BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF SOUTH DAKOTA

IN THE MATTER OF THE APPLICATION OF CROWNED RIDGE, II LLC FOR A FACILITIES PERMIT TO CONSTRUCT A 300.6 MEGAWATT WIND FACILITY

Docket No. EL19-

DIRECT TESTIMONY AND EXHIBIT

OF MARK THOMPSON

July 9, 2019

INTRODUCTION AND QUALIFICATIONS

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. Mark Thompson, 700 Universe Blvd., Juno Beach FL 33408.

Q. WHAT IS YOUR JOB AND WHAT ARE YOUR JOB RESPONSIBILITIES?

A. I am the Manager of Wind Engineering within the Engineering & Construction ("E&C") organization at NextEra Energy Resources, LLC ("NEER"). As the Manager of Wind Engineering, one of my primary roles is to coordinate or provide support for the development of new wind sites that include underground collector systems, substations, and transmission lines. I also provide support in permit acquisition, system engineering, specification and standards development, material and services procurement, construction management, commissioning, system integration, compliance, and project close-out in heavily regulated, environmentally-sensitive, and multi-system operational environments.

Q. **WHAT IS THE ORGANIZATIONAL RELATIONSHIP BETWEEN NEER AND CROWDED RIDGE WIND, II LLC?**

A. Crowned Ridge Wind, LLC ("CRW II") is an indirect, wholly-owned subsidiary of NEER.

Q. **PLEASE DESCRIBE YOUR BACKGROUND AND QUALIFICATIONS**

A. I have over 17 years of experience in design, engineering, permitting, project management, and construction at both Florida Power & Light Company and NEER, including wind plants and their associated facilities. I hold a Bachelor of Science Degree in Electrical Engineering from the University of Technology, Jamaica in 1996 and a

Master's in Business Administration Degree from Nova Southeastern University in Florida in 1999. My resume is attached as Exhibit MT-1.

Q. HAS THIS TESTIMONY BEEN PREPARED BY YOU OR UNDER YOUR DIRECT SUPERVISION?

A. Yes.

Q. **HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE SOUTH DAKOTA PUBLIC UTILITIES COMMISSION?**

A. Yes, I submitted testimony in Docket EL18-019 related to Crowned Ridge Wind II's request for a facility permit for a transmission line and in Docket No. EL19-003 related to Crowned Ridge Wind, LLC's wind application.

PURPOSE OF TESTIMONY

Q. PLEASE DESCRIBE THE PURPOSE OF YOUR TESTIMONY.

A. The purpose of my testimony is address the design, construction, operation and maintenance ("O&M"), and decommissioning of the proposed CRW II Facility ("Wind Facility" or "Project").

DESIGN AND CONSTRUCTION

Q. PLEASE DESCRIBE THE TECHNICAL DESIGN SPECIFICATIONS OF THE WIND TURBINES.

A. The Crowned Ridge Wind Farm would consist of 132 three bladed, horizontal-axis wind turbines. The Project will utilize GE 2.3MW turbines with 116-meter (381-feet) rotor diameter and 90-meter (295-feet) hub height. GE 2.3MW turbines with 116-meter (381-feet) rotor diameter and an 80- meter (262-feet) hub height will also be utilized in select locations.

The tubular towers proposed for the Project are conical steel structures and consist of 3 tubular steel sections with bolted connections. A steel door at the base of the tower provides secure access. An internal ladder with fall protection, which is connected to the steel wall of the tower, provides access to the top of the tower. The turbines will be grounded in accordance with National Electrical Safety Code ("NESC") standards and comply with all Federal Aviation Administration ("FAA") requirements. The towers will be painted off-white to minimize visual impact.

The main mechanical and electrical components of the wind turbine are housed in the nacelle. The nacelle is mounted on a sliding ring that allows it to rotate, or "yaw," into the wind. The nacelle components include the drive train, gearbox, and generator. The nacelle is housed in a steel-reinforced fiberglass shell that protects internal machinery from the environment. The housing is designed to allow for adequate ventilation to cool internal machinery. The nacelle is externally equipped with an anemometer and a wind vane to measure wind speed and direction. The generated electricity is conducted through cables within the tower to the down tower assembly mounted at the base of the turbine tower. A rotor assembly is mounted on the drive shaft and operates upwind of the tower.

