EIGHT POINT WIND ENERGY CENTER

Case No. 16-F-0062

1001.5 Exhibit 5

Electric System Effects

Contents

Appendices

Exhibit 5: Electric System Effects

Exhibit 5 of this application includes a discussion of the electric system effects of the Project. While the discussion focuses primarily on the proposed Eight Point Wind Energy Center, certain discussions below also include discussion of the proposed 16.5-mile electric transmission facilities subject to review under Article VII of the PSL and that are not subject to the Siting Board's jurisdiction under N.Y. Public Service Law Article 10. Such Article VII facilities will include an approximately 16.5-mile overhead 115 kV transmission line to be constructed to connect the Project to the New York transmission grid that will be evaluated and certificated through a parallel and separate Article VII process. The dead-end structure adjacent to the fence line between the Project collection substation and the 115 kV transmission line shall be the demarcation point between the Project and the Article VII facilities. The Article VII facilities will terminate at the Point of Interconnection (POI) at New York State Electric and Gas Corporation's (NYSEG's) Bennett Substation.

5(a) System Reliability Impact Study

A System Reliability Impact Study (SRIS) was completed in January 2017 for the Eight Point Wind Energy Center Project by the New York Independent System Operator (NYISO). The SRIS evaluates a number of power flow base cases, as provided by the NYISO, including expected flows on the system under normal, peak, and emergency conditions to evaluate the effects on stability of the interconnection. Additionally, as per the Application requirements, technical analyses of thermal, voltage, short circuit, and stability were performed to evaluate the impact of interconnection.

The SRIS is currently complete based on the originally proposed 32 GE 3.23 MW wind turbine generators. The Applicant is filing a Material Modification Determination request with NYISO updating the items listed below. The changes are:

- Change wind turbines from (32) GE 3.23 MW to (27) GE 3.43 MW plus (4) GE 2.3 MW
- Interconnection length change to 18 miles from 16.5 miles.

The Applicant anticipates the proposed changes will be deemed to be non-material and the SRIS results show that there will be no significant adverse impacts to the New York State Transmission System.

The information contained in the SRIS is proprietary, therefore, the Applicant will seek the requisite trade secret protection for this information pursuant to POL Section 87(2) (d) and 16 NYCRR § 6-1.3.

5(b) Potential Significant Impacts

The results presented in the SRIS indicate that the Eight Point Wind Project will not adversely impact the reliability of the New York State Transmission System. This conclusion is based on the following understandings and assumptions:

- The Project will be operated in accordance with all NYISO requirements, including all applicable NYISO and Transmission Owner day ahead and real time operational procedures and limits. The NYISO will operate the project in a manner that does not negatively impact the New York State Transmission System; this may include dispatching patterns that eliminate potential reliability issues that may exist during certain system conditions.

- The Project and associated interconnection facilities will be designed in accordance with all the Applicable Reliability Standards.
- The SRIS results and conclusions are based on the studied scenarios and various assumptions related with the study methodologies, system, and project modeling information provided by the Developer; any project modeling change can result in different results and possible re-study.
- The SRIS did not include any evaluation of a deliverability standard or test, although such a standard may apply to the Project in the future.

Subject to the above, NYISO Staff is satisfied that the Study was performed in accordance with the approved scope and in conformance with the existing Applicable Reliability Standards. Therefore, the SRIS has been approved. Additionally, the Project has been entered into the 2017 Class Year and has executed the Facility Study.

5(c) Ancillary Services and Electric Transmission System Impacts

The SRIS analysis does not show the Project to have any significant adverse impact to the New York Transmission System. For the N-1-1 Summer peak load case the post-contingency thermal analysis found that when the Bennett 115/34.5 kV transformer and Moraine transmissions line is taken out of service the Howard – Bath Line becomes overloaded, but can be mitigated by either backing down Howard Generation by 13 MW or the Project by 14 MW. In addition, it was also found that when both network transmission lines are out of service the Bennett 115/34.5 kV transformer becomes overloaded, but this can be mitigated by backing down the Project by 34 MW.

For summer peak, N-0 and N-1 thermal analyses did not identify any violations. The post-contingency voltage analysis identified violations that are outside the voltage criteria but these violations could be mitigated by adjusting transformer taps and the switched shunts in the area.

5(d) Reasonable Alternatives to Mitigate Adverse Reliability Impacts

Under the Minimum Interconnection Standard (MIS), any potential adverse reliability impact identified by the Interconnection Study that can be managed through the normal operating procedures of the NYISO, will not be identified as a degradation of system reliability or noncompliance with the North American Electric Reliability Corporation (NERC), Northeast Power Coordinating Council (NPCC), or New York State Reliability Council (NYSRC) reliability standards. It is assumed that the owners and operators of the proposed facilities will be subject to, and shall abide by, the applicable NYISO operating procedures (e.g., security constrained economic dispatch, meaning that pre-contingency the system will be dispatched at all times in such way to not violate the post-contingency applicable limits). Consequently, under the NYISO MIS requirements, no System Upgrade Facilities (SUFs) other than local SUFs are required to address them. The Project does not present any significant adverse impacts to the reliability of the affected transmission systems.

5(e) Estimate of the Total Transfer Capacity across each Affected Interface

The transfer analysis was performed for summer peak cases for both pre-project and post-project cases. The thermal transfer analysis was performed for Dysinger open & close, West Central open & close, and Volney open & close interfaces. The voltage transfer and stability transfer were performed for Dysinger open & close, West Central open & close, and Volney open & close interfaces. The thermal transfer capability increased for the interfaces evaluated with the addition of the Project. The Voltage transfer capability decreased with the addition of the Project for Dysinger East and West Central, but increased for Volney East. Comparing the thermal and voltage transfer limits, the thermal transfer limits are more controlling for all interfaces.

The Dysinger-East, West Central and Volney East normal thermal transfer limits were increased by 10%. Each case evaluated the system performance for various faults. The analysis showed that the system remained stable and damped for all faults tested.

