everpower™

Baron Winds Project

Case No. 15-F-0122

1001.5 Exhibit 5

Electrical System Effects

TABLE OF CONTENTS

EXHIBIT 5 ELECTRICAL SYSTEM EFFECTS

(a) System Reliability Impact Study

ABB Inc. (ABB) prepared a System Reliability Impact Study (SRIS) for the Facility on behalf of the New York Independent System Operator (NYISO) in 2015. The SRIS is Appendix F to this Application, but will be filed separately under confidential cover, as NYISO requires the SRIS to remain confidential due to Critical Energy Infrastructure Information (CEII) regulations. The Facility is participating in the NYISO 2017 Class Year.

(b) Potential Reliability Impacts

The SRIS evaluated a number of power flow base cases, as provided by the NYISO, including 2018 Summer Peak, Winter Peak and Light Load system conditions. The study system included the West Region (Zone A), Genesee Region (Zone B) and Central Region (Zone C) in the New York ISO system. In base case normal operating conditions, the power flow steady state analyses indicate that the Facility will cause no thermal violations for summer peak and winter peak case loadings. Under contingency operating conditions with the Facility, both the summer and winter peak case show some overloads on the 230 kilovolt (kV) and 115 kV lines under several contingencies. The Facility also reduced loading of a few facilities in the area for both summer and winter peak cases.

For the winter peak case, the Facility caused an adverse impact on the Hickling – West Erie 115 kV line following several contingencies at Hillside 230 kV, with the largest impact of 53.7% increase in the loading of the Hickling – West Erie line. Additional analysis was performed per the NYISO Emergency Operations manual. These simulations showed that the tripping of Hickling – West Erie 115 kV line and associated West Erie 115/34.5 kV transformer, or tripping of Sullivan Park – West Erie 115 kV line, would mitigate these overloads. For an overload on the North Waverly – East Sayre 115 kV branch, there is a Special Protection System (SPS) which trips this line by over-current protection for actual overloads. The tripping of the branch does not cause an unacceptable impact on local reliability. Under Minimum Interconnection Standards (MIS), no System Upgrade Facilities (SUFs) are required. The Facility also causes an overload on the Meyer – Moraine 115 kV line. However, the overload can be mitigated by reducing the local generation at this or nearby facilities in order to protect overloads on the line. The addition of the Facility also reduced the overload on the South Perry – Meyer line, thus causing a positive impact on the system. Adverse impacts on voltages were observed of several buses in the local area. However, the violations could be resolved (or become insignificant) by adjusting local transformer taps or changing the status of existing switched shunts in the vicinity of these buses.

For the summer peak case, the results were similar to those in the winter peak case. The Facility could have an adverse impact on the Hickling – West Erie 115 kV line. Similarly to the winter peak case, the additional tripping of Hickling – West Erie branch overloads the West Erie 34.5 kV transformer. If this transformer is also tripped, then no overloads on nearby facilities are observed. The Facility also causes an overload on the Meyer – Moraine 115 kV line. However, the overload can be mitigated by reducing the local generation. The addition of the Facility also reduces the overload on the South Perry – Meyer line, thus causing a positive impact on the system.

The peak load conditions analyzed are based on many “worst-case” scenarios (i.e., peak summer load, plus power outage on a line, plus power outage on another line, etc.). These “worst-case” scenarios are not anticipated to occur frequently, and, if they do occur, will only last for a short time period. In addition, the Hickling – West Erie 115 kV line and the North Waverly – East Sayre 115 kV line are already overloaded under the same contingencies, due to existing generation in the area. While the addition of the Facility will not help the overload, it will not have a reliability impact on the system as a whole.

(c) Benefits and Detriments of the Facility on Ancillary Services

As described above in Section 5(b), adding the Facility to the summer and winter peak cases will be beneficial under contingency operating conditions by reducing overload on the 115 kV South Perry – Meyer line. Adverse impacts were identified as a result of adding the Facility to the winter and summer peak case, but this overload can be resolved by the tripping of additional lines/transformers. Adverse impacts identified for the summer peak case can be mitigated by reducing local generation.

(d) Reasonable Alternatives to Mitigate Adverse Reliability Impacts

As discussed above in Section 5(b), in the winter peak case, the addition of the Facility could result in several high voltage violations at some buses under several contingencies. These voltage violations could be resolved by adjusting local transformer taps or changing the status of existing switched shunts in the vicinity of these buses. Overloads to the Hickling – West Erie 115 kV line were identified, but the overload could be resolved by the tripping of additional lines/transformers. Therefore, beyond tripping of additional line/transformers, load tap changes and changing the status of switched shunts, no additional mitigation measures are necessary for adverse reliability impacts in the winter peak case conditions.

