EXCELSIOR ENERGY CENTER

Case No. 19-F-0299

1001.5 Exhibit 5

Electric Systems Effects

Contents

Appendices

Exhibit 5: Electric Systems Effects

This Exhibit will track the requirements of Stipulation 5, dated July 6, 2020, and therefore, the requirements of 16 New York Codes, Rules and Regulations (NYCRR) § 1001.5.

5(a) System Reliability Impact Study

A System Reliability Impact Study (SRIS) was completed on June 4, 2019 for the Excelsior Energy Center (Project) by the New York Independent System Operator, Inc. (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 for the proposed collection substation and interconnection facilities, as well as any upgrades that may be deemed necessary for the Project. Additionally, technical analyses of thermal, voltage, short circuit, and stability were performed to evaluate the impact of interconnection.

The SRIS Report, provided as Appendix 5-1, contains proprietary, confidential, and critical energy infrastructure information; therefore, the Applicant is seeking the requisite trade secret protection for this information pursuant to Public Officers Law (POL) Sections 89(5) and 87(2)(d) and 16 NYCRR § 6-1.3.

5(b) Potential Significant Impacts

The SRIS Report shows that the Project will have no significant impacts on the reliability of New York's transmission system. This conclusion is based on the following understandings and assumptions:

- The Project will be operated in accordance with all applicable requirements, including Article 10 (of the Public Service Law [PSL]) certificate conditions and NYISO and Transmission Owner day-ahead and real-time operational procedures and limitations. The Project will be operated in a manner that does not negatively impact reliability of the New York State Transmission System; this may include dispatching patterns that eliminate potential reliability issues that may exist during certain system contingency conditions.
- The Project and associated interconnection facilities will be designed in accordance with all applicable reliability standards.

5(c) Ancillary Services and Electric Transmission Systems Impacts

The SRIS analysis concluded that the Project will have no adverse impact to the New York State Transmission System. For the Summer and Winter Peak, the steady state analyses did not observe any significant thermal overloads under pre-contingency conditions. For the Summer and Winter Peak, the steady state analyses identified thermal violation that could be mitigated in post-contingency conditions. The post-contingency N-1-1 steady state analysis did not show any thermal violations. Post-contingency N-1-1 voltage analysis identified few buses that are outside of voltage criteria with a delta more than 0.005 per unit (p.u.). The delta is positive for all the low voltages and the voltages are better with post-project compared to the pre-project conditions.

5(d) Reasonable Alternatives to Mitigate Adverse Reliability Impacts

The Project does not present any adverse impacts to the reliability of the affected transmission systems. 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 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 Project 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 as to not violate the post-contingency applicable limits). Consequently, under the NYISO MIS requirements, no System Upgrade Facilities (SUF) other than local upgrades are required. 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 results of the thermal, voltage, and stability transfer analyses show that the Project has a positive impact on the transfer capability of Dysinger East, West Central, and Volney East open and closed interfaces. The transfer analyses were performed for summer peak cases on the normal and emergency thermal transfer limits for the Dysinger East, West Central, and Volney East interfaces (all open and closed). The voltage transfer limit for Dysinger East was open 29 MW/ closed 80 MW, West Central open 207 MW/ closed 268 MW, and Volney East open 38 MW/ closed 38 MW. The results of the thermal transfer analysis showed that the Project has no adverse impact on the normal and emergency transfer limit capacity. The analyses showed 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 Project will be designed in accordance with applicable standards, codes, guidelines, and using best industry practices.

The Project will generate electricity using photovoltaic solar panels. The panels generate power at a low voltage, which will be converted from DC to AC at the Project's inverters. Additionally, an energy storage system will be DC-coupled at a select number of the Project's inverters. The Project's collection system will consist of 12 34.5 kV feeders, each of which connects the padmount transformers together and terminates at a 311 MVA 345/34.5/13.8 KV wye grounded/wye grounded/delta buried transformer with +/- 2.5 fixed taps at the project collector substation. The Project's collection system will consist of approximately 37.7 miles of 34.5 kV lines. The Project will use a 34.5 kV power collection system to connect the Project to the 34.5 KV/345 kV collector substation, proposed switchyard, and two approximately 160-foot 345 kV interconnection line looping from the switchyard to the NYPA 345 kV #DH2 transmission line. The collection lines will feed into a collection substation that will step up power to 345 kV. The collection line will be directly buried in soil. The type and size of the cable conductor will be determined to carry the required load with the conductor not to exceed 105 degrees Celsius during normal operation. The collection substation will connect to the point-of-interconnection (POI) facilities, which will consist of an onsite 345 kV three beaker ring bus switchyard and two 160 foot long 345kV transmission tie-in lines that will be transferred to NYPA to own and operate, connecting to the adjacent NYPA's #DH2 345kV line also owned by NYPA. The interconnection facilities will be located within the Project Area. The Project's components will be designed in accordance with (but not limited to) the following design codes, guides, and references:

