BEFORE THE
PUBLIC SERVICE COMMISSION OF WISCONSIN

Application for a Certificate of Public Convenience and Necessity of Vista Sands Solar LLC to Construct a Photovoltaic Electric Generating Facility, a Battery Energy Storage System, Collector and Project Substations, a 345 kV generator tie line, and 138 kV collector transmission lines (Vista Sands Solar Farm) in the Village of Plover and Towns of Plover, Buena Vista, and Grant, Portage County, Wisconsin	Docket No: 9820-CE-100

DIRECT TESTIMONY OF CHRIS ANDREWS

Q. Please state your name and business address.

A. My name is Chris Andrews, and my business address is 10000 Midlantic Drive, Suite 300W, Mount Laurel, NJ 08054-1520.

Q. On whose behalf are you providing this testimony?

A. I am providing this testimony on behalf of the Applicant, Vista Sands Solar LLC ("Vista Sands Solar").

Q. By whom are you employed and in what capacity?

A. I am employed by Stantec Consulting Services Inc. ("Stantec") as a Senior Electrical Designer. In this capacity, I am serving as a consulting Electrical Designer for Vista Sands Solar's 1,310.4-megawatt ("MW") alternating current ("AC") solar generation project, 345 kilovolt ("kV") transmission line, 138 kV collector transmission lines, and associated facilities to be located in the Towns of Plover, Buena Vista, and Grant, and the Village of Plover, Portage County, Wisconsin ("Project").

Q. Please describe your responsibilities with respect to the Project.

A. In my capacity as Lead Electrical Designer, I am responsible for preliminary engineering and design of the Project's photovoltaic ("PV") panel arrays and associated facilities, the Project's 345 kV and 138 kV transmission lines, the Project substations, the collector substations, and the battery energy storage system ("BESS").

Q. Please summarize your education and professional background.

A. I completed my bachelor's degree in Science and Electrical Engineering at Excelsior University. I have spent the last 13 years working in design and construction administration services within the renewable energies sector, particularly solar and BESS. I am primarily responsible for the study and design of the low and medium voltage systems and layouts on ground mount, rooftop, and canopy solar PV farms, BESS, and PV facility solar production analysis. I am currently leading upfront electrical design for several gigawatts of solar and battery energy storage projects. My preliminary PV design experience in Wisconsin includes Albany Solar (50MW), Badger State Solar (149MW), Onion River Solar (100MW), Paddock Solar (65MW), Wautoma Solar (99MW), Beaver Dam Solar (50MW), Cassville Solar (50MW), Apple River Solar (100MW), Springfield Solar (100MW), Portage Solar (250MW w/50MW BESS), Saratoga Solar (150.5MW w/50MW BESS), Elk Creek Solar (314MW w/76.6MW BESS), Dane County Solar (12MW), and Grant County BESS (100MW), My resume is provided as Ex.-VSS-Andrews-1.

Q. What is the purpose of your direct testimony?

A. The purpose of my direct testimony is to describe the technical specifications for the Project's PV arrays and associated facilities, the Project's 345 kV and 138 kV transmission lines, the Project substations, the collector substations, and the BESS.

Q. Do you sponsor any exhibits with your testimony?

A. Yes. I sponsor the following exhibit:

Ex.-VSS-Andrews-1: Resume of Chris Andrews

Project Components and Specifications

Q. Please describe the current PV array design for the proposed Project.

A. The Project is proposed to be located within approximately 6,842 acres of primarily agricultural land in Portage County, Wisconsin, which includes the primary array areas (the "Primary Site") and alternative array areas ("Alternative Site"). The Primary Site is designed to host approximately 2,715,908 solar panels with a generating capacity of 1480.17 MW direct current ("DC"). The Alternative Site is designed to host approximately 986,648 panels with a generating capacity of 537.7 MWDC. The final design will be developed during the detailed engineering phase and in accordance with the applicable National Electric Safety Code ("NESC"), National Electric Code ("NEC") provisions, and Certificate of Public Convenience and Necessity ("CPCN") ordering conditions.