As discussed above in Section (b), in the summer peak case, the Facility could have an adverse impact on the Hickling – West Erie 115 kV line. The overload could be mitigated by the tripping of additional lines or transformers. Overloads on the Meyer – Moraine 115 kV line, as discussed above, can be mitigated by reducing local generation, such as Canandaigua Wind or Indec units.

(e) Estimated Change in Total Transfer Capacity

The transfer limit analysis, conducted during summer peak condition, evaluates the incremental impact of the Facility on the transfer limits of the Dysinger-East (Open/Closed), West-Central (Open/Closed), and Volney-East (Open/Closed) interfaces. The Dysinger-East and West-Central interfaces experience a benefit due to the Facility of about 175 megawatt (MW) to 200 MW for Open interfaces and approximately 250 MW for Closed interfaces under normal thermal transfer criteria. Under normal thermal transfer criteria, the impact on the Volney-East interface is not significant. Similarly to the normal thermal transfer criteria, the Facility under emergency thermal transfer criteria will result in a benefit of 200 MW for Open interfaces and 250 MW for Closed for the Dysinger-East and West-Central interfaces. Under emergency thermal transfer criteria, a slight reduction on transfer limits of approximately 50 MW to 75 MW (around 1%) was observed for the Volney-East interface.

For voltage transfer limits, the Facility decreases the transfer limits for the Dysinger-East and West-Central interfaces by approximately 50 MW for the Open interfaces, but increases the limits on the Closed interfaces by 100 MW. The Facility improves the Open interface limit for Volney-East by 50 MW and the Closed interface by 125 MW.

System stability was not limiting for any of the interface levels tested in the transfer limit analysis. The SRIS concluded that the Facility does not have significant adverse impacts on transfer limits of the subject interfaces.

(f) Criteria, Plans, and Protocols

(1) Applicable Engineering Codes, Standards, Guidelines, and Practices

The Facility will be designed in accordance with applicable standards, codes, and guidelines. For portions owned by the Applicant (e.g., collection system), best industry practices will be used. For the point of interconnection (POI) station, NYSEG requirements will be followed. Additional detail is as follows:

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

The overhead lines in the Facility will be designed in accordance with (but not limited to):

- RUS Bulletin 1724E-200
- NESC – National Electric Safety Code
- ANSI – American National Standards Institute

- ASTM – American Society of Testing of Materials
- OSHA – Occupational Safety and Health Administration
- IEEE – Institute of Electrical and Electronics Engineers
- ASCE – American Society of Civil Engineers
- NEC – National Electric Code

Each line will be on wood pole structures tangent, guyed wood pole angle and dead-ends, with overhead optical fiber running the entire length of each line.

- Conductor - 795 kcmil ACSR 'Drake' (26/7 Stranding) or similar
- OPGW Shield Wire - 24 fiber single mode cable or similar
- Shield Wire - ½" diameter 7-stranded EHS Steel wire or similar

The limits for the tension of the conductor and shield wires will be based on NESC standards.

The insulator selection will take into consideration the design BIL of the line and substation. 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-ends, the percentage of strength rating is 50% of specified mechanical load as per the NESC mechanical properties requirement.

The vertical clearance requirements for the transmission line have been calculated based on NESC C2 requirements. The clearances will be checked for the following weather conditions:

1. Maximum Conductor Operating Temperature; for the final Sagging and Clearances of 212º F with no wind.
2. Facility-specific condition as per NESC table 230-1, Zone 1 with radial ice thickness of 0.5" at 32º F with no wind.
3. Clearance between the crossing line and other utility facilities (existing distribution or communication lines, in order to minimize impact or interference with those facilities) will confirm the requirements of owning utility. Clearance will be computed with the upper conductor at 212º F, final condition with the lower conductor or wire at 32º F unloaded.

The Facility falls within the isokeraunic level of 20-40 (RUS Bulletin 1724E-200, page E-4, Figure 1). RUS recommends the use of shield wire in all locations where the isokeraunic level is above 20 with the shield angle of 30 degree for structure height 92 ft. above ground.

The ground resistance value at each structure will be measured after the ground rod has been installed, but prior to bonding any interconnection wires such as static wire(s). The resistance will be 25 ohms or less. If the measured value cannot meet the requirements, then another method of grounding as described in NESC Rule 94B will be used to meet the requirement of NESC Rule 96A.

All suspension and deadend structures will be designed to meet or exceed various applicable loadings outlined per the NESC C2.

