ConnectGen Chautauqua County LLC
South Ripley Solar Project
Matter No. 21-00750

900-2.22 Exhibit 21

Electric System Effects and Interconnection

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EXHIBIT 21 ELECTRIC SYSTEM EFFECTS AND INTERCONNECTION

(a) Proposed Electric Interconnection

The Facility will interconnect to National Grid's 230 kilovolt (kV) South Ripley Substation via a direct tie-in to an existing unutilized and available bus. In December 2019, the Applicant filed an Interconnect Request to the New York State Independent System Operation (NYISO) for interconnection of the solar component of the Facility utilizing a preferred primary POI at the existing National Grid-owned 230 kV South Ripley Substation bus via an expansion of the existing switchyard to accommodate a direct interconnection into an existing 230 kV bus. An alternative POI of a new 3-ring breaker bus switchyard located adjacent, and connecting to, the existing National Grid-owned South Ripley to Dunkirk 230 kV line (Line 68) was also identified. This request was assigned Queue Position 783 (QP 783). In early 2019, the Applicant opted to perform an Optional Feasibility Study for QP 783. Results of the Optional Limited Feasibility Study were finalized in July 2019. In May 2020, the Applicant filed an Interconnect Request to NYISO for interconnection of the BESS component of the Facility. This request was assigned Queue Position 1014 (QP 1014). In October 2019, the scope of the System Reliability Impact Study (SRIS) for QP 783 was finalized and the SRIS was initiated for the solar component. In June 2020, the SRIS was completed, and results were finalized at the TPAS meeting in August, 2020. In April 2021, NYISO confirmed that due to an upgrade in the Interconnection Procedures for Large Generator Facilities, the energy storage QP 1014 could be combined with the ongoing QP 783 and the two components would no longer be studied separately. This process was completed in April 2020, and the Facility officially kicked-off the ongoing Class Year Facilities Study process in May 2021 (having submitted entry documentation in March 2021).

(1) Design Voltage and Voltage of Initial Operation

The electrical collection system proposed for the Facility will carry the power generated by the Project's solar photovoltaic modules (collectively referred to a PV arrays) at a voltage of approximately 1,500 volts-direct current (DC). The DC power from the PV arrays will be collected by inverters, which convert power from DC to alternating current (AC) power at a voltage between approximately 600 volts (AC) depending on the final inverter design. The AC power produced by the inverters will be directed to medium voltage transformers (MV transformer) that will increase the voltage to a medium voltage of approximately 34.5 kilovolts (kV) for the collection system. The Facility's collection system will delivery power generated by each PV array to the collection substation sited adjacent to the existing National Grid-owned 230 kV South Ripley Substation. A main power transformer within the collection substation will increase the 34.5 kV collection voltage to the utility transmission voltage of 230 kV, for interconnection to the National Grid-owned 230 kV South Ripley Substation. No new off-site transmission lines will be required for interconnection.

(2) Type, Size, Number and Materials of Conductors

The collection substation will be located on the northeastern side of the existing 230 kV South Ripley Substation, south of NE Sherman Road. A transmission line (approximately 200 feet in length) would connect the proposed collection substation, which supports 270 MW of output, to the 230 kV South Ripley Substation. The 230 kV 200 ft span between the collector substation and the South Ripley substation will utilize three (3) bare 795 Drake ACSR conductors per circuit. Please see Exhibit 5 and Appendix 5-C for detail regarding overhead MV collection system conductor type, size, and materials.

(3) Insulator Design

Typical utility-grade ceramic/porcelain or composite/polymer insulators, designed and constructed in accordance with American National Standards Institute (ANSI) C29, will be used. Insulators in the collector substation will generally be porcelain, though insulators used for the interconnection span may utilize composite polymer. Please see Exhibit 5 and Appendix 5-C for detail regarding overhead MV collection system insulator design.

(4) Length of Transmission Line

The proposed collection substation will be located directly adjacent to the 230 kV South Ripley Substation Point of Interconnection (POI). The connection line length between the collection substation and the 230 kV open bus POI is anticipated to be approximately 200 feet. Please see Exhibit 5 and Appendix 5-C for detail regarding overhead MV collection system lengths.

