Cassadaga Wind Project

Case No. 14-F-0490

1001.34 Exhibit 34

Electric Interconnection

EXHIBIT 34 ELECTRIC INTERCONNECTION

Interconnection of the Facility to the electric transmission system is achieved using multiple systems. The wind turbines themselves produce power at a low voltage, which is stepped up to a medium voltage at the output of each turbine. A medium voltage collection system comprised of underground and overhead wires transmits the power to a collection substation. The substation steps the voltage up to a high voltage and a high voltage transmission line carries the power to a Point of Interconnection (POI) station, which will be owned by National Grid. The POI station connects the Facility to the National Grid transmission system.

(a) Design Voltage and Voltage of Initial Operation

A padmount transformer located near the base of each wind turbine tower, or internally within the tower, will raise the voltage of electricity produced by the turbine generator from 650 volts up to the 34.5 kilovolts (kV); the voltage level of the collection system. The electrical collection system will total approximately 32.8 miles in length, and will be installed below ground and adjacent to Facility access roads to the extent practicable. Up to five incoming circuits will convene at the collection substation, which is the terminus of the 34.5 kV collection system. The collection substation, to be located on the west side of Cleland Road in the Town of Charlotte, will increase the voltage of the collection system from 34.5 kV to 115 kV.

The overhead 115 kV generator lead line runs approximately 5.5 miles west from the collection substation. The point of interconnection will be National Grid's existing 115 kV Moon Switching Station, which will be rebuilt to a six (6) breaker ring bus and will connect to both 115 kV lines #161 and #162. Moon Station is located on the north side of Moor Road in the Town of Stockton. The line to the Hartfield Substation will be connected in one bay and the Applicant's interconnection line connected in another.

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

The collection system will total approximately 32.8 miles, including 24.1 miles of buried and 8.7 miles of overhead cable systems. Of the 8.7 miles of overhead collection lines, 3.8 miles will be co-located with generator lead line (see discussion of generator lead line below). The underground system will be comprised of numerous cable sections in parallel, connecting each of the wind turbines to the collection substation. Each section will be comprised of 3 type URD aluminum conductors, each surrounded by electrical insulation (typically tree-retardant cross linked polyethylene, TRXLPE) and an overall jacket (typically linear low density polyethylene, LLDPE). The size of each conductor will

depend on how many turbines are producing power into that conductor, but will typically range from 4/0 to 1500 kcmil AWG.

The overhead system is similar in concept to the underground section. Each section is comprised of 3 ACSR (aluminum conductor, steel reinforced) conductors. The size will range from 336.4 to 795 kcmil. Determination of specular or non-specular material construction will be made during final design.

The collection substation will contain both rigid and flexible conductors. The system will be comprised of 3 conductors – flexible conductors will be AAC (all aluminum conductor) ranging in size from 336.4 to 1590 kcmil – rigid conductors will be tubular 6063-T6 aluminum alloy schedule 40 pipe ranging in size from 1.5 to 5 inches.

The generator lead line is similar to the overhead collection system. The line is comprised of 3 ACSR conductors sized at 795 kcmil. Determination of specular or non-specular material construction will be made during final design.

The POI station has the same concept and materials as the collection substation.

(c) Insulator Design

Typical utility-grade ceramic/porcelain or composite/polymer insulators, designed and constructed in accordance with ANSI C29, will be used. Insulators in the collection substation and POI substation will generally be porcelain and insulators on the 115 kV lead line and overhead collection system will be polymer.

(d) Length of the Transmission Line

The overhead generator lead line will run approximately 5.5 miles between the collection substation and the POI.

(e) Typical Dimensions and Construction Materials of the Towers

Although generator lead line is currently preliminary, it is anticipated that the line will be carried on treated wood pole structures that range in height from 65 to 80 feet above ground level, and will have an average span length of approximately 400 feet. Refer to drawings SK-001-01 through -04 and SK-002-01 through -04 in Appendix J.

(f) Design Standards for Each Type of Tower and Tower Foundation

Generator lead line structures and conductors will be designed in accordance with the following standards:

- National Electric Safety Code (NESC) standards for heavy loading and high wind
- American Society of Civil Engineers (ACSE) Manual 72, "Design of Steel Transmission Pole Structures," and Standard 48, "Design of Steel Transmission Pole Structures"
- Rural Utilities Service Bulletin 1724E-200 "Design Manual for High Voltage Transmission Lines."
- ANSI – American National Standards Institute
- ASTM – American Society of Testing of Materials
- OSHA – Occupational Safety and Health Administration
- IEEE – Institute of Electrical and Electronic Engineers
- NEC – National Electric Code

The foundation for each wooden pole is granular fill that is installed into the voids around the pole in the hole drilled for embedment. The fill is compacted in small lifts to ensure a solid, compacted base for each pole.

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

The underground cable systems described in section (b), along with the fiber optic communication cables that comprise a single circuit, will collect the electricity produced by wind turbine generators. Direct burial methods through use of a cable plow, rock saw, rock wheel trencher and/or similar equipment will be used during the installation of underground electrical collection system whenever possible. If a rock saw is used, water or other nonhazardous compound would be used as a lubricant. Direct burial will involve the installation of bundled cable (electrical and fiber optic bundles) directly into a "rip" in the ground created by the plow, saw blade or rock wheel. The rip disturbs an area approximately 24 inches wide with bundled cable installed to a minimum depth of 36 inches in most areas, and 48 inches in active agriculture and pasture lands. Sidecast material will be replaced with a small excavator or small bulldozer. All areas will be returned to approximate pre-construction grades and restored. Design of the system will comply with:

- ANSI – American National Standards Institute
- ASTM – American Society of Testing of Materials
- OSHA – Occupational Safety and Health Administration
- IEEE – Institute of Electrical and Electronic Engineers

- NEC – National Electric Code

(h) Profile of Underground Lines

Refer to drawing SK-103-01 in Appendix G for depth of the underground collection cable and associated material. As stated above, the depth may increase in certain areas (agricultural/pasture lands). There is no additional insulation/cooling system required, such as pumped oil or water. There are no below-grade manholes required.

(i) Equipment to be Installed in Substations or Switching Stations

The collection substation will include 34.5 and 115 kV busses, a transformer, circuit breakers, steel towers, a control building, metering units, and air break switches. The POI will include six breaker ring bus and other assorted equipment. The POI equipment is expected to include all of the above equipment in the collection substation except for the transformer. The POI will be designed in accordance with National Grid standards. Refer to Appendix I drawing SK-101-01 in for a plan/overview of the POI station and drawing SK-102-01 for a plan/overview of the collection substation.

(j) Any Terminal Facility

The only terminal facilities expected are the POI and collection substation and are described/shown above in section (i).

(k) Need for Cathodic Protection Measures

There are no cathodic protection measures expected to be required for installation of the underground systems, as no metallic pipelines will be used.