Also, electric motors within the rotor hub vary the pitch of each blade according to wind conditions to maximize turbine efficiency at varying wind speeds.

Q. PLEASE DESCRIBE HOW THE TURBINES WILL BE CONSTRUCTED.

A. The wind turbines will be constructed at a location that meets both permit and geological subsurface requirements. These locations are documented on a site plan with permitted access roads and crane path that would provide access during construction. At the foundation location, topsoil would be stripped and stockpiled for reclamation. The foundation is designed based on the physical attributes of the turbine tower (height and weight) and the geological characteristics of the soil below the ground. Equipment is used to excavate an 8 feet deep by 50 feet wide depression to facilitate the rebar cage, anchor bolts, and concrete for the foundation. The concrete is transported from either an on-site or off-site batch plant and poured over the nested rebar within the form. After the concreate has been cured, the native soil is used to back fill/cover up the majority of the foundation, leaving a one foot reveal known as pedestal, which will accommodate the turbine tower. The base section of the tower is affixed to the pedestal with anchor bolts. The mid and top sections are then sequentially connected with bolted flanges. The remaining excavated soil will be used to construct a pad to facilitate set up for the crane needed to raise tower sections, rotor, blades, and nacelle.

Q. PLEASE EXPLAIN WHAT REMEDIAL ACTIVITIES WILL OCCUR AFTER CONSTRUCTION.

A. After construction is concluded, crane paths and construction access roads are reclaimed to a width of approximately 16 feet to accommodate O&M activities. A post

construction erosion plan is implemented to prevent site degradation due to water runoff. All wind turbine service roads constructed or widened for temporary construction efforts will be removed, sub-based, e-compacted, and replaced with previously stockpiled native topsoil such that the land is restored to pre-construction conditions.

Q. PLEASE DESCRIBE THE DESIGN OF THE COLLECTOR SUBSTATION.

A. The collector substation is a fully fenced facility located approximately in the geographic center of the wind farm. The seven feet high fence is topped with one foot of barbed wire for a total of eight feet. The fence has an 18-20 feet wide access gate for equipment and vehicular access and man gate for personal access during operations. Located within the fenced area are equipment such as 34.5 kilovolt ("kV") medium voltage breakers, switches, support structures with insulators, and bus work used to connect the collector system to the generator step up unit ("GSU"). At the 230kV high voltage side of the substation are switches, breakers, metering unit, support structures with insulators, and bus work used to connect the substation to the transmission pull-off structures. The design of the station takes into account the clearance requirement as recommended by various governing bodies such as Institute of Electrical and Electronics Engineers and NESC. A control house is located within the fenced area and it contains all the controlling devices such as relay panels, Supervisory Control and Data Acquisition ("SCADA") Panels, communication panel, battery, and Programmable Logic Controls needed for the safe and reliable operation of the site.

Q. PLEASE DESCRIBE HOW THE COLLECTOR LINES WILL BE CONSTRUCTED FROM THE TURBINES TO THE COLLECTOR SUBSTATION.

A. Each wind turbine will be connected to the Project's collector substation by underground power cables called collection lines and fiber optic communication cables. A pad-mounted transformer at each turbine location converts the power from 690 volt to 34.5 kV. The permitted paths for the collection lines are included in the construction design drawings. The collection line contractor uses specialized equipment, known as trenchers, to open trenches approximately 12 inches wide and at least 36 inches deep, while simultaneously laying the power and fiber cables at the bottom of the trench. The trench is then backfilled. Junction boxes are installed above-ground where splicing of collection lines is required. In areas where trenching is not permitted, collection lines are installed using horizontal directional bores.

Q. PLEASE DESCRIBE HOW THE METEOROLOGICAL TOWERS ("MET") TOWERS WILL BE CONSTRUCTED.

A. The permanent METs are installed in a predetermined location that gives the best indication of the site's wind resource. The tower is selected based on the hub-height of the turbines to be installed. The foundation for the MET tower will be designed to meet the tower characteristics (height and weight) and the characteristics of the sub surface soil. In order to install the MET tower, the contractor would complete the following tasks:

- Clear and grub MET tower site;

- Auger hole for foundation;
- Install bolt cage for tower foundation;
- Pour concrete for foundation;
- Assemble tower, including MET stations arms;
- Install tower with required crane; and
- Install instrumentation (anemometer, wind vane, barometer).