(5) Dimensions and Construction Materials of the Towers

The Facility interconnection will require two steel structures located at the south side of the collection substation and north side of the South Ripley substation for interconnection. The proposed 3-pole dead end structures will support the 230 kV circuits connecting the collection substation to the POI in the South Ripley Substation. 3-pole dead ends will be installed on drilled shaft foundations with an above ground height of approximately 60-70 feet and are expected to utilize steel monopoles similar to those used for existing connection to the 230 kV transmission system. The proposed interconnection structures are depicted in Appendix 5-D. Please see Exhibit 5 and Appendix 5-C for detail regarding overhead MV collection system dimensions and construction materials.

(6) Design Standards for Towers and Tower Foundations

The interconnection structures and foundations were designed in accordance with the following standards:

- American Society of Civil Engineers Manual 72, “Design of Steel Transmission Pole Structures”

- American Society of Civil Engineers Standard 48, "Design of Steel Transmission Pole Structures"
- American Society of Civil Engineers MOP 113, "Substation Structure Design Guide"
- Rural Utilities Service Bulletin 1724E-200 "Design Manual for High Voltage Transmission Lines"
- ANSI – American National Standards Institute
- ASTM – American Society for Testing and Materials
- OSHA – Occupational Safety and Health Administration
- IEEE – Institute of Electrical and Electronic Engineers
- NEC – National Electric Code

(7) Type of Cable System and Design Standards for Underground Construction

No underground lines or cabling are expected for the 230 kV interconnection between the collection substation and the South Ripley Substation. The 34.5 kV underground collection system will consist of primarily underground cross-linked polyethylene cables. Design of the underground collection system will comply with the following codes and standards:

- ANSI – American National Standards Institute
- ASTM – American Society for Testing and Materials
- OSHA – Occupational Safety and Health Administration
- IEEE – Institute of Electrical and Electronic Engineers
- NEC – National Electric Code
- NFPA – National Fire Protection Association

Please see Exhibit 5 for more information regarding the MV collection system.

(8) Profile of Underground Lines

No underground lines are expected for the 230 kV interconnection between the collection substation and the South Ripley Substation at the transmission voltage. The Facility will include underground 34.5-kV collection lines in the MV collection system. Cross section details of the 34.5 kV collection lines are presented in Appendix 5-C.

Collection lines will be buried at a depth of 4 feet. No oil pumping stations or manholes are proposed. More details regarding the MV collection system can be found in Exhibit 5.

(9) Equipment to be Installed in Substation or Switchyard

The collection substation will include one 34.5 to 230 kV main power transformer (rated to supply 270 MWac of power to the electric grid), a 34.5 kV bus, 34.5 kV underground feeder risers, 34.5k V overhead feeder bays, high-voltage and medium-voltage breakers, metering/relaying transformers, disconnect switches, an equipment enclosure containing power control electronics, lightning masts, lighting poles, 230 kV Dead-end structure, capacitor banks, ground grid and streel support structures. The equipment for the collection substation will be constructed on concrete foundations, helical piles, or a similar support structures. The design of the collection substation will be finalized through the NYISO Class Year Facilities Study (underway) and the pre-construction detailed design.

As identified in the New York State Independent System Operator (NYISO) interconnection process, the primary POI has been identified at the existing National Grid-owned 230 kV South Ripley Substation bus via an expansion of the existing switchyard to accommodate a direct interconnection into an existing 230 kV bus. An alternative POI of a new 3-ring breaker bus switchyard located adjacent, and connecting to, the existing National Grid-owned South Ripley to Dunkirk 230 kV line (Line 68) was also identified. In either scenario, the existing South Ripley Switchyard needs to be expanded as follows: expansion of the POI switchyard will be designed, owned, and constructed by National Grid. Based on typical National Grid practices, the POI switchyard expansion is expected to include: one (1) 230 kV breaker, two (2) 230 kV disconnect switches, three (3) 230 kV metering units, one (1) 230 kV dead-end structure, bus supports, buried control wiring, buried ground wires, and an expansion of the fenced substation gravel yard. If a new 3-ring break bus switchyard adjacent to South Ripley Substation (alternative POI) is identified as required through the ongoing interconnection study process, it will consist of the following: three (3) 230 kV breakers, six (6) 230 kV disconnect switches, three (3) 230 kV metering units, nine (9) 230 kV voltage transformers, three (3) 230 kV dead-end structures, bus supports, buried control wiring, buried ground wires, control enclosure, and fenced substation gravel yard.

Refer to preliminary drawings in Appendix 5-D for a plan/overview of the collection substation and the expansion of the POI switchyard via the primary POI option as studied through the System Reliability Impact Study.