Horizontal deflections at the top of angle and deadend vertical members will be limited, by camber if necessary, to less than five percent (5%) of the total structure height above ground, at a temperature of 60º F, with no wind and no ice. If the deflection is six inches or greater at the top of the structure, and camber is not required by the above criteria, the final design drawings will furnish a construction rake offset distance. Horizontal and vertical deflections of the horizontal members will be limited to be less than 0.5% of the span distance.

Collection substation

The substation design will incorporate, but is not limited to, the following standards and codes when applicable:

- NESC - National Electric Safety Code.
- NFPA 70 - National Fire Protection Association - National Electric Code
- NFPA 850 - National Fire Protection Association – Recommended Practice for Fire Protection for Electric Generating Plants and High Voltage Direct Current Converter Stations
- ACI - American Concrete Institute
- ANSI - American National Standard Institute
- ASCE - American Society of Civil Engineers
- ASTM - American Society for Testing and Materials
- IBC - International Building Code
- IEEE 80 - IEEE Guide for Safety in AC Substation Grounding
- IEEE C37.2 - IEEE Standard Electrical Power System Device Function Numbers and Contact Designation
- IEEE C37.90 - IEEE Standard for Relays and Relay Systems Associated with Electrical Power Apparatus
- IEEE C37.110 - Guide for the Application of Current Transformers Used for Protective Relaying Purposes
- IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers
- IEEE 485 - IEEE Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications
- IEEE C57.12.10 - IEEE Standard Requirements for Liquid-Immersed Power Transformers

- IEEE 998 - IEEE Guide for Direct Lightning Stroke Shielding of Substations
- IEEE C37.119 - IEEE Guide for Breaker Failure Protection of Power Circuit Breakers
- IEEE 605 - IEEE Guide for Design of Substation Rigid-Bus Structures
- IEEE 693 - IEEE Recommended Practices for Seismic Design of Substations
- IEEE 980 - IEEE Guide for Containment and Control of Oil Spills in Substations

The substation grading will be done in the most economical and efficient manner and will be slightly elevated in relation to the surrounding ground levels in order to give it positive drainage and ensure that water does not pond at or inside the substation. Grading slopes inside the substation fence will preferably be between 0.5 to 1% but under no conditions will the slope be more than 2%. The graded area will extend a minimum of 5 feet beyond the substation fence to allow for yard stone and the perimeter loop of the ground grid. All clearing, grubbing, excavation, and cut/fill will conform to geotechnical report recommendations and the Stormwater Pollution Prevention Plan (SWPPP) (see Appendix II for the Preliminary SWPPP).

Design of the collection substation will consider various environmental data such as:

- Altitude
- Maximum 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 maximum load (both static and dynamic) that will be applied to the steel structures and/or the equipment. Either drilled piers or spread footing will be used to support steel structures as per geotechnical report recommendation. Cast-in-place headed anchor rods with leveling nuts will be used/designed to connect substation structures/equipment to their foundations.

Oil containment will be designed/installed for the main transformer as required by federal, State and local regulations. The oil containment will have an oil capacity of no less than 110% of equipment total oil capacity.

The steel structure design will conform to the provisions and requirements of the American Institute of Steel Construction (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 (WF) Shapes and Tees cut from WF: ASTM A992, Grade 50 or multi-certification A36/A572, Grade 50
- Tubular – a structure composed of closed sections (tubes) of circular, multi-sided, or elliptical cross section and tapered or untapered: ASTM A595 or A500 Grade B
- Pipe: A53, Grade B
- M shapes, S shapes, HP, Channels, and Angles: ASTM A36
- Structural Plates and Bars: ASTM A36

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 will conform to ASTM A325, A394 or A490, ASTM A563, and ASTM F436, respectively, and will be galvanized in accordance with ASTM A153.

The station 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, 50 kg 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 the 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 substation bus and equipment using statistical methods and will not exclude all strikes 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. The coordination study will include 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 detect abnormal conditions. The settings will be chosen according to the IEEE standards to protect the equipment, detect the minimum fault current flows, and coordinate as possible with adjacent protective relay devices.

34.5 kV Underground Collection System

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

- ANSI - American National Standards Institute
- ASTM - American Society for Testing and Materials
- IEEE 48 - Standard Test Procedures and Requirements for Alternating Current Cable Terminations 2.5 kV through 765 kV
- IEEE 80 - Guide for Safety in AC Substation Grounding
- IEEE400 - Guide for Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems
- IEEE 400.1 - Guide for Field Testing of Laminated Dielectric, Shielded Power Cable Systems Rated 5 kV and Above with High Direct Current Voltage
- IEEE 400.3 - Guide for Partial Discharge Testing of Shielded Power Cable Systems in a Field Environment
- IEEE C2 - National Electric Safety Code (NESC)
- IEEE C57.12.10 - American National Standards for Transformers
- NFPA 70 - National Electric Code (NEC)
- TIA/EIA - Telecommunications Industry Association/Electric Industry Alliance
- NEMA - National Electrical Manufacturer's Association

Wind power projects commonly employ medium voltage (MV), low voltage (LV), and fiber optic (FO) cables to connect dispersed wind turbine generators to the collection substation. Determining the configuration and sizing of the cable runs (commonly called feeders) is a complex task, requiring a balance of a variety of considerations, including land use restrictions, cable characteristics, soil conditions, equipment and construction constraints, cost, reliability, maintainability, and efficiency. The design process incorporates these considerations in order to provide the client with the most robust, flexible, and cost-effective design possible.