5(f) Criteria, Plans, and Protocols for Generation and Ancillary Facilities

(1) Engineering Codes, Standards, Guidelines and Practices

The Eight Point Wind Energy Project will be designed in accordance with all applicable standards, codes, guidelines, and using best industry practices. For the point-of-interconnection (POI) substation, the Applicant will adhere to all applicable New York State Electric & Gas (NYSEG) requirements. Additional detail is as follows:

34.5 kV Overhead Collection System and 115 kV Transmission Line

The Project overhead collection and the 16.5-mile transmission line (that will be permitted through the Article VII process) will be designed in accordance with (but not limited to) the following design codes, guides, and references:

- RUS Bulletin 1724E-200
- Council of Large Electric System (Cigre)
- National Electric Safety Code (NESC)
- ANSI – American National Standards Institute
- ASTM – American Society of Testing of Materials
- OSHA – Occupational Safety and Health Administration
- IEEE – Institute of Electrical and Electronic Engineers
- ASCE – American Society of Civil Engineers
- NEC – National Electric Code

The 16.5-mile transmission line (that will be permitted through the Article VII process) will be single circuit and consist primarily of steel monopole tangent structures with davit arms and suspension insulators. Guyed steel structures shall be utilized for angle and dead-end applications. In certain locations, wood multi-pole structures and self-supporting steel caisson structures will be utilized per land owner requests. A single overhead optical fiber shall run the entire length of the line, and a 3/8" EHS steel shield wire shall be utilized when multi-pole structures require additional lightning protection.

- Conductor - 1590 kcmil ACSR 'Lapwing' (45/7 Stranding) or similar
- OPGW Shield Wire - 48 fiber single mode cable or similar
- Shield Wire - 3/8" diameter 7-stranded EHS Steel wire or similar

A short (3560 feet) overhead collection line segment will be required due to severe topography variations making underground collection installation non-feasible. The overhead collection line segment will be double circuit and consist of wood monopoles for tangent structures and steel monopoles for guyed angle and deadend structures. Tangent structures shall be framed with cross arms and pin-top insulators to help prevent unwanted uplift. A shield wire shall be utilized for lightning protection and communication purposes.

- Conductor - 477 kcmil ACSR 'Hawk' (26/7 Stranding) or similar
- OPGW Shield Wire - 48 fiber single mode cable or similar

The tension of the conductor and shield wires shall not exceed NESC requirements. Shield wires shall be tensioned to match 70-80% of the conductor sag at an everyday condition, and entrances into substations may utilize slack spans.

Loads will be applied at all phases and shield wires with all wires sloping down to pullers, tensioners, or temporary anchors. The horizontal and vertical components of this load are derived from the wires at a 3 horizontal to 1 vertical slope. This load shall only be evaluated on strain and terminal structures, as pulling and tie downs shall not be allowed on braced post insulators. Based on tangent structure configuration, maintenance shall be conducted from a bucket truck. Maintenance loads are only considered on pole, not arms or hardware.

Uplift load case shall check for negative vertical load to any attachment point that would either lift an insulator assembly string or cause other undesired effects on the transmission line structure assembly. Uplift loads are identified in the design process from a review of the load tables from PLS-CADD. Uplift loads shall be corrected by standard design methods to alleviate any uplift.

The structure will be checked for yaw (skewed) wind directions to determine the adequacy of the structure. Wind direction shall be evaluated every 5° up to 90°, relative to the conductor bisector. Structure deficiency will be corrected based on if this wind case governs.

The line shall be evaluated for placement of Stockbridge dampers for conductors, as well as spiral vibration dampers for OPGW and OHSW to reduce the effects of Aeolian vibration. This evaluation will be done utilizing the average annual temperature, and average temperature of the coldest month weather cases

The insulator selection shall take into consideration the design of the line and substations. Consideration of mechanical and electrical properties of the insulators is critical to ensure that insulators can withstand the mechanical loads and electrical stresses on them. For both suspension and dead-end insulators, the allowable strength rating is 50% of specified mechanical load per the NESC mechanical properties requirement.

The 16.5-mile transmission line shall be designed for minimum clearances as specified in C2-2012 National Electric Safety Code (NESC). Vertical Buffer shall be 3’ conservatively. Buffer is based off 1.5’ for construction tolerances; this includes but is not limited to stringing and tensioning, embedment, and slip joint tolerances. Also a buffer of 0.5’ for survey accuracy and 1’ for design buffer, respectively shall be utilized. Vertical buffer shall also encompass the sag difference between maximum design temperature and maximum operation temperature to ensure no violations under maximum operation.

When special clearance considerations arise, such as stringent railroad requirements or additional pivot irrigation and farm equipment clearances shall be revised accordingly. The clearances will be checked for the following weather conditions:

- Maximum Conductor Operating Temperature; for ACSR conductor this will be at a final condition at 212ºF with no wind.
- Facility specific condition as per NESC table 230-1, Zone 1 with radial ice thickness of 0.5” at 32ºF with no wind.
- Clearance between the crossing line and other utility facilities (existing distribution or communication lines, in order to minimize impact or interference with those facilities) shall confirm the requirements of owning utility. Clearance shall be computed with the upper conductor at 212ºF, final condition with the lower conductor or wire at 32ºF unloaded.
- Clearances will also be maintained under NESC 250C extreme wind and 6psf wind

For the 16.5-mile transmission line, a 100 ft. right-of-way width is typically required for the project, but 75 ft. will be required in specific areas due to land owner constraints. Additionally, where large canyon crossings exist, additional blowout easements may be required.

For the overhead collection segment, a right-of-way width of 75 ft. will be requested, but once the routing is optimized and final the right-of-way may be able to be reduced to 50 ft.

The Project will utilize an OPGW for lightning protection and communication purposes. All shield wires shall be grounded at each structure.

The ground resistance value at each structure shall measure after ground rod has been installed. The resistance shall be 25 ohms or less. If the measure value cannot meet the requirements, then additional ground rods or counterpoise will be required.