(10) Terminal Facilities

As discussed in Section 5 and Section 9 above, the collection substation will include a dead-end structure to connect to the 230 kV span interconnection into the South Ripley switchyard. Both the collection substation and the South Ripley switchyard will include new dead-end structures. These structures are detailed in Appendix 5-D.

(11) Cathodic Protection Measures

There are no cathodic protection measures expected to be required for installation of the underground systems, as no metallic pipelines or conduits are anticipated to be used in the Facility Site. Therefore, cathodic protection measures are not discussed further in this Application.

(b) System Reliability Impact Study

A System Reliability Impact Study (SRIS) was completed for the Facility (QP 783) in accordance with the NYISO Applicable Reliability Standards set forth in the Attachment X of the NYISO Open Access Transmission Tariff (OATT), by NYISO, National Grid, and their consultants in June 2020. The SRIS is included as Appendix 21-A 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 Project has entered the NYISO 2021 Class Year Facilities Study which is expected to be completed in early 2022. Results of this study are summarized below:

- **Steady-State Analysis (N-0, N-1 & N-1-1), Summer Peak and Winter Peak:** Under pre-contingency, single element post-contingency, and multiple element post-contingency Summer Peak and Winter Peak conditions, no thermal or voltage violations due to the Facility were identified in the study area. Therefore, Study found that the Facility causes no significant thermal or voltage adverse impacts under steady state system conditions.
- **Transfer Limit Analysis, NY-PJM/PJM-NY Interfaces:** Thermal transfer assessment was performed on the summer cases NY-PJM/PJM-NY interfaces under normal and emergency transfer criteria. The Study showed that the Facility has no significant impact on the Normal Transfer Limit and Emergency Transfer Limit of the NY-PJM interface. However, the Facility was shown to impact the Normal Transfer Limits and the Emergency Transfer Limits of the PJM-NY interface by reducing the interface's transfer limits beyond criteria; being most limited, respectively, by the post-contingency loading and the pre-contingency loading of the East Towanda to Hillside 230 kV line. This impact can be mitigated by an identified System Upgrade Facility (SUF) at the Hillside 230 kV substation. This SUF will be further studied in the NYISO Class Year Facilities Study.

- **Stability Analysis, Summer Peak and Light Load:** Stability Analysis was performed for summer peak and light load system conditions to determine the impact of the facility on the system performance within the Study Area for the selected system design contingencies. The Study results show that, for both design and local contingencies, the Facility and the New York State Transmission System (NYSTS) remained stable and positively damped for the Summer Peak and Light Load system conditions.
- **Northeast Power Coordinating Council (NPCC) A-10 Testing:** NPCC A-10 Testing was performed to identify if any existing stations near the Facility POI could be classified as Bulk Power System (BPS) due to the addition of the Facility. The testing was performed for the Summer Peak case at 230 kV stations within the proximity of the Facility, South Ripley and Dunkirk. The Study results show that the Facility does not change the BPS classification of the tested substations.
- **Short-Circuit Analysis:** Short Circuit analysis was performed to determine the impact of the Facility on the fault duty of buses, as well as to identify any circuit breaker and/or fuse ratings that have been exceeded within the Study Area. This analysis was performed in accordance with the NYISO Guideline for Fault Current Assessment. The Study results indicated that the Facility increased the total bus fault currents at nearby substations by more than 100 A, but the highest fault current at those stations did not exceed the available lowest breaker ratings. Hence, the Project causes no significant short circuit impacts to the NYSTS in the Study Area.

The SRIS Study results indicate that the Facility has no significant adverse impact on the reliability of the NYSTS. As discussed above, Steady State Analysis, Transfer Limit Analysis, Stability Analysis, and Short-Circuit Analysis were performed with the addition of Project in making this determination. A single potential SUF was identified during the Study; therefore, the Class Year Facilities Study will further confirm the need for any SUF as a result of Facility Interconnection.

(c) Potential Reliability Impacts

The solar SRIS evaluated several power flow base cases developed by the NYISO including 2024 summer peak, winter peak, and light load system conditions.

The SRIS concludes that the Project does not cause any adverse impacts to the reliability of the NYSTS. Please see Section (b) above.