The standard installation configuration is for the cables to be bundled and directly buried in the native soil, approximately 3 feet below grade (4 feet in agricultural areas). Unique installation configurations may be required where the cables cross public roads, utility easements, etc.

The ampacity of all cable configurations (standard single circuit, or unique configurations such as multiple circuits in parallel, circuits crossing each other, etc.) will be determined based on Neher-McGrath methods. The analysis will include the effects of various parameters, including soil thermal resistivity, shield grounding connections, mutual heating from parallel cables, and special thermal backfill resistivity (if used). The calculations will ensure that all cables can carry the expected loads without overheating and damaging components of the cables.

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 Type Certification

Of the turbines under consideration, currently, the Vestas V136 3.6 MW type certification is available to the Applicant. The third-party type certificate is Appendix G of the Application, but will be filed separately under confidential cover. The Applicant will ultimately select a turbine that has achieved the necessary third-party certification, and proposes to submit this information to the Siting Board as a post-Certification compliance filing.

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

The various aspects of the Facility will have a written inspection, testing and commissioning plan, as summarized below, that is adhered to during all stages of construction as well as a post-construction inspection and testing phase. When completed, all documentation will be provided to the Siting Board and stored at the Facility Site for easy review/access in the future.

34.5 kV Overhead Collection System

The overhead lines will be inspected, tested and commissioned in accordance with various ANSI, IEEE, NFPA, NETA, ASTM, etc. requirements, as necessary. All tests will be performed with the line de-energized, except where specifically required for it to be energized for functional testing.

All material received for construction of the overhead lines will be visually inspected for defects and compatibility with the design/specifications. This includes, but is not limited to, anchors, poles, conductor, fiber, insulators, hardware, and grounding material.

Structures/poles will be verified such that location/coordinates, elevation, embedment, height, plumbness, rotation, etc. are all verified and confirmed per the design. Anchors/guy wires will be verified for location, angle to pole, embedment, etc.

Hardware such as dead-ends fittings, splices, etc. are to be installed per manufacturer specifications to ensure adequate mechanical strength and electrical continuity. Verification of functionality and calibration of compression tools, torque wrenches, etc., as necessary, will be completed prior to installation.

Conductors, fibers and shield wires will be verified to ensure that sagging, tension, etc. are in conformance with the design. This verification must account for environmental conditions such as temperature, as well as the amount of time that conductors are left hanging before being tensioned/clipped into final position. Clearances will follow NESC and Facility requirements between conductors, structures, roads, adjacent facilities, etc. Phasing of the conductors will be checked to ensure that the end-to-end connection of each conductor is correct per the design of the station/equipment at each end of the line.

Fiber cables run with the overhead lines may be spliced numerous times along the path due to reel length limitations or other reasons. End-to-end testing of each fiber strand, using an OTDR or power meter test, will be completed to ensure that there was no damage or bad connection during the fiber installation.

34.5 kV Underground Collection System

The collection system will be inspected, tested and commissioned in accordance with various ANSI, IEEE, NFPA, NETA, ASTM, etc. requirements, as necessary. All tests will be performed with the equipment de-energized, except where specifically required for it to be energized for functional testing.

Underground cables systems have comparatively fewer components than the overhead lines or substation described above. All material received for construction of the underground lines will be visually inspected for defects and compatibility with the design/specifications. This includes, but is not limited to, cables, transformers, fiber, splices/junction boxes and grounding material.

During installation, materials used for cable trench installation will be tested for conformance with the design, including backfill material (gradation, compaction, thermal resistivity, etc.). The cables themselves will be installed in the proper configuration, at the proper depth and the proper spacing (see Appendix H for typical details). Care must be taken to ensure that the required/minimum/maximum bending radius or pulling tension (if installed in conduit/duct) of the cable is met to avoid damage.

Hardware/terminations at the ends of the cables will be installed in accordance with manufacturer requirements to ensure adequate mechanical strength and electrical continuity. Cable shields/neutrals will be installed per the design and solidly connected to the grounding system or surge arresters, or taped/insulated, where applicable. Phasing of the conductors will be checked to ensure that the end-to-end connection of each conductor is correct per the design of the station/equipment at each end of the cable.