All suspension and deadend structures will be designed to meet or exceed various applicable loadings outlined in the NESC and NEER transmission line design criteria. A project specific ice loading of 1” of radial ice will be utilized. Differential ice and broken wire loads will be evaluated during detailed design. Construction stringing loads will also be utilized to ensure construction and installation can occur safely.

Horizontal deflections at the top of steel tangent and non-deadend structures shall be limited to one percent (1%) and two percent (2%) respectively. These percentages are relative to the above ground structure height at the average temperature, with no wind and no ice. No steel structure deflection under any load case shall exceed seven percent (7%). Wood pole deflections shall be analyzed to ensure buckling will not occur under any load case, but a specific deflection limitation for wood structures is not required.

See Eight Point Wind, LLC 115kV Transmission Line Design Criteria for additional details found in Appendix 5-2.

Collection Substation and POI Substation

The substation designs shall incorporate, but is not limited to, the standards and codes below when applicable. NYSEG will be responsible for all POI substation design and construction.

- IEEE C27.13 – Standards for High Accuracy Instrument Transformers
- ANSI/IEEE 81 Part 1 – Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
- ANSI/IEEE 81 Part 2 – Guide for Measurement of Impedance and Safety Characteristics of Large, Extended or Interconnected Grounding Systems
- IEEE 100 – The Authoritative Dictionary of IEEE Standards Terms
- IEEE 487 – Recommended Practice for the Protection of Wire-Line Communication Facilities Serving Electric Power Stations
- IEEE 519 – IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
- IEEE 605 – Guide for Bus Design in Air Insulated Substations
- IEEE 693 – Recommended Practice for Seismic Design at Substations
- IEEE 738 – Standard for Calculating the Current – Temperature Relationship of Bare Overhead Conductor
- IEEE 980 – IEEE Guide for Containment and Control of Oil Spills in Substations
- IEEE 998 – Guide for Direct Lighting Stroke Shielding of Substations
- IEEE 1427 - 2006, IEEE Guide for Recommended Electrical Clearances and Insulation Levels in Air-Insulated Electrical Power Substations
- NESC C2 - National Electrical Safety Code
- ANSI C29.9 – Wet-Process Porcelain Insulators – Apparatus, Post-Type
- ANSI 37.32 – High Voltage Switches, Bus Support and Accessories Schedule of Preferred Ratings, Construction Guidelines and Specifications.
- ANSI 57.12.10 – Requirements for Liquid Immersed Transformers
- ANSI C84.1 – Electric Power System and Equipment – Voltage Ratings (60 Hz)
- National Fire Protection Association (NFPA) 70 - National Electrical Code
- NERC Operating Standards
- NERC/ Planning Standards
- NERC/ Reliability Criteria including:
- Reliability Criteria for System Design
- Power Supply Design Criteria
- American Society of Mechanical Engineers (ASME)
- American Society for Testing and Materials (ASTM)
- National Electric Manufacturers Association (NEMA)
- Electronics Institute of America (EIA) RS-232-D
- Electronics Institute of America (EIA) RS-310-D
- Electronics Institute of America (EIA) RS-422-D
- Electronics Institute of America (EIA) RS-485

- Electronics Institute of America (EIA) 568
- Electronics Institute of America (EIA) 569
- International Electrotechnical Commission (IEC) 8802 or IEEE-802
- International Electrotechnical Commission (IEC) 1131
- ICC International Building Code (IBC)
- NYSEG company standard requirements (POI station only)

The collection substation grading will be done to all applicable codes and standards. Grading slopes inside the collection substation fence will be determined to minimize impact to surrounding features. All clearing, grading, excavation, cut/fill will confirm to geotechnical report recommendations and the SWPPP.

Design of the collection substation and the POI substation will consider various environmental data such as the items below. NYSEG will be responsible for all POI substation design and construction.

- Altitude
- Max. wind speed
- Normal ambient temperature
- Extreme Ambient temperature
- Precipitation
- Humidity
- Seismic Hazard (acceleration as percent of gravity)

The foundation design will be based on the IEEE, ASCE and ACI guidelines that will be applied to the steel structures and/or the equipment. Foundation design will incorporate the soil capacity determined from the geotechnical study. Pier and slab-type foundations shall be used. Other foundation types shall be considered only in consultation with NEER.

Ground supported pieces of equipment, such as circuit breakers and transformers, shall be supported by cast-in-place reinforced concrete slabs unless otherwise indicated by the geotechnical report.

Foundations for the equipment support structures (bus supports, switches, etc.) and dead end structures shall be cast-in-place reinforced concrete drilled piers or spread footings, whichever is appropriate based on the subsurface soil information, unless otherwise indicated by the geotechnical report. Anchor bolts for all structures shall be of sufficient length to allow for the use of leveling nuts. The use of grout between the structure base plate and the top of the structure foundation is not required. Foundation design shall conform to ACI 318, County and State Codes,

The roadways shall be designed for the width and turning radius of the largest vehicle using roadway with required clearance to overhead power lines. Drive area clearances shall be a minimum of 20 feet or NESC, Section 124, "Guarding Live Parts" whichever is greater. The collection substation internal roadways will be designed to incorporate a 45-foot turning radius (radius is measured to the inside edge of the road)

Oil containment will be designed/installed for the main transformer as required by Federal, State and Local regulations. Oil-filled equipment shall be separated from other equipment and buildings to prevent potential fire hazards that may impede restoring or maintaining electric service. Power transformers containing between 500 and 5000 gallons of oil shall be located a minimum of 25 feet from any building unless the exposed walls consist of or are protected by a wall or barrier having a two-hour fire rating. The barrier shall extend horizontally and vertically such that any exposed part of the building is a minimum of 25 feet from the transformer. Transformers shall also be spaced an adequate distance from a fire-rated building wall to ensure that this 25 foot minimum is maintained to any other parts of the building that do not have a two-hour fire rating. Clearances to unoccupied buildings may be reduced with NEER approval.