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

The SRIS did not identify any benefits or detriments to the Facility on Ancillary Services. The SRIS identified both Connecting Transmission Owner Attachment Facility Upgrades and System Upgrade Facilities not located at the POI required for interconnection of the Facility. Connecting Transmission Owner Attachment Facility Upgrades include system upgrades at the existing National Grid 230 kV South Ripley Substation directly related to the connection of the Facility to the system (as would be required for any interconnection). System Upgrade Facilities include the installation of a Direct Transfer Trip at the National Grid 230 kV Dunkirk Substation and the installation of a Phase Angle Regulator (PAR) at the National Grid Hillside Substation. The need for these upgrades will be confirmed and finalized during the ongoing Class Year Facilities Study. No negative impacts are anticipated as a result of the identified potential upgrades, which would all be located within existing transmission and substation facilities and would benefit the reliability of the grid.

(e) Estimated Change in Total Transfer Capacity

A transfer assessment to determine the incremental impact of the Facility on the NYISO/PJM interfaces was performed by the NYISO during the SRIS. The results of the transfer assessment show that the Facility increases the transfer capability from PJM to NYISO but decreased the transfer capability from NYISO to PJM. To mitigate the impacts to NYISO-to-PJM interface, the Applicant may need to sponsor the procurement and installation of a phase angle regulator near one of the interface substations between NYISO and PJM. The NYISO will analyze interface transfer capability again during the 2021 Class Year Study and final determination of necessary facilities to address interface impacts, if any, will be identified as well as required sponsorship by the Applicant and other members of the 2021 Class Year Facilities Study.

(f) Criteria, Plans, and Protocols

The Applicant intends to contract with an engineering, procurement, and construction (EPC) contractor to finalize design, build, and commission the Facility. The Applicant will require that all contractors and sub-contractors to comply with all applicable federal, state, and local codes, standards, and requirements through the design, construction, and commissioning of the Facility. The Facility will be constructed based on design drawings stamped by a New York State Professional Engineer.

(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, along with any standards/preferences set by the companies designing the Facility. For the point of interconnection (POI) switchyard, National Grid requirements will be followed.[1]

- NESC - National Electric Safety Code
- NEC 2020 – National Electric 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
- IEEE 1313.2 - IEEE Guide for the Application of Insulation Coordination
- IEEE 48 - Standard Test Procedures and Requirements for Alternating-Current Cable Terminations 2.5 kV through 765 kV
- IEEE 400 - Guide for Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems

[1] Note, as discussed above, the Facility will participate in the NYISO 2021 Class Year Facilities Study. Accordingly, details regarding the design and construction of the POI switchyard presented in this exhibit and elsewhere in this Application are preliminary and may change based on the results of the study referenced above and the requirements outlined in the Interconnection Agreement reached between the Applicant and National Grid, and any other applicable rules and protocols.

- 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 C57.12.10 - American National Standards for Transformers
- TIA/EIA - Telecommunications Industry Association/Electric Industry Alliance
- NEMA - National Electrical Manufacturer's Association

And all NYISO codes and standards regulating the design, construction, and commissioning of electrical and interconnection facilities.

(2) Generation Facility Type Certification

The equipment used in the final Facility design will be new and will meet applicable local, state, and federal requirements. The equipment will be sourced from Tier 1, investment-grade suppliers 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. Generating equipment will have equipment-specific certifications by Underwriters Laboratories (UL) or other nationally recognized testing laboratory as required by NFPA 70. Datasheets for the major equipment are provided in Appendix 5-E. All final selected equipment will comply with the applicable standards and requirements, including any applicable conditions as outlined in 19 NYCRR Subpart 900-6, Uniform Standards and Conditions.

(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 Office of Renewable Energy Siting and stored at the Facility Site for easy review/access in the future.

MVAC Collection System

All material supplied as part of this part of the project shall require factory acceptance test reports showing compliance with the applicable ANSI/IEEE/NETA standards and requisite project design standards. All testing and test reports shall be performed under the supervisions of a licensed NY Professional Engineer. All tests shall be performed with the equipment de-energized, except where specifically required for it to be energized for functional testing. This includes, but is not limited to, poles, insulators, hardware, cables, fiber, cable accessories, sectionalizing equipment, fill materials, and grounding material.

During construction, all materials, equipment, and methods used for underground cable installation will be tested and inspected for conformance with the design according to the approved construction drawings (see Appendix 5-B and Appendix 5-C for typical details). All materials, equipment, and methods used for installing aerial conductors and the associated poles & hardware will also be tested and inspected for conformance with the design and project standards according to the approved construction drawings (see Appendix 5-C for typical details). All materials, equipment, and methods used for installing the SCADA fiber optic cabling throughout the facility will also be tested and inspected for conformance with the design and project standards according to the approved construction drawings.