Very Low Frequency (VLF), at a minimum, or Partial Discharge (PD) testing will be performed on cables, in accordance with IEEE recommendations, in order to identify any deficiencies or damage in the cable system that could result in outages or failure. Testing of transformers will be performed in accordance with applicable ANSI/IEEE specifications.

Collection Substation

The substation will be inspected, tested and commissioned in accordance with various ANSI, IEEE, NFPA, NETA, ASTM, etc. requirements, as necessary. All tests will be performed with the equipment de-energized, except where specifically required for it to be energized for functional testing.

All material received for construction of the station will be visually inspected for defects and compatibility with the design/specifications. Various industry standard electrical and mechanical tests are performed on equipment before leaving the manufacturers' facilities. Some tests are performed on a "class" of equipment, such that the passing test results apply to all specific equipment produced. Other tests are required to be performed on each individual piece of equipment. Additional tests will be performed on specific equipment after installation at the Facility Site to ensure that there was no damage during handling, including, but not limited to:

- Main transformer

- High/medium voltage circuit breakers
- Disconnect switches
- Instrument transformers (current transformer, voltage transformer, etc.)
- Surge arresters
- Station service transformer
- High/medium voltage cables
- Capacitor bank or reactor banks
- DC battery bank and charger

Other standard tests will be performed on “installations” or “systems” to ensure that the components of a design were constructed/installed at the Facility Site in the correct manner. These include, but are not limited to:

- High/medium voltage bus connections and hardware
- Grounding grid (including electrical resistivity of surface stone)
- Low voltage protection, control and instrumentation wiring
- Protective relaying systems
- System Control and Data Acquisition (SCADA)/communication systems

All circuits will be energized and verified for functional operation. Each control circuit will be functionally tested and documented. This will include operation of all equipment, verification of each interlock and trip function. Each alarm device/point will also be verified and documented. This will include an actual operation of the alarm whenever possible.

Concrete foundations will be inspected in various ways. Visual/dimensional inspections will be performed on reinforcing steel/rebar (for bar size, configuration, tie/welds, etc.), anchor bolts (size, location, elevation, plumbness, etc.), formwork (size, dimensions, location, height/reveal, etc.) prior to pouring the concrete. Excavations, subgrade and compacted backfill will be verified to be in accordance with design requirements. The mix design of the concrete will be reviewed for conformance with the design requirements. During pouring of concrete, samples will be taken to ensure that the proper slump, air content, temperature and any additives are in accordance with design requirements. Numerous test cylinders will be obtained for future strength/compression testing at periodic points after pouring (7 days, 28 days, etc.). The cylinders will be tested to determine if the concrete is curing at the proper rate and will meet design strength prior to being loaded.

Any imported yard subbase, surface stone, etc. will be tested for proper sieve gradation, compaction, etc., as necessary. Adequate quantities/dimensions of imported material will be verified. A final survey of station benchmarks, elevations (overall pad and concrete foundations, etc.) will be performed.

Wind Turbines

Turbine commissioning will occur once the wind turbines and substation are fully installed and the NYISO is ready to accept transport of power to the New York grid. The commissioning activities will consist of testing and inspection of electrical, mechanical, and communications systems, as well as turbine foundations. Turbine foundation testing and inspection will be in accordance with guidance from the American Wind Energy Association (AWEA)/ASCE 2011 document entitled *Recommended Practice for Compliance of Large Land-based Wind Turbine Support Structures*. These procedures are summarized below:

- Equipment required: Support trucks, which will be driven to the construction site.
- Materials brought on site: Gearbox oil, lubricating grease, two temporary portable generators. The only chemicals required for this phase are oils, gasoline, and grease used to operate construction equipment and portable generators, gearbox oil, and lubricants. Fuel-handling will be conducted in compliance with the Facility-specific Spill Prevention, Control and Countermeasures (SPCC) Plan (see Exhibit 23 for additional information on the Preliminary SPCC).
- Timing: Commissioning will preferentially be completed in late spring or summer to take advantage of typically drier weather. If necessary, this activity can be completed in the spring, fall or winter depending on weather conditions.
- Material generated: Some packing material waste will be generated. The recyclable material will be separated from the non-recyclable material on site. Both types of waste will be removed by a licensed sub-contractor.

