7.0 miles) 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 and wetlands and potential Facility impacts. See Exhibit 9(c)(4) 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, etc.) is outlined in Exhibit 9(b)(5).

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

The Applicant has identified several recreational facilities in the area around the Facility Site, including, but not limited to, trails (i.e., hiking, snowmobile, biking, etc.) and several state forests (see Figure 4-6). The closest state forest is Lyon Brook State Forest which is located approximately one mile west of the Facility Site. In general, land use at the Facility Site consists of scattered single family residences, agricultural fields, and large tracts of undeveloped second-growth forest. The Facility generally will be compatible with these land uses and will have primarily temporary impacts associated with construction. See Exhibit 4 and 31 of this Application for more detailed discussion of land use in the area around the Facility.

As discussed in Exhibit 20, the Applicant submitted Phase 1A Historic and Archeological Resources Surveys to the New York State Office of Parks, Recreation, and Historic Preservation (NYSOPRHP) for review and coordination (see Appendices 20-A and 20-D). Staff from the NYSOPRHP reviewed and accepted the work plans

in the spring of 2019. See Exhibits 20 and 24 of this Application for more detailed information on the recreational, cultural, and other uses of the Facility Site.

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. For example, turbine 105 and associated access roads and collection lines were moved to avoid stone features. See table 9.1 for other specific examples of alternative design measured implemented by the applicant that avoided impacts. Where impacts were unavoidable, mitigation measures are being considered.

(3) Engineering Feasibility

A Report of Expected Geotechnical Conditions was prepared by Terracon Consultants that included a literature review of publicly available information and data pertaining to surface and subsurface soil, bedrock, and groundwater conditions near the proposed Facility, as well as preliminary soil borings performed at select locations within the Facility Site to obtain additional information pertaining to the subsurface soil and bedrock features to assess the general constructability of the proposed Facility. The Assessment concluded the Facility Site is generally suitable for the proposed Facility (see Appendix 21-C). The literature review and preliminary borings suggest the proposed turbines can be constructed on spread footing or rock anchors foundations depending on each turbine foundation location. Due to the overall shallow depth to bedrock in many turbine sites, blasting will likely be required for the construction of the turbine foundations. It is expected that the excavations for the construction of the proposed Facility will be completed using conventional construction equipment including bulldozers, track hoes, and possibly pan excavators. Additional information regarding the geotechnical assessment and the engineering feasibility of the Facility Site are presented in Exhibit 21 of this Application. With respect to interconnections, a System Reliability Impact Study (SRIS) was conducted that found the NYSEG's Jennison to East Norwich 115 kV transmission line in the Town of Guilford can accommodate the interconnection and accept and transmit the power from the Facility. See Appendix 05-A and Exhibit 9(b)(4).

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, 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

A System Reliability Impact Study (SRIS) was completed in 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. As such, there was no need to evaluate alternatives which would avoid or minimize reliability or electric system effects. 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 100.8 MW of clean, renewable energy without emitting any conventional air pollutants or greenhouse gases (GHGs), or 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 Exhibit 9(f) for additional information on the benefits of wind power.

The Facility is expected to displace approximately 66,732 short tons of carbon dioxide (CO_2) emissions from conventional power plants on an annual basis. This represents approximately 0.21% of all CO_2 emissions estimated to be produced by New York State in 2021. 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 certain 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, direct mortality to avian and bat species, and impacts to streams and wetlands.

As described in this exhibit, the process for designing the Facility layout involved balancing technical and economic constraints against impacts to 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 drill (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 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

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 Resources.