All MVAC electrical cables, equipment, and fiber optic communication cables will be tested in accordance with IEEE/ANSI/NETA recommendations to identify any deficiencies or damage in the system that could result in outages or failure. MVAC electrical cable testing may include Very Low Frequency (VLF), at a minimum, or Partial Discharge (PD) testing. Testing of transformers will be performed in accordance with applicable ANSI/IEEE standards. The SCADA Fiber Optic communication cables will be tested for continuity and attenuation after cable placement, splicing, and termination. Post installation attenuation testing results shall be compared with the pre-installation attenuation results and any change in attenuation shall not exceed the tolerance of the original approved specifications. All test results shall be submitted to the OWNER for review and approval prior to moving to the next stage.

Energization of the MVAC Collection System shall only occur when the following conditions have been achieved:

- The Underground MVAC line commissioning testing has been successfully completed.
- The Aerial MVAC lines commissioning testing has been successfully completed.
- All SCADA communications systems have been installed and commissioned.
- The Collection Substation switching & tagging procedures are in effect.
- All Collection Substation operating procedures are in effect.
- The Collection Substation has been installed, tested, commissioned and ready for safe and reliable energization.
- The Collection Substation protection system have been installed, tested, and commissioned.

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 shall 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 substation 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 tests 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 power transformer
- High and medium voltage circuit breakers
- Disconnect switches
- Instrument transformers (current transformer, voltage transformer)
- Surge arresters
- Station service transformer
- Medium voltage cables
- Capacitor bank and/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:

- 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

Concrete foundations, helical piles, or similar support structures will be utilized for the collection substation. 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.

PV Plant

Plant commissioning will occur once the PV modules, collection substation, and POI switchyard are fully installed and the NYISO is ready to accept transport of power to the New York electrical grid. Commissioning and operation of the Facility relies on consistent systems monitoring and testing. Systems monitoring includes the following strategies and considerations:

- DC array inspection through manual electrical testing and/or aerial thermal imaging. Manual electrical testing is used to detect faults in the DC system that the monitoring system was unable to identify. This type of monitoring provides the defects currently causing module failures. Manual inspection requires that, should system testing suggest incorrect operation of some of the Facilities, wiring enclosures, combiner boxes/harnesses, and module junction boxes be accessible for more detailed inspection. Aerial thermal imaging inspection strives to detect string, module, and sub-module faults as well as the racking and balancing of the system (e.g.. racking shifts, systemic shading, major erosion) in arrays by monitoring thermal variations between modules.
- Equipment required: Support trucks will be driven to the construction site for manual inspections. Aerial thermal imaging is typically conducted by manned survey aircraft or unmanned aerial vehicles (UAVs).
- Timing: If possible, commissioning will preferentially be completed in late spring or summer to take advantage of typically drier weather with more stable irradiance. If necessary, this activity can be completed in the spring, fall, or winter depending on weather conditions.

Battery Energy Storage System (BESS)

BESS commissioning will typically occur in parallel with the PV plant commissioning. Prior to energization, the BESS will undergo the typical electrical tests for the ancillary equipment as defined in the NETA ATS. Manufacturer-specific site acceptance tests will also be performed.

Following the acceptance test, the following parameter, performance, and implementation tests are typically performed per IEC 62933-2-1

- Parameter test
- Actual energy capacity test
- Input and output power rating test.
- Roundtrip efficiency test
- Expected service life test
- System response test; step response time and ramp rate
- Auxiliary power consumption test
- Self-discharge of BESS test
- Voltage and frequency range test
- Performance test for class A applications
- Performance test for class B applications
- Performance test for Class C applications
- Available energy test

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

In accordance with Section 900-10.2(e)(3) of the 94-c regulations, the Applicant will prepare a Facility Maintenance and Management Plan, which will be submitted as a pre-construction compliance filing. This Plan will be implemented at the Facility once it becomes operational and is based on the Applicant's experience and typical operations and maintenance requirements for solar and battery energy storage projects. The objective of the Facility Maintenance and Management 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.

Solar energy projects typically consist of multiple inverters that are electrically connected to produce the desired project output. Each inverter requires periodic, preventative maintenance as well as corrective maintenance in the event of a malfunction within the individual inverter. Typically, solar energy facility maintenance cycles occur semi-annually and on an as-needed basis. These maintenance cycles can last from days to weeks. During maintenance activities, solar arrays will remain in-service to the greatest extent practicable.