Because of advancements in technology and panel availability, the final PV module selection cannot be made until detailed engineering is completed. Prior to construction and during the detailed design phase, several PV module offerings from different suppliers will be evaluated and a final selection will depend on availability and supply logistics. The Project design currently uses the Longi LR5- 72KBD bifacial M10 wafer 545W cell modules. Other modules under consideration are the (i) Waaree, ELITE SERIES BiN-08-560-580W, Bi-Facial, TOPCon, (ii) Jinko, JKM579N-72HL4-BDV, Bi-Facial, TOPCon and (iii) Trina, TSM-590NEG19RC.21, Bi-Facial, TOPCon. The PV modules will be on a tracking system that will follow the sun from east to west throughout the day. The panels will also be covered in heat-strengthened glass with anti-reflective coating.

Q. Are there associated facilities with the Project besides the PV modules?

A. Yes. The other Project facilities include medium-voltage collection lines, a 345 kV transmission line, three 138 kV transmission lines, inverters, single-axis trackers, two Project substations, three collector substations, a generator tie line ("Gen-Tie Line"), internal access roads, up to two one- or two-story O&M buildings, and the BESS.

Q. Describe the collector circuit.

A. The collector circuit will be 34.5 kV medium-voltage cabling that connects the inverters to the collector substations. The Project's collector circuit will be underground. However, Vista Sands Solar will inform the Commission if it determines during final engineering that the use of overhead collector circuits is advantageous. The preliminary design includes a total of approximately 120 miles of collection for the Primary Site and 82 miles for the Alternative Site.

Q. Describe the Project's Proposed 345 kV transmission line.

A. The Project's Proposed 345 kV transmission line will be approximately 5.12 miles long and occupy a 150 feet wide right-of-way ("ROW"). The Proposed 345 kV transmission line has three segments. The first segment is approximately 1.66 miles long, running through the Project area to the existing ATC-owned 115 kV single-circuit transmission line. Approximately 0.75 miles of Segment 1 will be constructed along the east side of 125th St. The second segment is approximately 3.2 miles long and would replace an existing ATC-owned 115 kV single-circuit transmission line. ATC would build and maintain the second segment of the Proposed 345 kV transmission line within its existing transmission line ROW. Segment 3 of the Proposed 345 kV transmission line is approximately 0.25 miles long, diverging from the existing ATC-owned 115 kV transmission line and connecting to Project Substation 1.

Q. Describe the Project's Alternative 345 kV transmission line.

A. The Alternative 345 kV transmission line will be approximately 6.54 miles long on a 150-foot-wide ROW. The Alternative 345 kV transmission line has two segments. Segment 1 will run east and north approximately 4.44 miles from Project Substation 2 to Project Collector Substation A. Approximately 2.86 miles of Segment 1 would run along the north side of Birch Drive. Segment 2 of the Alternative 345 kV transmission line will run north approximately 2.09 miles from Project Collector Substation A to Project Substation 1.

Q. Describe the Project's 138 kV transmission lines.

A. The primary purpose of the 138 kV transmission lines is to deliver power from the collector substations to Project Substations 1 and 2. The 138 kV transmission lines will be new construction and will include overhead double-circuit (B-2, C-2) or overhead single-circuit (A-1) line on steel monopoles using direct embed or concrete pier foundations. Pole heights for these transmission lines will be approximately 86-90 feet above ground. Conductors will typically be 50 feet or higher above ground and spans will typically be 500 feet long. More detailed information about the proposed 138 kV transmission lines can be found at Ex.-VSS-Application-Application (T-Line): Section 5.3.2.1.

Q. Describe the Gen-Tie Line.

A. The Project requires the construction of a 345kV transmission Gen-Tie Line that is approximately 1,600 feet long. The 345 kV Gen-Tie Line will require a ROW width of 150 feet and will be located on participating Project parcels.

Q. Describe the Project Substation 1.

A. Project Substation 1 is located in the northeast area of the Project near the switchyard, BESS and point of interconnection ("POI"). Project Substation 1 will receive power from a 138 kV transmission line delivering power from Collector Substation A located in the eastern paneled area. Project Substation 1 will contain two 34.5 / 345kV main power transformers to send and receive power to and from the BESS. Project Substation 1 will also receive power from the Project 345 kV Transmission Line 2-1 delivering power from Project Substation 2 located in the central and western paneled areas. Project Substation 1 will deliver power to the grid via the Gen-Tie Line.