Facility Component	Resource(s)	Alternative Design Measure(s)	Result
Wind Turbine			
T105	Cultural Resources	Wind turbines and associated access roads and collection lines shifted southeast.	Impacts to two stone features avoided completely.
T118	Wetlands	Wind turbine and associated access roads and collection lines shifted east, to a lower elevation site.	Permanent impacts to Wetland 4I and 4H avoided completely.
T122	Land Use; Agricultural	Wind turbine and associated access roads and collection lines shifted northwest, off the topographical high point--located in the middle of an active agricultural field--to the field edge.	Compliance with NYSDAM guidelines, reduced impacts to active agricultural land.
T123	Wetlands	Wind turbine and associated access roads and collection lines shifted approximately east, off the topographical high point.	Impacts to Wetland 2K avoided completely.
T134	Wetlands	Wind turbine shifted southwest.	Impacts to Wetland 6A significantly reduced.
T135	Wetlands	Wind turbine shifted south; associated access roads and collection line routes redesigned.	Impacts to Wetland 6E significantly reduced.
Access Road			
Access Road to T104	Wetlands	Access road and collection line shifted northeast .	Impacts to Wetland 1Z significantly reduced.
Access Roads to T112 and T113	Wetlands; Surface Waters; Vernal Pools	Access road and collection line routes redesigned.	Impacts to Stream 8V, Vernal Pool VP-4A, Wetlands 3H, 3J, and 3N avoided completely; impacts to Wetlands 3I and 3O significantly reduced.
Access Road to T118	Wetlands; Surface Waters	Access road and collection line routes redesigned.	Impacts to Wetlands 4N and 6G, and Streams 9W, 9X, and 9Z avoided completely.
Access Road to T124	Wetlands; Vernal Pools	Access road and collection line shifted north .	Impacts to Wetland 2V and Vernal Pool VP-SYA avoided completely.
Access Road to T126	Cultural Resources	Access road and collection line shifted east.	Impacts to one stone feature avoided completely.

Facility Component	Resource(s)	Alternative Design Measure(s)	Result
Access Road to T131	Wetlands	Access road shifted east.	Permanent impacts to Wetland 5J completely avoided.
Access Road to T134	Wetlands; Surface Waters	Access road and collection line routes redesigned.	Impacts to Wetland 6A and 5P avoided completely; impacts to Stream 10Z significantly reduced.
Collection Line			
(Preliminary) Collection line between T103 and T122	Transportation	Half mile section of collection line paralleling SR 37 removed.	Potential transportation impacts during construction reduced.
(Preliminary) Collection line between T123 and T104	Wetlands; Vernal Pools	Quarter mile section of collection line redesigned and removed.	Impacts to Wetland 2I and Vernal Pool VP-4 avoided completely.
Collection line between T104 and the collection substation	Wetlands; Surface Waters	Trenchless technologies used to cross Moses Brook.	Impacts to Moses Brook (Stream 7F) and Wetland 1V avoided completely
Collection line between T104 and T124	Cultural Resources; Wetlands; Surface Waters	Collection line shifted south.	Impacts to a stone feature avoided completely; impacts to Wetland 2Y significantly reduced.
Collection line between T113 and T115	Wetlands; Surface Waters	Collection line shifted northeast.	Impacts to Wetland 3Q significantly reduced.
Collection line between T124 and T112	Cultural Resources; Wetlands; Surface Waters; Vernal Pools	Trenchless technologies used to cross Kent Brook; collection line shifted in four locations.	Impacts to Kent Brook (Stream 8O), Vernal Pools VP-SYJ and VP-BC, Wetlands 2Z, 3D, and 3E, and one stone feature avoided completely; impacts to Wetlands 2Y, 3A, 3B, 3G, and Stream 8N significantly reduced.

As stated above, the Facility may result in short-term and long-term impacts to several environmental resources. 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). Approximately 117.4 acres will be temporarily disturbed during construction and 111.3 acres will be converted to

a successional state, while permanent loss of habitat through conversion of natural habitat to built facilities will total 43.5 acres (approximately 1% of the 3,921-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 of an area as is practicable. The small size of the Facility limits the area of potential visibility within the Visual Study Area. Even considering the size of the Facility, the presence (i.e., visibility) of Facility turbines will likely result in a change in perceived land use from some viewpoints. The Visual Impact Analysis (VIA) indicates the Facility's overall contrast with the visual/aesthetic character of the area will generally be moderate (see Appendix 24-A). 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 an 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.

A detailed description of specific micro-siting and resource impact avoidance is provided in Exhibit 9(c)(4) below.

(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. Properly siting the Facility and individual Facility components is a key part of this process. 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 NYSEG's Jennison to East Norwich 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 Exhibit 14.