Similar to a solar energy project, the BESS components require periodic preventative maintenance on a semi-annual or as-needed basis. The exact maintenance schedule is prescribed by the equipment vendor in support of the performance guarantee for the BESS. BESS components are taken offline sequentially for maintenance and inspection. Maintenance can be performed without taking the entire system out of service.

MVAC Collection System

The MVAC collection system is largely passive and only requires monitoring and failure correction. There are typically no ongoing maintenance requirements other than monitoring or visual inspections. The primary equipment for sensing and managing electrical faults in the MVAC collection system is in the collector substation, but additional sectionalizing equipment are located throughout the project along the MVAC Collection System routes. This sectionalizing equipment are set at key points between the aerial and underground portions of the MVAC Collection System to detect or protect it from electrical faults that may occur during the lifetime operation of the facility. Depending on detailed design, additional remote indication or control equipment may be applied to the MVAC collection system and may include, but are not limited to:

- Transformers – there is generally a transformer associated with each inverter skid and, if desired, can be designed/installed with high/low temperature or oil level alarms.
- Fault Indicators – the devices are applied to the underground cable portions of the collection system at certain intervals 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 – Switchgear with remote control capabilities are anticipated. However, if manual operation of the collection system is required, such work will be completed 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 always be worn/used. 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 aerial lines of the MVAC collection system allow regular visual inspection and access for assessing their condition and operation during facility operations. Since most of the underground collection system cannot be inspected visually, various “access points” will allow for a limited amount of visual observation during the operational lifetime of the facility. These “access points” include but are not limited to riser poles, junction boxes, switchgear, and transformers. While terminations and cable ends can be inspected at these points, they are more valuable as a point to connect electrical testing equipment.

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 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 ORES, but is generally accomplished using a communications line (T1, POTS, etc.) to transfer signals from an operator station to the substation equipment.

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/reactor 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.

The substation will be visually inspected at regular intervals, as well as after significant weather events such as extremely high winds, severe snow and ice, etc. Substation design adequacy will be monitored during the operations period of the Facility to ensure changes in environmental circumstances, utility changes, or equipment changes are evaluated for impact to the Facility.

(g) POI Switchyard Transfer Information

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

National Grid is the interconnecting transmission owner for this Facility. It is anticipated that the interconnection of the Facility will be accomplished via an expansion of the existing National Grid 230 kV South Ripley substation on existing National Grid property, however final POI design and specification will be completed during the ongoing Class Year Facilities Study. It is anticipated that POI substation facility construction would take place starting in late 2022 with completion in mid-to-late 2023 prior to project commissioning. Given the facilities are anticipated to be located on National Grid property, no land transfer will be required, but management and ownership of the expansion equipment will be taken over by National Grid prior to Facility operation. See Appendix 5-B for a preliminary General Arrangement Plan View drawing of the POI via an expansion of the South Ripley substation.

(2) Transmission Owner's Requirements

Design and construction of the POI may be done by National Grid or by the Applicant. If by the Applicant, National Grid will be responsible for design reviews, construction oversight, and commissioning. The description of the design will not be known until the Facilities Study is complete.

(3) Operational and Maintenance Responsibilities for the POI Switchyard

National Grid, as the transmission owner, will define and perform the operational and maintenance responsibilities for the POI switchyard. The Applicant will be responsible for the operations and maintenance activities at the collection substation and may coordinate with National Grid regarding the interconnection location. The final arrangement will be determined during final design in coordination with Nation Grid.

(h) Criteria and Procedures for Sharing Facilities with Other Utilities

The Applicant does not anticipate sharing facilities with other utilities at this time.

(i) Availability and Expected Delivery Dates for Major Components

Availability and delivery times for major Facility components may vary depending on selected equipment, inventory, manufacturer, and market conditions. The Applicant is not aware of any equipment availability restrictions but will monitor availability to guide the final selection of equipment. The delivery of major Facility components is expected to be generally within the ranges identified below:

- PV Modules: Spring 2023 to Fall 2023
- Inverters and medium voltage transformers: Summer 2022 to Fall 2023
- High voltage transformers: Spring 2023 to Summer 2023
- Battery Energy Storage System: Spring 2023 to Fall 2023

Note that the equipment procurement strategy will be decided during the final engineering and planning stage of the Facility, prior to construction. As needed, adjustments to equipment procurement may be made after starting Facility construction.