Q. Describe the Project Substation 2.

A. Project Substation 2 is located between the central and western areas of the Project. Project Substation 2 will receive power from Project 138 kV Transmission Line B-2 delivering power from a Collector Substation B located in the southern paneled area and Project 138 kV Transmission Line C-2 delivering power from Collector Substation C located in the western paneled area. The Project 345 kV Transmission Line 2-1 will deliver power from Project Substation 2 to Project Substation 1, for eventual delivery to the grid.

Q. Describe the collector substations.

A. The Project's three collector substations will contain 34.5 kV / 138 kV main power transformers to step up power from the paneled areas delivered via 34.5 kV collector circuit cabling. The collector substations will deliver power to either Project Substation 1 or 2 via the three Project 138 kV Transmission Lines.

Q. What are the major components of the Project and Collector Substations?

A. The major components of the Project and collector substations are described in detail in Ex.-VSS-Application-Application: Section 2.4.1.

Q. Is there a non-transmission alternative for these lines?

A. No. Transmission lines are needed to deliver the Project energy to the transmission grid. However, Vista Sands Solar is currently evaluating and engineering a different solution that would remove Project Substation 2, Collector Substations A, B, C, Project 345 kV Transmission Line 2-1, Project 138 kV Transmission Lines A-1, B-2, C-2; and instead using underground 34.5 kV cabling to deliver all generated power to Project Substation 1. This potential change is discussed in more detail in the direct testimony of Jon Baker.

BESS Design

Q. Please provide an overview of the BESS design for the Project.

A. The BESS is currently designed with the power injection capability of 300 MW and the energy storage capacity of 1,200 megawatt-hours ("MWh"). This means the BESS will have capacity to store 1,200 MWh and can dispatch that stored energy at a maximum power of 300 MW for four hours. The BESS will occupy approximately 5.5 acres of land (including access roads and security fencing) on an approximately 40-acre parcel in the northeast area of the Project that will also host Project Substation 1, the switchyard, and the POI.

Q. What are the main components of the BESS?

A. The main components of the BESS include the battery modules which are housed in a series of 288 battery containers, and approximately 72 power conversion systems ("PCS"). The PCS include bi-directional inverters and transformers.

Q. Has Vista Sands Solar identified the specific equipment that will be used in the BESS?

A. No, not at this time. The BESS design and layout submitted in the CPCN application is conceptual in nature and does not represent the final design and layout of the Project's

BESS facility. Sungrow PowerTitan 2.0 BESS equipment was used for the conceptual design. The final equipment manufacturer chosen may differ from that used for the conceptual design due to the evolving market and advancements in technology. Committing to specific equipment now could preclude Vista Sands Solar from taking advantage of technological advances that develop between now and when the Project is constructed.

Q. What type of battery cell will be used in the BESS?

A. A lithium-ion chemistry battery cell is contemplated for the Project. Vista Sands Solar has not made a final selection of the vendor or chemistry details at this stage.

BESS Safety

Q. How have Stantec and Vista Sands Solar taken safety into consideration when designing the BESS?

A. Safety is an important principle for Stantec for all projects and facilities during design, construction, and operation. Safe design, construction, and operation of a BESS begins with safe equipment and compliance with safety codes and regulations. Accordingly, Stantec has (on behalf of Vista Sands Solar) included several safety considerations in designing and planning for the BESS. The Sungrow PowerTitan 2.0 includes a fire suppression system comprised of vent panels, smoke and heat detectors, internal sprinklers, sound beacon, and ventilation system. These components will be included in whichever BESS is selected for final design and construction. Prior to operation, Vista Sands Solar will conduct a Hazard Mitigation Analysis workshop with relevant stakeholders including the battery manufacturer, the battery integrator, the installer, and the local fire department to determine how thermal and off-gassing events are detected, communicated to first responders, and mitigated.

Q. Which safety standards will Vista Sands Solar apply to its BESS?

A. Internationally recognized standards, certifications, and code requirements will be followed during design, construction, and operation of the Project, including the following:

- The BESS equipment shall be stringently tested to prominent safety standards including UL 1642, UL 1741, UL 9540, UL 9540A, and UN 38.3;
- The BESS design shall comply with the International Fire Code 2018;
- The BESS design shall comply with the National Fire Protection Association 855 Standard for the Installation of Stationary Energy Storage Systems; and
- The BESS design and operation shall comply with the National Electric Code (NFPA 70).

Q. Does this conclude your direct testimony?

A. Yes, it does.