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 62 full-time equivalent jobs (FTE) during the construction phase. Of these, 58 will be construction and interconnection labor, while 5 will be in construction-related services (e.g., engineering and other professional services)(see Exhibit 27). As described in Exhibit 27 and in the supporting Socioeconomic Report (Appendix 27-A), the Job and Economic Development Impact (JEDI) model estimates 62 full-time jobs associated with on-site construction for a total of $4.7 million for annual earnings for New York State residents. The JEDI model also indicates the operation and maintenance of the proposed Facility is estimated to generate 5 full-time jobs for NYS residents with combined estimated annual earnings of approximately $0.4 million. 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 having 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., mining, timber harvesting, agricultural production). Taxing districts within the Facility Site include Chenango County, the Town of Guilford, the Norwich City School District, the Bainbridge-Guilford School District and the Gilbertsville-Mt. Upton Central School District. These taxing districts will receive substantial payments through a Payment in Lieu of Taxes (PILOT) Agreement and/or Host Community Agreements. 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 the closest environmental justice areas to the Facility Site.

(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, a Health and Safety 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 developed in coordination with local emergency service providers 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, nor are the alternatives considered for this Project expected to impact public health. Therefore, a comparative assessment of alternatives was not performed to address public health impacts which would be largely the same across the alternatives. Claims of health impacts related to noise and shadow flicker have been considered, but the consensus of the scientific literature on the topic is 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. Regardless, the Applicant has worked with landowners and the local community to make changes to the Facility layout to avoid and reduce impacts. Some of those changes are summarized in Table 9-1. 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 very low seismic hazard, with a peak ground acceleration value less than 3% of the acceleration force of gravity, with a 10% probability of exceedance in 50 years (DHSES, 2014). Chenango County has no recorded earthquakes (DHSES, 2014). The USGS Earthquake Hazards Program does not list any young faults or faults that have had displacement in the Holocene

epoch within the vicinity of the Facility Site. Exhibit 21 of this Application provides a more detailed description of the Facility's potential vulnerability to seismic disturbance. There were no differences in vulnerability to seismic disturbances among the alternatives considered, and these factors were not used in selecting the preferred alternative.

In New York State, climate change is predicted to result in rising sea levels, more frequent intense precipitation events, and higher average temperatures. Temperature increases linked to climate change may drive broad shifts in ecosystems across New York State (NYSERDA, 2011). 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. Ecological communities most vulnerable to climate change (e.g., boreal spruce-fir forests, high elevation alpine tundra communities, etc.) do not occur at the Facility Site. Lastly, Federal Emergency Management Agency (FEMA) flood insurance rate maps indicate that no 100- or 500-year floodplains are located within the Facility Site. The Applicant identified locally designed Special Flood Hazard Areas and determined that the Facility layout avoided those areas of potential concern.

(11) Objectives and Capabilities of the Applicant

With respect to capabilities, the Applicant is a wholly owned subsidiary of Calpine Corporation (Calpine), which is headquartered in Houston, Texas. Calpine specializes in developing, constructing, owning and operating generation assets that use advanced technologies to produce electric power in a low-carbon and environmentally responsible manner. In early 2015, Calpine launched a new development group with the goal of being a long-term owner and operator of wind energy projects throughout the United States.

Given the Applicant's objectives and capabilities, the proposed Facility best advances company objectives, as well as the State Energy Plan, Clean Energy Standard, and Reforming the Energy Vision initiative. The Applicant does not currently have experience in many types of energy generation, such as hydroelectric, solar or nuclear, such that these were considered to be viable alternatives to the proposed Facility. The Applicant's current portfolio of proposed and operating generation facilities includes natural gas, geothermal and wind energy. Given that the Applicant's principal objective is to take advantage of the existing wind resource at the Facility Site, no other alternative generation technology, even if it were within the Applicant's capabilities, would achieve that objective.

The Town of Guilford 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 Chenango 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 proposed Renewable Portfolio Standard and State Energy Plan goals for the consumption of renewable energy in the State and the reduction of greenhouse gas emissions.

Lastly, 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 by the Applicant to a wind energy generating facility, and as such, do not allow the Applicant to site other alternative energy production facilities (e.g., solar).

(c) Description of Reasonable Alternatives

(1) General Arrangement and Design

As discussed above, the arrangement and design of the Facility is constrained by several factors. The Facility Site is approximately 3,921 acres in size within the Town of Guilford. Turbines are arranged to follow the network of ridgelines that provide the best access to the wind resource and facilitate interconnection to the existing 115 kV transmission line. Table 9.1 above lists specific methods used 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

It is the Applicant's intent and objective to develop a wind power project that harnesses the existing wind resource in Chenango County to the greatest extent possible while minimizing impacts to the environment.