Q. EXPLAIN THE SAFETY MEASURES THAT WILL BE EMPLOYED DURING CONSTRUCTION.

A. During construction a full time site safety officer will be present. The safety officer will be responsible for coordinating the safety programs for the entire Project. This includes meeting with the various contractors prior to mobilizing on site to assure their requirements satisfy the minimum requirements established for the site. Weekly "All-Hands" meetings are held to discuss safety. Safety meetings are also held at the start of the Project and continue daily through the duration of the Project life. Frequent safety audits are also conducted by the site supervisor.

O&M

Q. EXPLAIN THE ICE DETECTION SYSTEM THAT WILL BE EMPLOYED.

A. An ice detector and ice detection system will be used for all Crowned Ridge Wind wind turbines. More specifically, the turbine is capable of detecting ice buildup on the blades

by activating sensors that compare wind speed, ambient temperature and rotor (blade) rpm to the power output of the turbine. If the ice buildup is at a level that causes the turbine output to be outside expected limits set by GE, the turbine will automatically shut down. In addition, ice buildup can be detected through higher than normal vibration, in which case the turbines will shut down automatically.

Q. Will a cold weather package be used for CRW II?

A. Yes, CRW II's turbines will have an extreme cold weather package that allows the turbines to operate in temperatures as low as - 40 degrees Fahrenheit.

Q. PLEASE DESCRIBE WHAT IS INVOLVED IN THE O&M OF THE WIND FACILITY.

A. The Project is monitored 24/7 by a SCADA system. This system technology enables the monitoring and controlling of the entire Project, including the wind turbines. The SCADA system collects data and allows real time adjustments to be made to the turbines to ensure optimum performance. The wind technicians are located on site at the O&M building and constantly monitor via inspections the performance of the turbines to ensure that they are operating in a safe, reliable, and efficient manner. The Commercial Operations Center, a full-time remote monitoring and control facility located in Denver Colorado, further ensures safe and reliable operations by providing remote real-time monitoring of the Project 24 hours a day, 7 days a week.

Q. HOW MANY PERSONNEL WILL BE EMPLOYED TO CONDUCT O&M?

A. The Project site will employ approximately 7-12 employees, including wind technicians, a wind technician lead, and a site manager, who have the following duties:

- Wind Technician – Conduct scheduled/unscheduled maintenances on Wind Turbines.
- Wind Technician Leader – Conducts work on the business side of the wind farm operation; also does some scheduled/unscheduled work on Wind Turbines.
- Wind Site Manager – Oversees all operations of the Wind Farm and manages all employees on site.

Q. PLEASE DESCRIBE THE DESIGN AND PURPOSE OF THE O&M FACILITY.

A. The O&M building is an approximately 8000 square-feet single story pre-fabricated building assembled on a concrete slab foundation. It is located directly adjacent to the collector substation. The O&M facility will include a main building with offices, spare parts storage, restrooms, a septic system, a shop area, outdoor parking facilities, a turn-around area for larger vehicles, outdoor lighting, and gated access with partial or full-perimeter fencing. The building houses operating personnel, operations, and communication equipment. The purpose of the O&M building is to provide accommodations for O&M personnel whose responsibility is to ensure that the facility will be maintained safely and operated in compliance with applicable North American Electric Reliability Corporation Reliability Standards.

DECOMMISSIONING

Q. WHAT IS THE ESTIMATED LIFE OF THE WIND FACILITY?

A. The Wind Facility estimated life is 25 years. The estimated life of the Project can be increased through repowering.

Q. WILL THE WIND FACILITY BE DECOMMISSIONED AT THE END OF ITS USEFUL LIFE?

A. Yes.

Q. WHO WILL BE RESPONSIBLE FOR THE DECOMMISSIONING COSTS?

A. CRW II will be responsible for all decommissioning costs.

Q. PROVIDE AN OVERVIEW OF THE DECOMMISSIONING PLAN.

A. The decommissioning of the CRW II project will involve:

- Removal of 132 wind turbine generators and all existing above ground facilities;
- Removal of roads and staging areas that are not desired by land owners to remain in place;
- Restore property or properties to pre-construction conditions;
- Restore property or properties with site specific characteristics such as topography, vegetation, drainage and other unique environment features; and
- Repair county roads impacted by movement of oversized loads or heavy haul vehicles and frequent vehicle trips.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes.