- RUS – Rural Utility Services Bulletin 1724E-200
- ANSI – American National Standards Institute
- ASCE – American Society of Civil Engineers
- ASTM – American Society for Testing and Materials
- Building Code of New York
- IEEE – Institute of Electrical and Electronic Engineers
- NEC – National Electric Code
- NERC – North American Electric Reliability Council
- NESC – National Electric Safety Code

- NFPA – National Fire Protection Association
- NPCC – Northeast Power Coordinating Council, Inc.
- NYSCR – New York State Reliability Council
- OSHA – Occupational Safety and Health Administrator
- Underwriters Laboratories (UL)

In addition, the POI facilities, collection lines, and collection substation proposed by the Applicant will adhere to all applicable NYPA requirements. A complete list of all engineering codes, standards, guidelines, and practices with which the Applicant will conform is provided in Exhibit 11(i). Additional information is included in Appendix 5-2, Collection Substation Design Criteria.

(2) Generation Facility Criteria

The materials and equipment used in the final Project configuration will be new and will meet applicable requirements. The equipment will be investment-grade to facilitate the long-term, reliable operation of the Facility. Type certification, as commonly provided for wind turbines, is not applicable for photovoltaic (PV) solar power equipment; however, some equipment, such as the PV modules or the inverters, may be listed per the requirements of the National Electric Code. Several PV module and inverter suppliers will be considered. A representative specification sheet for solar modules, inverters, and the energy storage systems are presented in Appendices 2-1, 2-2, and 2-3, respectively. Each of these equipment types under consideration have received an UL certification. Final selection of the major solar equipment will be completed prior to construction and will depend on a variety of factors including market conditions; irrespective of which equipment type is ultimately utilized, all equipment will comply with the applicable standards and requirements.

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

The purpose of completing the inspection, testing, and commissioning process is to validate electrical connections, validate panel operation, and perform appropriate field tests to ensure the integrity of the Project's components. Panel commissioning will occur once the panels, collection substation, and switchyard are fully constructed 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. All inspection, testing, and commissioning will be completed in accordance with all applicable engineering, design, and manufacturer standards. Upon completion of all applicable

commissioning processes, the Applicant will provide documentation that all processes were completed in accordance with all appropriate engineering and manufacturer standards.

Post-construction inspection, testing, and commissioning procedures for Project Components are described below.

Panels

The inspection, testing, and commissioning process for the Project's panels includes, but is not limited to:

- Abiding by employee safety requirements
- De-energized verification to ensure no current is flowing through panel electrical components
- Verifying all wires and cable have been routed properly without sharp bends
- Confirming all protective equipment has been properly installed
- Checking that all fuses, connections, safety switches, breakers, inverters, and all other systems/components are appropriately installed and securely fastened
- Ensuring that there are no short circuits or short protections to confirm components are ready to receive power
- Panel and inverter testing

Collection System

All materials used in the construction and installation of the collection system will be visually inspected for any defects and to ensure that all design specifications are met. The Applicant and its contractor(s) will ensure proper installation of this system using Best Management Practices outlined in the Quality Assurance and Quality Control Plans found in Appendix 12-1.

The commissioning process for the collection substation includes, but is not limited to:

- Visual, mechanical, and electrical testing of power transformers and high-voltage breakers
- Testing of all metering units
- 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

Energy Storage System

The inspection, testing, and commissioning process for the Project's energy storage system includes, but is not limited to:

- Abiding by employee safety requirements
- Confirming all systems and protective equipment have been properly installed
- Testing of the grounding systems
- Checking that all fuses, connections, safety switches, breakers, and all other systems/components are appropriately installed and securely fastened
- Confirming Battery Management System (BMS) is operating properly
- Charging and discharging the system to ensure proper functionality

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

The Project's Operations and Maintenance (O&M) procedures will include Project maintenance and management plans, procedures and criteria addressing vegetation management, and Project inspection and maintenance. The O&M of Project Components will follow industry standard practices. Operations will be monitored for events outside of the normal range expected, and equipment will be immediately and automatically shut-down if such an event is recorded. Local on-call technicians will be available to respond quickly to such events as required. Reports will be generated and received by the Applicant's Renewables Operations and Control Center (ROCC)/Fleet Performance and Diagnostic Center (FPDC) which monitors Project critical controls, responds to alarms, and ensures safe and reliable operation of the Project.