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

The Applicant has prepared a Preliminary Operations and Maintenance Plan (O&M Plan), which is included in this Application as Appendix I. This Plan, which is intended to be the foundation of the final O&M Plan, will be implemented at the Facility once it becomes operational, and is based on the Applicant's experience and typical O&M maintenance requirements for wind power projects. Ultimately, the Applicant's Facility Operators will be responsible for the O&M Plan's implementation. The objective of the O&M Plan is to optimize the Facility's operational capacity and availability through best in class maintenance guidelines and inspections that are designed to pro-actively detect any significant safety or maintenance issues.

Wind energy projects typically consist of multiple wind-to-energy generators that are electrically connected together to produce the desired project output. Each of these stand-alone generators requires periodic preventative maintenance (semi-annually) as well as corrective maintenance in the event of a malfunction within the individual generator, each of which represents an "outage" for the given wind turbine generator. One of these maintenance outages is typically designated as "minor scheduled maintenance" and is completed in one working day per unit. The other is "major scheduled maintenance" and usually takes one to two working days to complete. For a typical wind energy facility, each semi-annual maintenance cycle is scheduled to be performed outside of high-wind season (usually spring or fall) and a crew or crews will work on individual units until the entire maintenance cycle is completed. Depending on the size of a given project, each maintenance cycle typically lasts for about two months for the entire project. On any given day during the maintenance cycle, one or more wind turbine generators is taken out of service for scheduled maintenance, typically no more than 5% of the total project's generating capacity. The Applicant is an experienced manager of turbine services and has five different turbine manufacturers under long-term service agreements.

In addition to the Preliminary O&M Plan included in Appendix I, detailed operations and maintenance plans, procedures, and criteria related to the Facility's electrical components are presented below.

The 34.5 kV collection system and collection substation will be operated and maintained in accordance with the plans and procedures that apply to the entire Facility (including the wind turbines and plant SCADA system), including staffing, on-site or on call technicians, etc.

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

The overhead 34.5 kV lines are passive systems that do not require active operation activities. They generally do not have the direct ability to notify or alarm an operator or technician in the event of any material problems or developing problems, such as excessive conductor sag or insulator damage. Any serious issues with the line will likely manifest themselves as an electrical fault, in which case the protection system in the collection substation would sense and clear the fault. While not common, fault detectors could be installed to assist in locating problems with the line.

The overhead lines, including the 34.5 kV collection lines, will be visually inspected at regular intervals (two to three times per year), as well as after any significant weather events such as extremely high winds, severe snow and ice, etc. Inspections can be done at ground level (using binoculars or magnifying devices, as necessary) and will locate and identify any:

- Changes in wire location that could result in clearance violations

- Damaged insulators, including signs of arcing/tracking/flashover
- Encroaching vegetation (see Section (i)(2) below for vegetation maintenance)
- Foreign objects on or near conductors and insulators
- Broken or damaged structures, guy wires or grounding system
- Damaged conductor or fiber
- Damaged or missing hardware, fittings, dampers or spacers
- Discharged surge arresters
- Evidence of animal activity/nesting

Any damage to equipment/material or changes in the wire configuration will either be repaired/replaced, or presented for engineering review of adequacy/impacts.

Foreign objects can be assessed depending on size, location, or material. It may be beneficial to remove the object as quickly as possible or it may be deemed to be a low risk. Depending on the type and location of the object, a line outage may be needed to remove it, or it could be removed while the line is energized by a qualified contractor familiar with, and trained in, energized work and safety procedures.

Insulator tracking could be the result of a material/equipment issue, and could be the result of naturally occurring environmental conditions, such as dirt or moisture deposits on the insulator surface. If determined to be the result of contaminants/deposits, insulator cleaning can be performed either during a line outage or while energized by a qualified contractor (as noted above).

Periodic infrared scanning will be performed on hardware/connections to confirm continued low resistance of all current carrying connections. Concentrated areas of high temperatures could be an indication of a poor electrical and mechanical connection. The high temperatures ("hot spots") could lead to early failure of material/equipment. If hot spots are identified in connections, inspection and/or repair should be performed during an outage condition. Re-testing of the transmission line grounding system will be performed every one to two years to ensure that the integrity and effectiveness of this system has not changed. These changes could occur due to deterioration of materials, changes in soil properties, etc.

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

The underground collection system is also passive such that it does not require active operations. As with the overhead lines, the underground lines generally do not have the ability to notify or alarm operators of a problem, unless it manifests itself as an electrical fault that can be sensed by equipment in the substation. Depending on detailed design, there could be some equipment that could provide remote indication or control which includes, but is not limited to:

- Pad-mount transformers – there is generally a transformer associated with each wind turbine and, if desired, it could be designed/installed with high/low temperature or oil level alarms;
- Fault locators – the devices are installed at certain intervals through the collection system to assist in locating faults on underground cables (that cannot be verified visually). There are options for these detectors to have remote signaling capabilities;
- Metal-enclosed switchgear.