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
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)

The turbine model selected for the Facility may be one of these models or another 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. Please note, the use of less productive (i.e., smaller) turbines would require the installation of more turbines to meet the same 100.8 MW output proposed by 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 25-turbine layout proposed by the Applicant avoids and minimizes impacts wherever possible, while maintaining the feasibility of the Project. See Appendix 06-A for turbine brochures containing additional information about wind turbine technology.

(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 available turbine models and technologies available to the Applicant. These constraints reduce the feasibility of constructing a facility with electric power generation capabilities above 100.8 MW within the proposed the Facility Site. Considering the Applicant is a private 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 feasible. 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 100.8 MW interconnection request with NYSEG, the preferred alternative is to construct a facility that can produce up to 100.8 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 sale/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) Turbine Quantities, Micro-Siting and Impact Avoidance

Layout is also a function of the turbine model that is ultimately used. As discussed previously, the number of turbines constructed as part of the proposed Facility will depend on the capacity of the turbine model selected. For example, if the Vestas V150-5.6 is selected, then up to 18 turbines will be constructed. By comparison, if the

Nordex 3N149 4.0 is selected, then up to 25 turbines will be constructed. Turbine models are selected based upon numerous factors, such as site suitability, 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 25 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 several 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 southwest 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 (e.g., not siting turbines on steep slopes or narrow ridgelines), 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.
- *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' 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.

See Table 9-1 and Exhibit 9(b)(5) for specific information pertaining to micro-siting and impact avoidance.

(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 Exhibit 9(a) and will provide the public health benefits associated with wind energy generation. Electricity generated from zero-emission wind energy facilities like the proposed Facility can displace the electricity generated from conventional power plants, reducing emissions of conventional air pollutants, such as mercury and sulfur and 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 climate (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 require the mining/extraction, refining or transportation of fuels, and 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 benefit 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 non-viable. As discussed above, increasing the number of turbines above the 25 sites evaluated in this Application, without increasing the generating capacity of the Facility, 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 calls for reducing GHG emissions 40% from 1990 levels and generating 50% of electricity from renewable energy sources by 2030 (NYSEPB, 2015). 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 State Energy Plan, the Governor's Reforming the Energy Vision (REV) initiative, and the Clean Energy Standard (CES). The 2015 State Energy Plan 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 State Energy Plan 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 State Energy Plan calls for 50% of generation of electricity from renewable energy sources by 2030 (NYSEPB, 2015). The No Action Alternative would not help advance the objectives of the State Energy Plan (i.e., it would not contribute toward reducing GHG emissions or assist the State in achieving the 50% renewable energy generation objective).

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 State Energy Plan 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.

The No Action Alternative also would not contribute to the State's goal of increasing energy storage capacity. The Clean Energy Standard (CES) Order declares that "[s]torage is a critically important component of the energy system that is both distributed and increasingly reliant on intermittent resources. Unlike other resources, the load shifting and fast response capabilities of various forms of storage resources allow them to provide simultaneous value as an energy and reliability resource" (PSC, 2016, pp. 103-104).The High Bridge Wind Facility is the first large-scale wind energy project in the State to include an energy storage component, making it a particularly valuable addition to New York's energy market and a potential model for other facilities.

(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 High Bridge Wind Project is to add a significant source of renewable energy to the State's electric system that will qualify for participation in the New York State Clean Energy Standard 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 High Bridge Wind Project will produce. Solar is a potential alternative energy supply source; however, the development of a solar energy generating facility is outside the current capabilities of the Applicant. Further, considering the largely forested condition of the Facility Site, solar energy development—which has a much larger footprint than wind energy development—would likely result in substantially greater environmental and cultural impacts in this case. Overall, available alternative power generation technologies do not meet the objectives or capabilities of the Applicant.

Although not an alternative, the Applicant has incorporated battery storage into the design of the Facility. This demand-reducing technology will increase the utility of the energy generated by the Facility, helping the system manage peak demand by storing excess supply and deploying it during periods of greater demand.

(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.

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