Computer aided analysis and design shall include secondary moments from non-linear effects (p-delta) for structure stresses. The collection substation support structures shall be designed for the load combinations as identified in Table 3-17 of ASCE Manual of Practice 113. Under these factored loads, structural member stresses shall remain below the design strength specified by AISC LRFD. In the case of tapered tubular members, structural member stresses shall not exceed the allowable stresses as defined by ASCE Manual 74 (ASCE Manual 113 Substation Structures). Structure deflections shall be checked for loading combinations with all load factors equal to 1.0.

The calculated deflections shall not exceed the values listed below.

Line Support Structures and Shield Poles
- Horizontal deflection of vertical members: 1/100 of height
- Horizontal deflection of horizontal members: 1/200 of span
- Vertical deflection of horizontal members: 1/200 of span

All Other Structures
- Horizontal deflection of vertical members: 1/200 of height
- Horizontal deflection of horizontal members: 1/300 of span
- 20 of 36
- Vertical deflection of horizontal members: 1/300 of span

The steel structure design will conform to the provisions and requirements of the AISC and ASCE “Substation Structure Design Guide, Manual of Practice 113”. Materials for structural steel and miscellaneous steel will conform to the following requirements of the ASTM:

- Wide Flange and Tees (W- and WT-shapes): ASTM A992
- HSS: ASTM A500 Grade B
- Tubular (tapered or untapered): ASTM A572 Grade 50 or higher
- Pipe: A53 Grade B
- Channels and Angles: ASTM A36
- Structural Plates and Bars: ASTM A36 or A572 Grade 50

All structures will be galvanized conforming to the requirements of ASTM A123, ASTM A143, and ASTM A153 as applicable. All structural welding design will conform to the requirements of AWS D1.1. All high strength bolts, nuts, and washers shall conform to ASTM A325 or A394, ASTM A563, and ASTM F436, respectively, and shall be galvanized in accordance with ASTM A153.

The stations will maintain voltage-dependent electrical clearances per ANSI/IEEE requirements.

All necessary associated overhead bus, conductors, supports, insulators, terminations etc. will comply with IEEE 605 and all other relevant standards. All connections from the tubular bus to equipment will be made using flexible conductor.

Busses will be designed to carry the maximum load possible, including full load capability (highest name plate rating) of all the transformers feeding off of or supplying the bus. Design will incorporate schedule 40, 6063-T6 seamless aluminum bus tube and stranded All Aluminum Conductor (AAC) flexible conductor. Bus tube will include internal damping cable to reduce Aeolian vibration in accordance with methods given in IEEE 605. Bus calculations considering bus diameter, span length and short circuit forces will be provided in accordance with the methods given in IEEE 605.

Grounding design study will be performed in accordance with IEEE 80. The study will ensure that the ground grid is designed to maintain safe touch and step voltages within IEEE tolerable limits. The ground grid analysis will have following basis: Fault Current, 50kg body weight, a fault current split factor, soil resistivity and fault duration of 0.5 seconds.

The lightning protection will be designed by using the rolling sphere method per IEEE 998, which will reduce the probability of a direct lightning strike to each station. A constant radius sphere will be used in conjunction with flashover probability calculations to design an efficient and economical shielding system. The shielding calculations will provide shielding for the collection substation bus and equipment using statistical methods and will not exclude all strokes from the protected area.

The collection substation will be designed with adequate, secure, reliable and redundant protective and control schemes. The protection zones will be overlapped to maintain redundancy while ensuring that the major equipment will be protected. The applicable utility protection practices will be incorporated into the protection and control settings as necessary in the design.

A protective device coordination study will be performed to develop the necessary calculations to select protective relay characteristics and settings, ratio and characteristic of associated current transformers. Coordination study will be included time current curves (TCC) which will be showing the various protective devices settings and the time margin between settings. Relay settings are set to protect equipment and to detect abnormal conditions. The settings chosen will be according the IEEE standards to protected the equipment, detect the minimum fault current flows and coordination as possible with adjacent protective relay devices.

See Eight Point Wind, LLC 115 kV Substation Design Criteria for additional details found in Appendix 5-3.

<u>34.5 kV Underground Collection System</u>

The underground line design shall incorporate, but is not limited to, the following standards and codes when applicable:

- ACI - American Concrete Institute
- ADC - Air Diffusion Council
- AEIC - Association of Edison Illuminating Companies
- AISC - American Institute of Steel Construction

- AMCA- Air Movement Control Association
- ANSI - American National Standards Institute, Inc.
- ARI- American Refrigeration Institute
- ASCE - American Society of Civil Engineers
- ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers
- ASTM - American Society for Testing and Materials
- AWS - American Welding Society
- IBC – International Building Code
- ICEA-Insulated Cable Engineers Association
- IEEE - Institute of Electrical and Electronics Engineers
- NEBB - National Environmental Balancing Bureau
- NEC- National Electrical Code
- NEMA- National Electrical Manufacturers Association
- NFPA- National Fire Protection Association
- SMACNA- Sheet Metal and Air Conditioning Contractors National Association
- TIA/EIA - Telecommunications Industry Association/Electric Industry Alliance

The Project collection system will deliver over 100 MW to the collection substation. The project will involve GE 3.4 MW and GE 2.3 MW WTGs. Four (4) radial collection feeders, carrying approximately 25 MW each, will terminate in the collection substation at two (2) dedicated 34.5-kV outdoor rated circuit breakers.

One (1) 690/34,500 V 2750 kVA padmount step-up transformer will be located at the base of each wind turbine. The step-up transformers will be 2 winding transformers connected in a grounded wye-grounded wye configuration.

One (1) Power Distribution Panel (PDP) will be located at the base of each wind turbine. The 690V power output from the turbine, and the 690V side of the padmount step-up transformer, both terminate in the PDP. The PDP contains fuses, breakers, surge arresters, metering equipment, and auxiliary power sources for the WTG.