The O&M personnel will conduct routine inspection of solar array, access roads, revegetated areas, collection lines, the collection substation, and the energy storage systems, to document Project and equipment condition, compliance with required certificate conditions, and to identify any maintenance or improvement required to satisfy such conditions or compliance requirements. Additionally, inspections will evaluate environmental conditions and assess the effectiveness of restoration activities until site restoration efforts have been completed. Periodic environmental audits will be performed, generally every three years, to ensure compliance with all regulatory and permit requirements. Findings of non-compliance will be immediately resolved by on-site staff whenever possible or otherwise in consultation with permit issuing authorities. Positive operating

procedures will be documented and disseminated to other operational solar facilities in efforts to improve best management practices.

During the O&M phase of the Project, vegetation will be mowed at least twice a year within array fence lines and will not be allowed to grow over the height of the lowest portion of the panels. Vegetation around the outside of fence lines will be mowed, maintained or brush-hogged periodically to prevent shading on the panels and to facilitate maintenance along the fence line; this brush removal or mowing will likely take place every two to three years. All brush removal and mowing clippings will be left on-site.

Selective use of herbicides may be used as a secondary means of control where necessary. All applications would be handled in spot treatment method and target specific discrete locations; broadcast aerial application of herbicides is not proposed. If necessary, herbicides will be used to treat invasive species as needed. All herbicide use will follow best management practices for controlling the species identified and will comply with the regulations and requirements of New York State Department of Environmental Conservation's (NYSDEC's) Pesticide Control Regulations. If necessary, herbicides used would be typical of those used in farm settings and residential applications. Project maintenance and management plans, procedures, and criteria are further described in Exhibit 5(i).

5(g) Heat Balance Diagrams

The Project will not have a thermal component, and, therefore, heat balance diagrams are not applicable.

5(h) Substation and Interconnection Standards and Requirements

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

Interconnection facilities will include a 345 kV switchyard and two 160 foot 345 kV interconnection lines from the switchyard looping into the existing NYPA 345 kV #DH2 Transmission line, that will be transferred to NYPA to own, maintain, and operate. NYPA, the transmission owner, will control the operational and maintenance responsibilities of the interconnection facilities. This transfer is anticipated to occur after an Article 10 certificate is issued and during construction of the Project or within twelve months of the commencement of commercial operation.

(2) Transmission Owner's Requirements

The switchyard will be designed in accordance with NYPA requirements.

(3) Operational and Maintenance Responsibilities

NYPA will define and complete the O&M responsibilities for the switchyard. However, the Applicant will assume all O&M responsibilities until POI ownership transfer is complete.

5(i) Maintenance, Management, and Procedures

(1) Solar Panel Maintenance, Safety Inspections, and Racking and Mounting Post Integrity

All scheduled and unscheduled service and required preventative maintenance of all equipment will be performed according to the PV module and inverter O&M Manuals. Scheduled and unscheduled services will be provided to the electrical system from the inverters to the substation including the pad-mount transformers and collection system. Appendix 5-3 provides a description of the preventive maintenance task and schedule.

(2) Collection Substation, Collection System, Gathering and Interconnection Line Inspections, Maintenance, and Repairs

Vegetation Clearance Requirements

Vegetation control will be conducted in accordance with Article 10 certificate conditions and BMPs approved thereunder. All vegetation within the clear-cut boundary, with the exception of low-lying growth, will be completely cleared to the ground level. As the Project's POI is located within an existing agricultural field, minimal vegetation clearing will be required.

The minimum distance of vegetation clearance will be based on line voltage, sag, blowout, and wind loading, and any requirements that the New York Power Authority (NYPA) will require.

Vegetation Management Plans and Procedures

The vegetation management practices are to use an integrated vegetation management approach to achieve program objectives through:

- Identification of compatible and incompatible vegetation through inspection.
- Implementation of appropriate selective control methods to discourage incompatible vegetation (i.e. mowing, spot herbicide application, etc.).
- Promotion of compatible vegetation (i.e. seeding, invasive species control, etc.).