Unless any switchgear is ordered with remote control capabilities, operation of the collection system will be performed manually by qualified operators. Main operation of the collection system is actually performed at the collection substation by opening or closing the circuit breaker that protects each cable circuit. Sectionalizing/disconnection of circuit section can be accomplished at junction boxes or switchgear. These activities will be performed by personnel familiar with and trained in the operation and safety hazards of high-voltage electrical equipment. Personal protective equipment (PPE) appropriate for the activities being performed will be worn/used at all times. Hazards such as arc flash will be present, but are mitigated to the extent practical during detailed design. In accordance with industry standards, hazard labels will be installed on electrical equipment that can be operated/accessed to provide guidance for additional PPE required for operational activities.

The majority of the underground collection system is not able to be inspected visually. There will be "access points" that will allow for a limited amount of visual verification such as riser poles that transition to overhead collection or the collection substation, junction boxes that combine multiple cable sections or splices, and entrances to the wind turbines. While terminations and cable ends can be inspected at these points, they are more valuable as a point to connect electrical testing equipment. As with the initial testing/commissioning phase described above, the underground cables will be subject to partial discharge testing during a maintenance outage each year in order to identify and locate any cable damage or impending failures.

Some equipment provided by manufacturers will have O&M manuals specific to that product, similar to the substation equipment described below. These maintenance intervals and procedures will be used where applicable and can apply to equipment such as pad-mount transformers or metal-enclosed switchgear.

Collection Substation

The collection substation will have a SCADA (System Control and Data Acquisition) system that will send status and alarm signals to the overall Facility SCADA system. These signals will notify the operators of items such as breaker trips, transformer high/low temperature or oil level, battery charger trouble, etc. The SCADA system will also allow for remote operation of electrically-operated equipment. The operations team will be able to open and close circuit breakers, motor-operated disconnect switches, the transformer tap changer, etc. The details of this system will be determined during the design phase after certification by the Siting Board, but is generally accomplished using a communications line (T1, POTS, etc.) to transfer signals from an operator station to the substation equipment.

Any local/manual operation of substation equipment will be performed by personnel familiar with and trained in the operation and safety hazards of high-voltage electrical equipment. PPE appropriate for the activities being performed will be worn/used at all times. Hazards such as arc flash will be present, but are mitigated to the extent practical during detailed design. In accordance with industry standards, hazard labels will be installed on electrical equipment that can be operated/accessed to provide guidance for additional PPE required for operational activities. For typical substation operation, “tools” required may include a ladder to access panels and control switches, a “hot stick” to open manual switches or cutouts, etc. Some operations within the substation can be performed from within the electrical equipment enclosure (typically a sheet metal structure that holds protection/relaying equipment, low voltage power distribution systems, communications systems, etc.). Control switches or an HMI screen will allow for similar control as the remote SCADA system. When an operator is controlling the substation locally, a signal will be sent to the SCADA system to inform the remote operators of their presence (which can also be used as an intrusion alarm) and will generally disable remote functionality/control.

Since many items in the substation are large pieces of equipment supplied by major manufacturers, these items will be inspected and maintained in accordance with the manufacturers’ O&M manual, which will be stored at the substation. The requirements will differ depending on which manufacturer is used. These items may include, but are not limited to:

- Main power transformer
- High and medium voltage circuit breakers
- Instrument transformers
- Disconnect switches
- Capacitor banks
- Metal-clad switchgear
- Standby generators

- Station service transformers
- Stationary battery and charger

Many of these items will be designed to send preventative alarm signals to the SCADA system to notify operators of problems before they become more significant or costly.

Similar to the overhead lines, the substation will be visually inspected at regular intervals (weekly), as well as after any significant weather events such as extremely high winds, severe snow and ice, etc. Inspections can be done at ground level (using binoculars or magnifying devices, as necessary) and will locate and identify any:

- Changes in wire/bus location that could result in clearance violations
- Damaged insulators, including signs of arcing/tracking/flashover
- Encroaching vegetation (see Section (i)(2) below for vegetation maintenance)
- Foreign objects on or near conductors and insulators
- Broken or damaged structures, guy wires or grounding system
- Damaged conductor or fiber
- Damaged or missing hardware, fittings, dampers or spacers
- Discharged surge arresters
- Evidence of animal activity/nesting
- Battery water levels

The methodologies presented above for overhead lines will also be applied to the substation. In addition, during planned outages for maintenance, the relaying, control and alarm circuits can be re-tested to ensure that any broken or loose wires are repaired. This would otherwise prevent proper operation of the protective relaying system during an electrical fault, or proper notification of alarms and statuses.