Fiberglass sectionalizing enclosures will be placed at node points for the collection feeders and as required for Partial Discharge (PD) testing.

The collection system trench shall be a minimum of 12 inches wide with a minimum depth of 48 inches from the top conductor to the finished grade. This depth shall be lower if required by the lease agreements with the landowners.

Cable ampacity shall be based on a cable ampacity calculation using the following criteria:

- Soil thermal resistivity (rho) for final design shall be based on worst case backfill with a compaction of 85%.
- Cables shall be rated at a maximum of 95% of the ampacity based on the final soil thermal resistivity.
- The maximum cable temperature is not to exceed 90° C under continuous full load.
- Load factor of 100%.

A bare copper ground conductor with a minimum size of 2/0 AWG shall be installed at the same approximate depth with the conductor. Fiber optic cable shall be installed in direct-buried innerduct in the trench with the 34.5-kV conductors and bare copper ground, at approximately the same depth.

If overhead 34.5-kV circuit routing is necessary, wood pole structures shall be utilized.

Estimated electrical losses will be calculated as a percentage of the expected energy production of the Facility. Losses will be determined for all cables and transformers.

(2) Generation Facility Certification

The analysis to determine suitability, prepared by GE, certifies that the wind turbines proposed for the site are within IEC 61400 TC design load standards and installation and operation of these wind turbines are approved by the manufacturer. The full report which is included as Appendix 5-4 contains confidential information therefore the Applicant will seek the requisite trade secret protection for this information pursuant to POL Section 87(2)(d), 16 NYCRR § 6-1.3, other applicable law, and/or a protective order as necessary.

(3) Procedures and Controls for Facility Inspection, Testing and Commissioning

Turbine commissioning will occur once the wind turbines and Project collection substation are fully constructed, upgrades to the POI Bennett Substation are completed and the NYISO is ready to accept transport of power to the New York State grid. The commissioning activities are comprised of testing and inspecting the electrical, mechanical, and communications systems associated with the Project.

The Article 10 Application for the Eight Point Wind Project consists of a 34.5 kV collection system, wind turbine generators, and a collection substation. These Project components have testing, inspection and commissioning procedures post-construction as described below.

34.5 kV Underground Collection

The collection system will be inspected, tested, and commissioned in accordance with all of the above listed engineering and design standards.

All materials used in the construction and installation of the underground collection system will be visually inspected for any defects and to ensure that all design specifications are met. The Applicant and Construction Contractor will use ensure proper installation of this system using Best Management Practices and in accordance with the QAQC Plans found in Appendices 5-5 and 5-6.

Wind Turbine Generators (WTGs)

The testing, inspection, and commissioning of the wind turbine generators (WTGs) will occur after the construction and installation of all Project components and NYISO is prepared to accept power entering the electrical grid. WTG commissioning and testing will be completed with all appropriate engineering, design and manufacturer standards.

The purpose of completing the commissioning, testing and inspection process is to validate electrical connections, to validate wind turbine operation, and to perform appropriate field tests to ensure the integrity of the electric WTG system. The commissioning process includes but is not limited to:

- Abiding by Employee Safety Requirements
- De-Energized verification to ensure no current is flowing through WTG electrical components
- Verifying all wires and cable have been routed properly without sharp bends
- Ensuring that all tools are in a safe area, away from moving components of the WTG
- Confirming all protective and access panels are securely fastened.
- Checking all fuses, connections, safety switches, breakers, transformers, rotors, power cables, generators, and all other systems/components are appropriately installed and securely fastened.
- Ensure there are no short circuits or short protections to confirm WTG components are ready to receive power
- Configuration of controllers, Ethernet connections, and other turbine specific parameters
- Testing of lighting, cooling, and calibration systems
- Nacelle, hub, and blade acceptance testing

Upon completion of all applicable commissioning processes, a detailed report will be finalized ensuring that all proper commissioning procedures were complete in accordance with all appropriate engineering and manufacturer standards.

Collection Substation

The collection substation inspection, testing, and commissioning will be completed with all appropriate engineering, design and manufacturer standards. All materials used in the construction and installation of the underground collection system will be visually inspected for any defects and to ensure that all design specifications are met. All testing equipment will be specifically for electrical power system testing and shall have adequate accuracy for testing all parameters in the commissioning testing procedures. The commissioning process for the collection substation includes but is not limited to:

- Visual, mechanical, and electrical testing of power transformers
- Testing of all metering units
- Visual, mechanical, and electrical testing of high voltage breakers
- Testing of all surge breakers, transformers, switches, relays, computer systems, valves and other instruments
- Switchgear and switchboard inspections and testing
- Testing and diagnostics of all cables
- Testing of the grounding systems
- Substation integration into the data collection system

Upon completion of all applicable commissioning processes, a detailed report will be finalized ensuring that all proper commissioning procedures were complete in accordance with all appropriate engineering and manufacturer standards.

(4) Maintenance and Management Plans, Procedures, and Criteria

The operation and maintenance will follow the industry standard best management practices (BMPs). The Project will be staffed full time with both technical and administrative employees. The primary workers will be wind technicians, along with a site supervisor and administrator. O&M staff offices will be located in the O&M building at a location as yet to be determined within the Project Area or local community. Additionally, the Project will always have an on-call local technician who can respond quickly if required. If an event outside the normal operating range of the turbine occurs, the wind turbine will immediately and automatically shut down. A report will then be generated and received by the operations center. Project critical controls, alarms, and functions are properly coordinated for safe and reliable operation.

Eight Point Wind operations will be based at the O&M building to provide direct access to wind turbine arrays and the electrical collection substation and will involve a range of tasks including administrative functions, recordkeeping, ordering of supplies, health and safety training, site security, monitoring of wind turbine components and ancillary structures, environmental monitoring, technical training, inspection of access/service road conditions, etc. In addition to routine maintenance activities, additional tasks and/or unscheduled maintenance associated with wind turbines, electrical components, access/service roads, ancillary structures and the collection substation will be completed as needed.