Control methods are based on potential environmental impacts and anticipated effectiveness, along with site characteristics, security, economics, current land use and other factors. These methods include, but are not limited to pruning, removal, mowing, and, if necessary, selective herbicide application.

Vegetation management objectives:

- Managing vegetation prior to encroachment for NERC and Non-NERC lines.
- Minimizing fire risk by reducing fuel levels to acceptable limits.
- Compliance with governmental vegetation related regulations and restrictions.

Inspection and Maintenance Schedules

Generally, scheduled work will be determined by the inspection process. Routine inspections will occur via ground patrols, aerial patrols, Light Detection and Ranging (LiDAR) and/or imagery analysis. NERC applicable lines and lines designated as critical to the reliability of the electrical system in the region shall be inspected, at a minimum, annually with no more than 18 months between inspections. The timing and number of inspections may be adjusted in order to respond to changing conditions such as fuel loading, heavy rain falls, high winds, landowner intervention and tree mortality.

Notification and Public Relations For Work in Public Right-Of-Way (ROW)

The electrical system will require periodic preventative maintenance. Notification will be addressed with the appropriate agencies prior to starting the work.

Minimization of Interference with Electric and Communications Distribution Systems

The collection lines will conform with applicable safety standards, including those that provide for separation distances from existing electric and communications lines.

5(j) Vegetation Management Practices

Vegetation management and maintenance of the Project Area will be incorporated into the overall long-term O&M plan for the Project. The Project Area will be routinely visited for various tasks, during which general site conditions will be evaluated and documented. These checks will include monitoring and evaluation of the vegetation and site stabilization conditions within the Project Area. A long-term vegetation management plan will be filed with the Secretary to the Siting Board following issuance of a certificate.

Ensuring stable site ground conditions and functioning storm water management features are among the goals of the vegetation management plan. Additionally, effective vegetation management will be employed to reduce risk of damage to the solar components and prevent shading of the PV modules. The plan will also incorporate long-term maintenance of any perimeter landscaping required for visual screening of the Project. All work should be restricted to within the limits of disturbance (LOD); however, inspections and checks may be warranted anywhere in the Project Area.

Initial Operation Period:

During the early months of operation, vegetation management will focus on promoting early stage growth of the site ground cover, landscaping features, and stormwater management features. The stormwater management features will be checked more frequently during that time.

Seed mixes will be selected based on time of year or re-seeding efforts to ensure optimal growth and stabilization during the initial site revegetation efforts. Reseeding will occur in subsequent seasons as needed to establish adequate cover. Revegetated areas will be checked at greater frequency during the first year of operation to ensure successful establishment and growth. If bare areas are found during inspections, additional methods may be employed to ensure establishment (i.e. scarification of soil, re-seeding, fertilization, etc.).

Seeded areas will be monitored for weeds or unwanted growth, including invasive species, during the initial growing period until desired vegetation establishes. The regular vegetation inspections will include periodic inspection for invasive species as per the Invasive Species Management and Control Plan (ISMCP) to be filed with the Secretary. The initial operation period site checks will specifically include monitoring of populations of invasive species previously identified for density and spread, as well as areas recently disturbed for construction or re-vegetation which are particularly susceptible to invasion. The Certificate Holder will consult a vegetation expert to assist with checks for invasive species and consider focused invasive species identification and management training of Project staff to facilitate more frequent checks for invasive species by the regular vegetation management staff.

Depending on the season, weather conditions, and the conditions of any newly planted trees and shrubs, watering may be required and performed during the first several weeks to promote establishment. The newly planted trees and shrubs will be inspected more frequently during the

early months and during the first spring season following planting as they exit the dormant period. Repairs and/or replacement of trees may be implemented, as necessary.

Perimeter trees which may potentially shade panels will be identified during the construction period. Trees or shrubs will be pruned as necessary during the initial operation period to prevent shading. O&M staff will continually check the status of the ground stability in perimeter areas and generally check for perimeter tress that may be causing excessive shading or present risk of falling damage. Pruning and/or removal of these trees may occur as required to prevent these risks.

On Going Operation:

The long-term management plan will continue the efforts described above, but on less frequent basis depending on site conditions. The plan will shift focus to long-term maintenance of vegetation and site stability. Mowing and target trimming will typically occur more often during late spring/early summer period, and then again as needed, typically after autumn rains. Depending on site conditions, targeted mechanical vegetation trimming may be performed around inverters, energy storage systems, substations, fencing, gates, and select portions of roadways. To avoid potential environmental impacts to the maximum extent practicable, herbicides are planned as a targeted secondary strategy as opposed to wide broadcast or aerial treatment, the latter of which will not be employed.