The engineering/design of the substation will be reviewed every few years, or after significant changes in the utility system or other "non-visual" inputs to the original design. Items that could trigger the need for a design review, and their possible impacts, include, but are not limited to:

- Changes in available short circuit current from the utility – this could impact:
    - Electrical ratings of circuit breakers, disconnect switches, etc.
    - Adequacy/safety of the substation grounding system including sizes of the grounding materials themselves
    - Rigid bus insulator strength, due to changes in mechanical forces that result from electrical short circuits

  - Reactive power device sizes/control
  - Protective relaying settings
- Changes in typical/normal utility system voltages – this could impact:
  - Electrical ratings of circuit breakers, disconnect switches, etc.
  - Protective relaying settings
- Changes in environmental conditions including drought or lightning frequency – this could impact:
  - Adequacy of the substation grounding system
  - Adequacy of the lightning protection system
- Changes in industry/jurisdictional requirements or facility ownership
- Awareness/notification of equipment failures, flaws or warranty claims

(g) Heat Balance Diagrams

Since there will be no thermal component to the Facility, this requirement is not applicable to the proposed Facility.

(h) Interconnection Substation Transfer Information

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

New York State Electric & Gas Corporation (NYSEG) is the connecting transmission owner for this Facility. The POI will be NYSEG's existing 230 kV Canandaigua Switching Station, which will be upgraded to add a breaker, motor operators, and associated equipment. See Appendix J for a General Arrangement Plan View drawing of the POI substation. The details of the arrangement with NYSEG will not be known until the Facilities Study is complete.

(2) Transmission Owner's Requirements

The POI substation upgrades within the existing substation pad will be designed by NYSEG (i.e., the transmission owner), 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) Operation and Maintenance Responsibilities

NYSEG, as the transmission owner, will define the operation and maintenance responsibilities for the POI substation. The Applicant will assume such responsibilities, to be implemented in accordance with the transmission owner's standards, as directed by NYSEG.

(i) Facility Maintenance and Management Plans

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

(1) 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

As previously noted, 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, turbines will occasionally 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 and Collection Line Inspections

(i) Vegetation Clearance Requirements

Vegetation near the Facility 34.5 kV overhead collection system must be reviewed, inspected and cleared/maintained as necessary to avoid faults, outages and damages to the lines. These issues are generally due to vertical movement (sagging) in the wires caused by thermal and mechanical loads, as well as horizontal movement caused by wind (blowout). These issues can also be caused by uncontrolled growth of the vegetation itself.

Included in Appendix H are drawings that illustrate the requirements for clearing vegetation around the 34.5 kV overhead 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.

(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.).

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. See Appendix H for typical details associated with vegetation management for the overhead 34.5 kV lines.

(iii) Inspection and Maintenance Schedules

The electrical system will require periodic preventative maintenance. Routine maintenance will include condition assessment for aboveground infrastructure and protective relay maintenance of the substation, in addition to monitoring of the secondary containment system for traces of oil. See Section (f)(4) above for information on the maintenance schedule for the electrical system.

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

If work is to be performed in a public right-of-way, notification and any permit(s) to conduct such work will be addressed with the appropriate agencies prior to starting the work.

(v) Minimization of Interference with Distribution Systems

The overhead 34.5 kV collection lines will comply with safety standards referenced in Section (f)(1), which provide for separation distances from existing electric and communication distribution lines. In addition, the lines have been sited primarily on private lands and will perpendicularly cross public rights-of-way where existing distribution systems may be present.

(j) Vegetation Management Practices for Collection Substation Yard

Vegetation management around substations are similar to the practices and requirements discussed above for overhead lines. Appendix H also includes Drawing SK-004, which illustrates clearing requirements for the areas outside of the substation fence.

Within the substation fence, and immediately surrounding, it is important to eliminate all above-ground growth. Vegetation in this area could come in contact with the 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.

(k) Criteria and Procedures for Sharing 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 co-location. The Applicant will evaluate the proposal taking into account potential conflicts of interest, interference and reliability issues with the proposed co-location. 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.

(l) Availability and Expected Delivery Dates for Major Components

The Applicant is not aware of any equipment availability restrictions. The Applicant currently plans to place the Facility in-service in late 2019. Based on this in-service time-frame, major Facility components would be expected to arrive onsite starting in Spring 2019 through Fall 2019

(m) 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. Not all power stations have or need blackstart capability. 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.

(n) Identification and Demonstration of Compliance with Relevant Reliability Criteria

Reliability criteria are identified in the SRIS, Appendix F, which includes input from the NYISO and NYSEG. The Facility will comply with all reliability criteria required by the interconnection agreement and interconnection studies.