O&M personnel will complete routine inspections of wind turbines, the electrical collection substation, access/service roads, revegetated areas, met towers, transmission lines and other ancillary structures to document facility conditions and identify any potential maintenance or improvement actions that may be needed. During these inspections, environmental conditions throughout the Project will also be observed and recorded for evaluation of the effectiveness of restoration activities. The Project will include implementation of the corporate Wildlife Resource Recovery System (WRRS) which is a standardized wildlife monitoring program and corporate documentation of any findings (see Appendix 5-7). The WRRS is conducted prior to any maintenance work at turbine sites.

In addition to inspections, a detailed O&M schedule will be developed for interior and exterior inspections of all wind turbines. As part of these routine activities, the wind turbine components (*i.e.,* tower, nacelle, rotor hub, blades, gear box, electrical equipment, etc.) will be inspected and the results recorded. The structures around the towers (including step-up transformers and concrete pads, if needed) will also be inspected along with tower doors, locks and revegetated areas. The conditions around the towers will be recorded and incidental observations of wildlife also noted.

Specific schedules and frequency of routine O&M activities, facility inspections and anticipated preventative maintenance and/or additional periodic activities required for the safe, reliable and efficient operation of the Project are being developed. Detailed plans, specifications, maintenance recommendations, performance curves and any other manuals or documentation available for the selected turbines will be obtained from the manufacturer and maintained at the O&M building for ease of reference and troubleshooting.

In addition to on-site operations and maintenance, NEER has a twenty-four hour a day, seven day a week Control and Monitoring Center located in Juno Beach, Florida. This center operates over 10,000 turbines and is responsible for:

- Resetting of turbines as needed
- Calling out technicians based on projected wind conditions to optimize a project
- Communication with the local system operator and energy customer as required
- Monitor wind farm status;
- Allow for autonomous turbine operation;
- Alert operations personnel to wind farm conditions requiring resolution;
- Provide a user/operator interface for controlling and monitoring wind turbines;
- Collect meteorological performance data from turbines;
- Monitor field communications;
- Provide diagnostic capabilities of wind turbine performance for operators and maintenance personnel;
- Collect wind turbine and wind farm material and labor resource information;
- Provide information archive capabilities;
- Provide inventory control capabilities; and
- Provide information reporting on a regular basis.

The SCADA system offers access to wind turbine generation or production data, availability, meteorological, and communications data, as well as alarms and communication of error information. Performance data and parameters for each machine (generator speed, wind speed, power output, etc.) can also be viewed, and machine status can be changed. There is also a system that collects operating data to aid in diagnostics and troubleshooting of problems.

The Control and Monitoring Center provides performance and reliability optimization through remote turbine operation and fault reset capability, the use of advanced real-time equipment performance statistical modeling for advanced diagnostics, benchmarking among similar components and replication of best practices across the fleet.

New York State Electric and Gas (NYSEG) is the connecting transmission owner for the proposed Project and the point of interconnection (POI) will be NYSEG's existing 115kV Bennett Substation, which will connect to a proposed 115 kV interconnection line be permitted separately under Article VII of the New York PSL. Furthermore, NYSEG, as the transmission owner, will define the operational and maintenance responsibilities for the POI substation.

Wind energy generation facilities do not have blackstart capabilities.

The electrical system will require periodic preventative maintenance. If the work is to be performed in a right-of-way (ROW), notification and any permit(s) to work will be addressed with the appropriate agencies prior to starting the work. Routine maintenance will include condition assessment for aboveground infrastructure and protective relay maintenance of the collection substation, in addition to monitoring of the secondary containment system for traces of oil.

Vegetation control will be conducted in accordance with BMPs and are required immediately adjacent to the interconnect line to ensure safe operation and prevent damage to the line.

Maintenance Schedule

The on-site operations staff will be responsible for the maintenance of the proposed Project on a daily basis. Several daily checks will be made in the first three months of commercial operation to verify that the proposed Project is operating within expected parameters. Once installed, the proposed Project service and maintenance is carefully planned and divided into the following intervals:

- **First Service Inspection.** The first service inspection will take place one to three months after the turbines have been commissioned. At this inspection, particular attention is paid to tightening all bolts by 100 percent, a full greasing, filtering of gear oil, the yaw system, pitch control, and additional checks to ensure all systems are operating as intended.

- **Minor Service Inspection.** Regular service inspections commence roughly six months after the first inspection. The annual inspection consists of lubrication, a safety test of the turbine, yaw testing, pitch testing, brake testing, and inspections of all main turbine components. This set of inspections will be in accordance with all applicable manufacturer and safety standards.

- **Major Service Inspection.** The annual service inspection consists of an annual inspection plus a full wind turbine generator component check. This is a fully comprehensive inspection and testing of all components of the wind turbine generator both interior and exterior. The specificity of this inspection goes down to testing a representative number of bolts are with a torque wrench to ensure they are properly tightened.

- **Two-Year Service Inspection.** The two-year service inspection consists of the annual inspection, plus checking and tightening of terminal connectors.

- **Five-Year Service Inspection.** The five-year inspection consists of the annual inspection, an extensive inspection of the wind braking system, and checking and testing of oil and grease, balance check, and tightness of terminal connectors.

General Maintenance Duties

O&M field duties include performing all scheduled and unscheduled maintenance, including periodic operational checks and tests, regular preventive maintenance on all turbines, related plant facilities and equipment, safety systems, controls, instruments, and machinery, including:

- Maintenance of the wind turbines and of the mechanical, electrical power, and communications system;
- Performance of all routine inspections;
- Maintenance of all oil levels and changing oil filters;
- Maintenance of the control systems, all proposed Project structures, access roads, drainage systems and other facilities necessary for the Project’s operation;

- Maintenance of all O&M field maintenance manuals, service bulletins, revisions, and documentation for the proposed Project;
- Maintenance of all parts, price lists, and computer software;
- Maintenance and operation of proposed collection substation;
- Provision of all labor, services, consumables, and parts required to perform scheduled and unscheduled maintenance on the wind farm, including repairs and replacement of parts and removal of failed parts;
- Cooperation with avian and other wildlife studies as may be required, to include reporting and monitoring;
- Management of lubricants, solvents, and other hazardous materials as required by local and/or state regulations;
- Maintenance of appropriate levels of spare parts in order to maintain equipment. Order and maintain spare parts inventory;
- Provision of all necessary equipment including industrial cranes for removal and reinstallation of turbines;
- Hiring, training, and supervision of a work force necessary to meet the general maintenance requirements;
- Implementation of appropriate security methods; and
- Remote monitoring on a daily basis.