STATE OF FLORIDA)

) ss

COUNTY OF PALM BEACH)

I, Mark Thompson, being duly sworn on oath, depose and state that I am the witness identified in the foregoing prepared testimony and I am familiar with its contents, and that the facts set forth are true to the best of my knowledge, information and belief.

Mark Thompson

Subscribed and sworn to before me this 26th day of June 2019.

SEAL

Notary Public

My Commission Expires _____

SHARON R ROMERO
MY COMMISSION # FF955072
EXPIRES January 31, 2020
(407) 398-0153 FloridaNotaryService.com

MARK A. THOMPSON

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MANAGER OF WIND ENGINEERING IN THE ENGINEERING & CONSTRUCTION ORGANIZATION

ENGINEERING & CONSTRUCTION OF RENEWABLE INFRASTRUCTURES

Fifteen years' experience in design, construction and maintenance of renewable power generation and transmission infrastructures from inception to successful execution.

AREAS OF EXPERTISE

- Wind Generating Facility Design
- Transmission Line Design
- Procurement Strategies
- Major Equipment Evaluation
- Six Sigma, Value Engineering
- Budgeting & Resource Planning
- Engineering Design & Analysis
- Infrastructure Restoration & Maintenance
- Quality Management
- Project Management
- System Engineering Analysis

PROFESSIONAL EXPERIENCE

NEXTERA ENERGY RESOURCES — JUNO BEACH, FL

MANAGER, WIND ENGINEERING — **JAN 2010 – PRESENT**

- Designed and constructed over 12000 MW of wind infrastructure including substations and generation tie lines.
- Devised a robust design process for wind engineering including the development of a critical task list.
- Delivered well-rounded technical support and recommendations for early-stage development, estimation, and business management as well as for generator interconnection and power purchase agreement negotiations.
- Led technical design review for various complex wind generating projects while reviewing and approving all technical exhibits for the new turbine technology and all technical documents required for project financing.
- Negotiated technical requirements for Grid Operators including MISO, CAISO, SPP ERCOT, and PJM NYISO.

FLORIDA POWER & LIGHT CO. – INTEGRATED SUPPLY CHAIN (ISC) — JUNO BEACH, FL

SENIOR BUYER FOR POWER EQUIPMENT — **NOV 2007 – JAN 2010**

- Critically researched market forces and developed purchasing strategies focusing on cost reduction.
- Sourced potential suppliers and cultivated key partnerships to slash equipment costs and improve vendor performance.
- Expertly negotiated equipment lead time to ensure timely construction and engineering schedule adherence to complete projects on-time and under budget.
- Devised robust procurement strategies for procuring critical equipment need for greenfield and brownfield expansion.

SUBSTATION DESIGN ENGINEER — **NOV 2004 – NOV 2007**

Led the design of distribution substations ranging from 23kV to 230kV step-down stations to connect the transmission system.

- Enhanced power quality by implementing a capacitor bank design.
- Created temporary substation to facilitate equipment replacement in critical substations.
- Oversaw storm restoration to restore distribution infrastructure damaged by hurricanes.

MASTEC (Contractor for Florida Power and Light) — JUNO BEACH, FL

OVERHEAD LINE DESIGN ENGINEER — **SEP 2002 – NOV 2004**

Designed underground distribution facilities for new commercial and residential development while leading the storm restoration crews after storms for restoration and maintenance activities.

- Effectively managed the restoration crew with over 140 linemen to restore power lines are major hurricanes.

PRIOR EXPERIENCE

ALUMINA PARTNERS OF JAMAICA | **MAINTENANCE ENGINEER**

EDUCATION & PROFESSIONAL DEVELOPMENT

MBA – Nova Southeastern University – Davie, FL

Bachelor of Science in Electrical Engineering (Honors) – University of Technology – Kingston, Jamaica

Six Sigma Black Belt in Quality Improvement

Certificate in Leadership Edge Training