The long-term vegetation management plan, to be filed with the Secretary post-certification, may consist of all or some of the measures listed below, to be implemented as dictated by changing site conditions. The Certificate Holder will prepare the plan considering the Article 10 certificate conditions.

- Regular planned routine inspections. Check for:
    - Excessive growth of ground cover grass or weeds;
    - Strive to keep vegetation below bottom edge of PV modules;
    - Bare spots and/or excessive weed growth;
    - Condition of landscaped trees (e.g., signs of stress, potential to pose hazard to equipment or facilities);
    - Deterioration of erosion control and storm water management features;
    - Vegetation that impedes on facility equipment;
    - Condition of the wetland vegetation;

    - Signs of uncontrolled runoff or sedimentation;
    - Signs of damage to the perimeter fence due to vegetation growth;
    - Trash and debris;
    - Inspections for invasive species per ISMP; and
    - Check road conditions and signs of mud tracking off-site, and address accordingly.
- Periodic mowing and repairs to grassed areas:
    - Based on actual observed growth (typically maintained to below 18-24”);
    - Approximately 3–6 mows annually depending on conditions;
    - Avoid mowing while ground is wet or with 24-48 hours after heavy rain;
    - Mow fenced area and between solar module rows;
    - Mow less often just outside fence (about 5 to 15 feet);
    - Mow select landscaped areas as needed to promote tree growth;
    - Add or repair stakes and support cables for newly planted trees, as needed;
    - After full growth, trimming of shrubs and landscaping trees may be required;
    - Trim targeted storm water management features and ditches;
    - Trim around and within substations;
    - Repair bare or eroded areas as necessary; and
    - Check for and remove loose debris.
- Periodic selective herbicide treatment:
    - Only United States Environmental Protection Agency and NYSDEC-approved products; and
    - Used to support vegetation management efforts.
- Periodic management of perimeter landscaping:
    - Trim branches and remove hazardous trees as needed;
    - Repair stakes and guide strings; and
    - Remove dead or fallen trees and limbs, as needed.
- Periodic repairs to storm water management and erosion control features as necessary, which may include vegetation management measures.

The vegetation management inspections and maintenance measures will be periodically summarized by the O&M staff in O&M reports. The O&M plan should include an environmental compliance review that may, amongst other things, address vegetation management requirements as required by the Article 10 certificate conditions. The Certificate Holder will periodically assess effectiveness of the plan and adjust accordingly.

5(k) Sharing Above Ground Facilities with Other Utilities

The Applicant is not proposing that the Project share any aboveground facility with other utilities.

5(l) Equipment Availability and Component Delivery

The Applicant is not aware of any equipment availability restrictions. The Applicant currently plans to place the Project in service in Q4 of 2022. Based on this in-service timeframe, major Project components would be expected to arrive onsite starting in Q4 of 2021 through Q4 of 2022.

5(m) Blackstart Capabilities

Solar energy generation facilities do not have blackstart capabilities, therefore a description of such is not applicable.

5(n) Compliance with All Applicable Reliability Criteria

Reliability criteria are identified in the SRIS Report, which includes input from the NYISO and New York State Electric and Gas Corporation (NYSEG). In addition, the Applicant consulted with New York State Department of Public Service (NYSDPS) and Northeast Power Coordinating Council, Inc. (NPCC) regarding reliability criteria and they indicated that the consultation completed through the SRIS is sufficient for compliance with relevant reliability criteria. The SRIS report shows that the Facility will have no significant adverse impact on the reliability of the existing transmission system.

As part of the interconnection process, the Applicants will execute an interconnection agreement with NYISO and NYPA. The interconnection agreement will require compliance with NYPA's technical and operating standards, among which the operation and protection settings compliance with Institute of Electrical and Electronics Engineers (IEEE) 1547 (anti-islanding standard). The Applicant will require the procured Facility inverters to comply with this standard and other NYPA standards applicable to the Facility.

5(o) Proposed Maintenance and Inspection Schedule

A proposed maintenance and inspection schedule to the extent known at the time of Application filing is included in Appendix 5-3. This also includes the frequency of inspections for the solar field panels, inverters, energy storage systems, and switchyard.