5(g) Heat Balance Diagrams

This section is not applicable as the facility does not include a thermal component.

5(h) Substation and Interconnection Standards and Requirements

(1) Description of Substation Facilities to be Transferred and Timetable for Transfer

NYSEG is the connecting transmission operator for this Facility. The point of interconnection (POI) will be NYSEG's existing 115 kV Bennett Substation via a 16.5-mile 115 kV transmission line that will be permitted through the Article VII process. All upgrades required for the Project at the existing POI Bennett Substation will be the property of NYSEG.

(2) Transmission Owner's Requirements

The POI substation will be designed by NYSEG (i.e., the owner of the Bennett Substation), and therefore the POI substation will be in accordance with their requirements. The description of the design will not be known until the Facilities Study is complete.

(3) Operational and Maintenance Responsibilities

NYSEG, as the owner of the Bennett Substation, will define and complete the operational and maintenance (O&M) responsibilities for the POI substation. The Applicant will not assume responsibilities in relation to O&M activities for the POI substation.

5(i) Maintenance, Management, and Procedures

(1) Turbine Maintenance, Safety Inspections, and Tower Integrity

The operation and maintenance will follow the industry standard best management practices (BMPs). The Project will be staffed full time with both technical and administrative employees. The primary workers will be wind technicians, along with a site supervisor and administrator. O&M staff offices will be located in the O&M building at a location as yet to be determined within the Project Area or local community. Additionally, the Project will always have an on-call local technician who can respond quickly if required. If an event outside the normal operating range of the turbine occurs, the wind turbine will immediately and automatically shut down. A report will then be generated and received by the operations center. Project critical controls, alarms, and functions are properly coordinated for safe and reliable operation.

Eight Point Wind operations will be based at the O&M building to provide direct access to wind turbine arrays and the electrical collection substation and will involve a range of tasks including administrative functions, recordkeeping, ordering of supplies, health and safety training, site security, monitoring of wind turbine components and ancillary structures, environmental monitoring, technical training, inspection of access/service road conditions, etc. In addition to routine maintenance activities, additional tasks and/or unscheduled maintenance associated with wind turbines, electrical components, access/service roads, ancillary structures and the collection substation will be completed as needed.

In addition to inspections, a detailed O&M schedule will be developed for interior and exterior inspections of all wind turbines. As part of these routine activities, the wind turbine components (*i.e.,* tower, nacelle, rotor hub, blades, gear box, electrical equipment, etc.) will be inspected and the results recorded. The structures around the towers (including step-up transformers and concrete pads, if needed) will also be inspected along with tower doors, locks and revegetated areas. The conditions around the towers will be recorded and incidental observations of wildlife also noted. The Project will include implementation of the corporate Wildlife Resource Recovery System (WRRS) which is a standardized wildlife monitoring program and corporate documentation of any findings (see Appendix 5-7). The WRRS is conducted prior to any maintenance work at turbine sites.

The Applicant will be responsible for the operation, inspection, and maintenance requirements of all Facility components. These activities can generally be classified as scheduled inspection/maintenance, unscheduled maintenance/repairs, or electrical system inspection/maintenance. Each of these is briefly described below.

Turbine Maintenance and Safety Inspections

All maintenance and repair activities will be in accordance with applicable permits and associated conditions. To the extent practicable, repairs will be facilitated through use of existing Facility-related infrastructure (e.g., permanent gravel access roads, crane pads, etc.). If existing infrastructure is not adequate to accommodate certain repairs, any additional infrastructure improvements will be conducted in accordance with the applicable regulations and road use agreements with the local municipalities (e.g., widening of an access road within or adjacent to a wetland will be conducted in accordance with Section 401 and 404 of the Clean Water Act, and Article 24 of the Environmental Conservation Law, as applicable).

Scheduled Inspection and Maintenance

Routine and preventative wind turbine maintenance activities are scheduled semi-annually with specific maintenance tasks scheduled for each maintenance visit. Maintenance is done by removing the turbine from service and having wind technicians climb the tower to spend a full day carrying out maintenance activities. Consumables such as various greases used to keep the mechanical components operating and oil filters for gearboxes and hydraulic systems are used for routine maintenance tasks. Following all maintenance work on the turbine, the area is cleaned up. All surplus lubricants and grease-soaked rags are removed and disposed of as required by applicable regulations. All maintenance activities will adhere to the same spill prevention industry best practices undertaken during the construction phase.

Unscheduled Maintenance/Repairs

Modern wind turbines are very reliable and the major components are designed to operate for up to 30 years. However, wind turbines are large and complex electromechanical devices with rotating equipment and many components. As a result, at times, turbines will require repair, most often for small components such as switches, fans, or sensors; typically, such repairs will take the turbine out of service for a short period of time until the component is replaced. These repairs can usually be carried out by a single technician visiting the turbine for several hours. Events involving the replacement of a major component such as a gearbox or rotor are not typical. If they do occur, the use of large equipment, sometimes as large as that used to install the turbines, may be required. Typically only a small percentage of turbines would need to be accessed with large equipment during their operating life.

(2) Electric Transmission, Gathering and Interconnection Line Inspections, Maintenance, and Repairs

(i) Vegetation Clearance Requirements

Vegetation control will be conducted in accordance with BMPs and is required immediately adjacent to the overhead collection line and the Article VII 16.5-mile transmission line to ensure safe operation and prevent damage to the line. Vegetation near the 115 kV transmission line and 34.5 kV overhead collection system must be reviewed, inspected and cleared/maintained as necessary to avoid faults, outages and damages to the lines.

Appendix 5-8 illustrates the requirements for clearing vegetation around the overhead 115 kV line. Appendix 5-9 illustrates the requirements for clearing vegetation around the overhead 34.5 kV collection lines. All vegetation within the clear cut boundary, with the exception of low lying growth as shown, will be completely cleared. In addition, vegetation extending above the danger tree clearance line (outside of the clear cut boundary) will be cleared to prevent a potential tree from falling into the line. The dimensions are different for the 115 kV transmission line and the 34.5 kV overhead collection lines due to configuration/heights of the conductors.

(ii) Vegetation Management Plans and Procedures

Initial vegetation management prior to and during construction utilizes manual/mechanical methods such as chainsaws, pruners or other heavy machinery. Portions of trees and other vegetation that extend into the clearing regions are typically trimmed. Vegetation that is completely within the clearing regions may be trimmed down such that they are classified as low lying growth, or may be removed completely (up-rooting, removal, etc.). Please see the attached Vegetation Management Program Manual in Appendix 5-10 for further details.

Continued maintenance may be through a variety of manual trimming methods, as well as environmentally friendly herbicide treatments used to inhibit vegetation growth (where permitted). The frequency of inspection and management will depend on the rate of growth at the particular location along the lines. Low-lying growth and vegetation extending into the clear cut boundary will be checked regularly each year. Please see Appendices 5-8 and 5-9 for typical details associated with vegetation management for the overhead 115 kV lines and 34.5 kV lines, respectively.

(iii) Inspection and Maintenance Schedules

O&M personnel will complete routine inspections of overhead collection lines and transmission lines and other ancillary structures to document facility conditions and identify any potential maintenance or improvement actions that may be needed. Routine maintenance will include condition assessment for aboveground infrastructure and protective relay maintenance of the collection substation. Visual inspections of the overhead collection line and transmission line right-of-way will be completed every 12-18 months. These inspections will all be complete by an agent of the Applicant to ensure that proper maintenance and vegetation management is complete.

Specific schedules and frequency of routine O&M activities, facility inspections and anticipated preventative maintenance and/or additional periodic activities required for the safe, reliable and efficient operation of the Project are being developed. Detailed plans, specifications, maintenance recommendations, performance curves and any other manuals or documentation available for the selected turbines will be obtained from the manufacturer and maintained at the O&M building for ease of reference and troubleshooting.

(iv) Notifications and Public Relations for Work in Public Right-of-Way

The electrical system will require periodic preventative maintenance. If the work is to be performed in a right-of-way (ROW), notification and any permit(s) to work will be addressed with the appropriate agencies prior to starting the work.

(v) Minimization of Interference with Electric and Communications Distributions Systems

The transmission line and overhead collection system will comply with the safety standards referenced in this document. The right-of-way of the transmission and overhead collection lines shall be sufficient to provide adequate separation between existing electric, communication, natural gas, and other distribution lines. In addition, the transmission line has been sited primarily on private lands and will be aligned perpendicular to cross public rights-of-way at right angles where existing distribution systems may be present.

5(j) Vegetation Management Practices

Vegetation management practices around substations are similar to the practices and requirements discussed above in Section 5(i)(2) for overhead lines. Within substation fences and immediately surrounding, it is important to eliminate all above-ground growth. Vegetation in this area could come in contact with a substation's below grade grounding grid. If the vegetation extends above ground, coming in contact with a person could put them in danger in the event of an electrical system ground fault, which energizes the below grade grounding grid with high voltages and currents. Normally, a person is protected by the crushed stone on the surface of the station, but the vegetation could bridge the safety gap created by the stone. Pre-emergent herbicide is preferred to prevent vegetation from becoming established, but post-emergent herbicide and/or manual weed removal will be used in the event vegetation does begin to show. It should be noted that the collection substation is proposed to be located in an active agriculture (hay) field, so no woody vegetation is present currently. The Applicant is responsible for vegetation management at the collection substation. NYSEG is responsible for vegetation management at the POI substation.

5(k) Sharing Above Ground Facilities with Other Utilities

The Applicant will accept proposals for sharing of above ground facilities with other utilities as they are submitted. In consideration of such proposals, the Applicant will conduct a site visit with the party proposing the sharing facilities. The Applicant will evaluate the proposal taking into account potential conflicts of interest, interference and reliability issues with the proposal. If necessary, the Applicant may have a qualified third-party review the proposal to determine any detrimental impact of the proposal on the Applicant's Facility. The Applicant has designed the above ground facilities to accommodate 102 MW of capacity and does not anticipate being able to accommodate proposals from utilities for sharing of facilities.

5(l) Equipment Availability and Component Delivery

The Applicant currently plans to place the Facility in-service in mid-late 2019. Based on this in-service time-frame, major Facility components would be expected to arrive onsite starting in early-mid 2019.

5(m) Blackstart Capabilities

This section is not applicable as wind energy generation facilities to do not have blackstart capabilities.

Blackstart is the procedure to recover from a total or partial shutdown of the transmission system. It entails isolated power stations being started individually, and then gradually being reconnected to each other to re-establish an interconnected system. In general, power stations need an electrical supply to start up; under normal operation this supply would come from the transmission or distribution system. Under emergency conditions, blackstart stations receive this electrical supply from small auxiliary generating plant located onsite. Wind energy facilities, such as the proposed Facility, are not suitable for blackstart because there is no guarantee that wind would be blowing at sufficient speed. Therefore, the Facility will not have blackstart capabilities.

5(n) Compliance with All Applicable Reliability Criteria

Reliability criteria are identified in the SRIS, which includes input from the NYISO and NYSEG. In addition, the Applicant consulted with DPS regarding reliability criteria and they indicated that the consultation completed through the SRIS is sufficient for compliance with relevant reliability criteria.